Annual Research Report
2007-08

Program Leader

Dr. Md. Badirul Islam, CSO

Compiled and edited by

Dr. Md. Badirul Islam, CSO
Dr. Md. Yusuf Ali, PSO
Dr. Md. Mohabbat Ullah, SSO
Dr. A S M Mahbubur Rahman Khan, SSO
Md. Akhtar Hossain, SO
Md. Kamrul Hasan, SO

ON-FARM RESEARCH DIVISION
Bangladesh Agricultural Research Institute
Joydebpur, Gazipur 1701

August 2008

Annual Research Report, 2007-08

Published by:

Chief Scientific Officer
On-Farm Research Division
Bangladesh Agricultural Research Institute
Gazipur
Phone: 88029252085
Email: ofrdjoy@yahoo.com

Year of Publication:

July 2008

Cover page design

S M Obaidur Rahman
OFRD, BARI, Gazipur
Cell: 01552 325034
Email: obaidur97@yahoo.com

Word processing

S. M. Obaidur Rahman, SA
Md. Habibur Rahman, LDA-cum-Typist

PREFACE

On-Farm Research Division (OFRD) of Bangladesh Agricultural Research Institute (BARI) is going to publish its Annual Research Report for the experiments conducted during 2007-08 in the Farming System Research and Development (FSRD) and Multilocation Testing (MLT) sites all over the country. The mandate of OFRD is to conduct research for the improvement of existing farming system and testing and validation of on-station technologies under a wide range of agro-climatic situation for the fine tuning of the technologies. Development of location specific technology based on the local problems and needs is another mandate of OFRD. In this regard, major thrust was given on the improvement of existing cropping systems through introduction of improved varieties, crop management as well as soil fertility management practices.

Emphasis was also given on the improvement of existing cropping system practiced by the farmers' with introduction of new crops and varieties for coastal, rainfed and hill areas. Similarly, Soil fertility management is another important issue which to be addressed comprehensively for sustainable crop production through cropping pattern based balanced fertilization for major AEZs. Emphasis was given on IPNS approach and location specific soil test based fertilizer recommendation to maintain and improve soil fertility. Research report on socio-economic studies, integrated farming system, family nutrition and homestead gardening and on-farm verification of advanced lines and technologies were also included in this report.

On-farm trials on wheat, maize, tuber crops, pulses, oilseeds and horticultural crops conducted at different MLT and FSRD sites throughout the country through collaboration with development partners. Results of these activities also incorporated in this report. Different training activities and field days for farmers, DAE personnel, SSA/SA as well as for the scientists of OFRD was organized during 2007-08 through ICM and ATT project funded by BARC.

I hope this report will be very useful to the researchers, GO, NGO and extension personnel working in this field.

I expressed my sincere thanks and gratitude to DANIDA and BARC for providing financial assistance to conduct different research, training and Research-Extension linkage activities. I sincerely admire and appreciate my colleagues and SSA/SA who look after the experiments at different locations during study period. Special thanks to the cooperator farmers for their valuable cooperation. Last of all, I acknowledged those who worked very hard to accomplish this voluminous work.

Dr. Md. Badirul Islam
Chief Scientific Officer (A/C)
OFRD, BARI, Gazipur

CONTENTS

Title **Page no.**

Title **Page no.**

ON-FARM TRIALS WITH ADVANCE LINES AND TECHNOLOGIES

INTEGRATED FARMING SYSTEMS

Title	**Page no.**

Effect of Urea Super Granule (USG) as a Source of Nitrogen on Cabbage

Abstract

An experiment was conducted at six different locations viz. Tangail, Pabna, Comilla, Kishoreganj, Mymensingh and Rangpur during 2007-08 to find out the optimum and economic dose of urea super granule (USG) for cabbage production in comparison to prilled urea. The trial was laid out in RCB design with six dispersed replications. Four levels of N viz. T_1: Recommended dose of N as prilled urea, T_2: Recommended dose of N as USG, T_3: 10% less than recommended dose of N as USG and T_4: 20% less than recommended dose of N as USG were considered as treatments. The highest head yield (86 to 125 t/ha) was found from plants grown with recommended N as USG followed by 10% less of recommended N as USG at all the locations. Recommended dose of N as prilled urea and 20% less than recommended dose of N as USG produced similar yield. Application of 10-20% less than recommended dose of N as USG provided similar or even higher gross margin over that of recommended dose of N as prilled urea.

Introduction

Nitrogen is an important nutrient element for crop production. It is needed in each and every crop in large quantity. Among the all fertilizers, the efficiency of nitrogenous fertilizer is lowest due to various losses (gaseous, leaching, run-off etc.). It is reported that about 40% of applied N is used by the crop and the rest amount is lost from the soil. Nitrogen is mostly used as prilled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The loss will be minimized if it applied as super granule to the reduced zone. Moreover, the crisis of urea is a burning issue throughout the country. The urea super granule (USG) will release nitrogen slowly to the crop for longer period of time. Thus the N use efficiency as well as yield of the crop will be increased. The farmers are already using it in Boro rice. In some areas it is also used in different upland vegetables and fruit crops such as brinjal, cabbage, cauliflower, tomato, banana etc.

Cabbage is one of the most important and profitable crop in winter season. It is grown widely throughout the country. But the efficiency of USG to this crop is not yet ascertained. However, the farmers are already using it in their crop. According to Crass Well and De Datta (1980) broadcast application of urea on the surface soil causes loss up to 50% but point placement of USG in 10 cm depth may result negligible loss. Savant, *et al.* (1991) also reported that 8-10 cm depth of placement of USG in rice field can save 30% nitrogen than that of prilled urea. It is also reported that use of USG can save 10-20% nitrogenous fertilizer cost in upland crops (Anon, 2003). Therefore it is very important to evaluate the efficiency of nitrogen as USG in cabbage cultivation. Hence the experiment was undertaken to find out the optimum and economic dose of USG for cabbage cultivation in comparison to prilled urea at different locations.

Materials and Methods

The experiment was conducted at six different locations viz. Tangail, Pabna, Comilla, Kishoreganj, Mymensingh and Rangpur during 2007-08 to find out the optimum and economic dose of USG in cabbage production. The trial was laid out in RCB design with six dispersed replications (farmers). It was conducted in ICM/IPM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. The four treatments were T_1: Recommended dose of N as prilled urea, T_2: Recommended dose of N as USG, T_3: 10% less than recommended dose of N as USG and T_4: 20% less than recommended dose of N as USG. Nitrogen dose for each treatment was calculated on the basis of soil test under different AEZ. Crop management practices were done at different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary. Ten randomly selected plants from each plot were considered for different data collection. Collected data were analyzed statistically following CropStat/Mstat-C analytical package. Cost and return analysis was done also.

Table 1. Crop management practices done at different locations

Location	Tangail	Pabna	Rangpur	Mymensingh	Comilla	Kishoreganj
Variety	green crown	Atlas-70	K.K cross	Atlas-70	Atlas-70	Atlas-70
Unit plot size & spacing	10 m x 10 m 60cm x 45cm	8 m x 5 m 60 cm x 45 cm	8.4 m x 5.4 m 60 cm x 60 cm	8 m x 5 m 60 cm x 45 cm	8 m x 5 m 60 cm x 45 cm	8 m x 5 m 60 cm x 45 cm
Sowing time	3 to 6 Dec 07	29 Oct 07	29 to 30 Nov 07	27 Oct to 03 Nov 08	25 Nov 07	7-9 Dec 08
Harvesting time	14 Feb to 21 Mar 08	3 to 13 Feb 08	up to Mid February 08	10 to 25 Jan 08	27 Jan to 20 Feb 08	12-20 Feb. 08
Fertilizer dose (kg/ha)	TSP-287 MP-227 Gypsum-72	P-50, K-125, S-28, Zn-4, B-1	P-25, K-24, S-38, Zn-2, B-1	P-46, K-87, S-42	As recommended	P-36, K-145, S-35, B-1

Results and Discussion

TANGAIL

Results reveal that significantly higher head weight with outer leaves in both Madhupur (3.69 kg) and Ghatail (4.52 kg) was obtained from plants treated with recommended dose of N as USG (Table 2). The significant variation was also found in case of yield. The highest yield was found in same treatment in both Madhupur (87.78 t/ha) and Ghatail (125.33 t/ha) which was statistically different from other treatments. The second highest yield was obtained from plots treated with 10% less than recommended dose as USG in both the locations (78.16 t/ha and 112.85 t/ha). The lowest yield (68.45 t/ha) in Ghatail and Madhupur (94.72 t/ha) was recorded in plots treated with recommended dose of N as prilled urea which were at par with plants received 20% less than recommended dose as USG. Yield variations obtained in between the locations which might be due to location and management effects.

Cost and return analysis

Table 3 revealed that the highest gross return (Tk. 263340/ha and Tk. 375990/ha) was recorded from plots having recommended dose of N as USG followed by 10% less than recommended dose as USG (Tk. 234480 and 338550/ha) in both the locations. The lowest Gross return (Tk. 205350 and 284160/ha) was obtained in plots treated with recommended dose of N as prilled urea, though it was vary close to 20% less than recommended dose as USG treated plots (Tk. 210210 and 295530/ha). Total variable cost (TVC) in recommended dose of N as USG was higher than the other treatments, because price of USG was higher than prilled urea. The highest gross margin (Tk. 186483 and 299139/ha) was obtained from recommended dose of N as USG treated plots. Even the plots treated with 10% less than recommended dose as USG was also higher in gross margin than those of having recommended dose of N as prilled urea (Table 3). Similar findings were reported by Rahman *et al*. (2003) in cabbage production that agreed with the present results.

Farmers' reaction

Farmers of the FFS opined that they would apply USG instead of prilled urea in coming season if it is available in the market. During conducting of field days and field visits the DAE personnel also showed positive impact of USG in cabbage production.

PABNA

The results revealed that (Table 4) the highest marketable yield (124.4 t/ha) was obtained in recommended dose of USG plot which was identical with 10% less than of recommended N dose as USG applied plot followed by recommended prilled urea and 20% less than of recommended dose as USG applied plot (122 t/ha). It seems that USG has positive and relatively long term effect on cabbage than prilled urea which enhanced bigger size of cabbage head. It is indicated that the efficiency of N as USG is found better over prilled urea.

From the economic analysis, it was revealed that higher gross margin (Tk.80000/ha) was obtained from rec. dose followed by 10% less than of recommended dose as USG treatment (Table 6).

Farmers' reaction

Farmers were interested to use of USG due to higher yield of cabbage if it is available in the market. However, they also expressed their concern due to higher cost of USG.

COMILLA

Performance of USG on cabbage at Homna, Comilla are presented in Table 6. There was no significant difference among the treatments. Numerically head weight (2.74 kg) was higher in USG recommended dose treated plot and lower (2.4 kg) in USG (20% less) treated plot. Gross return was higher (Tk. 221493/ha) in USG 10% less treated plot and lower (Tk. 171201/ha) in urea (rec. dose) treated plot. Results indicate that USG has positive effect on cabbage production.

Farmers' reaction

Farmer opined that by use of USG, leaves became deep green continuously for whole season, heads were also bigger than prilled urea treated plot.

KISHOREGANJ

MLT site, Kendua, Netrakona

Higher head yield was obtained from recommended dose of N as USG (89.46 t/ha) followed by (T_3) 10 % less of recommended dose of N as USG (87.93 t/ha). About 9 and 8% higher yield over prilled urea were obtained with recommended dose of N as USG and 10% less of recommended dose of N as USG, respectively. The result indicated encouraging performance of USG on cabbage yield. The head yield obtained from (T_3) 10 % less of recommended N as USG was statistically identical with (T_2) recommended N as USG and statistically higher than (T_1) recommended prilled urea. It is indicated that the efficiency of nitrogen as USG is better than prilled urea.

Cost and return analysis

Table 8 reveals that the highest gross return (Tk.178920/ha) was calculated from (T_2) recommended N as USG followed by 10% less rec. USG. It is also noted that even (T_4) 20% less of recommended N as USG showed higher economic benefit over (T_1) recommended prilled urea.

MYMENSINGH

MLT site, Netrakona Sadar

Table 9 shows that recommended dose of N as USG gave better performance than any other treatment although its yield (87.43 t/ha) was identically followed by 10 or 20% less of USG dose. Application of N as prilled urea gave the lowest head yield of 78.24 t/ha. The USG application gave 10-12% higher yield than prilled urea. Thus, the results indicate that for cabbage cultivation about 10-20% urea can be saved and better yield can also be obtained if USG is applied for N instead of using it as prilled urea. From Table 10 it is evident that higher gross return (Tk.437150/ha) and gross margin (Tk.384068/ha) were obtained from recommended dose of USG.

Farmers' reaction

Farmers are interested to use USG in their cabbage crop. But they demanded easy method of applying it to the crop and availability of USG in the local market.

RANGPUR

The highest yield (90.3 t/ha) of cabbage was obtained from recommended dose of N as USG treatment (T_2) followed by T_1 (85.6 t/ha) treatment (Table 11). The lowest yield was recorded from T_4 (USG 20% <Rec. N as USG) treatment. It seems that USG has positive and relatively long-term effect on soil and cabbage than prilled urea, which enhanced bigger size of cabbage head. It is indicated that the efficiency of USG is found better over prilled urea. From cost and return analysis it was found that the highest gross margin Tk. 568667/ha given by T_2 treatment.

Farmers' reaction

Farmers are satisfied by T_2 (Rec. N as USG) treatment due to high yield and big size of cabbage. Urea Super Granule is not available in market. They will cultivate cabbage by USG if it is available in market.

Conclusion

From the results it may be concluded that application of urea super granule (USG) is better for cabbage cultivation and even 20 % less than recommended dose of N as USG is more profitable than recommended prilled urea. Therefore, 10-20% of nitrogen could be reduced by the application of USG instead of prilled urea. The result is very encouraging. It may be recommended as extension message for large scale production

References

Anonymous, 2003. "Application of Urea Super granule (USG) in vegetable crops. A Profitable Technology". Pp. 1-10. Bangladesh Agril. Res. Institute and SFFP.Dept. Agril. Ext.

Anonymous. 2004. "Statistical Year Book of Bangladesh". Bureau of Statistics. Dhaka.

Anonymous. 2006. Shabgi Utpadaner Unnato Kalakaushal. Bangladesh Agril. Res. Institute. P-44

Crasswell, E. T. and S. K. De. Datta, 1980. Recent Development in Research on Nitrogen fertilizers for Rice. International Rice research Institute. Res. Paper series No. 49.1-11.

Nazrul, M.I., M.J. Hossain, M.Y. Ali and R.U. Shamim. 2006. Shabgi Chashe Ghuti Urear Baboher 'Ekti Labjanak Prajukti' Bangladesh Agril. Res. Institute. P-5.

Rahman, M. A., M. H. Akand, M. M. Rahman and M. Y. Ali. 2003. Influence of Urea Super Granule and Prilled Urea application on the Tomato Production in the Young Jamuna Brahmaputra Flood Plain soil. J. Agric. Educ.Technol. 5 (1&2). 7-10.

Rahman, M. A., M. H. Akand, M. M. Rahman and M. Y. Ali. 2004. Effect of Urea Super Granule and Prilled Urea application on agro-economic performance of Potato. J. Agric. Educ. Technol. 6 (1&2). 17-20.

Savant, N. K.; S.S. Dhane and, S. C. Talashilkar. 1991. Fertilizer News. International Fertilizer development Center, Muscle Sholas, Albama and I. S. A. 36(3). 19-25.

Table 2. Effect of USG on the performance of Cabbage at the MLT site, Madhupur and Ghatail, Tangail during Rabi 2007-08

Treatments	Madhupur			Ghatail		
	Head wt. with outer leaves (kg)	Head circumference (cm)	Yield (t/ha)	Head wt. with outer leaves (kg)	Head circumference (cm)	Yield (t/ha)
T_1: Rec. dose of N as prilled urea	2.90	74.40	68.45	3.41	87.67	94.72
T_2: Rec. dose of N as USG	3.69	84.80	87.78	4.52	91.28	125.33
T_3: 10% less of rec. dose of N as USG	3.22	77.83	78.16	4.07	85.48	112.85
T_4: 20% less of rec. dose of N as USG	2.94	75.62	70.07	3.55	82.98	98.51
LSD (0.05)	0.19	3.44	5.02	0.42	2.52	11.60
CV (%)	4.9	3.6	5.4	8.9	2.4	8.9

Table 3. Cost and return analysis of Cabbage cultivation as influenced by USG at the MLT site, Madhupur and Ghatail, Tangail during 2007-08

Treatments	Madhupur			Ghatail		
	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)
T_1: Rec. dose of N as prilled urea	205350	76643	128707	284160	76643	207517
T_2: Rec. dose of N as USG	263340	76857	186483	375990	76857	299139
T_3: 10% less of rec. dose of N as USG	234480	76645	157835	338550	76645	261905
T_4: 20% less of rec. dose of N as USG	210210	76320	133890	295530	76320	219210

Price of input/output (Tk./kg): Urea= 6, USG= 6.50 TSP= 30, MP = 25, Gypsum= 7, Cabbage= 3

Table 4. Effect of USG on yield and yield attributes of cabbage at the MLT site, Bhabanipur, Sujanagar, Pabna during 2007-08

Treatments	Cabbage length (cm)	Cabbage breath (cm)	Marketable weight cabbage (kg)	Yield (t /ha)
T_1: Rec. dose of N as prilled urea	14.32	24.30	3.40	119
T_2: Rec. dose of N as USG	15.58	25.36	3.58	125
T_3: 10% less of rec. dose of N as USG	15.20	24.81	3.49	122
T_4: 20% less of rec. dose of N as USG	14.58	23.18	3.38	118
CV (%)	5.22	6.05	7.11	6.15
LSD	0.41	1.22	0.13	4.64

Table 5. Cost and return analysis of Cabbage as affected by USG at the MLT site, Bhabanipur, Sujanagar, Pabna during 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Rec. dose of N as prilled urea	148750	76545	72205
T_2: Rec. dose of N as USG	156750	76750	80000
T_3: 10% less of rec. dose of N as USG	152500	76488	76012
T_4: 20% less of rec. dose of N as USG	148000	76245	71755

Price of input/outputs (Tk./kg): Urea= 6, Cabbage = 1.25, USG= 6.50, TSP= 24, MP= 25, Gypsum = 6, Zinc sulphate = 60 & Borax = 40

Table 6. Head weight of cabbage and economics at Homna, Comilla during 2007-08

Treatment	Head weight/plant (kg)	Gross return (Tk./ha)
T_1: Rec. dose of N as prilled urea	2.42	171201
T_2: Rec. dose of N as USG	2.74	175178
T_3: 10% less of rec. dose of N as USG	2.70	221493
T_4: 20% less of rec. dose of N as USG	2.40	195523
CV (%)	7.4	-
LSD (0.05)	NS	-

Price: Cabbage = Tk. 6.00/head

Table 7. Effect of USG on yield and yield components of cabbage at the MLT site Kendua, Netrakona, during 2007-08

Treatments	Whole plant weight (kg)	Head pericycle (cm)	Marketable head weight (kg/plant)	Head yield (t/ha)
T_1: Rec. dose of N as prilled urea	3.01	69	2.09	81.70
T_2: Rec. dose of N as USG	3.09	74	2.48	89.46
T_3: 10% less of rec. dose of N as USG	2.99	71	2.27	87.93
T_4: 20% less of rec. dose of N as USG	2.87	68	2.14	84.40
LSD (0.05)	NS	NS	0.219	2.89
CV (%)	10.07	14.16	17.07	15.56

Table 8. Cost and return analysis of cabbage as affected by USG at the MLT site, Kendua Netrakona during 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Rec. dose of N as prilled urea	163400	59005	104395
T_2: Rec. dose of N as USG	178920	60005	118915
T_3: 10% less of rec. dose of N as USG	175860	59891	115969
T_4: 20% less of rec. dose of N as USG	168800	59777	109023

Price (Tk./kg): Urea= 6, TSP= 19, MoP= 16, Gypsum= 6, Zinc sulphate= 80, Boric acid= 280, Cabbage=2

Table 9. Yield and yield contributing characters of cabbage as influenced by application of Urea Supper Granule (USG) at the MLT site Netrakona during Rabi, 2007-08

Treatments	Plant height (cm)	Head			Yield (t/ha)
		Pericycle (cm)	Diameter (cm)	Weight (kg)	
T_1: Rec. dose of N as prilled urea	36.4	67.16	21.38	2.34	78.2
T_2: Rec. dose of N as USG	41.6	74.00	23.56	2.43	87.4
T_3: 10% less of rec. dose of N as USG	39.6	71.08	22.63	2.40	86.4
T_4: 20% less of rec. dose of N as USG	38.1	68.64	21.86	2.38	85.7
LSD(0.05)	2.18	NS	NS	NS	6.34
CV (%)	2.27	6.15	9.74	8.89	5.45

Table 10. Cost benefit analysis of cabbage as influenced by application of Urea Supper Granule (USG) at the MLT site Netrakona during Rabi, 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Rec. dose of N as prilled urea	391200	52482	338718
T_2: Rec. dose of N as USG	437150	53082	384068
T_3: 10% less of rec. dose of N as USG	432000	52780	379220
T_4: 20% less of rec. dose of N as USG	428500	52575	375925

Price of cabbage Tk. 5/kg

Table 11. Effect of USG on yield, yield attributes and economics of Cabbage at Ulipur MLT site during 07-08 OFRD, Rangpur

Treatment	Head length (cm)	Head diameter (cm)	Head yield (t/ha)	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Rec. dose of N as prilled urea	3.7 b	63.5 b	85.6b	599200	66333	532867
T_2: Rec. dose of N as USG	4.2 a	64.3 a	90.3a	632100	63083	569017
T_3: 10% less of rec. dose of N as USG	3.7 c	60.5 c	81.5c	570500	65167	505333
T_4: 20% less of rec. dose of N as USG	3.3 c	58.2 d	77.3d	541100	64458	476642
CV (%)	8.5	2.7	5.5	-	-	-

Price (Tk./kg): Urea= 6, USG= 7, TSP= 32, MP= 27, Gypsum= 8, Zinc sulphate= 100, Boric acid = 130, Cabbage= 7

Effect of Urea Super Granule (USG) As a Source of Nitrogen on Cauliflower

Abstract

The experiment was conducted at four different locations viz. Sherpur (Jamalpur), Mymensingh, Rangpur and Shyampur during 2007-08 to see the efficiency of Urea Super Granule on cauliflower and to find out the optimum and economic dose of USG for the crop. Significant variation was observed in different treatments. The yield from 10% less of recommended N as USG was at par with the application of N as prilled urea but the gross margin was higher from the application of N as recommended USG at all locations. Farmers opined that the availability of USG should be ensured in their locality.

Introduction

Nitrogen is an important nutrient element for crop production. It is needed in each and every crop in large quantity. Among the all fertilizers, the efficiency of nitrogenous fertilizer is lowest due to various losses (gaseous, leaching, run-off etc.). It is reported that about 40% of applied N is used by the crop and the rest amount is lost from the soil. Nitrogen is mostly used as periled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The loss will be minimum if it applied as super granule to the reduced zone. Moreover, the crisis of urea is a burning issue throughout the country. The urea super granule (USG) will release nitrogen slowly to the crop for longer period of time. Thus the N use efficiency as well as yield of the crop will be increased.

Cauliflower is as important winter vegetable crop in Bangladesh. It is a high value crop for early winter season. It is very popular to the farmers and they grow it as a commercial crop. But the farmers are not getting satisfactory yield due to lack of awareness about recommended fertilizer dose, method of application. Recently, some fertilizer manufacturing company are supplying different types of nitrogenous fertilizer materials in the market. The USG is one of the popular nitrogenous fertilizers which are now available in the market and the farmers are already using it in Boro rice crops. Moreover, they are using it in different upland vegetables and fruit crops such as brinjal, cabbage, cauliflower, tomato, banana, papaya etc. The areas under these crops are increasing day by day. Higher yield and economic returns were obtained from cabbage, brinjal and cauliflower by using USG in the farmers' field. Anon (2006) reported that by using USG in banana, the yield and economic returns were increased considerably as compared to prilled urea even at 10% less of recommended N as USG. But the efficiency of USG to these upland crops is yet not tested in different area although the farmers were already started to use it in different crops in a limited scale. Hence the study was undertaken to evaluate the performance of USG on cauliflower.

Materials and Methods

The experiment was conducted at four difference locations viz. Sherpur (Jamalpur), Mymensingh, Rangpur and Shyampur during 2007-08. It was laid out in a randomized complete block design with six dispersed replications (farmers). It was conducted in ICM/IPM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. Four levels of N viz. T_1: Recommended dose of N as prilled urea for HYG; T_2: Recommended dose of N as USG; T_3: 10% less than recommended dose of N as USG and T_4: 20% less than recommended dose of N as USG were tested. Crop management practices done under different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary. Ten plants were collected prior to harvest from each plot after attaining the maturity of the crop to collect data on yield attributes. Data on yield was recorded from whole plot basis. The collected data were analysed statistically.

Table 1. Crop management practices done in different locations

Location	Jamalpur	Mymensingh	Rangpur	Shyampur
Variety	BARI Fulcopi-1	Snow crown	Snow crown	Snow crown
Unit plot size & spacing	8m x 5m 60cm x 45cm	8m x 5m 60cm x 45cm	8m x 5m 60cm x 45cm	8m x 5m 60cm x 45cm
Planting time	29 Oct to 5 Nov 07	27 to 30 Oct 07	10-17 Nov. 07	1-7 Nov. 07
Harvesting time	28 Dec 07 to Jan 08	10 to 20 Jan 08	4 to 19 Feb. 08	5-15 Feb. 08
Fertilizer dose (P-K-S-Zn-B kg/ha)	105-38-30-4-1	84-173-34-0-0	As recommended	40-80-16-2-0.6

Results and Discussion

JAMALPUR

FSRD site, Sherpur: The result revealed that plant height was insignificant due to treatment variation (Table 2). The weight of curd/m^2 was found higher in recommended dose of N as USG followed by 10% less than recommended dose of N as USG. The highest marketable curd wt was recorded from recommended dose of N as USG was statistically identical to 10% less than recommended dose N as USG. The recommended dose of N as prilled urea gave next highest marketable curd weight. The 20% less than recommended dose of N as USG produced the lowest marketable curd weight. The highest curd yield was obtained from recommended N as USG (44.5 t/ha) and was statistically identical to 10% less than recommended dose of N as USG (40.7 t/ha) and to the recommended dose of N as prilled urea (40.2 t/ha) the 20% less than recommended dose of N as USG produced the lowest curd yield (35.8 t/ha). However, the yield was insignificant but about 11% yield increased in USG over prilled urea at recommended dose of N. The result indicated encouraging performance of USG on cauliflower yield. It also indicted that the efficiency of USG is better over prilled urea.

Cost and return analysis

Regarding economic return it was revealed that the highest gross return (Tk.357120/ha), gross margin (Tk. 252788/ha) and BCR (3.42) were obtained from recommended dose of N as USG (Table 3).

Farmers' reaction

Farmers opined that they will cultivate cauliflower with 10% less recommended dose of N as USG. The availability of USG should be ensured in their local market.

MYMENSINGH

MLT Site, Netrakona Sadar: Table 4 shows that all the yield contributing characters and yields of cauliflower did not vary significantly except plant height and pericycle of the individual curd. The overall performance of the crop was not good. Most of the curd was deformed and discoloured at the later growth stage might be due to climatic and soil related factor. However, curd yield in different treatments ranged from 17.64-18.37 t/ha. The treatment 10 % less Rec. dose of N as USG gave highest curd yield (18.37 t/ha) and the lowest curd yield (17.64 t/ha) was incurred from prilled urea. Though the crop performed not well but the results show an indication that application of USG is better than use of urea in the prilled form.

RANGPUR

Significantly higher yield (43.61 t/ha) of cauliflower was obtained from treatment (T_2) where rec. dose of N as USG was applied. Similar yield was obtained with rec. dose of N as prilled urea and 10% less of rec. dose of N as USG. But application of 20% less N as USG significantly reduced the yield. From cost and return analysis it was found that the highest gross return Tk. 436100/ha and gross margin Tk. 376047/ha was given by treatment USG (T_2 treatment).

SHYAMPUR, RAJSHAHI

The results revealed that (Table 6) the identically highest head diameter of cauliflower was achieved from recommended dose of N as USG (T_2), 10% less rec. N as USG (T_3) and 20% less rec. N as USG (T_4). The lowest head diameter was produced by rec. dose of N as prilled Urea (T_4). The similar trend was also observed in other major yield attribute like individual head weight. Similarly, the highest marketable yield was obtained in rec. dose of USG (27.63 t/ha) which was identical to 10% less rec. N as USG (26.43 t/ha) and 20% less rec. N as USG (26.85 t/ha). It seems that USG has positive effect than prilled Urea which increase yield and reduce nitrogenous fertilizer use. From the general observation, 100% recommended dose of N as USG plots were infested by thrips and cabbage butterfly but 10% and 20% less USG plot were not infested. It was also observed that cauliflower leaves were dark green in USG applied plots than prilled Urea applied plots.

From the economic analysis the highest gross margin (Tk.126733/ha) was observed in 100% rec. N as USG plot followed by 20% less of recommended N as USG treatment (Table 7).

Framers reaction

Farmers are satisfied with higher yield by application of USG. Pest infestation was also less in 10-20% less USG plots. They opined that 10% less rec. N as USG was better than others.

Conclusion

From the study it is evident that USG has a significant positive effect on growth and yield of cauliflower than prilled Urea. It was also found that 10-20% urea can be easily reduced if it is used as USG form. It may be recommended for large scale production.

Table 2. Effect of USG on yield and yield attributes of Cauliflower at the FSRD site, Kushumhati, Sherpur during 2007-08

Treatment	Plant ht. (cm)	Curd wt/m^2 (kg)	Marketable curd wt/kg	Curd yield (t/ha)
T_1: Rec. N as prilled urea	48.96	4.15 ab	812 b	40.2 a
T_2: Rec. N as USG	50.28	4.34 a	900 a	44.5 a
T_3: 10% less of rec. N as USG	47.84	4.45 a	858 ab	40.7 a
T_4:20% less of rec. N as USG	48.84	3.86 b	748 c	35.8 b
CV(%)	9.26	7.21	9.51	10.98

Figure in the column having similar letter(s) do not differ significantly

Table 3. Cost and return analysis of cauliflower as influenced by USG at the FSRD Site, Kushumhati, Sherpur during 2007-08

Treatment	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1: Rec. N as prilled urea	321520	104941	216579	3.06
T_2: Rec. N as USG	357120	104332	252788	3.42
T_3: 10% less of rec. N as USG	326000	104058	221942	3.13
T_4:20% less of rec. N as USG	286800	103785	183015	2.76

Price (Tk./kg): Urea= 6, USG=7, TSP= 36, MP= 32, Gypsum= 7, Zinc sulphate= 120, Borax= 40, Cowdung= 0.50, Curd = 8

Table 4. Yield and yield contributing characters of cauliflower as influenced by application of Urea Supper Granule (USG) at the MLT site, Netrakona, during Rabi, 2007-08

Treatment	Plant height (cm)	No. of leaves/ plant	Curd			Yield (t/ha)
			Pericycle (cm)	Diameter (cm)	Weight (g)	
T_1. Recommended dose of N as prilled urea	72.3	20	38.7	12.32	470.5	17.6
T_2. Recommended dose of N as USG	75.2	21	41.4	13.18	481.0	18.0
T_3.10 % less than rec. dose as USG	78.3	21	42.7	13.61	490.0	18.4
T_4. 20% less than rec. dose as USG	74.2	20	39.6	12.62	477.5	17.8
LSD (0.05)	5.31	NS	3.74	NS	NS	NS
CV (%)	4.42	3.14	5.75	8.67	7.11	5.07

Table 5. Effect of USG on yield, yield attributes and economics of Cauliflower at Ulipur MLT site during 2007-08

Treatment	Diameter of card (cm)	Wt. of each card (kg)	Yield of card (t/ha)	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)
T_1:(Rec. prilled)	50.57b	0.902	37.56b	375600	57428	318172
T_2:(Rec. USG)	53.90a	1.047	43.61a	436100	60053	376047
T_3:(10% <Rec. N as USG)	52.32ab	0.933	38.89b	388900	59710	329190
T_4:(20% <Rec. N as USG)	46.60c	0.787	32.78c	327800	59215	268585
CV (%)	4.7	7.2	7.2	-	-	-

Cauliflower price Tk. 10/- per kg.

Table 6. Effect of USG on yield and yield attributes of cauliflower during 2007-08 at MLT Paba, Rajshahi

Treatments	Curd diameter (cm)	Individual curd wt. (kg)	Yield
T_1	8.83	0.672	24.90
T_2	11.83	0.746	27.63
T_3	11.81	0.714	26.43
T_4	11.65	0.725	26.85
CV (%)	12.39	5.27	5.28
LSD (0.05)	1.68	0.0389	1.72

Table 7. Cost and return analysis of cauliflower as affected by USG at the MLT site Paba, Rajshahi during 2007-08

Treatments	Yield (t/ha)	Gross return (Tk./ha)	Variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1	24.90	149400	39047	110353
T_2	27.63	165780	39047	126733
T_3	26.43	158580	38841	119739
T_4	26.85	161100	38685	122415

Price (Tk/kg): Cauliflower: 6, Seedling= 350/1000 seedling, Urea= 6, TSP= 35, MP= 33, Gypsum= 6, Boric acid= 120, Zinc sulphate= 100, CD= 1.

Effect of Urea Super Granule (USG) As a Source of Nitrogen on Tomato

Abstract

An experiment was conducted at farmers' field of Tangail, Barind, Jamalpur, Kishoreganj, Mymensingh, Noakhali, Pabna, Patuakhali, Rangpur and Sylhet during 2007-08 to find out the optimum and economic dose of USG of tomato. The trial was laid out in RCB design with six dispersed replications. Four levels of N viz. T_1: Recommended dose of N as prilled urea, T_2: Recommended dose of N as USG, T_3: 10% less than recommendation dose as USG and T_4: 20% less than recommendation dose as USG were tested in the experiment. Results showed that application of USG at 10% less of rec. dose gave better yield than the application of N as prilled urea. But the higher gross margin was found from the application of rec. dose of N as USG.

Introduction

Nitrogen is an important nutrient element for crop production. It is needed in each and every crop in large quantity. Among the all fertilizers, the efficiency of nitrogenous fertilizer is lowest due to various losses (gaseous, leaching, run-off etc.). It is reported that about 40% of applied N is used by the crop and the rest amount is lost from the soil. Nitrogen is mostly used as periled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The loss will be minimized if it applied as super granule to the reduced zone. Moreover, the crisis of urea is a burning issue throughout the country. The urea super granule (USG) will release nitrogen slowly to the crop for longer period of time. Thus the N use efficiency as well as yield of the crop will be increased. The farmers are already using it in Boro rice. In some areas it is used in different upland vegetables and fruit crops such as brinjal, cabbage, cauliflower, banana, tomato etc.

Tomato is one of the most profitable crops in winter performance of USG to this crop is not yet ascertained. However, the farmers are already using it in their crop. According to Crass Well and De Datta (1980) broadcast application of urea on the surface soil causes loss up to 50% but point placement of USG in 10 cm depth may result negligible loss. Savant, *et al.* (1991) also reported that 8-10 cm depth of placement of USG in rice field can save 30% nitrogen than that of prilled urea. It is also reported that use of USG can save 10-20% nitrogenous fertilizer cost in upland crops (Anon, 2003). Therefore, it is very important to evaluate the efficiency of USG in Tomato cultivation. Hence the experiment was undertaken to find out the optimum and economic dose of USG for tomato cultivation in comparison to prilled urea.

Materials and Methods

The experiment was conducted at Tangail, Barind, Jamalpur, Kishoreganj, Mymensingh, Noakhali, Pabna, Patuakhali, Rangpur and Sylhet during 2007-08 to find out the optimum and economic dose of USG in tomato production. The study was laid out in RCB design with six dispersed replications (farmers). It was conducted in ICM/IPM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. The four treatments were considered as T_1: Recommended dose of N as prilled urea for HYG, T_2: Recommended dose of N as USG for HYG, T_3: 10% less than recommended dose of N as USG for HYG and T_4: 20% less than recommended dose of N as USG for HYG. Fertilizer dose for each treatment was calculated on the basis of soil test under different AEZ. Crop management practices at different locations are presented in the Table 1. Ten randomly selected plants from each plot were considered for different data collection. Collected data were analyzed statistically following CropStat/Mstat-C analytical package. Cost and return analysis was done also.

Table 1. Crop management practices done in different locations

Location	Tangail	Pabna	Barind	Jamalpur	Kishoreganj	Mymensingh	Patuakhali	Noakhali	Sylhet	Rangpur
Variety	Roma VF	Sonali	Surokkha (hybrid)	BARI Tomato-3	Shurakkha	BARI Tomato-2 Ratan	BARI Tomato-2	BARI Tomato-8	Epox (hybrid)	BARI Tomato-2 (Ratan)
Unit plot size & spacing	10m x 8m 60cm x 40cm	8 m x 5m 75cm x 60cm	3.5m x 4.5 m 60cm x 40cm	8 m x 5 m 60 cm x 45 cm	8 m x 5 m 60 cm x 45 cm	8 m x 5 m 60 cm x 45 cm	5 m x 4 m 60cm x 45cm	5 m x 4 m 60cm x 40cm	6 m x 5 m 75cm x 60cm	8.4 m x 4.8m 60cm x 60cm
Sowing time	3 to 6 Dec, 07	29 October 07	30 Sep 07	22 to 25 Nov 07	27 to 29 Nov 07	31 Oct to 11 Nov 07	5 to 10 Dec 07	3 Dec 07	25 Oct 07	29 to 30 Nov 07
Harvesting time	10 Feb to 20 march 08	3-13 Feb, 08	28 Nov 07 to 13 Jan 08	10 to 27 Mar 08	20 Jan to 25 Feb 08	10 Jan to 2 Feb	6 to 31 Mar	27 Feb to 25 march 08	26 Dec. 07 to 31 Mar. 08	20 Feb To 31 Mar 08
Fertilizer dose	P-20, K-160, S - 35	P-60,K-75, S-41, Zn-12, B-2	FRG 2005	P-75,K-95, S-20, Zn-4, B-1	P-50,K-130, S-20, B-2	P-50, K-108, S-21 & CD 5 t/ha	P-80,K-100, S-18, Zn-1, B-1	FRG, 2005	FRG, 2005	P-40,K-140, S-30, Zn-4, B-1

Results and Discussion

TANGAIL

The yield and yield contributing characters are presented in Table 2. Results reveal that the significant variation was found in case of number of fruits per plant. The highest number of fruits per plant (32) was recorded from recommended dose of N as USG which was statistically at par with plots having recommended prilled urea (28) and 10% less than recommended dose of N as USG (31). The highest fruit yield (59.70 t/ha) was obtained from plants treated with recommended dose of N as USG which was identical to plots having 10% less than recommended dose of N as USG (55.18 t/ha) but significantly different from other treatments. The lowest fruit yield (46.43 t/ha) was recorded from 20% less recommended dose of N as USG. Rahman *et al.* (2004) also reported that tomato plants treated with 10% less than recommended dose of N as USG produced more fruit yield in tomato and economic return compared to that of recommended prilled urea. The similar trend was observed in different yield parameters and fruit yield at Ghatail (Table 2). Fruit yield at Ghatail (66.69 t/ha) was higher than that of Madhupur (59.70 t/ha) which might be due to the variation in location and agronomic management practice. The results indicate that 10% less recommended dose of N as USG gave the higher fruit yield than that of recommended dose of prilled urea.

Cost and return analysis

Table 3 reveals that the highest net return (Tk. 246508/ha for Madhupur and Tk.284953/ha for Ghatail) was obtained from recommended dose of N as USG treated plots. Higher BCR was also obtained from the same treatment. Even the plots treated with 10% less than recommended dose as USG was also higher in net return than those of having recommended dose of N as prilled urea. Similar findings were reported by Rahman *et al*. (2003) in the case of Tomato that agreed with the present results.

BARIND, RAJSHAHI

Maximum fruit yield (48.35 t/ha) was recorded from T_2 that is identical to T_3 (44.81 t/ha). This phenomenon may be due to the cumulative effect of the highest number fruits/plant (45.25), the highest fruit weight/plant (1.95 kg), the highest unit fruit weight (50.15 g), the horizontal fruit dia (4.16 cm) and the vertical fruit dia (4.43 cm). Lower fruit yield of tomato (38.73 t/ha) was obtained from T_1 (38.83 t/ha) (Table 4).

Cost and return analysis of tomato was presented in Table 5. From economic point of view, the maximum gross margin (Tk. 254054/ha) was observed in T_2 followed by T_3 (Tk. 233423/ha) that is higher than T_1 (Tk. 196896/ha).

Farmers' reaction

- Farmers are pleased to get high yield
- Comparatively large size fruit were obtained by using USG
- Farmers used less labor and low amount of fertilizer for tomato cultivation by using USG; so they earned more profit.

SHERPUR

The result revealed that (Table 6) the number of fruits/plant found highest from the rec. dose of N as USG which was statistically similar to prilled urea and 10% less of USG. The 20% less USG produced the second highest number of fruits/plant. The highest fruit weight/plant was recorded from rec. N as USG was identical to prilled urea and 10% less USG. The 20% less USG produced the second highest fruits weight/plant. The fruit yield/plant was found highest in rec. N as USG. It was statistically different from other four treatments. However, the highest fruit yield was obtained from recommended N as USG (76.6 t/ha) and was statistically identical to 10% less than recommended dose of N as (74.2 t/ha), 20% less than recommended dose of N as USG (71.8 t/ha) and also to the recommended dose of N as prilled urea (67.9 t/ha).

Cost and return analysis

Regarding economic return, it was revealed that the highest gross return (Tk.383000/ha), net return (Tk.284367/ha) and BCR (3.88) was obtained from recommended dos of N as USG.

KENDUA, NETRAKONA (UNDER KISHOREGANJ)

Table 8 reveals that the number of fruits/plant was recorded from treatment T_3 followed byT_2. Similar trend was followed in case of individual fruit weight and fruit weight/plant. The yield of tomato was low due to severe disease infestation in the field. However, higher yield of tomato (62.10 t/ha) was obtained from 10 % less of recommended dose of N as a source of USG, which was statistically identical to T_2 treatments. It might be due to cumulative effects of number of fruits/plant and individual fruit weight. The lowest yield of tomato (42.93 t/ha) was observed in recommended N as prilled urea (T_1) treatment due to lower number of fruits /plant and individual fruit weight.

Cost and return analysis

The highest gross return (Tk.621000 t/ha) and gross margin (Tk. 558220/ha) was calculated from (T_3) 10 % less of recommended N as USG, which was very close to recommended N as USG (T_2). It is also noted that even (T_4) 20 % less of recommended N as USG showed higher economic benefit over (T_1) recommended prilled urea (Table 9).

NETRAKONA SADAR (UNDER MYMENSINGH)

From Table 10 it is evident that plant height, weight of fruits/plant and yields were statistically significant. The highest number of fruits/plant (27.9), weight of fruits/plant (1.33 kg) and fruit yield (44.22 t/ha) were obtained from 10% Rec. dose of N as USG. Other USG treated plots also gave higher yield (41.29-42.29 t/ha) than the Rec. dose of N as prilled urea. The results indicated that it is better to use USG in tomato than that of prilled urea. It also indicated that 10-20% less N as USG is better than prilled urea. Table 11 indicates the economic performance of tomato as influenced by USG and prilled urea. The treatment of 10% less Rec. dose of N as USG gave highest gross return (Tk. 442200/ha), gross margin (Tk.396362/ha) and benefit cost ratio (9.65). Rec. dose of prilled urea gave the lowest gross return (Tk.404900/ha) and gross margin (Tk.359360). Thus, the results indicate that for tomato cultivation 10-20% N can be saved and also better yield and economic return can be obtained if the crop is grown with N as USG instead of using it as prilled urea.

Farmers' reaction

Farmers are interested to use USG but it should be available to them. The farmers' are also need easy and cheap application method for USG.

NOAKHALI

Different parameters like, plant height, branches/plant, cluster/plant, no. of fruit/kg did not differ significantly among treatments. But number of fruits per plant and fruit yield per hectare was differed significantly. The highest no. of fruits/plant was recorded from T_1 which was identical to T_1 and T_3. Fruit size was bigger in recommended USG where 14.10 fruits contributed to be per kilogram. Since the number of fruit per plant and fruit size were higher in recommended USG treatment, fruit yield (77.01 t/ha) of this treatment was significantly higher followed by 10% less recommended dose of nitrogen as USG (T_3).

Regarding cost and return, higher gross return, net return and BCR were obtained from the treatment of recommended dose of nitrogen as USG were Tk. 462060/ha, Tk. 360118/ha and 4.53, respectively followed by 10% less recommended dose of nitrogen as USG (Table 13).

Farmers' reaction

- Better for yield and economic return
- Time consuming and laborious in application
- Unavailability of USG in local market

PABNA

Yield contributing characters and yield influenced significantly due to application of urea super granule except weight fruit^{-1}(Table 14). The maximum weight fruits^{-1} and fruit weight plant^{-1} was attained with 20% less than of recommended N as USG while the lowest performance was recorded in recommended N as prilled urea. The highest fruit yield was obtained from 20% less than recommended N as USG which was followed by 10% less than of recommended N as USG and rec. N as USG. This result indicated that the application of USG even 20% less than of recommended dose might have significant contribution to optimum growth and development of tomato plants which resulted maximum weight per fruits and fruit weight per plant and the highest fruit yield. Regarding economic return, the maximum gross margin was achieved with the application of 20% less than of recommended N as USG followed by 10% less than of recommended N as USG. The lowest economic return was recorded in rec. N as prilled urea (Table 15).

Farmers' reaction

- One time application resulted in better crops.
- Comparatively green plants in USG treated plots than prilled urea treated plots.
- Less cost for urea fertilizer (if I apply at least 10% less USG).
- Higher curd yield with USG application.
- Less weed infestation in USG treated plots

PATUAKHALI

Yield and yield attributes of tomato as influenced by USG was presented in Table 16. Treatment T_2 produced the highest number of fruits/plant which was statistically identical to T_3 followed by T_1. Treatment T_4 gave the lowest number of fruits/plant. The highest fruit weight/plant was obtained from T_2 followed by T_3 and T_1. Individual fruit weight also showed the same trend as fruit weight/plant. The highest fruit yield ha^{-1} was obtained from T_2 followed by T_3 and T_1 and the lowest yield was observed in T_4. It is found that 10% less N could produce similar yield as 100% recommended dose of N as prilled urea.

Cost and return analysis showed that maximum gross return, net return and BCR were calculated from rec. dose of N as USG followed by 10% less of N as USG.

Farmers' reaction

- Farmers are very much interested to use USG in Tomato.
- Unavailability of USG is a major problem.

RANGPUR

Table 18 reveals that the highest fruit yield (58.4 t/ha) was obtained from treatment T_4 followed by T_2 and T_3. The lowest yield was recorded from prilled Urea. From cost and return analysis it was found that the highest gross margin Tk. 231974/ha was found from the same treatment (20%<rec.). It seems that USG has positive and relatively long-term effect on soil and tomato than prilled urea. It is indicated that the efficiency of USG is found better over prilled urea.

Farmers' reaction

Farmers are convinced by T_4 (20% <Rec. N as USG) treatment for tomato production due to high yield, big size and economic return. But they are not satisfied due to higher cost of USG and application cost.

SYLHET

MLT site, Sunamganj: The highest fruit yield was found from USG rec. dose (81.89 t/ha) which was statistically identical with USG 10% less than rec. dose (80.06 t/ha) followed by USG 20% less than rec. dose (75.69 t/ha). This was happened probably due to higher no. of fruit/plant. Yield of tomato was increased significantly due to application of USG over prilled urea. Regarding economics (Table 19), the higher returns were also obtained from USG treatments. Therefore, using USG instead of prilled urea could save 10-20% nitrogenous fertilizer. From the results, it was clear that there were no significant differences between the treatments USG rec. dose and USG 10% less than rec. dose regarding yield and economic return. Therefore, using 10% less USG from the rec. dose could save the fertilizers minimizing the crisis of fertilizers and also reducing farmers' production cost effectively. Higher net return was obtained from the application of USG at recommended dose.

Farmers' reactions

- Farmers opined that USG is more effective and profitable than that of normal prilled urea.
- Less labour intensive as USG was placed only once and weed infestation was also less.
- The growth was uniform and quality was better than that of normal prilled urea.
- Farmers are interested to apply USG if it is available in the market.

Conclusion

The application of 10-20% less than recommended N as USG showed significant response on the yield attributes and fruit yield of tomato. It can be concluded that USG application even with 10-20% less than recommended N as USG increases the nitrogen use efficiency by the plants which results in optimum plant growth for maximizing yield and economic return in comparison to prilled urea. Therefore, it may be recommended for large-scale production in greater extrapolation areas.

References

Anonymous, 2003. Application of Urea Super granule (USG) in vegetable crops. A Profitable Technology. pp. 1-10. Bangladesh Agril. Res. Institute and SFFP. Dept. Agril. Ext.

Anonymous. 2004. "Statistical Year Book of Bangladesh". Bureau of Statistics. Dkaka.

Anonymous. 2006. Shabgi Utpadaner Unnato Kalakaushal. Bangladesh Agril. Res. Institute. P-23

Crasswell, E. T. and S. K. De. Datta, 1980. Recent Development in Research on Nitrogen fertilizers for Rice. International Rice research Institute. Res. Paper series No. 49.1-11.

Nazrul, M.I., M.J. Hossain, M.Y. Ali and R.U. Shamim. 2006. Shabgi Chashe Ghuti Urear Baboher 'Ekti Labjanak Prajukti. Bangladesh Agril. Res. Institute. P-8.

Rahman, M. A., M. H. Akand, M. M. Rahman and M. Y. Ali. 2003. Influence of Urea Super Granule and Prilled Urea application on the Tomato Production in the Young Jamuna Brahmaputra Flood Plain Soil. J. Agric. Educ.Technol. 5 (1&2). 7-10.

Rahman, M. A., M. H. Akand, M. M. Rahman and M. Y. Ali. 2004. Effect of Urea Super Granule and Prilled Urea application on agro-economic performance of Potato. J. Agric. Educ. Technol.6 (1&2). 17-20.

Savant, N. K.; S.S. Dhane and, S. C. Talashilkar. 1991. Fertilizer News. International Fertilizer development Center, Muscle Sholas, Albama and I. S. A. 36(3). 19-25.

Table 2. Effect of USG on the performance of Tomato at the MLT site, Madhupur and Ghatail, Tangail during Rabi 2007-08

Treatments	Madhupur			Ghatail		
	Plant height (cm)	Fruits/plant (no.)	Fruit yield (t/ha)	Plant height (cm)	Fruits/ plant	Fruit yield (t/ha)
T_1	63.53	28.14	48.14	54.63	24.00	50.24
T_2	62.87	31.58	59.70	66.87	27.50	66.69
T_3	62.23	30.82	55.18	63.87	25.00	60.51
T_4	64.48	26.65	46.43	59.07	23.50	49.09
LSD (0.05)	5.54	4.30	5.40	5.72	1.89	8.60
CV (%)	7.1	11.9	8.5	7.6	6.2	12.3

Table 3. Cost and return analysis of Tomato cultivation as influenced by USG at the MLT site, Madhupur and Ghatail, Tangail during Rabi 2007-08

Treatments	Madhupur				Ghatail			
	Gross return (Tk.. /ha)	Total production cost (Tk./ha)	net return (Tk./ha)	BCR	Gross return (Tk./ha)	Total production cost (Tk./ha)	net return (Tk./ha)	BCR
T_1	264770	81620	183150	3.20	276320	81620	194700	3.39
T_2	328350	81842	246508	4.01	366795	81842	284953	4.48
T_3	303490	81550	224940	3.72	332805	81550	251255	4.80
T_4	255365	81257	174108	3.14	269995	81257	188738	3.32

Price (Tk./kg): Tomato. 5.50, Urea= 6.00, USG= 6.50 TSP= 30.00, MP = 25.00, Gypsum= 7.00

Table 4. Effect of USG on the yield and yield attributes of tomato at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Treat	Plant height (cm)	Fruits/ plant (No)	Fruit wt/ plant (kg)	Unit fruit wt (g)	Hori. dia (cm)	Verti. dia (cm)	Yield (t/ha)
T_1	100.60	38.25	1.66	41.22	4.06	4.39	38.83
T_2	100.80	45.25	1.95	50.15	4.16	4.43	48.35
T_3	99.15	42.50	1.88	45.86	3.94	4.23	44.81
T_4	98.55	39.25	1.85	43.29	4.03	4.18	39.90
LSD (0.05)	NS	4.13	0.19	5.05	0.16	0.21	7.02
CV (%)	3.78	6.56	7.00	7.35	2.58	3.26	10.81

Table 5. Cost and return analysis as affected by USG on tomato at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Treat	Yield (t/ha)	Gross Return (Tk./ha)	Total Variable cost (Tk./ha)	Gross Margin (Tk./ha)
T_1	38.83	240746	43850	196896
T_2	48.35	299770	45716	254054
T_3	44.81	277822	44399	233423
T_4	39.90	247380	43559	203811

Table 6. Effect of USG on yield and yield attributes of tomato at the FSRD site, Kushumhati, Sherpur during 2007-08

Treatment	Plant height (cm)	Fruits/plant (no.)	Fruit weight (g)	Fruit yield/ plant (kg)	Yield (t/ha)
Prilled urea	89.3	31.6 ab	85.6 ab	2.35 b	67.9 ab
N as USG	94.2	33.0 a	89.2 a	2.66 a	76.6 a
10%less USG	93.4	30.8 ab	84.4 ab	2.32 b	74.2 a
20%less USG	93.2	29.8 b	80.2 b	2.30 b	71.8 a
CV(%)	8.90	5.20	10.99	7.88	9.12

Figure in the column having similar letter(s) do not differ significantly

Table 7. Cost and return analysis of tomato as influenced by USG at the FSRD site, Kushumhati, Sherpur during 2007-08

Treatment	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1: Rec. N as prilled urea	339500	98068	241432	3.46
T_2: Rec. N as USG	383000	98633	284367	3.88
T_3: 10% less of rec. N as USG	371000	98238	272762	3.78
T_4:20% less of rec. N as USG	359000	97843	261157	3.67

TVC includes the cost of land preparation, seeds, fertilizer, insecticides, intercultural operations and human labour cost etc.

Price (Tk./kg): Urea=6, USG=7, TSP= 36, MP= 32, Gypsum=7, Zinc sulphate= 120, Borax=40, Cowdung=0.50, tomato= 5.00

Table 8. Effect of USG on yield and yield components of tomato at Kendua MLT site, Netrakona, during rabi 2007-08

Treatments	Fruit/plant (no.)	Individual fruit weight (g)	Fruit weight/plant (kg.)	Fruit yield (t/ha)
T_1: Rec. N as prilled urea (276 kg/ha)	20.60	106	2.53	42.93
T_2: Rec. N as USG (276 kg/ha)	25.20	112	2.83	56.31
T_3: 10 % less of rec. N as USG (248 kg/ha)	27.20	118	2.88	62.10
T_4: 20 % less of rec. N as USG (221 kg/ha)	23.70	111	2.80	48.15
LSD (0.05)	3.05	3.75	0.25	6.17
CV (%)	16.39	8.18	19.64	16.22

Table 9. Cost and return analysis of tomato as affected by USG at Kendua MLT site, Netrakona, during rabi 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Rec. N as prilled urea (276 kg/ha)	429300	62855	366445
T_2: Rec. N as USG (276 kg/ha)	553100	63104	489996
T_3: 10 % less of rec. N as USG (248 kg/ha)	621000	62780	558220
T_4: 20 % less of rec. N as USG (221 kg/ha)	481500	62455	419045

Price (Tk./kg): Urea= 6, TSP= 19, MoP= 16, Gypsum= 6, Zinc sulphate= 80, Boric acid= 280, Tomato= 10

Table 10. Yield and yield contributing characters of tomato as influenced by application of Urea Supper Granule (USG) at the MLT site, Netrakona, during rabi, 2007-08

Treatment	Plant height (cm)	No. of branches/plant	No. of fruits/plant	Wt. of fruits/plant (Kg)	Yield (t/ha)
USG (Rec.)	80.80	15.1	27.0	1.27	42.29
USG (10%<Rec.)	82.80	15.9	27.9	1.33	44.22
USG (20%<Rec.)	78.24	14.3	26.4	1.24	41.29
Prilled urea (Rec.)	76.52	13.9	25.6	1.22	40.49
LSD (0.05)	4.56	NS	NS	0.08	1.73
CV (%)	4.16	11.38	7.03	4.60	3.98

Table 11. Cost benefit analysis of tomato at the MLT site, Netrakona Sadar during rabi 2007-08

Treatment	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)
USG (Rec.)	422900	46140	376760
USG (10%<Rec.)	442200	45838	396362
USG (20%<Rec.)	412900	45730	367170
Prilled urea (Rec.)	404900	45540	359360

Price (Tk./kg): Tomato= 10.00

Table 12. Effect of Urea Super Granule (USG) on the yield and yield attributes of Tomato at the FSRD site, Noakhali, during 2007-08

Treatment	Plant height (cm)	Branch/ plant (no.)	Cluster/ plant (no.)	Fruit/plant (no.)	Fruit/kg (no.)	Fruit yield (t/ha)
Prilled urea(RD)	58.9	4.21	6.38	23.27	15.14	64.41
USG (RD)	53.9	4.56	6.85	25.90	14.10	77.01
USG (10% less)	55.4	5.10	6.33	22.30	14.24	66.06
USG (20% less)	51.6	4.49	6.45	21.48	14.93	60.23
CV (%)	12.97	13.15	8.79	10.08	8.32	9.43
LSD (0.05)	NS	NS	NS	3.746	NS	10.09

Table 13. Effect of USG on cost and return of tomato at FSRD site, Noakhali during 2007-08

Treatment	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea(RD)	386460	101820	284640	3.80
USG (RD)	462060	101942	360118	4.53
USG (10% less)	396360	101537	294823	3.90
USG (20% less)	361380	101230	260150	3.57

Market price (Tk./kg). Tomato= 6, Urea= 7, USG= 7.50, TSP= 34, MoP= 30, Gypsum= 7, $ZnSO_4$= 100

Table 14. Effect of USG on upland crop Tomato during the rabi season of 2007-08 at the MLT site, Pakshi. Pabna

Treatments	Fruits/plant (no.)	Fruit weight /plant (kg)	Weight/ fruit (g)	Fruit yield (t/ha)
T_1: Recom. N as prilled urea	44.44	3.90	88.53	93.70
T_2: Recom. N as USG	49.67	4.15	83.68	99.60
T_3: 10% less of recom. N as USG	48.19	4.18	86.86	99.80
T_4: 20% less of recom. N as USG	53.17	4.35	86.27	109.10
CV (%)	9.47	5.62	8.83	10.21
LSD (0.05)	10.96	0.06	NS	11.82

Table 15. Cost and return analysis of upland crop Tomato as affected by USG during the rabi season of 2007-08 at the MLT site, Pakshi, Pabna.

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1:Recommended N as prilled urea	632475	76893	555582
T_2: Recommended N as USG	672300	77168	595132
T_3: 10% less of recommended N as USG	673650	76810	596840
T_4: 20% less of recommended N as USG	735750	76452	659298

Price (Tk./kg): Urea 6 USG 6.50, TSP 24, MP 25 Gypsum 6, Zinc sulphate 60, Borax 40, Tomato 06.75

Table 16. Effect of USG on tomato yield and yield attributes at Razakhali, Patuakhali during 2007-08

Treatments	Fruits/plant (No.)	Fruits weight/ plant (kg)	Individual fruit weight (g)	Fruit yield (t/ha)
T_1	47 b	3.2 b	67.58 b	89.9 b
T_2	55 a	4.7 a	87.86 a	98.2 a
T_3	52 a	3.6 b	68.90 b	90.3 b
T_4	38 c	2.2 c	58.80 c	74.1 c
CV (%)	8.23	6.91	7.36	10.65

Table 17. Cost and return analysis of tomato as affected by USG during rabi, 2007-08 at Razakhali, Patuakhali

Treatments	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1	539400	129690	409710	4.16
T_2	589200	130930	458270	4.50
T_3	541800	127580	414220	4.25
T_4	444600	119650	324950	3.72

Table 18. Effect of USG on yield and economics of tomato at Ulipur MLT site during 2007-08, OFRD, Rangpur

Treatment	Fruit yield (t/ha)	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1:(Rec. prilled)	33.9 c	169800	57375	11242
T_2:(Rec. USG)	51.5 b	257800	61458	196342
T_3:(10% <Rec. N as USG)	48.3 b	241250	60792	180458
T_4:(20% <Rec. N as USG)	58.4a	292100	60126	231974
CV (%)	6.1	-	-	-

Price (Tk./kg): Urea 6, USG 7, TSP 32, MP 27, Gypsum 8, Zinc sulphate 100, Boric acid 130, Tomato 5

Table 19. Effect of urea super granule (USG) on the yield and yield attributes of Tomato at the MLT site, Sunamganj, 2007-08

Treatment	Plant height (cm)	Branch/ plant (no.)	Cluster/ plant (no.)	Fruit/ plant (no.)	No. of Fruit/kg	Yield (t/ha)
Prilled urea (Rec.)	86.00	4.67	10.40	39.23	12.67	67.45
USG (Rec.)	93.93	5.93	12.03	42.77	11.86	81.89
USG (10%<Rec.)	92.00	5.53	11.53	41.93	12.09	80.06
USG (20%<Rec.)	90.00	5.17	11.20	39.57	12.38	75.69
Farmers practice	85.13	4.77	10.70	34.73	12.98	63.98
CV (%)	5.52	6.81	5.94	8.75	8.12	10.54
LSD (0.05)	0.1966	0.4534	0.6216	0.869	NS	2.706

Table 22. Effect of USG on the economics performance of Tomato at the MLT site, Sunamganj during 07-08

Treatment	Yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Gross margin (Tk./ha)	BCR
Prilled urea (Rec)	67.45	674500	107205	567295	6.29
USG (Rec)	81.89	818900	107770	711130	7.59
USG(<10%Rec)	80.06	800600	105499	695101	7.59
USG(<20%Rec)	75.69	756900	103228	653672	7.33
Farmers practice	63.98	639800	107838	531962	5.93

Market price (Tk./kg). Tomato=10, Urea=6, USG=6.30, TSP=16, MP=16, Gypsum=6, $ZnSO_4$=45

Effect of Urea Super Granule (USG) As a Source of Nitrogen on Brinjal

Abstract

An experiment was conducted at the farmers' field of Tangail and Rangpur during 2007-08 in medium high land irrigated situation under AEZ 9 and AEZ 3to find out optimum and economic dose of urea super granule (USG) on brinjal production. The trial was laid out in RCB design with six dispersed replications. Four levels of N viz. T_1: Recommended dose of N as prilled urea, T_2: Recommended dose of N as USG, T_3: 10% less than recommendation dose as USG and T_4: 20% less than recommendation dose as USG were considered as four treatments. The highest fruit yield was found from plants treated with recommended dose of N as USG followed by 10% less of N as USG. Recommended dose of N as prilled urea and 20% less than recommended dose of N as USG provided similar yield in Tangail. But the yield obtained from 20% less than recommended dose as USG was significantly higher than the recommended dose of N as prilled urea. The highest gross margin (Tk. 173616/ha) was recorded from recommended dose of N as USG treated plots.

Introduction

Nitrogen is an important nutrient element for crop production. It is needed in each and every crop in large quantity. Among the all fertilizers, the efficiency of nitrogenous fertilizer is lowest due to various losses (gaseous, leaching, run-off etc.). It is reported that about 40% of applied N is used by the crop and the rest amount is lost from the soil. Nitrogen is mostly used as periled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The loss will be minimized if it applied as super granule to the reduced zone. Moreover, the crisis of urea is a burning issue throughout the country. The urea super granule (USG) will release nitrogen slowly to the crop for longer period of time. Thus the N use efficiency as well as yield of the crop will be increased. The farmers are already using it in Boro rice. In some areas it is used in different upland vegetables and fruit crops such as brinjal, cabbage, cauliflower, banana, tomato etc. The farmers are already using it in Boro rice. In some areas it is used in different upland vegetables and fruit crops such as brinjal, cabbage, cauliflower, banana, tomato etc.

Brinjal is one of the most profitable crops. The performance of USG on this crop is not yet ascertained. However, the farmers are already using it in their crop. According to Crass Well and De Datta (1980) broadcast application of urea on the surface soil causes loss up to 50% but point placement of USG in 10 cm depth may result negligible loss. Savant, *et al.* (1991) also reported that 8-10 cm depth of placement of USG in rice field can save 30% nitrogen than that of prilled urea. It is also reported that use of USG can save 10-20% nitrogenous fertilizer cost in upland crops (Anon, 2003). Therefore, it is very important to evaluate the efficiency of USG on Brinjal cultivation. Hence the experiment was undertaken to find out the optimum and economic dose of USG for brinjal cultivation.

Materials and Method

The experiment was conducted at Tangail and Rangpur during 2007-08 to find out the optimum and economic dose of USG in brinjal production. The trial was laid out in RCB design with six dispersed replications (farmers). It was conducted in ICM/IPM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. The four treatments were considered as T_1: Recommended dose of N as prilled urea for HYG, T_2: Recommended dose of N as USG for HYG, T_3: 10% less than recommended dose of N as USG for HYG and T_4: 20% less than recommended dose of N as USG for HYG. Fertilizer dose for each treatment were calculated on the basis of soil test under different AEZ. Crop management practices done under different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary. Ten randomly selected plants from each plot were considered for different data collection. Collected data were analyzed statistically following Crop Stat /Mstat-C analytical package. Cost and return analysis was done also.

Table 1. Crop management practices done in different locations

Location	Tangail	Rangpur
Variety	Local (Kalo begun)	Khatkhatia
Unit plots size	10 m x 8 m	7.5 m x 5.4 m
& spacing	75 cm x 60 cm	75 cm x 60 cm
Planting time	3 Dec 07	28 to 30 Nov 07
Harvesting time	28 Feb. to 15 May 08	20 Feb-5 May 08
Fertilizer dose (kg/ha)	TSP-100, MP-200	P-25, K-24, S-35, Zn-2, B-1

Results and Discussion

TANGAIL

The yield and yield contributing characters are presented in Table 2. Results revealed that maximum number of fruits per plant (57) was obtained from plants treated with recommended dose of N as USG (T_2), which was statistically similar to those plots treated with 10% less than recommended dose as USG (T_3). The lowest number of fruits (50/plant) was borne by the plots having recommended dose of N as prilled urea (T_1) and it was at par with those of plots obtained 20% less than recommended dose as USG (T_4). The significant variation was found in case of number of fruit length. The highest fruit length (13.1 cm) was recorded in T_2 and that of the lowest (11.3 cm) from T_4. The highest fruit weight per plant (62.1 g) was also recorded T_2 which was statistically at par with T_3. The highest fruit yield (40.31 t/ha) was also obtained from the same treatment which was similar to T_3. The lowest fruit yield (31.11 t/ha) was recorded in T_4 and it was at par with T_1 recommended dose of N as prilled urea (31.74 t/ha). Rahman *et al.* (*2*004) also reported that 10% less than recommended dose of N as USG produced higher fruit yield and economic return in brinjal compared to that of recommended prilled urea. The results indicate that 10% less than recommended dose of N as USG gave the higher fruit yield than that of recommended dose of N as prilled urea.

Cost and return analysis

Table 3 reveals that the highest gross return (Tk. 241860/ha) was recorded from plots having recommended dose of N as USG (T_2) followed by 10% less than recommended dose of N as USG treated plots (Tk. 218820/ha). The lowest gross return (Tk. 186660/ha) was obtained in plots treated with 20% less than recommended dose as USG, though it was vary close to plots obtained recommended dose of N as prilled urea (Tk. 190440/ha). Variable cost in recommended dose of N as USG was higher than the other treatments, because price of USG was higher than prilled urea. The highest gross margin (Tk. 173616/ha) was also recorded from recommended dose of N as USG plots.

Farmers' reaction

Farmers of the FFS opined that they would apply USG in coming season if it would be available in the market.

RANGPUR

Table 4 reveals that the highest fruit yield (30.0 t ha^{-1}) of brinjal was obtained from recommended dose of N as USG (T_2) followed by T_3 (28.3 t ha^{-1}) treatment. The lowest yield was recorded from T_1 treatment. It seems that USG has positive and relatively long-term effect on soil and brinjal than prilled urea, which enhanced bigger size of brinjal. It is indicated that the efficiency of USG is found better over prilled urea. From cost and return analysis it was found that the highest gross return Tk. 360000/ha and gross margin (Tk. 292750/ha) given by T_2 treatment.

Farmers' reaction

- Yield was higher in Rec. USG plot
- Greenish colour was longer duration in USG plot
- Farmers were not satisfied due to higher price and unavailability of USG

Conclusion

From the results it may be concluded that usage of urea super granule (USG) is better for brinjal cultivation and even 10 % less than recommended dose of N as USG is more profitable than recommended dose of N as prilled urea. Therefore, it may be recommended for large scale production in greater extrapolation areas.

References

Anonymous, 2003. "Application of Urea Super granule (USG) in vegetable crops. A Profitable Technology". Pp. 1-10. Bangladesh Agril. Res. Institute and SFFP.Dept. Agril. Ext.

Anonymous. 2004. "Statistical Year Book of Bangladesh". Bureau of Statistics. Dkaka.

Anonymous. 2006. Shabgi Utpadaner Unnato Kalakaushal. Bangladesh Agril. Res. Institute. P-14

Crasswell, E. T. and S. K. De. Datta, 1980. Recent Development in Research on Nitrogen fertilizers for Rice. International Rice research Institute. Res. Paper series No. 49.1-11.

Nazrul, M.I., M.J. Hossain, M.Y. Ali and R.U. Shamim. 2006. Shabgi Chashe Ghuti Urear Baboher 'Ekti Labjanak Prajukti' Bangladesh Agril. Res. Institute. P-7.

Rahman, M. A., M. H. Akand, M. M. Rahman and M. Y. Ali. 2003. Influence of Urea Super Granule and Prilled Urea application on the Tomato Production in the Young Jamuna Brahmaputra Flood Plain Soil. J. Agric. Educ.Technol. 5 (1&2). 7-10.

Rahman, M. A., M. H. Akand, M. M. Rahman and M. Y. Ali. 2004. Effect of Urea Super Granule and Prilled Urea application on agro-economic performance of Potato. J. Agric. Educ. Technol.6 (1&2). 17-20.

Savant, N. K.; S.S. Dhane and, S. C. Talashilkar. 1991. Fertilizer News. International Fertilizer development Center, Muscle Sholas, Albama and I. S. A. 36(3). 19-25.

Table 2. Effect of USG on the performance of Brinjal (*var. Local*) at the MLT site, Ghatail, Tangail during Rabi 2007-08

Treatments	Plant height (cm)	No. of fruit/ plant	Fruit length (cm)	Fruit diameter (cm)	Fruit wt./plant (g)	Yield (t/ha)
T_1. Rec. dose of N as prilled urea	76.26	50	11.5	3.75	52.1	31.74
T_2. Rec. dose of N as USG	78.41	57	13.1	3.97	62.1	40.31
T_3. 10 % less than rec.dose as USG	77.41	54	12.4	3.85	59.1	36.47
T_4. 20% less than rec. dose as USG	76.02	51	11.3	3.67	51.1	31.11
LSD (0.05)	4.79	5.39	2.34	0.23	4.15	3.79
CV (%)	3.1	5.1	9.7	3.0	3.7	5.4

Table 3. Cost and return analysis of brinjal cultivation with USG at the MLT site, Ghatail, Tangail during Rabi 2007-08

Treatments	Gross return (Tk. /ha)	TVC (Tk./ha)	Gross margin (Tk./ha)
T_1. Rec. dose of N as prilled urea	190440	61826	122314
T_2. Rec. dose of N as USG	241860	68244	173616
T_3. 10 % less than rec.dose as USG	218820	68055	150765
T_4. 20% less than rec. dose as USG	186760	67866	118795

Price of Brinjal (Tk./kg). 6.00, Price of fertilizers (Tk./kg). Urea= 6.00, USG= 6.40 TSP= 21.00, MP = 20.00

Table 4. Effect of USG on yield, yield attributes and economics of Brinjal at Ulipur MLT site during 07-08 OFRD, Rangpur

Treatment	Fruit/ Plant (no)	Wt. fruit/ plant (Kg)	Fruit yield (t/ha)	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1:(Rec. N as prilled)	15.2 c	1.48 b	22.2 d	266400	60500	205900
T_2:(Rec. N as USG)	20.2 a	1.95 a	30.0 a	360000	67250	292750
T_3:(10% <Rec. N as USG)	18.1b	1.68 b	28.3 b	339600	64500	275100
T_4:(20% <Rec. N as USG)	16.4bc	1.62 b	26.0 c	312000	63000	249000
CV (%)	9.1	12.0	3.9	-	-	-
F-test	**	*	**	-	-	-

Price (Tk./kg): Urea= 6, USG= 7, TSP= 32, MP= 27, Gypsum= 8, Zinc sulphate= 100, Boric acid= 130, Brinjal= 12

Effect of Urea Super Granule (USG) As a Source of Nitrogen on Potato

Abstract

An experiment was conducted at the framers' field of Comilla, Rangpur, Shyampur (Rajshahi), Bogra and Kendua, Netrakona (under Kishoreganj) during rabi season of 2007-08 to evaluate the effect of USG on potato and to find out the optimum and economic dose of USG for potato cultivation. There were no significant difference in tuber weight due to application of different amount of USG in Comilla, Rajshahi and Bogra but highest yield was recorded from the application of recommended N as USG in Rangpur.

Introduction

Nitrogen is an essential element for the maximization of yield and needed in large quantity in each and every crop. The efficiency of nitrogenous fertilizer is lowest due to various losses (gaseous, leaching, run off etc). Among all the fertilizers, it is reported that about 40% of applied N is used by crop and rest amount is lost from the soil. Nitrogen is mostly used as the form of prilled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The can be minimize if it is applied as super granules to the reduced zone. Moreover crisis of urea is a burning issue throughout the country. Farmers usually grow potato with high amount of N, P, K, S, fertilizers. USG is already proven in rice but not in maize and vegetables. So the experiment was undertaken to know the effect of USG on potato yield.

Materials and methods

The experiment was conducted at farmer's field among ICM/IPM club members of Comilla, Rangpur and Shyampur, Rajshahi Bogra and Kendua, Netrakona (under Kishoreganj) during rabi season of 2007-08. The trial was laid out in RCB design with six dispersed replications. N was applied as four treatments viz. T_1: Recommended dose of N as prilled urea for HYG, T_2: Recommended dose of N as USG for HYG, T_3: 10% less than recommended dose of N as USG for HYG and T_4: 20% less than recommended dose of N as USG for HYG. USG was applied in the rows. Fertilizer dose for each treatment were calculated on the basis of soil test under different AEZ. Crop management practices done under different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary. Data on plant height, plants/m^2, shoots/plant, tuber/plant, tuber weight/plant, yield/plot and yield (t/ha) were recorded.

Table 1. Crop management practices done in different locations

Location	Comilla	Rangpur	Shyampur, Rajshahi	Bogra	Kendua, Netrakona
Unit plot size & spacing	8m x 5m 60 cm x 15cm	8m x 5m 60 cm x 15 cm	8m x 5m 60 cm x 15 cm	4.25 m x 5.4 m	8m x 5m
Planting time	15-20 Dec. 07	23 to 18 Dec 07	30 Nov. to 10 Dec. 07	30 Nov. 07	7-9 Dec 08
Harvesting time	1 to 6 march 08	29 Jan to 6 March 08	5-15 March 08	25 February 08	3-5 March 08
Fertilizer dose (P-K-S-Zn-B kg/ha)	As per TCRC, BARI	45-130-15-3.5-1	60-64-8-1.5-1.3	26-63-13-4-1	45-130-20-0-2

Results and Discussion

COMILLA

Daudkandi: Yield and yield attributes of potato at Daudkandi upazila are given in Table 2. There were no significant difference in shoot number, tuber number, tuber weight per plant and yield (t/ha). Numerically shoot per plant was higher in USG 10% less dose but higher tuber number per plant was found in USG 20% less dose. Higher tuber weight per plant and yield was found in prilled urea recommended dose; lower yield was found in USG 10% less then rec. dose.

Homna: Yield and yield attributes of potato in Homna upazila are given in Table 2. Significant differences were observed only in shoot number and tuber number per plant. Highest shoot number (3.13) was found in USG 10% less then recommended dose but tuber weight per plant was higher (142.19) in USG 20% less treated plot. Higher tuber no (3.83) and yield (10.16 t/ha) were observed in urea recommended dose and lowest in USG 10% less then rec. dose.

From average of two locations the potato yield (14.28 t/ha) was lower than the average yield of that locality, it might be due to late planting of potato in that locality and it was due environmental disaster like SIDR which delayed the planting. USG failed to show higher yield advantage over prilled urea in two locations of Comilla.

RANGPUR

MLT site, Domar: The highest yield (36 t/ha) of potato was obtained from USG treatment (T_2) followed by T_1 and T_3 (Table 3). The lowest yield was recorded (28.83 t/ha) from T_4 treatment. In cost and return analysis it was found that the highest gross return, net return and BCR were obtained from USG (T_2 treatment)

SHYAMPUR, RAJSHAHI

The results revealed that (Table 4) the highest plant height was found in T_4 (20% less of recommended N as USG) followed by T_3 (10% less of recommended N as USG) and T_2 (Recommended N as USG) respectively. The treatments T_2 and T_3 are statistically identical. The plant height was observed lowest in T_1 (Recommended N as prilled urea). It indicates that USG has positive effect on growth of crops. Application of different dosages of USG failed to produce significant difference in respect of stem per hill. However, numerically highest stem per hill was found in T_3 (2.67). In case of stem diameter, treatments T_2 (8.71 mm) and T_3 (8.58 mm) produced the highest and identical stem diameter which was similar to T_4 (7.97 mm). It indicated that presence of adequate Nitrogen in T_2 and T_3 treatments enhanced succulence and vegetative growth of potato Buckman and Brady (1980) also reported the same findings. The treatments showed insignificant effect for number of potato/plant. But treatment T_3 (6.53) produced numerically highest no of potato/plant. However, treatments T_2 and T_3 produced bigger grade potato. The highest per plant yield was found in T_3 (0.518 kg) followed by T_2 (0.46 kg) which were statistically similar. The treatment T_2 (0.46) was also similar to T_4 (0.412 kg). The lowest per plant yield was found in T_1 (0.350 kg).

The highest yield was found in T_2 (21.05 t/ha) followed by T_3 (20.74 t/ha) and T_4 (20.43 t/ha) which were statistically identical. The lowest yield was found in T_1 (18.73 t/ha). It seems that USG has positive effect on soil and potato yield than prilled urea by enhancing the bigger size of potato. This indicated better efficiency of USG than prilled urea. Economic analysis (Table 5) showed the highest gross margin (Tk. 140216/ha) was found in recommended N as USG (T_2) followed by 10% less of recommended N as USG (T_3) treatments.

Farmers' reaction

- Yield was higher in USG plots than prilled Urea
- 10-20% less Urea as USG produce higher yield than 100% prilled urea
- Not available in market

BOGRA

Yield and other parameters did not vary significantly among the treatments. However, numerically higher yield was obtained with rec. dose of N as USG treated plots. No. of tubers/plant and weight of tubers/hill also follow the same trend.

Farmers' reaction

Farmer expressed their interest to use USG in potato. They opined that the application of USG is quite lobour intensive compare to prilled urea. They were happy to get satisfactory yield T_2 (Rec. dose of N as USG).

KENDUA, NETRAKONA (UNDER KISHOREGANJ)

The result showed that number of tuber/hill, weight of tuber/hill and tuber yield was significantly influenced by different treatments (Table 7). Plant height was identical in all the treatments. Maximum number of tuber/hill was recorded from recommended dose of N as USG (T_2) followed by 10 % less of N as USG (T_3). Maximum tuber weight (432.30 g/hill) was obtained from T_2, which statistically different from other treatments. The treatments T_1, T_3 and T_4 were statistically identical. The treatment T_2 was produced statistically higher tuber yield (25.31t/ha) followed by 10 % less of N as USG (T_3) due to higher number of tubers/hill and tuber weight/hill. But the treatment (T_1) recommended dose as N as prilled urea gave the lowest tuber yield (22.93 t/ha) due to lower number of tuber/hill and tuber weight/hill.

The highest gross return (Tk.253100/ha) and net return was calculated from T_2, which was very close to T_3. It is also noted that even (T_4) 20 % less of recommended N as USG showed higher economic benefit over (T_1) recommended prilled urea.

Farmers' reaction

Farmers opined that they are interested to cultivate potato with 10 % less of N as USG in next season if USG available in their locality.

Conclusion

From the study it was evident that USG had a significant positive effect on the growth and yield of potato which is encouraging for the farmers. It was found that yield difference was not significant among recommended N as USG (T_2), 10% less USG (T_3) and 20% less USG (T_4). So, farmers can reduce 10-20% urea as USG in potato cultivation. Therefore, 10-20% less use of N as USG may be recommended as extension message.

Table 2. Yield and yield attributes of potato in Comilla during 2007-08

Treatment	Daudkandi				Homna			
	No. of shoots /halum	No. of tuber/ halum	Tuber wt./ halum (g)	Yield (t/ha)	No. of shoots /halum	No. of tuber/ halum	Tuber wt. /halum (g)	Yield (t/ha)
Urea(rec. dose)	2.20	4.60	262	18.41	2.47	3.83	137.21	10.16
USG(rec. dose)	2.13	3.53	180	15.84	2.33	3.53	126.57	9.42
USG(10% less dose)	2.53	4.60	220	15.19	3.13	3.13	126.50	9.31
USG(20% less dose)	2.40	4.93	256	16.84	2.53	3.20	142.19	9.65
CV (%)	19.03	21.17	26.05	11.58	9.62	6.47	6.98	12.12
LSD (5 %)	NS	NS	NS	NS	.050	0.44	NS	NS

Table 3. Effect of USG on yield and economics of potato at the MLT site Domar during 2007-08

Treatment	Yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1:(Rec. prilled)	29.20c	233600	109205	124395	2.14
T_2:(Rec. USG)	36.00a	288000	109260	178740	2.64
T_3:(10% <Rec. N as USG)	31.00b	248000	108013	139987	2.30
T_4:(20% <Rec. N as USG)	28.83c	230640	107820	122820	2.14
CV (%)	5.2	-	-	-	

Potato price Tk.. 8/- per kg .

Table 4. Effect of USG on yield and yield attributes of potato during 2007-08 at the MLT site Paba, Rajshahi

Treatment	Plant height (cm)	Stem/ hill	Stem diameter (mm)	Potato/ plant (no.)	Wt. of potato/ halum	Grade (%)			Yield (t/ha)
						< 28 mm	28-55 mm	> 55 mm	
T_1	44.05	2.53	7.97	5.3	0.35	57.8	30.5	11.7	18.73
T_2	47.38	2.43	8.71	6.4	0.46	55.0	27.4	17.6	21.05
T_3	48.40	2.67	8.56	6.53	0.52	54.5	29.7	15.8	20.74
T_4	51.28	2.50	7.59	5.87	0.41	57.8	27.3	14.9	20.43
CV (%)	4.82	6.81	8.30	15.13	13.38	-	-	-	6.34
LSD(0.05)	2.837	NS	0.839	NS	0.0674	-	-	-	1.79

Table 5. Cost and return analysis of potato as affected by USG at the MLT site Paba, Rajshahi during 2007-08

Treatment	Yield (t/ha)	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1	18.43	187300	70286	117014
T_2	21.05	210500	70284	140216
T_3	20.74	207400	70158	137242
T_4	20.43	204300	70032	134268

Price (Tk./kg): Potato= 10, Urea= 6, TSP= 35, MP= 33, Gypsum= 6, Boric Acid= 120, Zinc Sulphate= 100, CD= 1 and Potato seed = 30.

Table 6**.** Yield and yield attributes of potato as affected by urea super granules (USG) at Goneshpur, Shibganj site during rabi 2007-2008.

Treatments	Plant height (cm)	No. of haulms/ hill (no)	No. of tuber / hill (no)	Weight of tuber / hill (g)	Tuber yield (t/ha)
T_1 : Rec. N as prilled urea	44.6	3.5	8.8	328	21.26
T_2 : Rec. N as USG	46.5	3.9	10.6	346	22.40
T_3 : 10% less of rec N as USG	45.2	3.6	9.2	332	21.77
T_4 : 20% less of rec. N as USG	44.4	3.4	8.5	324	21.06

Table 7. Effect of USG on yield and yield components of potato at Kendua MLT site Netrakona, during *rabi* 2007-08.

Treatments	Plant height (cm)	Tuber/hill (No.)	Tuber weight /hill (g)	Tuber yield (t/ha)	Gross return (Tk./ha)	Total cultivation cost (Tk./ha)	Net return (Tk./ha)
T_1	68.80	5.93	345	22.93	229300	83908	145392
T_2	72.20	7.03	432	25.31	253100	86758	166342
T_3	71.20	6.80	353	25.10	251000	85548	165452
T_4	70.10	6.00	348	24.15	241500	84338	157162
LSD (0.05)	NS	0.765	36.75	0.787			
CV (%)	6.39	9.64	8.08	6.22			

T_1: Rec. N as prilled urea (195 kg/ha), T_2: Rec. N as USG (195 kg/ha), T_3: 10 % less of rec. N as USG (176 kg/ha), T_4: 20 % less of rec. N as USG (156 kg/ha)

Price of input (Tk./kg). Urea: 6, TSP= 19, MoP= 16, Gypsum = 6, Zinc sulphate = 80, Boric acid = 280
Price of output (Tk../kg). Potato = 10

Effect of Urea Super Granule (USG) As a Source of Nitrogen on Hybrid Maize

Abstract

An experiment was conducted in farmers' field Tangail, Rangpur, Comilla, Shyampur (Rajshahi) and Pabna during rabi 2007-08 to find out the optimum and economic dose of USG for hybrid maize production. The trail was laid out in RCB design with six dispersed replication Recommended dose of N as prilled Urea, recommended dose of N as USG, 10% less of recommended dose of as USG and 20% less of recommended dose of as USG were tested in the experiment. Although higher grain yield was obtained from the application of USG as recommended dose but there was no significance difference between prilled urea and 10% less recommended N as USG in Tangail and Rangpur. Yield was not varied among the treatments in Pabna. Higher yield was obtained from the application of 10% less recommended N as USG in Rajshahi.

Introduction

Nitrogen is an important nutrient element for crop production. It is needed in each and every crop in large quantity. Among the all fertilizers, the efficiency of nitrogenous fertilizer is lowest due to various losses (gaseous, leaching, run-off etc.). It is reported that about 40% of applied N is used by the crop and the rest amount is lost from the soil. Nitrogen is mostly used as periled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The loss will be minimized if it applied as super granule to the reduced zone. Moreover, the crisis of urea is a burning issue throughout the country. The urea super granule (USG) will release nitrogen slowly to the crop for longer period of time. Thus the N use efficiency as well as yield of the crop will be increased. The farmers are already using it in Boro rice. In some areas it is used in different upland vegetables and fruit crops such as brinjal, cabbage, cauliflower, banana, tomato etc. The farmers are using it in Boro rice and also using it in different vegetable and fruit crops such as brinjal, cabbage, cauliflower, banana etc. Maize now has become one of the profitable field crops in different locations. The land area of this crop is increasing day by day. But the efficiency of N as USG to this crop is not yet tested. Keeping this view in mind, the experiment was undertaken to find out the optimum and economic dose of USG for maize cultivation in comparison to prilled urea in the locality.

Materials and Methods

The experiment was carried out at Tangail, Rangpur, Comilla, Shyampur (Rajshahi) and Pabna during rabi 2007-08 to find out the optimum and economic dose of USG for hybrid maize production. The trial was laid out in RCB design with six dispersed replications (farmers). It was conducted in IPM/ICM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. Four fertilizer levels, viz. T_1: Recommended dose of N as prilled Urea for HYG, T_2: Recommended dose of N as USG for HYG, T_3: 10% less than recommended dose of N as USG for HYG and T_4: 20% less than recommended dose of N as USG for HYG were considered as the treatments. Nitrogen dose for each treatment was calculated on the basis of soil test following different AEZ. Crop management practices done under different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary.

Prilled urea was splitted into three equal portions. One third of prilled urea was applied as basal dose with other fertilizers. One third was applied as top dress at 30 days seedling emergence (DSE) and the rest one third was applied as top dress at 55 DSE but USG was applied as ring method 9-10 cm apart from plant stalk and 4-8 cm depth in soil 30 days of seedling emergence. Data on grain yield and other yield contributing parameters were recorded considering 20 plants randomly selected from each plot. Data on cost and return were also recorded. Collected data were analyzed statically and presented in Table 2 and 3.

Table 1. Crop management practices done in different locations

Location	Tangail	Rangpur	Comilla	Shyampur	Pabna
Variety	BHM-5	BHM-5	BHM-5	BHM-5	NK-40
Unit plot size	10 m x 8 m	6m x 7m	8m x 5m	10m x 8m	10 m x 8 m
& spacing	75 cm x 25 cm	75cm x 25cm	75cm x 20cm	75cm x 20cm	75 cm x 25 cm
Sowing time	4 to 5 Nov 07	14 to 16 Dec 07	2 Dec 07	2 Dec 07	15-16 Dec 07
Harvesting time	25 march 08	7 to 9 May 08	16 to 18 April 08	16 to 18 April 08	18-20 May 08
Fertilizer dose (kg/ha)	P-52, MP-110, S-47, Zn-3, B-1	FRG 2005	FRG 2005	FRG 2005	P-52, MP-110, S-47, Zn-3, B-1

Result and Discussion

TANGAIL

Table 2 showed that yield and yield contributing parameters of maize varied due to N levels applied. The highest number of grains per cob (568) was obtained from plots treated with recommended dose N as USG (T_2) which was at par with recommended dose of N as prilled urea (554) (T_1) and 10% less than recommended dose as USG (T_3) (527).The lowest number was found from plots of 20% less than recommended dose as USG (T_4) (486). The 1000-grain weight was the highest (429.9 g) in T_2. The lowest grain weight was obtained from recommended dose of N as prilled urea (410.7 g) (T_1). Grain yield was also the highest (10.30 t/ha) in T_2 and it was at par with T_3 (9.44 t/ha). However, rec. dose of N as prilled urea (T_1) also gave similar yield with T_3. The lowest yield (8.67 t/ha) was obtained from T_4. The result indicates that application of N as USG is more effective than that of N as prilled form. As USG is comparatively a larger and compact form of N and placed near to the root zone, the plants could receive it slowly having a longer period which might help in better growth and development of plants leading to better yield attributes and higher grain yield.

In cost and return analysis, the Table 3 shows that the highest gross return (Tk. 131428/ha) and gross margin (Tk. 82512/ha) was obtained from plots treated with recommended N as USG. The lowest gross return (Tk. 110735/ha) was found in plots treated 20% less than recommended dose as USG.

Farmers' reaction

Farmers of the FFS opined that they would apply USG in coming season if it would be available in the market.

RANGPUR

Yield and yield attributing parameters of maize varied due to N levels and sources (Table 4). The highest number of grain per com (476) was obtained from recommended N as USG and it was at par with 10 % less as USG (469) followed by recommended N as prilled urea (460). The lowest grain number (442) was obtained from 20% less recommended N as USG .The weight of 1000 grain was the highest (410.2 g) with N as recommended USG and it was statistically similar with that of plant treated with 10% less as USG (407.4 g) and recommended dose as prilled urea (405.1). The lowest grain weight was obtained from 20% less recommended dose as USG. Grain yield was also higher in 100% USG (10.05 t/ha) and it was at par with 10% less as USG (9.96 t/ha) and recommended dose of prilled urea (9.49 t/ha). The lowest yield (8.46 t/ha) was obtained from 20 % less as USG. USG is comparatively a larger and compact from of N and placed near to the root zone, the plants could receive it slowly for a long period which might be held in better growth and development of plants leading to higher grain yield and attributes.

The highest gross return was obtained from recommended N as USG (Tk.110600/ha) but higher gross margin was found from 10% less USG (Tk.64055/ha). The lower gross return and gross margin was found in 20% less as USG (Table 5).

Farmers' reaction

The USG treated plants were superior in terms of yield but additional cost and labour cost was high.

COMILLA

Yield and yield attributes of hybrid maize are presented in Table 6. Significant difference were found in different yield attributes, i.e. cobs per m^2, cobs per plant, cob length, grains per cob, grain weight per cob and yield (t/ha). USG recommended dose treated plot showed better performance in respect of cobs per m^2 (8.9), cobs per plant (1.3), cob length (17.53 cm), grains per cob (495), grain weight per cob (122.29), which ultimately contribute to the highest maize yield (11.26 t/ha). But it was identical to recommended dose of prilled urea treated plot (10.89 t/ha).

SHYAMPUR, RAJSHAHI

The results revealed that (Table 7) there were no significant difference observed in different parameters among the treatments. Yield also insignificant which indicated that reduced nitrogen application as USG increase nitrogen use efficiency of maize resulting equal yield of 100% prilled Urea.

Generally it was observed that growth and greenness duration of maize in USG plots were greater than prilled Urea applied plots. From economic analysis, it was revealed that higher gross margin (104148 Tk./ha) was obtained from 10% less of rec. N as USG treatment.

Farmers reaction

- Yield was similar in 10-20% less USG to 100% prilled Urea
- Less production cost

PABNA

Yield and yield contributing characters were found statistically insignificant (Table 1). However, higher grain yield were obtained from recommended dose of N as USG (T_2) treatment followed by 10% less (T_3) and 20% less N as USG (T_4) treatment. Recommended N as prilled urea dose showed relatively poor performance though it is identical with other treatments. It is noteworthy that this yield trend was the cumulative effect of number of seeds cob^{-1} and 100 seeds weight. All USG treatments gave higher yield compare to prilled urea though the N rate was similar or less. It might be due to slow and long time releasing of N from USG sources. On the other hand, stover yield was relatively higher in recommended dose N as prilled urea treatment and the reverse trend of grain yield was found for other treatments in case of stover yield. This trend might be due to higher N availability at plant growth stage. Plant height also supported this result.

From the economic point of view, the highest gross margin was recorded in recommended dose of N as USG treatment followed by 10% less recommended dose of N as USG, 20% less recommended dose of N as USG and recommended prilled urea treatment (Table 8).

Farmer's reaction

Farmers are now very much motivated about USG though its application is laborious but they opine that it has very good effect on maize. They like to produce maize with 20% less USG next time if it will be available.

Conclusion

From the results it may be concluded that usage of urea super granule (USG) is better for maize cultivation regarding yield and economic return. Even 10% less recommended dose of N as USG is more profitable than recommended prilled urea. Therefore, it may be recommended for large scale production in greater extrapolation areas.

Table 2. Yield and other yield parameters of hybrid maize as influenced by source and level of nitrogen at the MLT site, Ghatail during 2007-08

Treatments	Plant height (cm)	Cob length (cm)	Cob breath (cm)	Grains/ cob	1000-grain wt. (g)	Grain wt/ Cob (g)	Grain yield (t/ha)
T_1. Rec. dose of N as prilled urea	221	20.56	15.75	554	410.7	219	9.21
T_2. Rec. dose of N as USG	229	21.71	16.19	568	429.9	231	10.30
T_3. 10 % less than rec. dose as USG	226	20.68	16.11	527	417.5	222	9.44
T_4. 20% less than rec. dose as USG	219	20.21	15.57	486	416.0	210	8.67
LSD (0.05)	7.13	0.38	1.03	70.16	23.53	9.30	0.82
CV (%)	1.5	0.9	3.2	6.6	2.8	2.1	4.4

Table 3. Cost and return analysis of hybrid maize production with USG at the MLT site Ghatail, Tangail during 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1. Rec. dose of N as prilled urea	117623	45937	69188
T_2. Rec. dose of N as USG	131428	46157	82512
T_3. 10 % less than rec.dose as USG	120523	45805	72392
T_4. 20% less than rec. dose as USG	110735	45453	63197

Price (Tk../kg). Grain =12.50, Prilled urea =6.00, USG = 6.40, Stover =0.25

Table 4. Yield and yield attributes characters of BARI hybrid maize 5 as influenced by Different source and levels of nitrogen at the MLT site, Gobindaganj, Rangpur During 2007-08

Treatments	Plant height (cm)	Cob length (cm)	Cob breath (cm)	Grain /cob (No)	1000grain wt(g)	Grain yield (t/ha)	Stover yield (t/ha)
T_1	195.25a	16.9a	13.78a	460b	405.1a	9.49a	9.98a
T_2	209.68a	18.6a	14.50a	476a	410.2a	10.05a	10.10a
T_3	196.35a	17.0a	14.48a	469a	407.4a	9.96a	10.70a
T_4	188.13b	14.94b	12.55b	442c	392.4b	8.46b	8.62b
CV(%)	9.15	8.98	7.89	6.87	5.99	7.26	9.32

Table 5. Cost and return analysis of BARI hybrid maize-5 production as influenced by different source and level of nitrogen at the MLT site, Gobindaganj during rabi 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1	104880	45584	59296
T_2	110600	47584	64016
T_3	111525	47470	64055
T_4	94220	42242	51978

In put price (Tk./kg). Urea =6, TSP =38, MP= 35, Gypsum=6.50, Zinc sulphate =135, Boric acid =130 and Maize seed =150., Out put price (Tk./kg) . Maize=10

Table 6. Yield and yield attributes of hybrid maize at Homna, Comilla

Treatment	Cobs/m^2	Cobs/ plant	Cob length (cm)	Grains /cob	Grains Wt/cob	Grain yield (t/ha)
Urea (rec. dose)	9.5	1.1	16.62	464	111.41	10.89
USG (rec. dose)	8.9	1.3	17.53	495	122.29	11.26
USG (10% less)	7.7	1.2	16.51	491	114.95	9.19
USG (20% less)	8.3	1.3	16.09	448	109. 01	9.26
CV (%)	7.59	6.41	1.39	4.11	3.61	6.55
LSD (0.05)	1.306	0.15	0.46	39.01	8.24	1.33

Table 7. Effect of USG on yield and yield attributes of maize during 2007-08 at the MLT site Shibpur, Rajshahi.

Treatment	Plant height (m)	Cob height (cob)	No. of seed row/cob	No. of seeds/row	100-seed wt. (g)	Yield (t/ha)
T_1	2.14	1.07	13.73	28.42	25.68	9.78
T_2	2.20	1.10	13.67	31.38	26.18	9.43
T_3	2.18	1.22	14.23	30.77	24.35	10.15
T_4	2.10	1.07	13.73	31.53	25.62	9.43
LSD (0.05)	NS	NS	NS	NS	NS	NS

Table 8. Cost and return analysis of maize as affected by USG at the MLT site Shibpur, Rajshahi

Treatments	Yield (t/ha)	Gross return (Tk./ha)	Variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1	9.78	117360	17912	99448
T_2	9.43	113160	17912	95248
T_3	10.15	121800	17652	104148
T_4	9.43	113160	17404	95756

Price (Tk./ha). Maize= 12, Seed= 200, Urea= 6, TSP= 35, MP= 33, Gypsum= 6, Boric Acid= 120, Zinc Sulphate= 100, CD= 1.

Table 8. Effect of USG (1.1 g size) on yield and yield attributes of Maize at the FSRD site, Pushpopara, Pabna during the year of 2007-08.

Treatments	Days to maturity (day)	Plant height (cm)	Cob length (cm)	No. of seeds/cob	100-seed wt (g)	Grain yield (t/ha)	Straw yield (t/ha)
Rec. N as prilled urea	155	191.10	18.07	464.27	36.66	8.76	7.64
Rec. N as USG	155	190.77	18.27	464.93	39.14	9.71	7.11
10% less of rec. N as USG	155	183.17	18.47	450.53	37.59	9.38	6.97
20% less of rec. N as USG	155	184.83	18.30	460.13	38.63	9.02	6.89
LSD (0.05)	-	NS	NS	NS	NS	NS	NS
CV (%)	-	8.01	2.85	7.90	6.43	6.15	7.32

Table 9. Cost and return analysis of Maize as affected by USG at the FSRD site, Pushpopara, Pabna during the year of 2007-08.

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
Rec. N as prilled urea	116020	46719	69301
Rec. N as USG	125885	47000	78885
10% less of rec. N as USG	121810	46635	75175
20% less of rec. N as USG	117510	46268	71242

Price (Tk./ha): Maize (grain)= 11.50, Maize (stover)= 2.00, Urea= 6, USG = 6.50, TSP= 24.00, MP= 24.00, Gypsum= 6.00, Borax= 100.00, Zinc Sulphate= 100.00, Cowdung= 1.00

Effect of Urea Super Granule (USG) As a Source of Nitrogen on Boro rice

Abstract

An experiment was conducted at Tangail, Comilla, Barind, Noakhali, Pabna, Sylhet, Netrakona sadar during 2007-08 to find out optimum and economic dose of urea super granule (USG) in boro rice production in comparison to prilled urea. The trial was laid out in RCB design with six dispersed replications. Three levels of N viz. T_1: Recommended dose of N as prilled urea, T_2: Recommended dose of N as USG and T_3: 25 kg less N than recommendation dose as USG were considered as three treatments. The highest grain yield and the highest gross margin were recorded from plots having recommended dose of N as USG in all the locations except Barind. Besides, recommended dose of N as prilled urea and 25 kg N less as USG produced similar yields.

Introduction

Nitrogen is an important nutrient element for crop production. It is needed in each and every crop in large quantity. Among the all fertilizers, the efficiency of nitrogenous fertilizers is lowest due to various losses (gaseous, leaching, run off etc). It is reported that about 40% of applied N is used by crop and rest amount is lost from the soil. Nitrogen is mostly used as prilled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The loss may be minimized if it is applied as super granules to the reduced zone. Moreover, crisis of urea is a burning issue throughout the country. The USG releases nitrogen slowly to the crop for a longer period of time. Thus, the N use efficiency as well as yield of crops will be increased. Rice is the staple food in our country and covers about 64 lakh hectare of lands which are about 78% of the total cultivated land in our country (DAE, 2007). Farmers use a huge amount of urea in rice every year. As such, the experiment was conducted to know the effect of USG on Boro rice in comparison to prilled urea.

Materials and Method

The experiment was conducted at Tangail, Comilla, Barind, Rajshahi, Noakhali Pabna, Sylhet and Netrakona during Boro season 2008. The trial was laid out in RCB design with six dispersed replications (farmers). It was conducted in Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. The three treatments were considered as T_1: Recommended dose of N as prilled area T_2: Recommended dose of N as USG, T_3: 25 kg less N than recommended dose as USG. Fertilizer dose for each treatment were calculated on the basis of soil test under different AEZ. USG was applied as hill method and 3-4 cm depth in soil 7-10 days after transplanting (DAT). Prilled urea was applied as top dress in three equal instalments at 15, 45 and 70 DAT. Crop management practices done under different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary. Plants of 3 m^2 area having three different places selected randomly from each plot were considered for different data collection for each treatment. Collected data were analyzed statistically following Crop-Stat/Mstat-C analytical package. The crop (Boro rice) is already harvested and data are under process in 8 locations (Rangpur, Shyampur, Bogra, Jamalpur, Patuakhali). Results will be incorporated in the final report.

Table 1a. Crop management practices done in different locations

Location	Tangail	Comilla	Barind	Barind (T.aman)	Noakhali
Variety	BRRI dhan 29	BRRI dhan 29	BRRI dhan 28	BRRI dhan 39	BRRI dhan 28
Unit plot size & spacing	10m x 8m 20cm x 20cm	10m x 8m 25cm x 15cm	4m x 5m 20m x 20m	3m x 4m 20m x 20m	8m x 5m 20m x 20m
Sowing time	29 Jan 03 Feb 08	13 to 28 Jan 08	15 to 16 Jan 08	2 August 07	-
Harvesting time	15 to 19 may 08	24 April to 13 may 08	27 to 28 April 08	26 Oct 07	-
Fertilizer dose (kg/ha)	TSP-140, MP-80, Gypsum-80	-	-	-	-

Table 1b. Crop management practices done in different locations

Location	Pabna	Sylhet	Netrakona sadar	Kendua, Netrakona
Variety	BRRI dhan 29	BRRI dhan 29	BRRI dhan 29	BRRI dhan 29
Unit plot size &	5m x 8m	10m x 8m	10m x 8m	10m x 8m
spacing	20cm x 20cm	20cm x 20cm	20cm x 20cm	20cm x 20cm
Sowing time	25 Jan 08	22 Jan-12 Feb' 08	17-21 Jan 08	27-28 Jan 08
Harvesting time	15 may 08	10-30 May 08	16-07 May 08	15-18 May 08
Fertilizer dose (kg/ha)	P_{14} K_{36} S_8 Zn_1	FRG' 2005	FRG' 2005	FRG' 2005

Results and Discussion

TANGAIL

The yield and yield contributing characters are presented in Table 2. Results reveal that maximum number of tillers (18/hill) was obtained from plants treated with recommended dose of N as USG, which was statistically similar to those plots treated with 25 kg less N than recommended dose as USG (17/hill) but it differed from that of prilled urea (15/hill). Significantly the highest number of filled grains (122/panicle) was counted in plots treated with recommended dose of N as USG which differed from other two treatments. In case of 1000 grain weight, the highest weight (22.9g) was measured from plots received recommended dose of N as USG and it was at par with the plots treated with 25 kg less N than recommended dose as USG (22.5g). The lowest weight (21.5g) was found from prilled urea treated plots. The highest grain yield (7.91 t/ha) was recorded from plots treated with recommended dose of N as USG and it was at par with the plots treated with 25 kg less N than recommended dose as USG (7.53 t/ha). The lowest yield (7.04 t/ha) was found from prilled urea treated plots.

Cost and return analysis

Table 3 reveals that the highest gross return (Tk.137997/ha) was recorded from plots having recommended dose of N as USG followed by 25 kg less N than recommended dose as USG treated plots (Tk.130772/ha). The lowest gross return (Tk.122100/ha) was obtained in plots treated with prilled urea. The highest gross margin (Tk. 81565/ha) was also recorded from plots having recommended dose of N as USG.

Farmers' reaction

Farmers of the FFS opined that they would apply USG in coming season if it is available in the market.

COMILLA

Significant difference was found in plant height and different yield attributes, i.e.panicle per m^2, panicle length, grain weight per panicle and yield (t/ha). Treatmetn T_2 (Rec. N as USG) and T_3 (USG 25 Kg N/ha less than recommended dose) treatment showed better performance in respect of plant height (100 cm), panicle per hill (14.7), panicle per m^2 (406), panicle length (24.7 cm), and grain weight per panicle (3.26 gm), which ultimately contribute to the higher grain yield. But the treatment T_1 (rec. dose of N as prilled urea) produced significantly lower yield. Partial budget analysis indicates that gross margin was also the highest (Tk.61450/ha) in treatment T_3 (25 kg N/ha less than recommended dose) and the lowest (Tk.42446/ha) in treatment T_1 i.e. Urea rec. dose (Table 5).

BARIND, RAJSHAHI

Yield and yield attributes of boro rice significantly differed with USG application except plant height and 1000 grain weight (Table 6). Significantly the highest grain yield (5.51 t/ha) was obtained from T_2 probably due to the cumulative effect of the higher number of tillers/hill (15), highest number of tillers/m^2 (322.33) and higher number grains/panicle (139.30). Treatment T_3 (25 kg less of USG) also gave identical yield with T_2. Similarly, the higher gross return and gross margin were also calculated from the same treatment.

NOAKHALI

Table 8 reveals that the tallest plant (96.90 cm) was recorded from T_2 (recommended dose of USG) which was statistically identical with T_3 (25 kg N less than recommended dose of USG). The highest number of effective tiller was found in T_3 (12.67) which was statistically identical with T_2 (11.67) . The highest panicle length was observed from T_3 (24.60 cm). The maximum filled grain was obtained from T_3 (119.7). Maximum and minimum 1000 grain weight was observed from T_3 (20.91 g) and T_1 (20.76 g) respectively. The highest grain yield was found from T_3 (4.43 ton/ha) and the lowest one was found in T_1 (4.09 t/ha).

The highest gross margin (Tk.53836/ha) was found in T_3 treatment which was followed by T_2 treatment (Tk.53383/ha) and the lowest (Tk.48355/ha) in T_1 (Table 9). This variation was occurred due to the variation of grain yield and fertilizer cost.

Farmers' reaction

25 kg N less than Rec. dose as USG performed better than Rec. dose of N as USG and Rec. dose of N as prilled Urea. Rec. dose of N as USG was not suitable for BRRI Dhan-28 for its short duration. Rec. dose of N as USG may be applied in BRRI Dhan-29. This method is labour intensive, so it should be minimized by mechanical means.

PABNA

Yield contributing characters and yield showed significant variation due to treatments except plant height and straw yield. Among the yield attributes, the maximum number of tiller hill^{-1}, grains panicle^{-1}, weight of 1000 grains was observed in 25% less of recommended dose of N as USG. The highest grain yield was also obtained from 25% less of recommended dose of N as USG probably due to the cumulative effect of yield contributing characters. The lowest grain yield was attained from prilled urea. In case of 25% less of recommended dose of N as USG, some positive factors might enhance the growth and development of crop plats during the vegetative and reproductive stage resulting higher yield. Grain yield obtained from 25% less of recommended dose of N as USG was 5.33% and 2% higher over recommended dose of N as prilled urea and recommended dose of N as USG, respectively. From the economic analysis, it was revealed that maximum gross margin and benefit cost ratio was achieved from 25% less of recommended dose of N as USG followed by recommended dose of N as USG treatment. This result indicated that application of USG even 25% less was promising for sustainable boro rice production in view of low nitrogenous fertilizer, higher production and economic return and soil health.

Farmer's reaction

The achievements of farmers own set of selection criteria made encouraging responses among the farmers and they were motivated to use USG instead of prilled urea. In this connection they approached extension personnel to make USG available to the local level

SYLHET

Yield & yield contributing characters of rice (BRRI dhan 29) were presented in Table 12. All parameters were found statistically significant. The highest plant height was observed in treatment T_2. It was found that higher effective tiller/hill (10.93) was in T_1 but it was statistically identical to treatment T_3. The highest no. of non effective tiller/hill was observed in T_2. The higher filled grains/panicles were observed in treatment T_3 (121.37) that were statistically similar to T_1 (117.9). The highest 1000 seed weight (22.32 g) was found in treatment T_3. The highest grain yield (6.67 t/ha) was obtained from treatment T_3 due to the highest weight of 1000 seeds, higher effective tiller/hill & filled grain/panicle which was followed by T_1. It was observed that higher straw yield (7.04 t/ha) was found in treatment T_3 which was followed by T_1 and the lowest straw yield was found from the treatment T_4.

Farmers' reaction

Farmers opined that USG was more effective than that of prilled urea and it may be a portion of urea saved using urea as USG than normal prilled urea.

MYMENSINGH

Netrakona Sadar

The agronomic and economic performances of boro rice as influenced by application of urea super granule. From Table 13 it is evident that number of tillers/plant, number of filled grains/panicle, grain and straw yields varied significantly. But plant height and 1000 grain weight did not vary significantly. The highest plant height (88.30cm), Number of tillers/hill (13.22) was observed in USG (Rec.) treatment and lowest in farmers' practice. USG (25% <rec.) treatment produced highest number of filled grains/panicle (141.17) but farmers' practice produced the lowest (87.17) number of filled grains/panicle. The maximum grain yield (8.29 t/ha) was also obtained from the treatment USG (25%<rec.).On the other hand, farmers' practice produced the minimum grain yield of 6.92 t/ha. Prilled urea (rec.) gave significantly lower grain yield of 8.17 t/ha. Ahmed *et al*. (2000) reported that USG was more efficient than prilled urea at all respective levels of nitrogen in producing all yield components and in turn, grain and straw yields. The highest gross return (Tk.140940/ha), and gross margin (Tk.102186/ha) were in treatment USG (25% < Rec.).

Farmers' reaction

Farmers are interested and fully convinced to apply USG in their boro rice crop but they want easy application method as well as easily available of it in local market.

KISHOREGANJ

Kendua, Netrakona

Grain yield and yield attributes of boro rice was significantly affected by different treatments (Table 15). Yield attributes of boro rice (*Oryza sativa*) rice viz. number of effective tillers/hill, filled grains/panicle and 1000 grain weight (g) varied significantly in different treatments. The treatment T_2 : recommended dose of N as USG was produced higher number of effective tillers /hill over other treatments. The similar trend was also followed in case of number of filled grains/panicle and 1000-grain weight. Grain yield of boro rice was significantly influenced by different treatments (Table 1). Higher grain yield (8.07t/ha) of boro rice was obtained with recommended dose of N as USG (T_2) followed by 25 % less of recommended dose of N as USG (T_3) which were 16 and 11 % higher than recommended dose of N as prilled, respectively. This might be due to USG release nitrogen slowly to the crop for a longer period of time. Thus, the N use efficiency as well as effective tillers/plant, filled grains/panicle, 1000-grain weight was higher in T_2 treatment which ultimately contributed the higher grain yield . The lowest grain yield was recorded from recommended dose of N as prilled urea (T_1) due to less N use efficiency as well as effective tillers/plant, filled grains/panicle, 1000-grain weight was lower in T_1 treatment which ultimately contributed the lower grain yield. A considerable response of USG was apparent in the yield of boro rice. The highest grain yield was recorded in recommended dose of N as USG (T_2) which indicated that T_2 (recommended dose of N as USG) showed better performance among different fertilizer treatments. Straw yield of boro rice followed the trend of grain yield.

The cost and return analysis of boro rice has been presented in Table 16. The highest gross return and gross margin (Tk.137320/ha and Tk. 98320/ha) was calculated from treatment T_2 (recommended dose of N as USG) followed by T_3.

Farmers, reaction

Farmers are interested to cultivate boro rice with USG in next season if USG should be available in their locality. Because they will get higher grain yield to use same amount of urea and apply once in a season. Although some farmers opined that USG placement is laborious.

Conclusion and Recommendation

From the results it may be concluded that application of urea super granule (USG) is better for boro rice cultivation and even 25 kg less N than recommended dose as USG is more profitable than recommended dose of N as prilled urea. Therefore, it may be recommended for large scale production in greater extrapolation areas.

Table 2. Effect of USG on the performance of Boro rice at the MLT sites, Ghatail, Tangail during Rabi 2007-08

Treatments	Plant height (cm)	Tillers/ hill (no.)	Panicle Length (cm)	Filled grains/ panicle (no.)	Unfilled grains/ panicle (no.)	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1: Rec. dose of N as Prilled urea	95.10	15	22.10	97	50	21.6	7.04	7.70
T_2: Rec. dose of N as USG	98.71	18	24.27	122	59	22.9	7.91	9.46
T_3: 25 kg N less than rec. dose as USG	97.88	17	23.47	111	47	22.5	7.53	8.41
LSD (0.05)	3.91	1.62	0.80	10.64	7.38	0.67	0.73	0.98
CV (%)	3.1	7.7	2.7	7.5	11.0	2.3	7.6	8.9

Table 3. Cost and return analysis of Boro rice at the MLT sites, Ghatail and Madhupur, Tangail during Rabi 2007-08

Treatments	Gross return (Tk.. /ha)	TVC (Tk./ha)	Gross margin (Tk./ha)
T_1 . Rec. dose of N as Prilled urea	122100	55282	66818
T_2 . Rec. dose of N as USG	137997	56432	81565
T_3 . 25 kg less N than rec. dose as USG	130772	56010	74762

Price (Tk./kg) . Urea-6.00, USG-6.40, Rice-16.25, Straw-1.00

Table 4. Yield and yield attributes of Boro rice at the MLT site Daudkandi, Comilla during 2007-08

Treatment	Plant height (cm)	Panicle/ m^2	Panicle length (cm)	Grains/ panicle (No)	Grain wt./panicle (gm)	Grain yield (t/ha)
Urea (recommended dose)	97	351	23.4	132	2.50	5.33
USG (recommended dose)	101	389	23.6	152	3.07	6.28
USG (25 Kg N/ha less rec. dose)	100	406	24.7	166	3.26	6.38
CV (%)	1.23	3.71	2.24	11.66	7.32	3.64
LSD (0.05)	2.78	32.08	1.214	NS	0.486	0.494

Table 5. Cost and return analysis as influenced by USG on Boro rice at Daudkandi, Comilla during 2007-08

Treatment	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
Urea (recommended dose)	95963	53517	42446
USG (recommended dose)	113063	53700	59363
USG (25 kg N/ha less than recommended dose)	114750	53300	61450

Out put price. Rice grain= Tk. 18/kg

Table 6. Effect of USG on the yield and yield attributes of Boro rice at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Treat	Plant height (cm)	No. of tillers/hill	Tillers/m (No)	Grain/panicle (No)	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	99.33	12.00	254.67	99.47	22.20	4.68	5.52
T_2	104.57	15.00	322.33	139.30	24.13	5.51	6.63
T_3	105.60	14.98	303.00	128.73	22.80	5.10	6.13
LSD (0.05)	NS	2.03	17.82	11.47	NS	0.53	NS
CV (%)	3.88	7.94	3.29	5.21	4.59	5.66	9.62

Table 7. Cost and return analysis as influenced by USG on Boro rice at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Treatment	Yield (t/ha)		Gross Return (Tk./ha)	Total Variable cost (Tk./ha)	Gross Margin (Tk./ha)	BCR
	Grain	Straw				
T_1	4.68	5.52	89760	31986	57770	2.80
T_2	5.50	6.63	105130	32500	72630	3.23
T_3	5.10	6.13	97930	31683	66247	3.09

Table 8. Effect of Urea Super Granule (USG) on the yield and yield attributes of Boro rice at the MLT site, Feni during 2007-08

Treatment	Plant height (cm)	No. of effective tillers/hill	Panicle length (cm)	No. of filled grains/ panicle	1000 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
Rec. dose of N as prilled Urea)	87.72	9.50	22.80	105.3	20.32	4.093	4.92
Rec. dose of N as USG)	96.90	11.67	24.30	111.8	20.76	4.280	6.00
25 kg N less than Rec. dose as USG	94.57	12.67	24.60	119.7	20.91	4.433	5.56
LSD (0.05)	5.583	1.190	NS	8.053	NS	0.257	0.918
CV (%)	4.66	8.20	6.39	5.58	2.68	4.70	13.01

Table 9. Effect of Urea Super Granule (USG) on cost return of Boro rice at the MLT site, Feni during 2007-08

Treatment	TVC (Tk./ha)	Gross return	Gross margin
Rec. dose of N as prilled Urea	46641	94996	48355
Rec. dose of N as USG	51041	104424	53383
25 kg N less than Rec. dose as USG	50428	104264	53836

Table 10. Yield and yield attributes of boro rice as influenced by USG and prilled urea during the rabi season of 2007-08 at the MLT site, Atghoria, Pabna.

Treatments	Plant height (cm)	No. of tiller/hill	No. of grains/ panicle	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
Rec. N as prilled urea	87.01	13.32	155.12	20.83	6.76	6.07
Rec. N as USG	87.01	17.55	176.20	22.33	6.98	6.25
25% less of rec. N as USG	87.22	17.77	185.30	23.83	7.12	6.20
LSD (0.05)	NS	0.61	4.42	1.02	0.11	NS
CV (%)	4.60	7.94	8.00	4.56	7.19	5.75

Table 11. Cost and return analysis of Boro rice as influenced by USG during the rabi season of 2007-08 at the MLT site, Atghoria, Pabna

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk. /ha)
Rec. N as prilled urea	124025	18832	105193
Rec. N as USG	128035	19079	108956
25% less of rec. N as USG	130340	18647	111693

Table 12. Effect of USG on the yield and yield contributing characters of boro rice (BRRI dhan 29) at the MLT site, Sunamganj during 2007-08.

Treatment	Plant height (cm)	Effective tiller/hill	Non effective tiller/hill	Filled grain/ panicle	Un-filled grain/pani	1000 seed wt. (gm)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	88.13	10.93	3.17	117.90	32.67	21.50	5.12	6.63
T_2	93.77	9.60	5.80	109.77	31.83	20.63	4.49	5.72
T_3	87.00	10.96	2.80	121.37	23.83	22.32	6.67	7.04
LSD (0.05)	2.64	2.49	1.09	3.55	4.24	1.44	1.06	0.70
CV (%)	1.60	13.27	14.74	1.67	7.42	3.67	11.83	5.81

T_1 :Prilled Urea, T_2 :Four granules of USG, T_3 :Three granules of USG, T_4 :Two granules of USG & T_5 :Farmers practice

Table 13. Yield and yield attributes of Boro rice as influenced by application of Urea Supper Granule (USG) at the MLT site, Netrakona during 2008

Treatments	Plant height (cm)	No. of tillers/ hill	No. of filled grains/panicle	1000 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
USG (Rec.)	88.30	13.22	126.67	24.44	8.74	7.55
USG (25%<Rec.)	87.46	13.21	141.17	23.68	8.92	7.14
Prilled urea (Rec.)	86.18	12.38	114.67	23.64	8.17	6.27
LSD(0.05)	NS	0.80	18.17	NS	0.51	0.89
CV (%)	6.35	5.25	12.57	3.84	5.02	11.21

Table 14. Cost benefit analysis of boro rice as influenced by application of Urea Supper Granule (USG) at Netrakona Sadar during 2008

Treatments	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)
USG (Rec.)	138650	39430	99220
USG (25%<Rec.)	140940	38754	102186
Prilled urea (Rec.)	128820	39284	89536

Price (Tk./kg): Rice grain 15, Rice straw 1, Urea 6.15, TSP 35, MOP 32, Gypsum 7.

Table 15. Effect of urea supper granule on the yield and yield attributes of boro rice at Kendua MLT site, Netrakona during rabi 2007-08

Treatment	Plant height (cm)	No. of effective tillers /hill	No. of filled grains/panicle	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	57.22	13.13b	115.76c	28.66b	6.96c	7.56
T_2	60.17	15.72a	134.25a	31.33a	8.07a	8.20
T_3	59.13	14.00b	124.26b	30.00b	7.70b	7.78
CV (%)	5.23	4.99	5.32	3.55	6.67	8.58

Figures in a column means followed by same letter(s) are not different significantly at 5% level by DMRT.

Table 16. Cost and return analysis of boro rice as influenced by USG at the MLT site Kendua, Netrakona, during rabi 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Rec. N as prilled urea (104 kg/ha)	118920	37551	81369
T_2: Rec. N as USG (104 kg/ha)	137320	39000	98320
T_3: 25 % less of rec. N as USG (77 kg/ha)	130980	38601	92379

Price (Tk./kg). Urea 7, TSP 19, MoP 16, Gypsum 7, Zinc sulphate 80, Boric acid 280,Rice 16 & Straw 1

Effect of Urea Super Granule (USG) As a Source of Nitrogen on T.Aman rice

Abstract

The experiment was conducted at farmers' field of Barind, Rajshahi, Patuakhali and Pabna during aman season of 2007- 08 to know the effect of USG on T.aman and to minimize the loss and reduce the fertilizer cost. In this study four treatments viz. T_1: Recommended dose of N as prilled urea, T_2: Recommended dose of N as USG, T_3: 25 kg less than recommended dose of N as USG. Comparatively higher yield was obtained from the application of recommended N as USG in all the locations.

Introduction

Nitrogen is an important nutrient element for crop production. It is needed in each and every crop in large quantity. Among the all fertilizers, the efficiency of nitrogenous fertilizers is lowest due to various losses (gaseous, leaching, run off etc). It is reported that about 40% of applied N is use by yield crop and rest amount is lost from the soil. Nitrogen is mostly used as prilled urea in the oxidized zone of the soil where it dissolves quickly and enters to loss process. The loss will be minimized if it applied as super granules to the reduced zone. Moreover, crisis of urea is a burning issue throughout the country. The USG will release nitrogen slowly to the crop for a longer period of time. Thus, the N use efficiency as well as yield of crops will be increased. Rice is the staple food in our country and covers about 64 lakh hectare lands which are about 78% of the total cultivated land in our country (DAE, 2007). Farmers use huge amount of urea in rice every year. The experiment was undertaken to know the effect of USG on T.Aman rice.

Objectives

1) To observe the effect of USG on T.aman
2) To minimize the loss and reduce the fertilizer cost.

Materials and Methods

The experiment was conducted at Barind, Rajshahi, Patuakhali and Pabna during aman season of 2007- 08. It was laid out in a RCB design with six dispersed replications. There were four treatments viz. T_1: Recommended dose of N as prilled Urea, T_2: Recommended dose of N as USG, T_3: 25 kg less than rec. dose of N as USG. In Pabna, the experiment conducted with the T_1 and T_2. Crop management practices done under different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary. Data were collected on different yield and yield components. The data were analyzed statistically and the economic analysis was done for gross return and gross margin.

Table 1. Crop management practices done in different locations

Location	Barind	Patuakhali	Pabna
Variety	BRRI dhan 39	BR 11	BRRI dhan 39
Unit plot size & spacing	8m × 5m, 20cm × 20cm	8m × 5m, 20cm × 20cm	8m × 5m, 20cm × 20cm
Sowing time	2 Aug,07	3-10 Oct.07	10 Jul.07
Harvesting time	26 Oct'07	26 Dec-5 Jan	26 Oct'07
Fertilizer dose (kg/ha) (P-K-S-Zn kg/ha)	As recommended dose	As recommended dose	5-18-6-0.5

Results and Discussion

BARIND

Significant variation of different parameters were observed in T.aman rice except plant height, TGW and straw yield (Table 2).Higher number of tillers/m^2 were found from T_2 (263.67) that is statically similar to T_3 (257.67). The significantly highest yield was recorded from T_2 (2.99 t/ha).

Cost and return analysis of T.aman rice was presented in Table 3. From economic point of view, the maximum gross margin (Tk.26212/ha) was observed in T_2 followed by T_3 (Tk.18832/ha) that is greater than T_1 (Tk.16191/ha).

Farmers' reaction

- Farmers are happy to have higher yield by using USG application
- Farmers required less labor and low quantity of fertilizer for and so they earned more net return by using USG

PATUAKHALI

Grain yield of T.Aman rice was influenced seriously by SIDR at 15 November, 2007 and yield was drastically reduced. At Razakhali and Amtali the highest grain yield was obtained in T_2 treatment followed by T_3 and T_1 and the last two was statistically identical. At Kuakata there was no significant difference in grain yield was found among the three treatments. Though there was strong effect of SIDR, it was clear that prilled urea at recommended dose and 25 kg less urea as USG produced statistically identical grain yield (Table 4). Therefore, it could be concluded that 20-25 percent less N supplied as USG is enough to produce similar grain yield as produced by recommended dose of prilled urea. 20-25 percent plants were influenced by sheath rot where prilled urea was applied. However, the result could not reflect the real effect of USG due to SIDR.

Farmers' reaction

- USG save production cost by reducing fertilizer amount.
- But it is laborious and needs extra cost for placement of USG.

PABNA

From the results it was found that yield contributing characters and other parameters like plant height, no. of tillers/hill, panicle length, no. of grains/panicle and 1000-grain weight were higher in USG treatment than prilled urea treatment. Grain and straw yield of USG treatment were also 7.95 and 1.38% higher, respectively than prilled urea treatment. It is clearly cumulative effect of yield contributing characters, which is influenced by the slow releasing and relatively long term availability of nitrogen from USG (Table 5).

From the economic analysis, it was revealed that higher gross margin and benefit cost of ratio was obtained from recommended dose of N as USG treatment (Table 6).

Farmers' reaction

- Plants of USG plot were found always green where prilled urea plot became sometimes yellowish.
- Yield is high in USG applied plot
- It needs extra labour for USG placement and not available in local market

Conclusion

Twenty five kg less N of USG performed identically with recommended dose of prilled urea on the lass of yield & return. So, USG had a significant positive effect on the growth, yield attributes and yield of rice which is encouraging for the farmers. But USG should be available in the market.

It is first year result; so the trial needs further study in the next year for final recommendation.

References

Gomez K A. & A A Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd edn. John Wiley and Sons. New York. . 680.

Perrin, R.K., D.L. Winkelman, E.R. Moseardi and J.R. Anderson. 1979. Farm agronomic data to farmer's recommendations. Information Bulletin 27, CIMMYT, MEXICO.

Table 2. Effect of USG on the yield and yield attributes of T.aman rice at the FSRD site, Kadamshahar, Rajshahi during 2007

Treatment	Plant height (cm)	No. of tillers/hill	No. of tillers/m^2	No. of grain/panicle	TGW (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	98.14	9.60	234.67	87.55	24.02	2.37	4.56
T_2	102.34	10.77	263.67	95.13	24.27	2.99	5.02
T_3	100.60	9.47	257.67	85.80	24.16	2.48	5.11
LSD (0.05)	NS	NS	39.54	NS	NS	0.84	NS
CV (%)	4.25	13.24	8.24	7.51	4.12	17.77	6.80

Table 3. Cost and return analysis as influenced by USG on T.aman rice at the FSRD site, Kadamshahar, Rajshahi during 2007

Treatment	Yield (t/ha)		Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
	Grain	Straw			
T_1	2.37	4.56	43072	26881	16191
T_2	2.99	5.02	53607	27395	26212
T_3	2.48	5.11	45410	26578	18832

Table 4. Yield of T.Aman rice as influenced by USG at different locations, Patuakhali in 2007-2008

Treatment	Grain yield (t/ha)			
	Razakhali	Amtali	Kuakata	Average
T_1	2.93	3.03	2.65	2.87
T_2	3.19	3.21	2.76	3.05
T_3	3.02	2.98	2.61	2.87
LSD (0.05)	10.35	12.04	NS	-

Table 5. Yield and yield attributes of T.Aman rice as influenced by USG and prilled urea during the kharif season of 2007 at the MLT site Atghoria, Pabna.

Treatments	Plant height (cm)	No. of tillers/ hill	Panicle length (cm)	No. of grains/ panicle	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1: Rec. dose of N as USG	89.65	8.45	21.3	91.73	24.17	4.48	5.86
T_2: Rec. dose of N as prilled urea	89.33	7.68	20.67	87.97	22.83	4.15	5.78

Table 6. Cost and return analysis of T.Aman as influenced by USG during the kharif season of 2007 at the MLT site, Atghoria, Pabna.

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Recom. dose of N as USG	93050	20683	72367
T_2: Recom. dose of N as prilled urea	87075	19683	67392

Performance of Intercropping Hybrid Maize with Different Vegetables

Abstract

An experiment was conducted at the farmers' field of Tangail, Comilla, Mymensingh and Rangpur during 2007-08 to identify the suitable and profitable vegetable crops for intercropping with maize. Four treatment combinations viz., T_1: Maize (Sole), T_2: Maize+ red amaranth, T_3: Maize + Garden pea and T_4: Maize + Spinach/bushbean were considered. Higher maize equivalent yield and gross margin were obtained from Maize + gardenpea/spinach intercropping in all the locations.

Introduction

Cropping intensity as well as crop production can be increased by multiple cropping practices. Intercropping is one of the way of multiple cropping has long been recognized as a very common practice. It is suggested that intercropping can provide substantial yield advances compared to sole crop (Singh *et al.,* 1992). Maize (*Zea maize*) is the third largest cereal crop in Bangladesh. It is also important source of carbohydrate. In Bangladesh, Maize occupies a total 50050 ha of land producing 241460 metric tons grain (BBS 2003-04). Maize is grown in Tangail which occupies 423 ha of land producing 1255 metric tons grain (BBS, 2003-04). Maize cultivation is going popular day by day.

Intercropping vegetables with maize is a profitable proven technology of BARI. Maize is grown in well drained medium high land, which is also suitable for growing other cash crops. Most of the farmers of Ghatail, Tangail grow different vegetables viz. sweet gourd, as gourd, red amaranth, garden pea, spinach, stem amaranth etc. as intercrop with maize having inadequate knowledge of agronomic practices as well as benefit of the crop. Intercrop should be selected such a way that there is no or little adverse affect on the main crop. The proper crop combinations of existing practices have not been standardized. Hence, it is necessary to find out the potential of intercropping maize with suitable vegetables to increase production as well as profitability of the farmers.

Materials and Methods

The experiment was carried out at Tangail, Comilla, Mymensingh and Rangpur during 2007-08 to identify the suitable and profitable vegetable crops for intercropping with maize. The trial was laid out in RCB design with six dispersed replications (farmers). It was conducted in IPM/ICM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. The four intercrops were considered as T_1: Maize (Sole), T_2: Maize + red amaranth, T_3: Maize + garden pea and T_4: Maize + spinach or Maize + bushbean. The variety BARI hybrid maize-5, BARI Lalshak-1, BARI Motorshuti-3, Kopipalong and BARI Jharshim-1 were used as planting materials. Two lines garden pea and two lines of bushbean were provided in maize inter rows, spinach and red amaranth were sown in broadcast. Crop management practices done under different locations are mentioned in Table 1. Weeding, mulching, irrigation and crop protection measures were taken as and when necessary. No additional fertilizer was applied for intercrops. Intercrop yield was recorded plot wise. Ten plants for maize and 3 m^2 areas for vegetable were collected randomly in each replication for collecting data. Collected data were analyzed statistically using CropState/Mstat-C analytical package.

Table 1. Crop management practices done in different locations

Location	Tangail	Comilla	Mymensingh	Rangpur
Variety	BHM-5	BHM-5	BHM-5	BHM-5
Unit plot size & spacing	10m x 8m 75cm x 25cm	6m x 5m 75cm x 20cm	6m x 5m 75cm x 20cm	10m x 8m 75cm x 20cm
Sowing time	Nov. 7, 07	10 Nov. to 2 Dec. 07	1-8 Dec. 07	13 Dec. 07
Harvesting time	May 1-5, 08	5-12 May 07	29 April-5 May	7 May 08
Fertilizer dose	As per FRG 2005	As per FRG 2005	As per FRG 2005	As per FRG 2005

Results and Discussion

TANGAIL

Table 2 reveals that the grain yield of maize was significantly influenced by intercropping. The highest grain yield (9.20 t/ha) was obtained from the sole plots followed by Maize + garden pea (8.63t/ha) and maize + Spinach (8.59 t/ha). The lowest grain yield (8.17 t/ha) was recorded from Maize + red amaranth intercropping. The highest maize equivalent yield (12.16 t/ha) was recorded from maize + Spinach treatment combination (Table 3) followed by maize + garden pea (11.99 t/ha). The lowest maize equivalent yield (10.99 t/ha) was obtained from maize with red amaranth inter cropping.

Cost and return analysis

Table 4 reveals that the highest gross return (Tk.154458/ha) was recorded from maize + spinach intercrop combination which was very close to maize + garden pea intercrop combination (Tk.146383/ha). Maize as Sole crop gave lowest gross return (Tk.117445/ha).

Farmers' reaction

Maize production intercropped with short duration vegetable is a profitable practice.

- Extra income can be earned.
- During field visit the DAE people also opined in favour of the new intercrop practice.

COMILLA

Yield and yield attributes of hybrid maize are presented in Table 5. Significant difference was found in different yield attributes, i.e. cobs per m^2, 100 grains weight and maize yield. Significantly highest maize yield was recorded when maize intercropped with Jharshim-1 that was at par with sole maize and maize with BARI Motorshuti-3. The lowest yield was observed in maize with red amaranth. Partial analysis budget indicates that the highest gross return, gross margin as well as MBCR were recorded in Maize + bushbean intercropping system (Table 6). Considering average of the location highest vegetable yield was recorded in Maize+Red amaranth and the lowest in Maize+Motorshuti intercropping system.

MYMENSINGH

Table 7 shows that yield and yield contributing characters of intercropped maize were not statistically significant. However, agronomic performance of sole maize was a little bit better than that of other treatments. Number of grains/cob ranged from 405-408, 1000-grain weight ranged from 325-330 g in different treatments. The highest grain yield (8.95 t/ha) was recorded from sole maize. The grain yield of maize in intercropped combination varied from 8.77-8.80 t/ha. Stover yield ranged from 13.03-14.15 t/ha. The yield data indicate that due to intercropping there was not significant yield loss of maize. Rather higher maize equivalent yield and economic returns were obtained from the intercropping combinations (Table 8). The highest maize equivalent yield (12.77 t/ha) was obtained from the maize + motorshuti followed by maize + bush bean with yield of 11.55 t/ha. The lowest maize equivalent yield (8.95 t/ha) was obtained from sole maize. Like equivalent yield, the highest gross return (Tk. 191550/ha) and gross margin (Tk.149414/ha) were also obtained from the intercrop combination of maize + motorshuti. The lowest gross return (Tk. 134250) and gross margin (Tk. 98114/ha) were obtained from sole maize.

Farmers' reaction

Farmers are interested to cultivate maize with other short duration vegetables but they want the seeds of these crops make available.

RANGPUR

The results showed that the highest maize yield 8.35 t/ha was found from sole maize and the highest vegetable yield 5.36 t/ha was recorded from bushbean (Table 9). Grain yield of maize did not influenced significantly due to different intercropping combination. The highest maize equivalent yield was obtained from treatment maize+ bushbean and the lowest maize equivalent yield 8.35 t/ha was obtained from sole maize. The highest gross return Tk. 113300/ha was found in treatment maize+ bush bean. The lowest gross return Tk.83500/ha was found in treatment sole maize (Table 10).

Conclusion

Considering the agro-economic performance and soil health maize + garden pea or maize + bushbean intercrop combination were found suitable almost all the locations.

Table 2. Yield and yield contributing characters of maize and vegetables yield under intercropping situation at the MLT site Ghatail, Tangail during 2007-08

Treatments combination	Maize plant height (cm)	Cobs /plant	Cob length (cm)	Cob breadth (cm)	Grain /cob (no.)	1000 grain wt (g)	Grain wt./cob (g)	Maize yield (t/ha)	Maize stover yield (t/ha)	Vegetable yield (t/ha)
Sole maize	223.33	1.75	20.46	15.75	531	41.74	218.90	9.20	9.78	0.00
Maize+Red amaranth	223.00	1.68	18.70	15.06	498	39.15	211.37	8.17	9.30	5.89
Maize+Garden pea	221.00	1.73	19.28	15.36	510	41.75	212.12	8.63	9.43	1.81
Maize + Spinach	222.67	1.72	20.32	15.59	506	41.44	216.03	8.59	9.45	5.59
LSD (0.05)	9.83	0.80	1.37	0.84	29.33	18.80	9.11	0.69	0.63	0.59
CV (%)	2.2	2.3	3.5	2.8	2.9	2.3	2.7	4.0	3.3	9.0

Table 3.Yield and equivalent yield of Maize and intercrop at the MLT site Ghatail, Tangail during 2007-08

Treatments combination	Maize yield (t/ha)	Intercrop yield (t/ha)	Maize equivalent yield (t/ha)
Sole Maize	9.20	0.00	9.20
Maize + Red amaranth	8.17	5.89	10.99
Maize + Garden pea	8.63	1.81	11.53
Maize + Spinach	8.59	5.59	12.16

Table 4. Cost and benefit analysis of maize intercropped with vegetables at the MLT site Ghatail, Tangail during 2007-08

Treatments combination	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
Sole maize	117445	45937	71508
Maize + Red amaranth	139790	55267	84523
Maize + Garden pea	146383	57049	89334
Maize + Spinach	154458	60481	93977

Price (Tk./kg): Maize = 12.50, Red amaranth = 6.00, Garden pea = 20.00, Spinach = 8.00, Stover = 0.25

Table 5. Yield and yield attributes of hybrid maize and average yield of vegetables yield in Daudkandi & Homna fields

Treatment	Cobs/ m2	Cobs/ plant	Cob length (cm)	Grains/ cob	100 Grains wt. (gm)	Maize yield (t/ha)	Veg. yield (t/ha)
Sole Maize	5.02	1.30	17.43	426	28.37	6.37	-
Maize+ Red ama.	4.44	1.21	16.41	409	28.40	6.21	9.83
Maize+ Motorshuti	4.17	1.13	16.97	410	26.90	6.50	1.39
Maize+ Jharshim	5.84	1.37	17.25	401	30.30	6.94	7.86
LSD (0.05)	0.97	NS	NS	NS	2.29	0.59	-
CV (%)	12.05	-	9.28	10.02	5.27	5.68	-

Table 6. Yield and partial economic analysis of intercropping hybrid maize with vegetables

Treatment	Maize yield (t/ha)	Veg. yield (t/ha)	Maize equivalent yield (t/ha)	Gross return (Tk./ha)	Variable cost (Tk./ha)	Gross margin (Tk./ha)	MBCR
Sole Maize	6.37 ab	-	6.37	71.69	37.05	34.64	-
Maize+ Red amaranth	6.21 b	9.83	13.20	148.50	41.99	106.51	14.55
Maize+ Motorshuti	6.50 ab	1.39	9.59	107.89	44.46	63.43	3.88
Maize+ Jharshim	6.94 a	7.86	30.36	341.45	51.87	289.58	17.20

Price of input/output (Tk./ka): Maize=11.25, Red amaranth= 8, Motorshuti= 25, Bushbean= 20, Bushbean seed= 400

Table 7. Yield and yield contributing characters of maize under different intercropping situation at Netrakona during rabi 2007-08

Crop combination	Plant height (cm)	No. of cobs/ plant	No. of grains/ cob	Weight of grains/cob (g)	1000-grain weight (g)	Grain yield (t/ha)	Stover yield (t/ha)
Sole maize	178.9	1.2	408	127	330	8.95	14.15
Maize+ Red amaranth	176.7	1.1	406	125	328	8.79	13.39
Maize+ Bushbean	176.4	1.4	405	125	326	8.80	13.35
Maize+ Motorshuti	176.3	1.3	405	125	325	8.77	13.03
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS
CV (%)	1.86	8.95	2.89	4.93	5.13	13.32	10.0

Table 8. Yield and economic analysis of intercropping hybrid maize with vegetable at Netrakona sadar during 2007-08

Crop combinations	Grain yield of maize (t/ha)	Yield of inter crop (t/ha)	Maize equivalent yield (t/ha)	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)
Sole maize	8.95	-	8.95	134250	36136	98114
Maize+ Red amaranth	8.79	4.75	11.32	169800	38386	131414
Maize+ Bushbean	8.80	2.06	11.55	173250	42136	131114
Maize+ Motorshuti	8.77	2.40	12.77	191550	42136	149414

*TVC includes cost of seed, fertilizer, insecticide, irrigation, man and animal labour cost.

Price (Tk./kg): Maize seed= 50, Maize non-seed = 15, Maize stover= 0.50, Red amaranth= 8, Bush bean= 20, Garden pea= 25

Table 9. Yield of Maize and vegetables in intercropping system, Gobindaganj, Gaibandha, 2007-08

Treatment	Yield (t/ha)	
	Maize	Intercrop (vegetable)
T_1: Sole maize	8.35 a	0
T_2: Maize +Red amaranth	8.13 ab	3.31
T_3: Maize + BARI garden pea	8.07 ab	3.39
T_4:Maize + Bush bean	7.89 ab	5.36

Table 10. Economic performance of Maize and vegetables in intercropping system, Gobindaganj, Gaibandha, 2007-08

Treatment	Maize equivalent yield (t/ha)	Gross return (Tk./ ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Sole maize	8.35	83500	45584	37916
T_2: Maize +Red amaranth	8.92	89200	46582	42614
T_3: Maize + BARI garden pea	10.13	101300	47084	54216
T_4:Maize + Bush bean	11.33	113300	47088	66212

Controlling of Cucurbit Fruit Fly with Sex Pheromone

Abstract

A demonstration trial on controlling of cucurbit fruit fly with sex pheromone was set at different locations- Rajshahi, Tangail, Bogra, Pabna and Manikganj during the rabi 2007-08 and kharif 2008. The experiment is still at the field in most of the locations. However, the sex pheromone showed excellent results and farmers showed their positive attitude towards sex pheromone.

Introduction

Cucurbits are a major group of summer vegetable crops in Bangladesh. Because it is cheap and highly nutritious, it is available throughout the year in all parts of the country. But the productions of these vegetables are not hopeful because of cucurbit fruit fly (*Bractrocera cucurbitae* Coquillett). About 50-70%, fruits were damaged due to infestation of cucurbit fruit fly .Farmers use huge amount of insecticides to control this pest, which is very harmful for human health as well as environment. Sex pheromones are species-specific organic compounds emitted by female insect to attract the males for matting. Sex pheromones are very much effective in cucurbit fruit fly control. So this demonstration trial was undertaken in different locations to control cucurbit fruit fly.

Materials and Methods

The demonstration trial was conducted in Rajshahi, Tangail, Bogra, Pabna and Manikganj during the rabi 2007-08 and kharif 2008. The trial was set in ICM/IPM club/FFS members' lands selected with the help of local DAE personnel. In this demonstration on sweet gourd, ash gourd and watermelon were used. In case of sweet gourd, the plot was 400 sq. m and 4 acres for watermelon. The pheromone bait trap comprises the pheromone and the locally fabricated water trough. The whole system consists of a 3-liter capacity, 22 cm tall rectangular or round clear plastic container. A triangular opening is cut in any two opposite sides starting 3-4cm from the bottom. Soap water of 3-4cm height is maintained inside the container (trap) throughout the season. A cotton wad measuring 2.5 x 1.5cm and soaked with 7-10 drops of "cuelure" 4-(p-acetoxyphenyl)-2 butane} or {4-(3-oxobutyl-phenylacetate)} is hung through the centre of the lid of the plastic container by means of a thin wire in such a way that the cotton wad remains 3-4cm above the soap water. The trap is then placed just above the crop canopy by means of a bamboo support. The pheromone remains active and continues to attract male flies for 2-3 months. One lure was placed in the field for 2 months. Data were collected randomly from 100 sq. m from the total land of the study area. The experiment is still at the field in most of the locations.

Results and Discussion

Comparative results of sex pheromone trap and farmers practice with regard to pest control cost, yields are presented in Tables 1 and 2

Table 1. Effects of sex pheromone in sweet gourd in farmers fields at Hazirhat, Noakhali during 2007-08

Effects of pest control measures	Sex pheromone method	Farmers practice insecticide spray 10 times
Deformed fruits	5%	33%
Pest control cost (Tk./ha)	5,500(3,578 less costly)	9,578
Sweet gourd yield(t/ha)	27 ton /ha (5 ton higher yield)	22 ton /ha

Note. Trap and lure unit cost is 50/= the container can use two to three years if it is stored properly.

Table 2. Effects of sex pheromones in Watermelon in farmers fields at Atkapalia, Noakhali during 2007-08

Effects of pest control measures	Sex pheromone method	Farmers practice insecticide spray 11 times
Deformed fruits	2%	29%
Pest control cost (Tk./ha)	5,500/=(4,500/=less costly)	10,000/= above depend on infestation of cucurbit fruit fly
Watermelon yield(t/ha)	35 t/ha (8 ton higher yield)	27 ton/ha

Note. Trap and lure unit cost is 50/= the container can use two to three years if it is stored properly.

It is clear from the above discussions that the infestation of cucurbit fruit fly can be easily and effectively controlled by adopting the sex pheromone trap, the farmers can obtain higher yield of watermelon, and sweet gourd. It is important to note that production of pesticide-free healthy watermelon and sweet gourd through sex pheromone trap will contribute to maintain better health of the consumers as well as the producers and open an opportunities for export.

Farmers' reaction

Farmers are very much interested about the sex pheromone trap but the trap is not available in the market. They should train up about this sex pheromone. It brings a new era of pest control against cucurbit fruit fly in char areas of Noakhali. They want to purchase it at any cost because of its effectiveness.

SHYAMPUR, RAJSHAHI

The results revealed that (Table 3) the highest number of infested fruit was found in the treatment T_3 (32.83%) followed by T_2 (25.03%). The sex pheromone trap placed plot showed the lowest infestation (2.73%). The highest number of edible fruit was produced by T_1 (4.78) where sex pheromone trap was placed. The T_2 (3.47) produced lower edible fruits/plant than T_1. The treatment T_3 produced the lowest fruit number/plant where no insecticides were used. Individual fruit weight was found higher in T_1 (5.57 kg) followed by T_3 (4.78 kg). The lowest fruit was produced by T_2 (4.2 kg) where frequent insecticides were sprayed.

The yield of sweet gourd produced significant difference among treatments. The sex pheromone placed treatment produced the highest yield (36.90 t/ha) followed by T_2 (20.0 t/ha) and T_3 (18.91 t/ha). The treatment T_2 and T_3 are statistically identical.

From the general observation, it was found that movement of pollinating agent was frequent in sex pheromone placed plot. But the pollinating agent was very low in insecticides sprayed field that may be the reason of deshaped and small size fruits. Pollinating agents movement were high in farmers' field without insecticide sprayed but insect damage was high that decreases fruit number/plant but increases individual fruit weight (Table 5).

From the economic analysis, it was revealed that the highest gross margin (Tk.145473/ha) and BCR (4.73) was obtained from sex pheromone applied field. Though the yield was insignificant in T_2 and T_3, the insecticides spray was not economically effective to control fruit fly in sweet gourd (Table 4).

Farmers reaction

Farmers are very much interested to use pheromone trap if that available in market. In field day, farmers demanded that demonstration should be repeated in next year on sweet gourd and cucumber for quick dissemination of this technology at farm level.

BOGRA

The results revealed that (Table 6) the highest number of infested fruit was found in the treatment T_2. The sex pheromone trap placed plot showed the lowest infestation. The maximum number of fresh and edible fruit was produced by T_1 where sex pheromone trap was placed. The treatment T_2 yield was lower edible fruits/plant than treatment T_1 (Sex pheromone). Individual fruit weight was found highest in T_1 (6.35 kg). The lowest weight of fruit was found in T_2 (5.77kg) where no insecticides were used. But in an observation, it was found that sex pheromone has direct effect on controlling fruit fly in sweet gourd.

Farmer reaction

Farmers are very much interested to use pheromone trap if that available in market. In field day, farmers demanded that demonstration should be repeated in the larger sized plot with more number of pheromone traps. Usually farmers of this region frequently use insecticides in their large commercial plots of cucurbits

TANGAIL

A significant statistical variation was found among the treatments. Significantly the highest number of fresh fruits 100/m^2 areas (225) was obtained from plants treated with sex pheromone trap. The lowest number of fresh fruits was obtained from absolute control plot (84/plot). The lowest number of infested fruits (31) was produced in plants treated with sex pheromone trap while the plants of absolute control plot produced the maximum number of infested fruits (70/plot). However, the FP showed intermediate performance in different parameters.

The highest gross return (Tk.245660/ha) and benefit cost ratio (2.85) was obtained from plants treated with sex pheromone trap. The lowest gross return (Tk. 125660/ha) and BCR (1.87) was found in the absolute control plot.

Farmers' reaction

Farmers are interested to use the sex pheromone trap. They opined they will use it if the pheromone trap is available in the market.

PABNA

From the results it was found that harvesting period is about one week more in sex pheromone plot than farmers practice and control plot (Table 1). It might be due to insect infestation and toxic effect of 5 times chemical pesticides used in farmers practice. Plant height was statistically insignificant but little bit higher in sex pheromone treatment. Incase of fruits plant^{-1}, the highest no. and percentage of fully damaged fruits were counted from control plot, which was also identical with farmers practice plot where infested occurred, but edible fruits plant^{-1} was highest in farmers practice plot, which was also identical with control plot. In both cases, sex pheromone plot showed the lowest infestation. Incase of non infested fruits plant^{-1}, edible fruit yield plant^{-1} and ha^{-1}, sex pheromone plot always showed the highest performance. So, it was found that by using sex pheromone trap fruit fly infestation could reduce bellow 11% where as infestation was more than 29% in farmers traditional practice.

From the economic analysis, it was revealed that higher gross margin and benefit cost ratio was obtained from sex pheromone treatment. It is mainly due to higher yield and relatively less cost than farmers practice.

Farmer's reaction

They also opined that the application of sex pheromone trap is very helpful and non hazardous for farmers. They were happy to get satisfactory yield. But their desire was to get sex pheromone timely and sufficiently in local market. Farmers also want other safe options for controlling thrips and other insects.

MANIKGANJ

The highest number fresh fruits (5137 no./ha) was obtained from the sweet gourd plot treated with sex pheromone. The lowest number of fresh fruits was recorded from farmers practice. The inverse trend observed in case of infested fruit in this study. The highest yield (19.71/ha) was record from pheromone trap tested plot. Apparently fewer insects were observed in sweet gourd in pheromone trap method compared to farmers practice. The gross margin (Tk. 166608/ha) was also found higher is sex pheromone trap method than farmer practice.

Farmers' reaction

Controlling of fruit fly through sex pheromone trap method is very helpful and non hazard. They wanted to get the pheromone trap sufficiently in local market with lower price.

Conclusion

Numerical less insect infestation was observed in sex pheromone treatment compared to pesticides used or control treatment. The yield and gross return were also found higher in sex pheromone treatment. This experiment created a good awareness to the sweet gourd growers because of good yield and economic return and environment friendly technique.

Extension message

This sex pheromone technique is highly accepted by the farmers' (popularly known as "Zadur Baksaw") if culture can be available in the cucurbit crops growing area. This method will be extended among the large number of farmers (100 ha).

Table 3. Effect of sex pheromone trap on performance of sweet gourd during 2007-08 at the MLT site Shibpur, Pathia Rajshahi

Treatment	% infested fruit	No. of fresh fruit/plant	Average fruit weight (kg)	Yield (t/ha)
T_1 (Sex pheromone)	2.73 c	4.78 a	5.57 a	36.90 a
T_2 (with insecticide)	25.03 b	3.47 b	4.20 c	20.0 b
T_3 (without insecticide)	32.83 a	2.83 c	4.78 b	18.91 b
CV (%)	22.37	12.06	7.15	11.01
LSD (0.05)	5.81	0.574	0.45	3.58

Table 4. Cost and return analysis of sweet gourd as influenced by sex pheromone trap at the MLT Shibpur Puthia, Rajshahi during 2007-08.

Treatment	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross Margin (Tk./ha)	BCR
T_1	184500	39027	145473	4.73
T_2	100000	40027	59973	2.50
T_3	94550	34027	60523	2.78

Price: Sweet gourd @ 5 Tk./kg, Seed @ 80 Tk./10g, Urea @ 6 Tk./Kg, TSP @ 35 Tk./Kg, MP @ 33 Tk./Kg, Gypsum @ 6 Tk./Kg, Boric Acid @ 120 Tk./Kg, Zinc Sulphate @ 100 Tk./Kg, CD @ 1 Tk./Kg.

Table 5. Insect traped frequency per week in sex pheromone traps during 9/3/08-12/4/08 in sweet gourd field at Shibpur, Puthia, Rajshahi

Dates	9.3.08	16.3.08	22.3.08	29.3.08	5.4.08	12.4.08
Insect number/trap	5	4	5	8	9	11

Table 6. Effect of sex pheromone trap on performance of sweet gourd during 2007-08 at the MLT site Sherpur, Bogra

Treatment	% infested fruit	No. of fresh fruit/plant	Average fruit weight (kg)	Yield (t/ha)
T_1 sex pheromone	22	1.18	6.35	18.837
T_2 control (Sungor 0.2 conc.)	45	0.72	5.77	10.386

Table 7. Insect trapped frequency per week in sex pheromone trap during 16.1.08-22.2.08 in sweet gourd field at the MLT site Sherpur, Bogra.

Dates	16.1.08	23.1.08	30.1.08	07.2.08	20.2.08	22.2.08	Mean
Insect number/trap	25	32	23	14	25	24	23.8

Table 8. Effect of sex pheromone trap on the production of ash gourd at Sadar MLT Site, Tangail during 2007-08

Treatments	Fresh fruits/plot (no.) (100 m^2)	Infested fruits/plot	Damaged fruit/plot
Sex pheromone trap	225	31	14
Farmers practice	131	48	37
Absolute control	84	70	44
LSD (0.05)	29.93	11.05	6.18
CV (%)	9.0	9.8	8.6

Table 9. Cost and return analysis of controlling cucurbit fruit fly with sex pheromone trap.

Treatments	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Sex pheromone trap	245660	85725	159935	2.85
Farmers practice	163250	75622	87628	2.15
Absolute control	125670	66850	58820	1.87

Table 10. Performance of sweet gourd as influenced by different controlling method against fruit fly at Choukibari and Trimohon village, Pabna during the year of 2007-08

Treatment	Harvesting period (Day)	Plant height (cm)	Fruits/plant						Edible fruit yield (kg/plant)	Edible fruit yield (t/ha)
			Fully damage (non edible)		Infested (edible)		Non-infested (edible)			
			No.	%	No.	%	No.	%		
T_1: Sex pheromone	67	274.00	0.38	10.7	0.55	15.58	2.60	73.65	8.79	40.35
T_2: Farmers practice	58	261.51	1.20	29.0	1.83	44.31	1.10	26.63	6.19	29.89
T_3: Control	61	229.50	1.58	40.10	1.46	37.06	0.90	22.84	4.67	22.14
LSD (0.05)	-	NS	0.402	-	1.26	-	0.6238	-	1.209	6.902
CV (%)	-	16.92	21.48	-	25.57	-	24.58	-	10.33	12.54

Table 11. Cost and return analysis of sweet gourd as influenced by different controlling method against fruit fly at Choukibari and Trimohon village, Pabna during the year of 2007-08

Treatments	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)	Benefit cost ratio
T_1: Sex pheromone	201750	36150	165600	5.58
T_2: Farmers practice	149450	37125	112325	4.02
T_3: Control	110700	34650	76050	3.19

Price : Single sex pheromone trap Tk. 20.00, Sweet gourd fruit = Tk. 5.00/kg, Insecticide cost/ha Tk. 2475.00

Table 12. Effect of pheromone on the production of sweet gourd at the MLT site, Manikganj, 2008

Treatment	No. of fresh fruit/ha	No. of infested fruit/ha	No. of damaged fruit/ha	Total yield (kg/ha)	GR (Tk./ha)	TVC Tk./ha)	Gm (Tk./ha)
T_1: Sex pheromone trap	5137	692	296	19.71	227864	61256	166608
T_2: Farmers practice	1268	3654	395	13.64	117957	66196	51761

Performance of BAICAO as a Bio-Pesticide for controlling Aphid of Different Crops

Introduction

Imbalance and abuse of different chemical pesticides on different crops are the serious problems for human health. It polluted our environment seriously. Most of them are poisonous and have a bad residual effect. On the other hand bio-pesticides extracted from different plant parts have no such effect but can control some harmful insect successfully. Now a day some pesticide companies came forward to produce or import bio-pesticides and trying to market those. Before recommendation it needs scientific verification for its efficiency as pesticide in any case. BAICAO is one of the bio-pesticide (insecticide) extracted from the plant parts of Neem, Thuja and Nayantara plants which contain 0.36% Matrine aqueous solution. It is imported and needs validation. Therefore, it is important to see the effectiveness of BAICAO for controlling harmful insects of common vegetables.

Materials and Methods

As the pesticide was not available during crop season for country bean and supplied late in January, 2008 an observation trial was carried out at Agricultural Research Station, BARI, Pabna during rabi season 2007-08. Before starting the trial, two crops i.e. mustard (BARI sarisha-11) and radish (BARI mula-1) were selected for controlling aphid. Then three aphid influenced plants of each crop were selected for BAICAO spraying. BAICAO was sprayed at the active stage of aphid incase of mustard on 5 February and incase of radish on 11 February, 2008 @ 1ml BAICAO/L water at 10.00 to 11.00 am of the respective days. Observation was done after 2 and 7 days of spraying.

Results and Discussion

Mustard

During the first observation at 2 days after spraying, there was no aphid alive i.e. 100% controlled. But during the second observation at 7 days after spraying, it was observed that those plants were again influenced with a few aphids which might be migrated from other plants.

Radish

Same result was found during the first observation but in case of second observation at 7 days after spraying, it was found that there was no aphid infestation.

Conclusion

From the trial, it was observed that BAICAO might be an effective bio-pesticide for controlling aphid but before recommendation it needs further trial in a well designed and controlled management system.

Suitability of Mustard Varieties in Mustard-Boro-T.Aman Cropping Pattern

Abstract

The trial on suitability of mustard varieties in Mustard-Boro-T.aman or Mustard-Boro cropping pattern was conducted at Tangail, Manikganj, Jamalpur, Mymensingh and Bogra during rabi 2007-08 in farmers' field condition to evaluate the BARI developed mustard varieties suitable for the cropping pattern. The trial was laid out in RCB design with three dispersed replications (farmers). Tested varieties were BARI Sarisha-9, BARI Sarisha-14, BARI Sarisha-15 & Tori-7 (local). Among the tested varieties, BARI Sarisha-14 gave the higher seed yield in Manikganj, Jamalpur, Mymensingh and Bogra but BARI Sarisha-15 performed better in Tangail.

Introduction

Bangladesh is to import a huge amount of vegetable oil and oil seed every year to meet up the deficiency. Mustard is the major oil seed crop grown in Bangladesh. It covers about 70% of the total oil seed production. The yield of this crop in Bangladesh is found much lower than the other countries of the world due to lower yield potential of existing local varieties and the poor management practices. The national average yield of mustard is 0.74 t/ha (Mondal and Wahab, 2001). Oil Seed Research Center (ORC) of BARI has developed some advanced promising varieties/lines of mustard which have been proved high yielder less diseases susceptible and higher oil content (44%). The mustard varieties (*Brassica camprestis*) are also resistant to white rust (Woods-DL and Falk. KC, 2001). Farmers normally use local varieties and as such they get lower yield. The average yield of mustard can be increased by using high yielding varieties. BARI developed short duration varieties may be used as the replacement of the existing low yielding varieties without disturbing the cropping pattern Mustard-Boro-T.aman. Hence, the study was under taken to evaluate the performance of newly released varieties of mustard in the cropping pattern under farmers' field condition.

Materials and Methods

The trial on suitability of mustard varieties in Mustard-Boro-T.aman or Mustard-Boro cropping pattern was conducted at Tangail, Manikganj, Jamalpur, Mymensingh and Bogra during rabi 2007-08 in farmers' field condition to evaluate the BARI developed mustard varieties suitable for the cropping pattern. The trial was laid out in RCB design with three dispersed replications (farmers). It was conducted in. ICM/IPM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. Tested varieties were BARI Sarisha-9, BARI Sarisha-14, BARI Sarisha-15 & Tori-7 (local).Data were analyzed statistically using CropState/Mstat-C analytical package. Crop management practices followed at different locations are presented in the presented Table 1.

Table 1. Crop management practices done in different locations

Location	Tangail	Manikganj	Jamalpur	Mymensingh	Bogra
Unit plot size	6m x 5m	8m x 5m	6m x 5m	8m x 5m	6m x 5m
Sowing time	23 Nov. 2007	-	10-15 Oct. 07	24 Nov. 07	29-30Nov'07
Harvesting time	15-22 Feb. 08	-	1-8 Feb. 08	2 Feb. 08	
Fertilizer dose (N-P-K-S kg/ha)	As per FRG 2005	As per FRG 2005	120-38-36-20	100-25-60-20	60-20-50-10-0.6

Results and Discussion

TANGAIL

Table 2 reveals that days to maturity, plant height, seed yield and other yield attributes were significantly influenced by different varieties. The variety Tori-7 matured earlier (78 days), followed by BARI sarisha-9 (83 days). The highest duration was taken by BARI sarisha-14 (87 days) and it was at par with BARI sarisha-15 (85 days). The highest plant height was observed from BARI Sarisha-15 (103.5 cm) and the shortest plant was found in Tori-7 (57.75 cm). The highest number of siliqua per plant (76) was obtained from BARI Sarisha-9 and BARI Sarisha-15 produced the lowest number of siliqua per plant (57). The variety BARI Sarisha-14 produced the highest number of seeds per siliqua (21) and that of the lowest was in Tori-7 (15). The highest thousand seed weight (4.07) was obtained from BARI Sarisha-15 and the lowest weight (2.87g) was from Tori-7. The variety BARI Sarisha-15 produced the highest seed yield (1449.82 kg/ha), which was statistically at par with that of BARI sarisha-14 (1422.91 kg/ha) and BARI sarisha-9 (1329.96 kg/ha). The lowest seed yield was produced by the variety Tori-7 (958.77 kg/ha).

Farmers' reaction

Farmers' are interested to cultivate BARI Sarisha-9 due to its short duration and reasonable higher seed yield. It's field duration is also acceptable and will not delay the succeeding boro crop. DAE personnel also opined in favour of BARI sarisha-9 production.

MANIKGANJ

The variety BARI sarisha-14 and BARI sarisha-15 gave higher pod/plant as compared to other varieties. But higher seeds/pod was observed in BARI sarisha-14 followed by BARI sarisha-9 and Tori-7. BARI sarisha-14 produced the highest 1000-seed weight followed by BARI sarisha-15.Among the four varieties BARI Sarisha-14 gave the highest yield. Though seed yield was higher in BARI sarisha-14 but field duration was 8 days more than traditional Tori-7 (Table 3).

MYMENSINGH

Table 4 shows the yield contributing characters and yields of mustard varieties. The mustard varieties matured within 76-80 days. Plant population and plant height did not varied significantly but other plant characters as number of siliqua/plant, number of seeds/siliqua, 1000 seed weight, seed and stover yield varied significantly. Number of seeds/siliqua and 1000 seed weight were significantly higher in BARI Srisha-14 which contributed to higher seed yield (1.11 t/ha) and it was followed by BARI Sarisha-15 with seed yield (0.90 t/ha). Stover yield was also higher (2.61 t/ha) in BARI Sarisha-14 which was identically followed by BARI Sarisha-15. The local variety gave the lowest seed (0.79 t/ha) and stover yield (2.22 t/ha).

JAMALPUR

Results obtained from the study indicated that the yield contributing characters were found significant (Table 5). The longest plant was recorded from BARI sarisha 15 was statistically identical to BARI Sarisha 9. BARI Sarisha 14 produced the second longest plant while Tori 7 produced the shortest plant. The number of plant/m^2 was found insignificant. The highest number of siliqua/plant was noted from BARI Sarisha 9 and was identical to BARI Sarisha 15 and Tori 7. The lowest number of siliqua was recorded from BARI Sarisha 14. The highest number of seed/siliqua was found in BARI Sarisha 14 followed by BARI Sarisha 15. The lowest number was recorded in Tori 7. The 1000 seed weight was statistically identical among the varieties except Tori 7. However, the highest seed yield was recorded from BARI Sarisha 14 (1627 kg/ha) followed by BARI Sarisha 15 (1489 kg/ha). The lowest yield was obtained from Tori 7 (789 kg/ha). Tori 7 matured 5 days earlier than the other varieties.

Farmers' reaction

Farmer could realize that the BARI varieties were better than their local variety and may be cultivated in between T.Aman and Boro. They preserved their seeds and will go for cultivation in the next year.

BOGRA

The yield and yield contributing characters of different varieties of mustard has been presented in Table-1. The result indicated that considerable variation was observed regarding days to maturity among the tested varieties. The maximum number of siliqua/plant was recorded from BARI Sarisha-

15 (67.05) which was similar with BARI Sarisha-9 (65.07). The lowest number of siliqua per plant was obtained from the variety BARI Sarisha-14 (58.76). Maximum no. of seeds/siliqua was recorded in BARI Sarisha-14 (28.28) which was varied with other variety. Seed yield of Tori 7 was the lowest among the tested varieties but field duration was 8 days less compared to BARI sarisha. The variety BARI Sarisha-14 and BARI Sarisha-15 showed higher yield as compared to other varieties.

Farmers' reaction

BARI sarisha-14 was preferred by the farmers for its bold and yellow coloured seeds. Most of the farmers choose both BARI sarisha -14 and BARI sarisha -9

Conclusion

As BARI sarisha-9 yielded higher over the existing local one (Tori-7) and can easily be fitted in the cropping pattern Mustard-Boro-T.aman without delaying the succeeding boro crop. The variety is proven to be promising, it may be recommended as extension message for large scale production.

References

Mondal, M.R.I and M. A. Wahab. 2001. Rape Seed and Mustard in; Production technology of oil crops, ORC, BARI, Gazipur. P.4.

Woods-DL and Falk.KC. 2001. Ac Sungold Summer turnip rape. Canadian Journal of Plant Science., 81.2., 285-87.

Table 2. Yield and yield contributing parameters of BARI developed mustard varieties at the MLT site, Ghatail, Tangail during Rabi 2007-08.

Variety	Plant population (m^2)	Days maturity	Plant height (cm)	Branches/ plant (no.)	Siliqua /plant (no.)	Seeds/ siliqua (no.)	1000 seed wt. (g)	Yield (kg/ha)
BARI Sarisha-9	70	83	95.97	14	76	17	3.35	1330
BARI Sarisha-14	63	87	102.53	7	63	21	3.88	1423
BARI Sarisha-15	58	85	103.95	6	57	16	4.07	1450
Tori-7	65	78	57.75	3	74	15	2.87	9588
LSD (0.05)	4.61	2.65	1.66	0.70	6.50	1.97	0.25	164.69
CV (%)	5.8	2.1	1.5	7.3	7.8	9.3	5.8	10.4

Table 3. Yield contributing characters and yield of mustard varieties at the MLT site, Manikganj during 2007-08

Variety	Days to maturity	Plant height (cm)	Plant/m^2 (No.)	Pod/plant (No.)	Seeds/ Pod (No.)	1000 seed wt.(g)	Seed yield (t/ha)	Straw yield (t/ha)
Tori- 7	78	70.35d	89.83a	56.50c	11.00b	3.25b	1.177b	1.88b
BARI Sarisha-9	84	93.43c	78.67b	68.83b	10.67b	2.82b	1.215b	1.93b
BARI Sarisha-14	86	123.80a	68.83c	84.83a	13.33a	4.37a	1.378a	2.18a
BARI Sarisha-15	86	112.63b	71.17c	77.83a	12.67ab	3.90a	1.318b	1.91a
CV (%)		3.38	6.11	8.60	14.88	11.05	4.50	8.03

Table 4. Yield and yield contributing characters of mustard varieties under Mustard-Boro-T.aman rice cropping pattern at Netrakona, 2007-08

Variety	Days to maturity	Plant populatio/ m^2	Plant height (cm)	No. of siliqua/ plant	No. of seeds/ siliqua	1000-seed wt. (g)	Seed yield (t/ha)	Stover yield (t/ha)
BARI sarisha-14	79	191	90.50	59.05	27	2.53	1.11	2.61
BARI sarisha-15	80	196	88.36	43.31	20	2.41	0.90	2.58
BARI sarisha-9	78	188	89.56	67.93	15	2.26	0.82	2.33
Tor-7	76	193	88.03	66.93	15	2.15	0.79	2.22
LSD (0.05)	-	NS	NS	5.27	1.02	0.04	0.06	0.10
CV (%)	-	11.73	2.37	7.22	4.60	1.42	5.08	3.36

N.B. Setting of the experiment was late due to depression and rain at the sowing time. So, the performance of the crop was not up to the mark.

Table 5. Yield and yield contributing characters of different turnip rape mustard at Jamalpur during 2007-08

Variety	Maturity (days)	Plant ht (cm)	Plants/m^2 (no.)	Siliqua/ plant (no.)	Seeds/siliqua (no.)	TSW (g)	Seed yield (kg/ha)
BARI Sarisha 9	86 a	114.6 a	66.3	73.4 a	15.9 c	3.23 a	1342 c
BARI Sarisha 14	82 b	109.6 b	71.2	53.0 b	33.0 a	3.35 a	1627 a
BARI Sarisha 15	86 a	125.1 a	65.8	62.4 ab	23.9 b	3.27 a	1489 b
Tori 7	81 b	101.3 c	66.0	59.8 ab	13.9 c	2.89 b	789 d
CV (%)	4.49	8.34	9.54	10.10	9.64	4.90	10.34

Figure in the column having similar letter (s) do not differ significantly

Table 6. Yield and yield contributing characters of mustard varieties at Gabtali MLT sites during rabi 2007-08

Variety	Field duration (days)	Plants/ sqm. (no.)	Siliqua/ plant (no.)	Seeds/ siliqua (no.)	1000-seed wt. (g)	Seed yield (t/ha)
BARI sarisha -9	82	50.20	65.07	18.42	2.59	1.216
BARI sarisha -14	85	50.83	58.76	28.28	2.58	1.250
BARI sarisha -15	87	51.50	67.05	18.58	2.60	1.240
Tori-7	77	52.17	63.17	14.47	2.56	0.820

Integrated Nutrient Management for Potato-Mungbean-T.Aman Cropping Pattern

Abstract

The experiment was initiated at the farmers' field of the MLT site, Domar, Nilphamari and MLT site, Joypurhat during rabi 2007-08 to develop agro-economically suitable fertilizer dose for Potato-Mungbean-T.aman cropping pattern. Potato variety, Dheera for Rangpur and Diamant for Bogra was tested along with four different fertilizer management approaches viz. Soil test based (STB) fertilizer dose for moderate yield goal, STB fertilizer for high yield goal (HYG) and Integrated Plant Nutrition System (IPNS) approach for HYG and farmers dose. During the reporting, the cropping pattern was yet to be completed. Results of potato at Nilphamari and potato and mungbean at Bogra were presented. The highest yield of potato was obtained from IPNS based fertilizer dose at both the locations.

Introduction

A crop production system with high yield targets cannot be sustainable unless nutrient inputs are supplied to soil against nutrient removable crops (Bhuiyan et. al. 1991). Sequential cropping ensures maximization of efficient use of moisture and nutrients for soil (Kanwar 1986). Integrated nutrient management for prevailing cropping systems appears to be one of the effective ways to meet the economical nutrition requirement of crop (Kulkarni et. al. 1993). Farmers usually use fertilizer on single crop basis without considering the cropping pattern followed round the year. But it is known that some nutrients have considerable residual effect on the succeeding crops, which may extend up to two/three crops. Similarly, inclusion of legume in the cropping system substantially contributes in nutrient supply. Legumes like mungbean can be fitted in potato based cropping systems owing to its short duration and grow well in summer conditions. However, it is important to find out the economically viable fertilizer dose for that cropping pattern. The present study is proposed to evaluate the impact of mungbean and pattern based fertilizer recommendation on the productivity of Potato-Mungbean-T.aman rice cropping pattern

Materials and Methods

The experiment was conducted at the farmers' field of MLT site, Domar, Nilphamari and MLT site, Joypurhat during rabi 2007-08 to determine cropping pattern based fertilizer recommendation. The trial was laid out in RCB design with six dispersed replications (farmers). It was conducted in ICM/IPM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. The unit plot size was 42m^2. There were four treatments viz. Soil test based fertilizer dose for moderate yield goal (T_1), STB fertilizer dose for high yield goal (T_2) Integrated Plant Nutrition System approach for HYG (T_3), and farmers practices (T_4). The crop potato variety Dheera at Rangpur and Diamant at Bogra were sown in 30 November-4 December 2007 and harvested from 25 February to 2 March 2008. Yield attributes were collected from 10 randomly selected plants. All data were analyzed statistically. Market price of the crop at harvest was recorded to calculate economics. The cropping pattern is yet to be completed hence, the result of potato from Rangpur and the yield of potato and mungbean from Bogra are presented here.

Table 1a. Initial status of soils of the experimental plots under the MLT site Domar, Nilphamari

Soil characteristics	MLT site Domar, Nilphamari	Critical limit
Land type and soil texture	MHL and Loamy	-
pH	6.63	-
OM(%)	2.09	-
K (mlq/100g soil)	0.19 (medium)	0.12
N(%)	0.09 (Very low)	0.12
P(Micro gram/g soil)	60.43 (Very high)	10.00
S(Micro gram/g soil)	10.44 (low)	10.00
Zn(Micro gram/g soil)	0.44 (very low)	0.6
B(Micro gram/g soil)	0.15 (very low)	0.20

Table 1b. Details of different treatments of the tested cropping pattern

Treatments	MLT site Domar, Nilphamari
	N-P-K-S-Zn-B-CD (kg/ha)
	Potato
T_1: Soil test based fertilizer dose for moderate yield goal	96-10-60-10-3-0-0
T_2: STB fertilizer dose for high yield goal	135-10-85-13-4-0-0
T_3: Integrated Plant Nutrition System approach for HYG	112.5-3-60-13-4-0-5000
T_4: Farmers practices	124-7.5-69-12-0-0-4000

Table-1.c. Soil analysis values of different samples collected from MLT site Joypurhat

Replication	Analyzed Results						
	pH	Total N (%)	P PPM	K m.eq/100g soil	S microgram/g soil	Zn	OC (%)
1	5.0	0.064	10.74	0.04	7.43	1.49	0.64
2	4.9	0.089	13.87	0.10	7.09	2.99	0.89
3	5.1	0.054	11.87	0.05	7.43	1.27	0.54
4	5.2	0.058	22.55	0.09	6.08	0.90	0.85
5	4.9	0.056	7.52	0.06	8.10	0.94	0.56
6	4.5	0.069	13.96	0.10	6.75	2.40	0.69
Average	4.93	0.0599 L	13.41 L	0.073 VL	7.146 VL	1.667 Optimum	0.599

L= Low, VL= Very low

Results and Discussion

NILPHAMARI

The highest yield (33.94 t/ha) was obtained from T_3 treatment followed by T_2 treatment. The lowest yield (29.76) was recorded from T_1 treatment. From the cost and return analysis it was found that the highest net return (Tk. 159616/ha) and BCR (2.43) was given by IPNS (T_3) treatment.

Farmers' reaction

Based on selection criteria (dark green leaf colour, less disease and insect infestation and good yield performance) farmers were interested to grow potato with IPNS basis fertilizer dose.

Scientists opinion

Among the different treatments IPNS showed the better performance due to use of organic manure and along with chemical fertilizer.

BOGRA

Highest tuber yield was obtained from T_3 i.e. IPNS for HYG (20.40 t/ha) which was identical to T_2 i.e. STB fertilizer dose for HYG (20.04 t/ha). The lowest tuber yield (14.03 t/ha) was obtained from T_1 i.e. STB fertilizer dose for MYG. Here in T_4 farmer practice, the farmer applied higher amount of TSP which yielded (17.79 t/ha). Average trend of tuber yield was low, due to infection of late blight of potato, which was also controlled. Mungbean the treatment T_2 with STB fest dose HYG gave the highest grain yield (1.239 t/ha) which was followed by T_2 i.e. IPNS for HYG (1.127 t/ha) while the lowest was harvested from T_1 (0.976). T. aman variety BR-11 was sown in the seed bed on 1st week of June. The crop expected to transplant with early July, 2008.

Farmer's reaction

Mungbean it was new crop to the farmers and the area with higher catena of Level Barind soil, the variety BARI mung-6 had the exciting and unique character to its early maturity (65-70 DAS). Use of low inputs like fertilizers and irrigation (1 or no) which contributed to have appreciable yield within quickest time, Farmer demand more seeds to grow in the following season.

In a field day when the farmers were taught about the fixation of atmospheric nitrogen to the root zone and the use of plant stalk (after picking of mungbean) as brown manure to enrich the soils. Farmer already incorporated these plants stalk to the soil.

Conclusion

IPNS showed the better performance comparing to other treatments for potato cultivation. The study on cropping pattern was not completed. Therefore, it is not possible to draw concrete conclusion. Although inclusion of mungbean in the cropping pattern (potato-mungbean-T. aman) especially in the higher catena of Level Barind soil of AEZ-25 created an enthusiasm among the farmers.

Table 2a. Effect of different fertilizer dose on yield attributes of potato at the MLT site Domar, Nilphamari

Treatment	Plant height	Tuber/ plant	Straw yield (ton/h)	Tuber yield (ton/ha)
T_1	73.18 bc	12.0 c	14.67c	29.76d
T_2	77.62ab	13.0b	16.44a	32.42b
T_3	78.78a	13.88a	16.98a	33.94a
T_4	71.95c	12.05c	15.71b	30.36c
CV (%)	5.6	4.8	3.2	5.8

Table 2b. Effect of different fertilizer dose on yield and economics of potato at the MLT site Domar, Nilphamari

Treatment	Tuber yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1	29.76d	238080	106566	131514	2.23
T_2	32.42b	259360	110661	148699	2.34
T_3	33.94a	271520	111904	159616	2.43
T_4	30.36c	242880	103626	139254	2.34
CV (%)	5.8	-	-	-	-

Potato price 8/- per kg

Table 3. Yield performance of potato (cv. Diamant)-Mungbean (BARI mung-6)-T.Aman (BR-11) cropping pattern at varying nutrients levels at higher catena of level Barind soil of Joypurhat, MLT site during 2007-08.

Treatments	Product Yield (t/ha)		
	Potato (Tuber)	Mungbean (Seed)	T.aman (Grain)
T_1: STB Fert. dose for MYG	14.03	0.976	Yet to have the data
T_2: STB Fert. dose for HYG	20.04	1.239	
T_3: IPNS for HYG	20.40	1.137	
T_4: Farmer’s practice	17.69	1.067	

Integrated Nutrient Management for Mustard-Mungbean-T.Aman Rice Cropping Pattern

Abstract

The experiment was carried out during the rabi season of 2007-08 at the MLT site, Atghoria, Pabna to find out a cropping pattern based fertilizer recommendation and to determine the economic dose of fertilizer for Mustard-Mungbean-T.Aman cropping pattern. The highest seed yield was obtained from integrated plant nutrient system and lowest from farmers practice treatment. The significant cumulative effect of important yield attributes supported to achieve the maximum yield.

Introduction

A crop production system with high yield targets cannot be sustainable unless nutrient inputs are supplied to soil against nutrient removable crops (Bhuiyan *et al.*1991). Sequential cropping ensures maximization of efficient use of moisture and nutrients for a soil (Kanwar 1986). Integrated nutrient management for prevailing cropping system appears to be one of the effective ways to meet the economical nutrition requirement of crop (Kulkarni *et al.* 1993). Farmers usually use fertilizers on single crop basis without considering the cropping pattern followed round the year. But it is known that some nutrients have considerable residual effect on the succeeding crops which may extend up to two/three crops. Similarly, inclusion of legume in the cropping system substantially contributes in nutrient supply. Legumes like mungbean can be fitted in mustard based cropping systems owing to its short duration and grow well in summer conditions. However, it is important to find out the economically viable fertilizer dose for that cropping pattern. The present study is proposed to evaluate the impact of mungbean and pattern based fertilizer recommendation on the productivity of Mustard-Mungbean-T.Aman rice cropping pattern

Objectives

i) To verify different nutrient management approaches
ii) To find out a cropping pattern based fertilizer recommendation
iii) To determine the economic dose of fertilizer

Materials and Methods

The experiment was carried out during the rabi season of 2007-08 at the MLT site, Atghoria, Pabna. The experiment was laid out in randomized complete block (RCB) design with six dispersed replications (farmer). It was conducted in ICM/IPM club/Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. The unit plot size was 8 m X 5 m. Four different nutrient managements viz. T_1: Soil test based fertilizer dose for medium yield goal (87-24-39-26-2-0.44 kg N-P-K-S-Zn-B/ha), T_2: Soil test based fertilizer dose for high yield goal (124-32-54-33-3-0.60 kg N-P-K-S-Zn-B/ha), T_3: Integrated plant nutrient system following HYG (109-27-39-33-3-0.60 kg N-P-K-S-Zn-B/ha +CD 5 t/ha), T_4: Farmers practice (86.6-22.6-17.5-13.8-1.7-0.80 kg N-P-K-S-Zn-B/ ha) were tested for the first crop mustard under Mustard-Mungbean-T.Aman cropping pattern. The seed of mustard (BARI Sarisha-13) was sown on November 8-9, 2007. Single irrigation was applied at first week of December just after thinning. Standard crop management practices were used for maintain the productivity of the pattern. The crop was harvested on February 13-15, 2008. Necessary data were collected and analyzed statistically.

Results and Discussion

The yield and yield contributing characters were significantly different among the treatments (Table 1). Identically higher plant populations were found in IPNS and MYG treatments where identically higher plant heights were measured in MYG and HYG treatments. Though the plant height measured lowest in IPNS treatment but its plant was healthier and contains higher number of siliqua/plant which was also identical with HYG and FP treatments. Number of seeds siliqua^{-1} and 1000-seed weight were also found higher in IPNS treatment where as FP treatment gave the lowest value. The highest seed and stover yield were also obtained from IPNS treatment where the FP treatment produced the lowest yield. This result is the cumulative effects of yield attributing characters.

Farmers' reaction

Farmers opined that yield was higher in both T_2 and T_3 treatments but T_3 is better. Farmers also want to see the fertilizers effect on next crop.

Conclusion

The combined application of organic and inorganic fertilizer for the crop production might have a positive effect on soil and crop productivity. This is the first crop result of the pattern, so, after completion of the whole cropping pattern it may be concluded.

Table 1. Yield and yield contributing characters of mustard as influenced by different fertilizer packages in Mustard-Mungbean-T.Aman cropping pattern during the rabi season of 2007-08 at the MLT site, Atghoria, Pabna

Treatments	Plant pop^n /m^2 (no.)	Plant height (cm)	Siliqua/plant (no.)	Seeds/siliqua (no.)	1000-seed wt. (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
T_1:MYG	61.17	134.3	122.4	22.50	3.57	2350	1615
T_2:HYG	59.67	130.5	124.6	22.75	3.52	2422	1586
T_3:IPNS	62.83	124.7	127.9	23.95	3.63	2783	1639
T_4:FP	56.83	128.5	123.7	20.53	3.33	2111	1511
LSD (0.05)	2.08	4.48	4.28	0.75	0.23	219.20	54.49
CV (%)	9.81	6.87	2.79	2.70	5.35	7.37	2.79

Evaluation of Different Fertilizer Management for Maize-Mungbean- T.Aman Cropping Pattern

Abstract

The experiment was carried out at Multilocation testing (MLT) site, Atghoria, Pabna during the rabi season of 2006 to kharif 07 to increase yield of maize and T.aman in the pattern through sustaining soil fertility. There were four combinations of chemical fertilizers (CF) along with absolute control arranged in a randomized complete block design. Among the nutrient management treatments, better response in yield of maize was found in recommended fertilizer (T_3) which was statistically similar with high yield goal fertilizer (T_1) and farmer's nutrient management (T_4). In T. aman rice, no significant difference was observed among the treatments except absolute control plot.

Introduction

Maize is an important cereal crop and last few years wheat yield is drastically reduced due to fluctuate weather condition and is being replaced by maize due to its high yield potential. But maize is an exhaustive as well as high nutrient demanding crop. Imbalance chemical fertilizer management and no addition of organic matter is becoming a threat for soil health and sustainable yield. From the previous study, it was revealed that maize yield declined substantially over 3 to 4 consecutive years. Leguminous crop is important for soil fertility concern because of its nitrogen fixation and subsequent adding to the soil. In maize based cropping pattern relaying of mungbean in the late reproductive stage of maize with low ground coverage making by top working of maize canopy. After harvest of first flash grain of mungbean and incorporation of brown biomass may lead to improve soil fertility and supply of available nutrients to the growing plants. Organic matter through adding mungbean biomass may exert subsequent effect on succeeding T.aman crop. In addition to that soil test based (STB) fertilizer management is deemed great significance for improvement of soil health and sustainable yield.

Objectives

i. To increase yield of Maize and T.Aman in the pattern through sustaining soil fertility
ii. To increase farmers income

Materials and Methods

The experiment was conducted at Multilocation testing (MLT) site, Atghoria, Pabna during the rabi season of 2006 to kharif season of 2007. The experimental site was in Gopalpur soil series belongs to the High Ganges River Flood Plain Soils (AEZ-11). Before experimentation, the cooperator farmers were selected from the supplied list of the members of ICM club, FFS and demonstration farmers of the respective Upazila Agriculture Office with the help of Sub-Assistant Agriculture Officer. The site team organized a participatory discussion meeting with the selected cooperators farmers and assesses their needs. Based on the resources and needs of the farmers required cropping pattern was identified and experiment was designed for the farmers**.** After identification of the cropping pattern, initial composite soil samples (0-15 cm depth) were collected from the experimental fields and was send to BARI laboratory for analysis. The experiment was laid out in randomized complete block (RCB) design with six dispersed replications. The unit plot size was 6 m × 5 m. Four different nutrient managements along with absolute control were tested for the pattern as follows.

Treatments	Maize N-P-K-S-Zn-B kg/ha	Mungbean	T. aman N-P-K-S-Zn-B kg/ ha
T_1: Soil test based inorganic fertilizer(HYG)	131-49-0-0- 2.36 – 0	0	62-7-22-9-0-0
T_2: Brown manuring(BM) with mungbean + Inorganic fertilizer for HYG	131-49-0-0-2.36– 0	0	62-7-22-9-0-0
T_3 : Recommended fertilizer (FRG' 2005)	195-36-57-24-2-1	0	40-5-14-6-1-0
T_4 : Farmers practice(FP)	225-150-75-115-5-0	0	60-14-19-13-0-0
T_5 : Absolute control	No fertilizer	0	Absolute control

Different nutrients were applied as per treatment specification. In maize ⅓ urea and other fertilizers were applied as basal during the final land preparation. Remaining ⅔ urea was applied in two equal instalments as top dress at 8-10 leaf stage and tasseling stage. Maize (var. BARI hybrid-5) seed was sown on December 15, 2006 with a spacing of 75 cm x 25 cm. Two irrigations were provided at 60 and 87 days after sowing of seed. Two days after 2nd irrigation crops were lodged due to rain and stormy wind. Earthing up was done after second top dress of urea. At the early vegetative stage, crop was infested with cut worm and Dursban was applied to control pest. During the grain filling stage, irrigation could not provide due to unavailable of irrigation water. Other intercultural operations were done when required. The crop was harvested on April 28, 2007. Data on yield and yield contributing characters were collected and analyzed statistically. At the maturity stage of maize, mungbean seed was sown on April 10, 2007 in between two lines after slight pulverize the soil. Mungbean was established partially due to heavy moisture stress. Later it was incorporated in to the soil during the land preparation of T. aman. The T.aman (var. BRRI Dhan 39) was transplanted on July 27, 2007. The crop was fertilized according to treatment specification. Half of MoP and all other fertilizer were applied during final land preparation except urea. Urea was applied in three equal splits at 15 DAT, 30 DAT and 45 DAT. Rest MoP was applied at 45 DAT as top dress. Crop protection measures and irrigation were applied when required. The crop was harvested on October 29, 2007.

Results and Discussion

Yield and yield contributing characters of maize responded significantly due to different nutrient managements. Maximum plant height was observed in T_3 which was similar with T_2 and T_4, respectively. The highest no. of grains per cob was recorded in T_3 and it was statistically similar to T_1. The lowest no. of grain per cob was obtained from control. The weight of 100 grain was statistically identical in all treatments except control. The highest grain yield was attained in T_3 and it was identical with T_1 and T_4. The cumulative effect of 100 grain weight and no. of grain per cob might be resulted in higher yield in T_3 and T_1 treatment. Treatment T_3 exerted comparatively better performance probably nutrient uptake by the crops was reasonable from the applied macro and micro nutrients. Since maize was the first crop of the pattern of the first cycle and plant received no residual effect of brown manuring, probably no remarkable impact on maize yield was observed in T_2 treatment.

Mung bean was established partially due to heavy moisture stress. Later it was incorporated in to the soil during the land preparation of T.aman.

In case T. aman, no significant difference was observed in yield and yield contributing characters among the fertilized treatments except the control plot. The significant difference was obtained between fertilized plot and control plot. Numerical higher yield obtained from farmers practice (3.55 t/ha) and lowest from control plot.

Farmer's reaction

As a new crop some farmers showed interest to grow maize. They stated that irrigation was a problem in that area especially at the later growth stage of crop which resulted lower yield. At the later stage of maize, mungbean is difficult to establish, because moisture stress was occurred during that time. Irrigation facility can be ensured at later growth stage of maize cultivation in that case mungbean can be grown successfully. Effect of brown manuring was not found on T. aman yield.

Conclusion

Among the nutrient management treatments, better response in yield was found in T_3, T_1 and T_4. Initial establishment of plant was hampered due to poor germination and insect infestation which finally influenced on yield of maize. In case of T. aman no significant difference was obtained among the fertilized treatments.

Table 1. Yield and yield contributing characters of maize influenced by different nutrient management under Maize-Mungbean-T.aman during the year of 2006-07 at the MLT site, Atghoria, Pabna

Treatments	Plant height (cm)	No. of grain/cob	100-grain weight. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	179.8	451	28.55	6.61	10.15
T_2	193.7	436	28.43	6.06	9.14
T_3	200.2	469	29.23	6.65	9.21
T_4	119.2	433	28.15	6.26	9.17
T_5	162.8	169	20.72	2.61	5.57
LSD(0.05)	17.91	23.41	1.211	0.406	0.715
CV (%)	8.28	4.90	4.66	5.95	6.77

T_1: Soil test based inorganic fertilizer (HYG)
T_2: Brown manuring (BM) with mungbean + Inorganic fertilizer for HYG
T_3 : Recommended fertilizer (FRG 2005)
T_4 : Farmers practice (FP)
T_5 : Absolute control

Table 2. Yield and yield contributing characters of T.aman influenced by different nutrient management under Maize-Mungbean-T.aman during the year of 2007 at the MLT site, Atghoria, Pabna

Treatments	Plant height (cm)	No. of effective tiller/m^2	Panicle length (cm)	No. of filled grain/ panicle	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	90.47	185.2	17.73	90.15	22.50	3.50	5.49
T_2	91.00	188.3	18.23	90.77	23.33	3.54	5.52
T_3	90.20	189.2	18.13	90.48	21.67	3.52	5.42
T_4	91.13	191.3	17.85	90.13	21.33	3.55	5.43
T_5	88.43	151.7	15.30	84.50	20.23	2.53	3.60
LSD(0.05)	1.173	4.256	0.509	1.564	1.53	0.093	0.197
CV (%)	7.08	6.95	8.43	9.46	5.81	12.32	11.21

Integrated Nutrient Management for Watermelon in the Coastal Area

Abstract

The experiment was conducted at farmers' field of Noakhali and Patuakhali during Rabi season of 2007-08 to find out the proper nutrient management packages for watermelon in char areas. Three treatments viz. soil test based fertilizer dose for high yield goal, integrated plant nutrient system and farmers' practices were tested in the experiment. Higher yield was found in IPNS treatment and higher BC was found from soil test based high yield goal in Noakhali and from IPNS in Patuakhali.

Introduction

Watermelon (*Citrulus vulgaris*) has been originated from South Africa and is cultivated throughout the tropical zones of this world (Anon., 1988). It is now one of the popular summer fruits and important labour intensive cash crop in Bangladesh. Generally it is grown in the areas of Chittagong, Camilla, Jessore, Faridpur, Rajshahi, Pabna and Natore districts. Recently it is cultivated in the vast char areas of Noakhali. The acceptance and area coverage of watermelon in Noakhali are increasing day by day. The production of watermelon in Noakhali is comparatively less than other area of Bangladesh. Variety, soil climate and imbalance use of fertilizer are the factors responsible for these gaps. The basic concept underlying the Integrated Plant Nutrition System (IPNS) is to provide an ideal nutrition for a crop through a proper combination of various nutrient resources and their optimum utilization along with maintenance of soil productivity .The sustainable crop production might be possible through the integrated use of organic manure and chemical fertilizer. Sustainable production of crops can not be maintained by using the chemical fertilizers alone and similarly it is not possible to obtain higher crop yield by using only organic manure (Bair, 1990). Watermelon up takes large quantities of different nutrients from soil. Farmers of Noakhali char areas are using different fertilizer doses for watermelon production. Therefore keeping all these views the present study was taken to find out the proper nutrient management packages for hybrid varieties of watermelon in char area of Noakhali and Patuakhali.

Materials and Methods

The experiment was conducted during the Rabi season of 2007-08, at Noakhali and Patuakhali. At Noakhali, the soil was silty clay loam with low organic matter content (1.66%) and soil pH neutral in nature. The N and P were low and very low where as K and S content were medium and optimum respectively (Table 1).

Table 1. Soil analysis data for experimental plot

Farmers plot	pH	Organic matter	Total N	K	P	S	Zn	B
		(%)		meq./100g soil	(ug/g soil)			
1	6.2	1.78	0.10	0.27	1	31	0.75	0.04
2	6.8	1.63	0.09	0.19	1	27	0.55	0.03
3	8.0	0.96	0.05	0.10	3	18	0.55	0.19
4	7.5	2.10	0.12	0.17	4	22	0.63	0.36
5	7.3	1.84	0.10	0.18	2	27	0.57	0.25
6	7.4	1.67	0.09	0.18	1	30	0.68	0.04
Average	7.2	1.66	0.092	0.18	2	25.83	0.62	0.15
Status	Neutral	Low	Low	Medium	Very low	Optimum	Low	Low

The levels of the fertilizers were selected based on target yields as per fertilizer recommendation guide 2005. The description of the treatments is stated Table 2.

Table 2. Description of the treatment and nutrient rates for watermelon

Treatment code	Description of the treatment	Nutrient rate						Cowdung (t/ha)
		N	P	K	S	Zn	B	
T_1	HYG(based on soil test according to FRG' 2005)	99	41	51	10	1.2	1.2	-
T_2	IPNS for HYG	63	29	11	8.7	1.2	1.2	8
T_3	Farmers practice	80	50	60	-	-	-	4

Note. HYG=High Yield Goal, IPNS=Integrated Plant Nutrition System.

The fertilizer dose used by the farmers was considered as Farmers Practice (FP). The source of nutrients were urea for N, TSP for P, MoP for K, Gypsum for S ,Zinc oxide for Zn and Boric acid for B. Half of nitrogen and all phosphorus, potassium , sulphur, zinc and boron applied in the planting furrow and covered with 6 to 8 cm of soil before sowing the seed and one half of the remaining nitrogen (1/4th of total N) applied 10 days after plant emergence. The remaining nitrogen applied about 30 days later. Both applications made 25-30 cm around the main stem. In case of IPNS, one-half of cow dung was applied during final land preparation and remaining was applied during pit preparation. The unit plot size was 10m x 4m. Glory was used as planted materials, the pits were prepared on 13 January 2008, and seeds were sown on 22 January 2008. The distances of pit-to-pit were 2 m .The crop was harvested at maturity during 10-30 April 2008. Intercultural operations viz. earthling up, weeding, irrigation, fungicide and insecticide spray were done in order to support normal plant growth. Data on yield and yield contributing characters of watermelon was recorded. In Patuakhali, the seeds were sown in 8m x 5m unit plot with spacing of 3m x 2m. Seeds were sown on 5 January and harvested during 5-25 April 2008. Observations were made on yield components from 10 randomly selected plants per plot. All the data were statistically analyzed and mean comparisons were made by DMRT at 5% level of significance.

Results and Discussion

NOAKHALI

Yield components of watermelon did not responded significantly to different fertilizer treatments (Table 3). Nevertheless, the highest fruit per plant was observed in treatment T_2 (3.17) and the lowest in treatment T_3 (2.91). The highest fruit length was observed in treatment T_2 (28.50 cm) and lowest in treatment T_3 (28.17 cm). Similar trend was observed in Fruit diameter, the highest in treatment T_2 (18.40 cm) and lowest the in treatment T_3 (17.15cm). In case of individual fruit weight the highest fruit weight was found in treatment T_2 (3.95 kg) and the lowest in treatment T_3 (3.68 kg) and yield was highest in treatment T_2 (37.47 t/ha) and the lowest in treatment T_3 (31.86 t/ha). The highest yield obtained from treatment T_2 might be due to use of both organic and inorganic fertilizer. However, the farmers also used both organic and inorganic fertilizer but yield was comparatively low. This is due to use of imbalance use of fertilizer.

Cost and return analysis

The highest gross margin (Tk. 145840/ha) was found in treatment T_1 and the lowest (Tk. 127440/ha) in treatment T_3 (Table 4). This variation occurred due to the different yield of watermelon and fertilizers cost. On the other hand, the highest BCR was found in treatment T_1 (2.66) and the lowest in treatment T_3 (2.02).

Farmers' reaction

Farmers usually use cowdung and they realize that IPNS is good for watermelon yield as well as improve soil health. They opined that it is difficult to maintain higher dose of CD because of scarcity of cowdung. They also interested about STB method but the facility of soil test is not available.

PATUAKHALI

Treatment T_2 produced the highest number of fruits plant^{-1} which was statistically identical to T_1 and it was lowest in T_3. There was no significant variation among the treatments in respect of fruit length, fruit diameter and individual fruit wt (Table 5). But yield was varied. The highest fruit yield was found in IPNS treatment and it was statistically identical to that of T_1. Farmers' practice produced the lowest yield. Regarding economic analysis (Table 6) IPNS gave the highest benefit cost ratio (BCR) which was closer to T_1. Considering soil fertility and production IPNS practice should be followed for sustainable higher crop production.

Conclusion

From the results of this investigation it may be concluded that the treatment of soil test based fertilizer for HYG and IPNS were found economically profitable for the production of watermelon in the char areas of Noakhali and Patuakhali, respectively.

References

Anonymous. 1988. Fruits, Vegetable and Spices Crops. Department of Agriculture Extension, Training Cell, Khamarbari, Dhaka

Bair, W. 1990. Characterization of the environment for sustainable Agriculture in Semi-Arid Tropics. In Proc.. Sustainable Agriculture Issues, Perspectives and Prospects in Semi-Arid Tropics. Hyderabad, India.1.90-128.

Perrin, R.K., D.L. Winkelman, E.R. Moseardi and J.R. Aderson.1979.Farm agronomic data to farmers' recommendations. Information Bulletin27, CIMMYT, MEXICO.

Table 3. Yield components of watermelon as influenced by nutrient management

Treatments	Fruits/ plant	Fruit length (cm)	Fruit diameter (cm)	Individual Fruit weight (kg)	Yield (t/ha)
T_1:HYG (based on soil test according to FRG 2005)	3.06	28.33	18.40	3.90	36.46
T_2 :(IPNS for HYG)	3.17	28.50	18.75	3.95	37.84
T_3 :Farmers practice	2.91	28.17	17.15	3.68	31.86
CV (%)	13.02	4.02	8.73	7.32	13.91
F-test	NS	NS	NS	NS	

Table 4. Cost and Return analysis for fertilizer use in watermelon production

Treatments	Gross return (Tk./ha)	Variable cost of fertilizers (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)	BCR
T_1	145840	12968	54717	91123	2.66
T_2	149880	24189	65938	83942	2.27
T_3	127440	21031	62781	64659	2.02

Price (Tk./kg): Urea=6, TSP=5, MoP=27, Gypsum=7, Zinc oxide=75, Boric acid=160, Cowdung=2,Watermelon = 4

Table 5. Effect of IPNS on watermelon yield and yield attributes during rabi, 2007-08

Treatment	Fruit/plant	Fruit length (cm)	Fruit diameter (cm)	Fruit wt. (kg)	Fruit yield (t/ha)
T_1	3.5 a	30	18	3.98	39.15 a
T_2	3.7 a	32	20	4.00	40.10 a
T_3	3.1 b	29	17	3.96	34.02 b
CV (%)	4.62	-	-	-	9.64

Table 6. Cost and return analysis of tomato as influenced by IPNS during rabi, 2007-08 at Kuakata, Patuakhali

Treatments	Gross return (Tk./ha)	Total variable Cost (Tk./ha)	Gross margin (Tk./ha)	BCR
T_1	158000	54840	103160	2.88
T_2	160000	33950	106050	2.96
T_3	136000	50490	85510	2.69

Effect of Liming on Potato

Abstract

The experiment was conducted at the MLT site, Lalmonirhat during the rabi season of 2007-08 to verify the effect of liming. Liming was done in before planting of T.Aman rice. The result showed that higher yield of potato (25.33 t/ha) was obtained with liming at the rate of 2.0 t/ha. Scab disease was less in liming treatment.

Introduction

Soil pH is the most important factor for availability of plant nutrient in soil which affects the potato yield and also influences the scab disease. So liming is recommended for low pH soil. Increasing soil pH which leads the availability of plant nutrient in soil. The experiment was under taken to minimize the acidity of soil and consequent increasing plant nutrient availability by liming the soil.

Materials and Methods

The experiment was conducted at the MLT site, Lalmonirhat during rabi season of 2007-08. The design of the experiment was RCB with six dispersed replications. The plot size was 6m x 5m. The treatments were L_0: without line & L_1: 2.0 t lime/ha. The variety was Diamant. The crop was fertilized at the rate of 115, 30, 125, 22 and 1.7 kg/ha of N, P, K, S & Zn, respectively and cowdung at the rate of 5 t/ha. All fertilizer except N was applied at the final land preparation as basal dose. Nitrogen was applied 50% as basal and rest 50% N as side dress at 30 DAP. The soil pH value of the experimental plot was ranged from 4.5 to 4.8. Liming was done one month before transplanting of Aman rice.

The whole potato was sown on 10 December 2007 with spacing 60cm x 25cm. Harvesting was done on 6 March 2008.

Results and Discussion

The yield and yield attributes of potato was shown in Table 1. Liming treatment L_1 gave the higher tuber, no. of tuber/hill, tuber wt/hill. Less disease incidence observed in liming treated plot. Gross return and net return were higher in the treatment L_1 where liming was applied.

Farmers' reaction

i) Next year they use lime for potato cultivation
ii) Tuber was transparent
iii) Market value was good

Scientist reaction: Liming is good for in creasing pH value that is why yield was increased.

Conclusion: Two t/ha lime was good for potato production

Table 1. Effect of boric acid on the yield and yield attributed of potato at Lalmonirhat during rabi season in 2007-08.

Treatments	Tuber/hill (g)	Tuber wt/hill (g)	Tuber wt./unit plot (kg)	Yield (t/ha)	% increased over control	Disease incidence (%)
L_0	10.50	325	65	21.67	-	20-40%
L_1	11.00	380	76	25.33	27	0-20%

Table 2. Cost & return analysis of potato at Lalmonirhat during rabi 2007-08

Treatments	Gross return (Tk./ha)	Cost of cultivation (Tk./ha)	Net return (Tk./ha)
L_0	173360	120184	82456
L_1	202640	128184	95816

Effect of Boric Acid on Potato Common Scab

Abstract

The experiment was conducted at the farmers' field of the MLT site, Lalmonirhat during the rabi season of 2007-08. There were two treatments i.e. B_0 (seed without treated) & B_1 (seed treated with boric acid 3 %) to develop management technique for potato common scab control. B_1 (seed treated with boric acid @ 3%) gave the higher yield (21.25t/ha) and less disease incidence (5-10%) compare to B_0 (seed without treated).

Introduction

Potato is one of the major commercial tuber crops in Bangladesh Boric acid is effective for potato common scab management and boron element of boric acid is also helpful for potato production.. With this view an experiment was taken to minimize common scab problem for potato production.

Materials and methods

The experiment was conducted at MLT site, Lalmonirhat during the rabi season of 2007-08. The treatments were i) B_0 (seed without treated) & B_1 (seed treated with boric acid @ 3%).The crop fertilized at the rate of 115, 30, 125, 22 and 1.7 kg/ha of NPKSZn, respectively and cow dung at the rate of 5 t/ha. All fertilizer was applied at the final land preparation as basal dose with 60cmx25cm spacing. Unit plot size was 6m x 5m with six replications. Harvesting was done on 7/3/08.

Result and Discussion

The yield and yield contributing characters of potato were shown in Table 1. The B_1 treatment gave the higher yield (21.25t/ha). The higher tuber/hill, tuber/hill was obtained from B_1treatment. Disease incidence was 20-50% in Bo treatment and 0-5% in B_1. A considerable effect of B on the tuber yield and control of scab disease of potato was observed.

Farmers' reaction

i) Less common scab was found in seed treated with boric acid @ 3%
ii) Potato was fresh and clean
iii) Market value was high
iv) Farmer will treat the seed with boric acid next year.

Conclusion

It could be concluded that potato seed treated with boric acid @ 3% was necessary to minimize common scab problem for potato production,

Table 1. Yield and yield attributes of potato as influenced by boric acid at Lalmonirhat, Rangpur 2007-08

Treatments	Tuber/hill (g)	Tuber wt/hill (g)	Tuber wt./plot (kg)	Yield (t/ha)	% Increased over control	Disease incidence (%)
B_0	10.50	250	50.00	16.67	-	20-50%
B_1	11.00	319	63.75	21.25	27%	0-5%

Table 2. Cost & return analysis of potato at Lalmonirhat during rabi 2007-08

Treatments	Gross return (Tk./ha)	Cost of cultivation (Tk./ha)	Net return (Tk./ha)
B_0	133360	120184	13176
B_1	191250	120444	70806

Price (Tk./kg) potato 8-9, Urea= 6, TSP=38, MP=35,Gypsum= 6.5, Zinc sulphate= 135 and Boric acid = 130

Determination of Fertilizer Doses for Maize as a Succeeding Crop Following Potato in a Potato- Maize-T.Aman Cropping Pattern

Abstract

The experiment was conducted at Bagdhani village under the MLT site Paba, Rajshahi during Rabi 2006-2007 and still it is ongoing. Two fertilizer treatments were applied on it, one was BARC recommended doses suggested in FRG, 05 and other was farmers' practices. FP (18.22 t/ha) produced higher yield of potato than FRG, 05 (12.78 t/ha). The next crop of this pattern is Maize. In case of Maize three different fertilizer package viz. T_1: Soil test basis NPKS B and Zn, T_2: Soil test basis full NSZnB + 65% PK and T_3: farmers practices (Average of 30 farmers) were used both in FRG '97 and in FP applied potato fields. T_2 (8.15 t/ha) performed better when it was applied in preceding FP package fields. T.Aman also performed better in FP (3.49 t/ha) than FRG, 05 (3.13 t/ha). Recommendation will be made after completion of three years cycle.

Introduction

Potato-Maize-T.Aman is a very popular cropping pattern of this region and the cropping pattern is increasing day by day in Rajshahi. Both potato and maize is exhaustive crop, therefore, nutrient management is necessary for sustainable higher yield. But farmers of this area use low dose of fertilizer (some time use only Urea) in maize. They grow maize in residual nutrients of preceding potato crop. It was observed that nutrient deficiency is common problem in maize that ultimately decreases the yield. Considering the above facts, the trial is undertaken to find out the suitable fertilizer dose for maize as a succeeding crop of potato.

Materials and Method

The experiment was conducted at Bagdhani village under the MLT site Paba during Rabi 2006-2007 and still it is ongoing. Before conducting the experiment soil samples were collected at a depth of 0-15 cm for laboratory analysis. The farmer's of this experiment was block demonstration group of DAE. The first crop potato of this pattern was sown in 4-7 December/2007 in RCBD with seven dispersed replication. Two fertilizer treatments were applied on it, one was BARC recommended doses suggested in FRG, 05 and other was farmers' practices. The plot size was 240 m^2 for each replication. The BARC recommended fertilizer dose and farmers practice are shown in table 8. In recommended practice entire amount of P, S Zn, B and $^1/_2$ N and K were applied as basal. Remaining N and K were applied as side of the row and covered with soil about 30-35 DAP at the time of earthing up followed by irrigation. But in farmers practice, entire P (Both in TSP and DAP form), S, Zn, B and ¾ K were applied as basal. 2/3 N and remaining K were used as side of the row during earthing up followed by irrigation. Remaining 1/3 N was used at the time of 3rd irrigation (about 50-55 DAP). The crop was harvested on 3-12 March/2007. Data were collected from the field and analyzed statistically. The next crop of this pattern is Maize. In case of Maize three different fertilizer package viz. T_1: Soil test basis NPKS B and Zn, T_2: Soil test basis full NSZnB + 65% PK and T_3: farmers practices (Average of 30 farmers) were used both in FRG 2005 and in FP applied potato fields. The variety of Maize was pacific-11.

The crop was grown in Kharif season, so all fertilizers were reduced by 30% as per rationale of FRG 2005. Then fertilizer for the treatments was calculated. Half Nitrogen and all phosphorus, Potassium and sulpher were applied as broadcast prior to sowing. The crop was grown in 75cm x 20cm spacing during 13-18 March/2007. Remaining nitrogen was applied as side dress at 8-10 leaf stage (25-30 DAS) followed by irrigation. The crop was harvested at 16-18 June/2007. The third crop of this pattern was T.Aman. Two fertilizer treatments were applied on it, one was BARC recommended doses suggested in FRG 2005 (66-5-14-6 kg/ha NPKS) and other was farmers practice (84-70-67-10 kg/ha NPKS). 30-35 days old T.Aman seedlings (BRRI dhan-39) were transplanted in 27-30 July/07.

All phosphorus, potassium and sulpher were applied as basal. As the soil have low soil test value 1st one third urea was applied immediately after seedling establishment and second one third at rapid tillering stage and third was at 5-7 day before panicle initiation stage. Two weeding were done at the time of 1st and 2nd top dress. The crop was harvested at 8-12 Nov./2007. All data were compiled and analyzed statistically.

Results and Discussion

Effect of recommended fertilizer package (FRG, 05) and farmers' package on yield and other characters of potato in Potato-Maize-T.Aman cropping pattern are presented in the Table 9. Tuber yield and other associated characters except shoot/plant differed significantly between recommended fertilizer package (12.78 t/ha) and farmers practice. Significantly higher tuber yield was recorded from FP probably due to higher dose of fertilizer applied in potato. Tubers/plant and tuber yield/hill also followed the same trend.

Effect of recommended fertilizer package (FRG, 05) and farmer package applied potato plots on yield and other characters of maize in potato-maize-T.Aman cropping pattern in presented in Table 1. Plant height and yield differed significantly between FRG 2005 and farmers' package. That may be due to the positive response of residual and applied fertilizer nutrients.

Effect of different fertilizer doses calculated from soil test values on yield and other characters area presented in Table 2. All the treatment except seed rows/cob and 1000-grain weight differed significantly among treatment means. Higher yield was found in treatment T_1 (7.49 t/ha) and in T_2 (7.10 t/ha). The lowest yield was found in T_3 (5.99 t/ha).

From the interaction table (Table 3), it was found that only plant height and grain yield varied significantly among treatments. The highest grain yield (8.15 t/ha) was found in the T_2 treatment which was applied in farmers package (FP) applied potato fields. It was also similar to FP x T_1 (7.95 t/ha) and FP x T_3 (7.35 t/ha). In FRG 2005 package applied potato fields, number of half filled and unfilled cobs (Table 4) was increased, that decreased the yield of maize in all treatments.

Effect of recommended fertilizer package (FRG, 05) and farmers practice (FP) on yield and yield attributes of T.Aman were presented on Table 5. FP performed better in respect of all character except plant height, 1000-grain weight and straw yield. The highest grain yield of T.Aman was found in FP package (3.49 t/ha) and lowest in FRG, 05 package (3.13 t/ha).

Conclusion

After one year experimentation, it was found that FP package performed better both in Potato and T.Aman production. But in case of Maize T_2 treatment **(**soil test basis 100% NSZnB+65%PK) perform better than FP (only 35 N/ha). However, the experimentation is still on going, so concrete conclusion will be made after completion of three years cycle. Visitors and experts suggested that FRG, 05 packages for Potato-Maize-T.Aman should be rechecked.

Table 1. BARC recommended dose and farmers' dose that used in Potato in Potato-Maize-T.Aman cropping pattern

Fertilizer dose	Kg/ha					
	N	P	K	S	Zn	B
FRG, 05	96	16	48	8	1	1
FP	260 + 34	75 + 38	225	40	5.5	2.5

Table 2. Effect of recommended fertilizer package (FRG, 05) and farmers practice (FP) package on yield and other characters of potato in Potato-Maize-T.Aman cropping pattern

Treatments	Plant height (cm)	Shoot/plant (no.)	Tuber/plant (no.)	Tuber yield/plant (g)	Tuber yield (t/ha)
FRG, 05	31.46	2.67	4.14	211.14	12.78
FP	42.91	3.14	5.23	306.14	18.22
T-test (0.05)	*	NS	*	*	*
Variance	4.12	-	0.085	268.19	1.23
Standard deviation	2.03	-	0.29	16.38	1.11

Table 3. Effect of preceding fertilizer management of potato crop on succeeding crop maize

Treatments	Plant height (cm)	Seed row/cob (no.)	Seed/cob (no.)	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
FRG, 05	221.58	14.33	34.50	244.67	7.82	18.64
FP	193.3	13.67	31.08	246.58	5.9	17.34
LSD	*	NS	NS	NS	*	NS
CV (%)	3.53	6.94	8.37	1.76	9.56	7.37

Table 4. Effect of fertilizer management packages used for succeeding crop maize in preceding potato plots

Treatments	Plant height (cm)	Seed row/cob (no.)	Seed/cob (no.)	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	218.4	24.5	34.63	242.75	7.49	19.94
T_2	210.5	14.25	33.63	248.37	7.10	18.66
T_3	193.5	13.25	30.13	245.75	5.99	15.37
LSD (0.05)	7.98	NS	2.99	NS	0.714	1.445
CV (%)	3.53	6.94	8.37	1.76	9.56	7.37

Table 5. Interaction effect of different preceding and present fertilizer package on yield and yield attributes of maize

Treatments	Plant height (cm)	Seed Row/cob (no.)	Seed/com (no.)	1000 grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
FP x T_1	226.25 a	15.0	36.25	240.0	7.95 ab	21.38
FP x T_2	224.0 ab	14.5	35.5	248.0	8.15 a	18.43
FP x T_3	214.5 bc	13.5	31.75	246.0	7.35 ab	16.13
FRG 05 x T_1	210.5 c	14.0	33.0	245.5	7.03 bc	18.50
FRG 05 x T_2	197.0 d	14.0	31.75	248.75	6.05 c	18.90
FRG 05 x T_3	172.5 e	13.0	28.5	245.5	4.63 d	14.63
LSD (0.05)	11.29	NS	NS	NS	1.01	NS
CV (%)	3.53	6.94	8.37	1.76	9.56	7.37

Table 6. Effect of recommended fertilizer package (FRG 2005) and farmers practice (FP) package on yield and yield attributes of T.Aman in potato-maize-T.Aman cropping pattern

Treatments	Plant height (cm)	Panicle/ m^2	Tiller/ Hill	Grain/ Panicle	1000 Grain weight	Grain yield (t/ha)	Straw yield (t/ha)
FRG, 05	115	293.2	10.67	109.2	24.87	3.13	5.2
FP	116	317.93	12.13	115.83	24.0	3.49	5.56
T-test	NS	*	*	*	NS	*	NS
Variance	-	15.03	0.27	2.41	-	0.007	-
Standard deviation	-	3.87	0.52	1.55	-	0.085	-

Effect of Boron on the Yield and Yield Attributes of Rapeseed in Barind Area

Abstract

An experiment was carried out at the FSRD site, Kadamshahar, Godagari, Rajshahi during the rabi season 2006-2007 and 2007-2008 to find out the effect of boron on the yield and yield attributes of rapeseed in Barind area. Three varieties of rapeseed (BARI Sarisha-6, BARI Sarisha-9 and BARI Sarisha-13) and four levels of boron (0, 1.0, 1.5 and 2.0) were tested in the study. The results showed significant variation among the varieties. Maximum seed yield 1.73 t/ha and 1.48 t/ha were produced by BARI Sarisha-13 during 2006-07 and 2007-08, respectively and BARI Sarisha-6 produced identical seed yield in both year. The lowest seed yield 1.07 t/ha and 1.05 t/ha were produced by BARI Sarisha-9 during 2006-07 and 2007-08, respectively. All the crop characters increased with the increasing rate of boron up to 1.5 kg/ha and thereby slightly declined. The highest seed yield, stover yield and MBCR were found at 1.5 kg B/ha in both the year 2006-07 and 2007-08. The response of boron was found to be quadratic in nature. The agronomically optimum boron dose was calculated from the response curve as 1.42 and 1.57 kg/ha during 2006-07 and 2007-2008, respectively.

Introduction

Mustard-Boro-T.Aman is one of the promising cropping patterns in High Barind Tract (AEZ-26). Farmers of this area cultivate local mustard variety and sometimes BARI sarisha-9. But yield of the varieties are below 1 t/ha. Rapeseed (BARI sarisha-13) is about 15 days earlier than BARI sarisha-11. It has high yield potentiality (2-2.5 t/ha). Boron influences the seed yield of mustard (Mehrotra *et al.*, 1977). Anon (2004) reported that application of boron at the rate of 1.0 kg/ha increased the seed yield of mustard by 24-53% in Old Brahmaputra Floodplain (AEZ-9). Rapeseed is more sensitive to Boron deficiency. Sometimes it is called indicator crop for Boron deficiency. Application of boron is not a common practice in Barind area for mustard cultivation. The soil of High Barind Tract contains 0.14-0.33 micro-gram/g soil of B. So there is a scope to enhance yield of rapeseed in this area by applying optimum dose of B. Therefore, the present study was undertaken to find out the optimum dose of boron of rapeseed varieties in High Barind soils.

Materials and Methods

The experiment was conducted at the FSRD site, Kadamshahar, Godagari, Rajshahi during the rabi season 2006-07 and 2007-08. The initial soil samples were collected from the experimental plot for laboratory analysis. The chemical properties of initial soil sample are presented in Table 1.

Table 1. Nutrient status of initial soil sample (0-15 cm depth) of the experimental plot

pH	Organic matter (%)	K	Total N (%)	P	S	B	Zn
		meq/100g soil		Micro gram/g soil			
6.00	1.33	0.32	0.07	11.00	13.63	0.18	0.76
Acidic	Low	Optimum	Very low	Low	Medium	Low	Low

The unit plot size was 3 m × 4 mother experiment was laid out in split-plot design with four replications. Three mustard varieties (BARI Sarisha-6, BARI Sarisha-9 and BARI Sarisha-13) and four boron levels (0, 1.0, 1.5, and 2.0 kg/ha) were examined in the experiment. The varieties were assigned in the main plots and boron levels in the sub-plots. The blanket doses of urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate were applied at the rate of 275, 175, 90, 170 and 5.6 kg/ha, respectively. The entire amount of all fertilizers and half of the urea were applied during final land preparation. The rest amount of urea was applied as top dressing at 27 and 24 days after sowing (DAS) in 2006-07 and 2007-08, respectively. The boron was applied in the form of boric acid and solubor as per treatment as a basal dose in 2006-07 and 2007-08, respectively. Seeds were sown in line at 30 cm interval with continuous on 5 November 2006 and 02 November 2007. Weeding and thinning were done twice by hand.

Weeding was done simultaneously at 13 and 23 DAS in the year 2006-07 and 12 and 20 DAS for 2007-08. Irrigation was done twice at 26 and 61 DAS for 2006-07 and 23 and 65 DAS for 2007-2008. Ripcord and Bavistin were applied once to control aphid and leaf spot, respectively as per dose in the year 2006-07. In the case of 2007-08, no pesticide was applied. The crop was harvested according to their maturity ranging from 31 January to 10 February 2007 and 28 January to 10 February 2008. Data on different yield components were recorded from randomly selected ten plants from each unit plot. Yield data was taken as plot wise and thereafter converted into ton per hectare. Recorded data were analyzed statistically and means were separated by Duncan's Multiple Range Test (Gomez and Gomez, 1984). The economic analysis was done for gross return and marginal benefit cost ratio (MBCR) for different boron levels following the method suggested by Perrin *et al.,* (1979).

Results and Discussion

Effect of rapeseed variety

The effect of variety on the yield and yield attributes like seeds/siliqua, 1000-seed weight, seed yield and stover yield were statistically significant in both the year. In 2006-07 maximum seed yield (1.73 t/ha) was found in BARI sarisha-13 that was identical to BARI sarisha-6 (1.39 t/ha) and the lowest seed yield (1.07 t/ha) in BARI sarisha-9. Reduction of seeds/siliqua and 1000-seed weight in BARI sarisha-9 was observed probably due to varietal characters that ultimately resulted in the lowest seed yield. Although the lower number of siliqua/ plant was observed in BARI sarisha-13 but the highest number of seeds/siliqua and 1000 seed weight contributed to higher seed yield. The stover yield was found to be highest (4.85 t/ha) in BARI Sarisha-6. Almost similar results were obtained in 2007-08. The variety BARI sarisha-9 was matured in 83 days, which was 9 and 11 days earlier than BARI sarisha-6 and BARI sarisha-13, respectively in 2006-07. In 2007-08, BARI sarisha-9 was matured 6 and 13 days earlier than BARI sarisha-6 and BARI sarisha-13, respectively.

Effect of boron

yield and yield components of rapeseed except plant population/m^2 and plant height (Table 4 and 5) was influenced significantly due to different doses of boron. Seed yield increased with the increase in boron rate up to1.5 kg/ha and the yield slightly declined with the next higher dose. In the year 2006-07, higher seed yield (1.56 t/ha) was obtained with of 1.5 kg B/ha that was similar to 2.0 kg B/ha (1.50 t/ha) and the lowest (1.13 t/ha) in control.

Fertilization with 1.5 kg B/ha showed an increase yield of 38% over control. These results are in agreement with the findings reported in BARI (2003). Stover yield (4.81 t/ha) was found higher at 1.5 kg B/ha treatment that was similar to 2 kg B/ha. Similar results were found in 2007-2008.

Interaction effect of varieties and boron

There was no significant interaction effect between variety and boron levels in both the year 2006-07 and 2007-08.

Cost and return analysis

In the year 2006-07, maximum gross return (Tk.43810/ha) was contributed by 1.5 kg B/ha (Table 6) followed by 2.0 kg B/ha (Tk.41960/ha). The maximum marginal benefit cost ratio (20.15) was obtained from 1.5 kg B/ha. Similar trend were observed in 2007-08.

Response of mustard to boron

For the two year results the response curve of boron was drawn from the computation of yield data of mustard. The response of mustard to boron was found to be quadratic in nature. Finally optimum doses for agronomic and economic yields were calculated from the response curve (Fig. 1 & 2 and Table 7).

Farmers reaction

- Farmers are pleased to get high yield from 1.5 kg/ha Boron dose
- Bold and weighty seed are found from 1.5 kg/ha Boron dose
- BARI Sarisha-6 and BARI Sarisha-13 are suitable variety for Barind condition due to higher yield

Conclusion

From the two year results it can be concluded that Boron application has a positive effect on rapeseed yield. Among the varieties tested, BARI Sarisha-13 and BARI sarisha-6 performed better in respect of yield and adaptability. From the two year result, the optimum dose of boron was determined that was 1.50 kg B/ha for mustard in Barind area.

References

Aonymous. 2004. Application of boron on mustard-A profitable technology for Mymensingh region. Published by On-Farm Research Division, BARI, Mymensingh-2200.p.6

BARI (Bangladesh Agricultural Research Institute). 2003. Annual Report (2002-2003), BARI, Joydebpur, Gazipur, Bangladesh. 400 p.

Gomez, K.A. and A.A. Gomez. 1984. Statistical procedures for agricultural research (2nd Edition). An International Rice Research Institute Book. John Wiley and Sons, New York, USA.680 p.

Mehrotra, O.N., R.D.L. Srivastara and P.H. Misra. 1977. Effect of micronutrient on the growth, yield and quality of Indian mustard. Indian J. Agric. Chem. 10. 81-86.

Perrin, R.K., D.L. Winkelman, E.R. Moseardi and J.R. Anderson. 1979. Farm agronomic data to farmer's recommendations. Information Bulletin 27, CIMMYT, Mexico.

Table 2. Yield and yield components of rapeseed as influenced by different varieties in 2006-07

Variety	Days to maturity	Plant pop./m^2	Plant height (cm)	PB /plant	Sliqua/ plant	Seeds/ Sliqua	1000-seed wt. (g)	Seed yield (t/ha)	Stover yield (t/ha)
BARI sarisha-6	92	59.50	111.53 a	4.88	92.43	22.58 b	3.42ab	1.39 ab	4.85 a
BARI sarisha-9	83	57.08	84.07 b	4.22	84.54	17.24 c	2.93 b	1.07 b	3.34 c
BARI sarisha-13	94	61.33	95.08 ab	5.40	72.90	26.74 a	3.68 a	1.73 a	4.10 b
CV (%)	-	5.92	5.67	12.24	14.56	11.55	7.41	7.78	11.44

Note. PB. Primary branch

Table 3. Yield and yield components of rapeseed as influenced by diff. varieties in 2007-08

Variety	Days to maturity	Plant pop./m^2	Plant height (cm)	PB /plant	Sliqua/ plant	Seeds/ Sliqua	1000-seed wt. (g)	Seed yield (t/ha)	Stover yield (t/ha)
BARI sarisha-6	86	58.06	116.31a	4.52	91.99	22.64a	3.47ab	1.46a	4.33a
BARI sarisha-9	80	59.75	86.93b	4.22	82.75	17.14b	3.02b	1.05b	3.24b
BARI sarisha-13	93	59.00	96.25b	4.96	71.88	23.25a	3.72a	1.48a	4.25a
CV (%)	-	5.89	10.30	14.79	15.33	14.68	6.67	10.75	10.09

Note. PB. Primary branch

Table 4. Yield and yield components of rapeseed as influenced by boron levels in 2006-07

Boron level (kg/ha)	Plant pop./m^2	Plant height (cm)	PB /plant	Sliqua/ plant	Seeds/ Sliqua	1000-seed wt. (g)	Seed yield (t/ha)	% yield increase over control	Stover yield (t/ha)
0	57.22	93.87	4.40 b	71.36 b	21.18 b	2.92 b	1.13 c	-	3.13 c
1.0	59.89	96.13	4.78 ab	77.56ab	21.96 b	3.42 a	1.40 b	23.89	4.00 b
1.5	59.67	98.83	5.26 a	93.60 a	24.57 a	3.54 a	1.56 a	38.05	4.81 a
2.0	60.44	98.73	4.90 ab	90.66 a	21.06 b	3.49 a	1.50 ab	32.74	4.46ab
CV (%)	5.92	5.67	12.24	14.56	11.55	7.41	7.78	-	11.44

Table 5. Yield and yield components of rapeseed as influenced by boron levels in 2007-08

Boron level (kg/ha)	Plant pop./m^2	Plant height (cm)	PB /plant	Sliqua/ plant	Seeds/ Sliqua	1000-seed wt. (g)	Seed yield (t/ha)	% yield increase over control	Stover yield (t/ha)
0	57.08	97.25	3.50 c	69.66b	18.29b	3.15b	0.97 c	-	3.54 b
1.0	58.25	99.00	4.35 b	76.98b	20.56ab	3.45a	1.28b	31.95	3.96ab
1.5	60.16	102.66	5.31 a	95.86a	23.56a	3.60 a	1.56a	60.82	4.27 a
2.0	60.25	100.41	5.12a	86.32ab	22.06ab	3.66a	1.49a	53.60	4.00ab
CV (%)	5.89	10.30	14.79	15.33	20.68	6.67	10.75	-	10.09

Note. PB. Primary branch

Table 6. Economic return of Rapeseed as influenced by Boron levels in 2006-07 and 2007-08

Boron levels (k/ha)	Gross return (Tk./ha)		Variable cost (Tk./ha)		Gross margin (Tk./ha)		MBCR (Over control)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
0	31380	52040	-	-	31380	52040	-	-
1.0	39000	67960	412	1500	38588	66460	18.49	10.61
1.5	43810	82270	617	2250	43193	80020	20.15	13.44
2.0	41960	78500	823	3000	41137	75500	12.86	8.82

Note. In the year 2006-07, Price of boric acid-70 Tk./kg, Mustard-25 Tk../kg, and straw-1.00 Tk./kg
In the year 2007-08, Price of solubor-300 Tk./kg, Mustard-50 Tk./kg, and straw-1.00 Tk./kg

Table 7. Optimum doses of rapeseed for agronomic and economic yields

Rapeseed	Agronomically optimum dose (kg/ha)		Economically optimum dose (kg/ha)	
	2006-07	2007-08	2006-07	2007-08
Boron	1.42	1.57	1.38	0.63

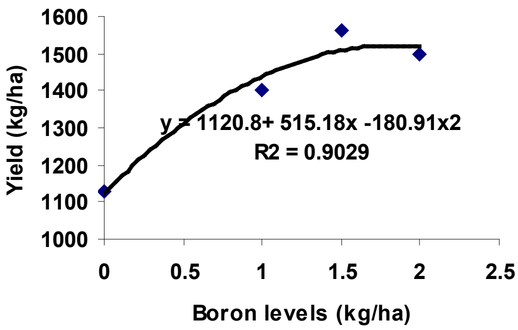

Fig. 1 Effect of boron on yield of Rapeseed in 2006-07

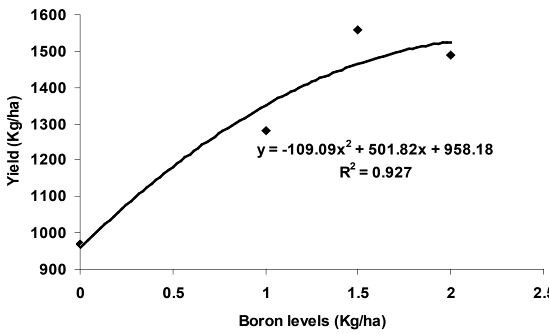

Fig.2 Effect of boron on yield of Rapeseed in 2007-08

Year Round Vegetable Production and Quick Growing Fruit Trees in Homestead

Introduction

Bangladesh is one of the developing countries with highest population density, of which 50 percent is under poverty level, 70 percent is under nourished and a vast population is unemployed. Even more that 30,000 people get blind at childhood every year due to deficiency in vitamin A (BARC, 1990). An earlier survey indicated that 93 percent family in Bangladesh suffering from vitamin C deficiency, 85 percent in riboflavin, 81 percent in vitamin A and calcium, 60 percent in protein and 59 percent in calorie requirement (Mahmud, 1985). There are about 18-20 million families in Bangladesh, most of them live in rural areas having a homestead for each. The homestead of rural Bangladesh are generally under utilized or crowded with unproductive spaces. About fifteen millions of homestead is there in the country which can help producing sufficient vegetables and fruits for the concerned families. In spite of agricultural country, the people are lack in production and consumption of fibrous food with a ratio of cereal and fiber at 5.1. More than 30000 children are suffering from blindness each year and majorities of its population are lack in required amount of vitamins, minerals and protein. Farmers' practices different patterns of vegetable and fruit in the vicinity of house hold but almost all are unplanned, poor yielder, uneconomic and non-scientific. On-Farm Research Division (OFRD) of Bangladesh Agricultural Research Institute has developed different Vegetables Production Models. To popularize these models, a production program was under taken at different locations (AEZ) with the financial assistance of Integrated Crop Management (ICM) program of DANIDA.

Objectives

i. To ensure appropriate utilization of all the available spaces in the homestead area with vegetables and fruit species
ii. To supply vegetables and fruits for the family members round the year and protect malnutrition hazards.
iii. To use family labours especially women and children in productive activities and assists in saving and/or generating additional cash income.

Materials and Methods

Before going to implement the project activities a household survey was carried out and detail information in respect of livelihoods maintained by the selected households were documented. Accordingly action plan for each of the selected households was prepared considering their available resources, needs and choice with active participation of the family members (both the male and female). The cooperator farmers (both the male and female) were given orientation on the program activities prior to implement. During the implementation period of project activities, Site working group meeting, review workshop, field day cum field visit and training for farmers (both the male and female) and field staffs were organized. Scio-agro-economic data of each of the program activities of all the selected households were recorded and all collected data considering averagely (06 farmers) up to 15 May 2008 were analyzed using simple statistical tools and their results have incorporated in this report.

A. PABNA

More or less nine production niches of the homestead were brought under cultivation with the suggested vegetables of Goyeshpur model under different farm categories at the FSRD site Pushpopara during the rabi season of 2007 to kharif season 2008. Before initiation of the program, 10 farmers were selected on the basis of available resources and potentials for homestead farming under different farm category. The selected farmers were provided training by the FSRD team on year round vegetable production following Goyeshpur model. The farmers were introduced with nine production units of their homestead. The crops were selected for the 9 production units on the basis of farmers' choice and preference. Production methodology was followed as per Goyeshpur Model. For sustainable production and intake participatory planning, implementation, monitoring and evaluation approach was followed. In the whole process farmers' need were given priority. The data on total production and disposal pattern were collected and documented in a register day by day.

The Goyeshpur model of homestead utilization system was used. It included nine production units under following patterns

	Spaces		Cropping patterns
1.	Open land	a.	Radish - Stem Amaranth - Indian spinach
		b.	Cabbage - Brinjal - Red Amaranth
		c.	Tomato -Spinach - Okra
2.	Roof	a.	Bottle gourd - Wax gourd
3.	Trellis	a.	Bottle gourd - sweet gourd
4.	Tree support	a.	Country bean - Yard long bean
		b.	Bitter gourd - Ribbed gourd - Sponge gourd
		c.	Snake gourd - Potato Yam
5.	Partial shady area	a.	Elephant foot yam
		b.	Leaf aroid (moulavi kachu)
		c.	Ginger
		d.	Perennial chilli
6.	Marshy land	a.	Pani kachu
7.	Fence	a.	Bitter gourd - Yard long bean -Bitter gourd
8.	Homestead boundary	a.	Papaya (3-5 plant)
		b.	Guava (1-2 plant)
		c.	Lemon (1-2 plant)
9.	Back yard/waste land	a.	Laizna (1-2 tree)
		b.	Plantain Banana (1-2 plant)

B. SHYAMPUR, RAJSHAHI

The experiment was started during the Rabi season, 2007-08 at the MLT site, Shibpur, Rajshahi in 4 homesteads. The family of selected homesteads is poor and marginal.

Different vegetable patterns were tested in different homestead as per Goyeshpur model. The annual work plan was also chalked out and critical inputs like vegetable and fruit seed/seedlings etc. were supplied. For the open sunny place and other places round the year vegetable patterns are as follows.

Utilization of different homestead spaces in different cropping seasons at Shibpur MLT site, Rajshahi during 2006-08

Space	Before intervention	After intervention			
		Bed	Rabi	Kharif-1	Kharif-2
Open sunny place	Fallow	Bed-1	Radish	Katuadata	Will grow red Amaranth
		Bed-2	Cabbage	Indian spinach	Will grow Spinach
		Bed-3	Tomato	Okra	Will grow Indian spinach
Fence crop	Never used	6 pit	-	Bitter gourd	Will grow based on farmer's need
Homestead boundary	Traditional management	5 prt	-	Papaya	Will grow based on farmer's need
Trellis	Traditional management	2 pit	-	Bottle gourd	Will grow based on farmer's need
		3 pit	-	Sweet gourd	Will grow based on farmer's need

C. BARIND, RAJSHAHI

Five poor and marginal farmers were selected from the FSRD sites, Kadamshahar, Rajshahi based on prefixed criteria. Then the farmers' homestead available resources, needs and choice assessments were done with active participation of the family members (both male and female). A farmers' participatory program planning workshop cum training was carried out on homestead vegetables and fruit production on September 2007 at the FSRD sites. The activities of the program were prioritized based on farmers' needs, problems, family nutrition and cash income. The year round vegetable production pattern was designed with the following of "Barind Model". The annual work plan was also chalked out in this regard. OFRD, Barind Station, Rajshahi supplied the critical inputs like fruit and vegetable seed/seedlings, net (for fencing), watering cane etc. OFRD provided technical support to the selected farmers' as per local need. In rabi season, bed preparation was done on 17-20 October 2007. The seed sowing was conducted on 20-25 October 2007 following "Barind Model". Entrepreneurship was developed for quality seeds and seedlings in each area with technical assistance from OFRD. Data on socio-agro economic aspect from all the selected households were recorded for *rabi* (2007-08) season. Two programs year round homestead vegetable production following "Barind Model" and plantation of quick growing fruit trees and management of existing fruit trees were conducted at the site.

Year round vegetables production following "Barind Model"

Utilization space by year round vegetables cultivation at farmers' homestead area under "Barind Model" during 2007-08

Niches/space	Cropping pattern for year round homestead vegetable production		
	Rabi	Kharif-I	Kharif-II
Open sunny land			
Bed-1	Red amaranth + Brinjal	Kangkong	Kangkong
Bed-2	Spinach	Indian spinach	Red amaranth
Bed-3	Radish	Stem amaranth	Jute leaf (*Pat Shak*)
Bed-4	China cabbage (*Batishak*)	Okra + Red amaranth	Onion + Red amaranth
Bed-5	Bushbean	Chili + Red amaranth	Chili
Cottage roof/top	Country bean, bottle gourd	Sweet gourd, White gourd	-
Trellis	Country bean, bottle gourd	Sweet gourd, yard long bean, bitter gourd	-
Fences/Boundary wall	Country bean	Bitter gourd, yard long bean	-
Non-fruit trees	-	White gourd, potato yam	
Partially shady land	Coriander leaf	Zinger, turmeric, aroids	-
Homestead areas	Brinjal, onion, garlic	Plantain banana, papaya, drumstick	-
Pond/ditch banks and slope	Bottle gourd, country bean	Indian spinach, sweet gourd, bitter gourd	-

D. COMILLA

Six homesteads three from Daudkandi and other three from Homna were selected among ICM/IPM club members with the help of DAE personnel for this purpose. BARI developed homestead model namely 'Tangail model' was introduced in this area, but in Comilla five beds were used with 6m × 1m size (30 cm drains between the beds) for vegetables production in each farmer's homestead. Homestead gardening was started from mid January'08 of about one decimal. Vegetables like red amaranth, amaranth, spinach, Indian spinach, ladies finger, summer onion, Zinger, turmeric, papaya and guava seedlings were given to the farmers. Ginger and turmeric was given to utilize the partial shady place and sown in 7.5 m^2 and 15 m^2 area maintaining spacing of 60 cm × 30 cm.

E. NOAKHALI

Homestead gardening Model (Atkapalia Model) was introduced among the 10 Resources Poor Farmers (RPF) within 25-35 m homestead area for year round vegetable production. In the homestead area 6 number of vegetables (red amaranth, batishak, radish, spinach, tomato, brinjal) was introduced for cultivation.

Niche/space		Year round homestead vegetable pattern		
		Rabi	Kharif I	Kharif II
Open sunny space	Bed 1	Lalshak-Radish-Tomato	Amaranths	Indian spinach
	Bed 2	Batishak-Tomato	Okra	Danta
	Bed 3	Cauliflower-Lalshak + Brinjal	Gimakalmi	Gimakalmi
	Bed 4	Cabbage-Spinach	Okra	Lalshak
	Bed 5	Radish-Batishak	Indian spinach	Amaranths
Roof top		Country bean/Bottle gourd	Ash gourd	
Trellis		Bottle Gourd	Ribbed gourd/Cucumber/Bitter gourd	

F. PATUAKHALI

Twelve homesteads were used at the FSRD site, Razakhali, Patuakhali for vegetables production round the year in 2007-08. Five beds of each 8 m × 1.5 m were taken for Lebukhali model. A fence was made with bamboo. Vegetables were cultivated round the year one after another from September, 2007 to April, 2008. Year round vegetable production in the open sunny place and other homestead spaces were utilized. Mainly female and school going boys/girls participated the major activities.

Utilization of spaces in homestead area (Lebukhali Model)

Spaces	Cropping pattern for year round homestead vegetable production		
	Rabi	Kharif-I	Kharif-II
Open sunny land			
Bed-1	Red amaranth + Radish	Brinjal	Summer onion
Bed-2	Bush bean	Okra	Indian spinach
Bed-3	Coriander leaf + cabbage	Stem amaranth	Kangkong
Bed-4	Red amaranth - Potato	Stem amaranth	Kangkong
Bed-5	Red amaranth + Tomato	Indian spinach	Indian spinach
Roof	Bottle gourd	Wax gourd	Bottle gourd
Fence	Bitter gourd	Yard long bean	-
Trellis	Country bean	Ribbed gourd	-
Non-fruit trees	-	Sponge gourd	Sponge gourd
Pond/ditch slope	Bottle gourd	Bitter gourd	-

G. RANGPUR

The experiment was conducted at Mominpur village under the FSRD site Laharirhat, Rangpur during Rabi season 2007-08. The farmers of Mominpur village of FSRD site, Laharirhat, Rangpur being mostly resource-poor, are often malnourished and there is an urgent need for the development and adoption of homestead, agro-forestry, and home gardening practices for year round production of vegetables and quick growing fruits mainly for income and family consumption. Considering the above circumstances, the ICM program has been under taken to implement at the Laharirhat FSRD Site of Rangpur. There are 6 farmers are involved under this program.

It represents mostly highland and medium highland areas of the Tista Meander Floodplain (AEZ 3). The area experiences annual rainfall of around 2169 mm with relatively early onset and late cessation. Similarly, the onset of winter is about 15 days earlier and the duration of winter is about a month longer compared to the other parts of the country. Most of the area is suitable for year round crop production with adequate irrigation facilities. The soils are generally loamy, rapidly permeable in the upper part of the ridges and slowly permeable silt loams in the lower part of the ridges and basins. The organic matter content in the upper ridges is generally below 1.0% but gradually increases to about 2.0% in lower ridges and basins.

H. TANGAIL

The experiment was conducted at the MLT site Ghatail, Tangail during 2007-08 under AEZ-9. The study was followed as Palima model (BARI developed homestead model) with 6 farm families. It was conducted in Farmers Field School (FFS) members' land, selected with the help of local DAE personnel. Twelve to 20 sqm open sunny area was used irrespective of homesteads. The unit bed size was 2m x 1m for each vegetable. To test Palima model, four different patterns were included in the study. Four patterns consisting 10 different kinds of vegetable e.g. radish, tomato, brinjal, lalshak, spinach, stem amaranth, cabbage, okra, Indian spinach and kangkong were considered for cultivation round the year. But the activity was started from kharif-1 season with stem amaranth, indian spinach, gimakalmi and Okra. Recommended seedling age, spacing and fertilizer dose were followed for all the vegetables. Partial shady and marshy place also utilized by ginger, turmeric, and aroid but not yet in harvesting stage. The tested patterns in open sunny place were as follows (Palima model).

Palima model

No. of Bed	Cropping pattern		
	Rabi	Kharif-1	Kharif-11
Open sunny place			
Bed-1	Radish- Tomato	Okra	Indian Spinach
Bed-2	Brinjal + Lalshak	Indian Spinach	Okra-Lalshak
Bed-3	Spinach/Lalshak-Stem Amaranth	Gimakalmi	Kangkong
Bed-4	Cabbage	Stem/Red amaranth	Indian Spinach
Partial shady place			
CP-1	Ginger	Ginger	Ginger
CP-2	Turmeric	Turmeric	Turmeric
Marshy land			
CP-1	Latiraj	Latiraj	Latiraj

Quick growing fruit trees: Sapling of Papaya, Guava and Banana planted but not yet in bearing stage

Results and Discussion

A. PABNA

Vegetable production

It was observed that the production of vegetables was higher at open sunny space in all farm categories. Among the season, more crops and production units were covered in rabi season. The overall production was higher in small farm followed by medium farm category probably due to their optimum management (Table 1a, 1b & 1c). The production was quite lower in marginal farmer probably because of involvement in other income generating activities. In addition to that marginal farmers had resource constraints and probably hence their total production was lower.

Utilization of vegetables

Disposal of different vegetables produced under different farm was recorded regularly. The result indicated that disposal pattern of vegetables varied with farm categories. The intake was higher in small and medium farm category over marginal farm. Vegetable intake per day per head was 142.26, 138.54 and 106.75 g for small, medium and marginal farm respectively (Table 2a, 2b & 2c). The distribution of vegetable was recorded 109.59, 86.66 and 54.48 kg for small, medium and marginal farm category, respectively. The vegetables sold by different farm categories were 108.34, 197.47 and 64.82 kg for medium, small and marginal farm respectively. The result clearly indicated that the intake, distribution and sold of vegetables by small farm category was higher followed by medium farm. The better utilization of homestead area with optimum management by their effective family labour might be enhanced optimum vegetable production and subsequent intake, distribution and sell in small farm group. Irrespective of farm category, the average total production round the year was 442.38 kg and its disposal was 235.75 kg intake, 83.58 kg distribution and 123.54 kg sold respectively (Table 2e).

Income

Total income recorded from medium, small and marginal was Tk.4168, 5424 and 2948, respectively. The net income round the year recorded by medium, small and marginal farmer was Tk.3653, 4773 and 2587, respectively. The net income was higher in small farm followed by medium farm probably they sold their vegetables with high price (Table 2a, 2b & 2c).

Nutrient uptake

Nutrient uptake especially protein, iron, carotene, vit.B_1 and vit. C by farm categories through year round vegetable consumption was estimated. Nutrient uptake was varied with different vegetable growing months. Uptake of nutrient was positively correlated with vegetable consumption. Nutrients such as protein, iron, carotene, vit.B_1 and vit.C uptake by medium farmer group was higher followed by small farm group probably due to intake more quantity of vegetables (Table 2d).

Nutrient supplementation

For better growth and development of human body necessary nutrient requirement are to be fulfilled daily. The supplementation of nutrients from the vegetables produced in homestead was estimated. The result showed that the percentage of the requirement of protein supplied from the homestead source was 9.14, 8.24 and 6.56 which was for medium, small and marginal farm categories (Table 4). The percentage of iron supplementation was 85.41, 76.24 and 51.83 while vit.A supplementation was recorded 28.71, 27.18 and 22.26 for medium, small and marginal which was supplied from homestead vegetable. The highest supplementation of Vit.B_1 and Vit C were recorded 264.54 and 105.87% in medium farm probably due to uptake of Vit.B_1 and Vit C enriched vegetable which was followed by small farm category. Supplementation of all tested nutrients was lower in marginal farm probably because of lower intake.

Table 1a. Round the year vegetables production from different niches under inorganic system of medium group farmer at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Niches		Rabi	Kharif-1	Kharif-2	Total
		Aasheen-Falgun	Chaitra-Jaistha	Aashar-Bhadra	
Open sunny space	Bed 1	32.17	43.83	23.33	99.17
	Bed 2	57.67	7.33	15.33	80.33
	Bed 3	31.83	19.67	15.00	6.50
Roof top		58.5	5.000	1.67	65.17
Trellis		52.00	3.83	2.67	58.50
Shady place		25.33	0.67	31.00	57.000
Marshy land		42.00	-	-	42.000
Unproductive tree		7.5	-	-	7.500
Fence		-	9.500	9.000	18.500
Back yard		-	50.00	2.00	52.00
Boundary		69.5	1.67	24.83	96.00

Table 1b. Round the year vegetables production from different niches under inorganic system of small group farmer at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Niches		Rabi	Kharif-1	Kharif-2	Total
		Aasheen-Falgun	Chaitra-Jaistha	Aashar-Bhadra	
Open sunny space	Bed 1	34.83	42.667	17.50	94.997
	Bed 2	41.75	11.00	14.50	67.250
	Bed 3	34.83	19.667	17.667	72.164
Roof top		86.75	-	-	86.750
Trellis		77.50	2.167	-	79.667
Shady place		17.75	1.000	26.00	44.750
Marshy land		42.00	-	4.17	46.170
Unproductive tree		6.50	-	-	6.500
Fence		4.00	3.667	1.167	8.834
Back yard		68.00	-	11.333	79.333
Boundary		84.00	-	32.833	116.833

Table 1c. Round the year vegetables production from different niches under inorganic system marginal group farmer at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Niches		Rabi	Kharif-1	Kharif-2	Total
		Aasheen-Falgun	Chaitra-Jaistha	Aashar-Bhadra	
Open	Bed 1	29.000	39.50	22.000	95.000
sunny	Bed 2	54.000	6.50	16.250	106.000
space	Bed 3	30.000	5.75	12.750	48.500
Roof top		15.000	-	-	15.000
Trellis		48.500	-	-	48.500
Shady place		7.000	2.000	16.000	25.000
Marshy land		11.667	-	-	11.667
Unproductive tree		2.333	-	-	2.333
Fence		-	5.500	6.500	12.000
Back yard		-	23.000	-	23.000
Boundary		20.667	-	-	20.667

Table 2a. Round the year vegetables production and utilization pattern of a medium group farmer under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008.

Bengali month	Name of vegetable	Total production (Kg)	Vegetable utilization (kg)			Cash income (Tk.)	Total income (Tk.)
			Intake	Distributed	Sold		
Baishakh	Data, Brinjal, Lady's finger, Moulobi Kachu, Long yard bean	18.83	9.000	3.83	6.000	70.00	220.00
Jaistha	Indian spinach, Brinjal Lady's finger, Sweet gourd	19.33	15.500	4.500	-	-	140.00
Aashar	Indian spinach, Brinjal Lady's finger, Sweet gourd,Moulobi Kchu	33.83	25.17	7.000	1.67	21.00	424.00
Sraban	Indian spinach, Brinjal, Ladys finger, gourd,Moulobi Kchu	42.000	25.5	8.33	8.33	108.00	545.00
Bhadra	Brinjal, gourd,Moulobi Kchu	9.33	7.33	2.000	-	-	126.00
Aasheen	Papaya, Water taro	38.83	8.67	3.500	26.67	195.00	284.00
Kartik	Papaya, Water taro	14.83	8.33	2.17	4.33	32.00	109.00
Agrahaon	Spinach, Bottle gourd, Bean, Elephant foot yam, Potato yam, Papaya	52.000	36.33	8.83	6.67	73.00	570.00
Poush	Radish, Cabbage, Spinach, Bottle gourd, Elephant foot yam, Papaya, Potato yam	62.500	38.67	14.33	8.67	75.00	541.00
Magh	Radish, Cabbage, Bottle gourd, Elephant foot yam, Papaya,	69.83	39.83	15.000	15.000	123.00	572.00
Falgun	Cabbage, Tomato, Data, Bottle gourd,, Papaya,	59.67	28.83	12.500	19.000	123.00	384.00
Chaitra	Data, Potato yam	26.33	9.67	4.67	12.000	116.00	253.00
Total		447.31	252.83	86.66	108.34	936.00	4168.00

Table 2b. Round the year vegetables production and utilization pattern of a small group farmer under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Bengali month	Name of vegetable	Total production (Kg)	Vegetable utilization (kg)			Cash income (Tk.)	Total income (TK.)
			Intake	Distribution	Sell		
Baishakh	Data, Brinjal, Lady's finger, Long yard bean, Moulobi Kachu	12.167	7.167	1.67	3.33	39	143
Jaistha	Brinjal, Lady's finger, Indian spinach, Long yard bean, Sweet gourd, Moulobi Kachu	33.50	17.67	3.67	7.17	107	501
Aashar	Brinjal, Lady's finger, Indian spinach, Sweet gourd, Moulobi Kachu	41.33	22.17	9.67	9.66	121	517
Sraban	Brinjal, Lady's finger, Indian spinach, Long yard bean, Sweet gourd, Moulobi Kachu	34.83	21.75	8.75	4.33	56	452
Bhadra	Brinjal, Papaya, Moulabi Kachu, Water taro	33.17	15.75	8.92	8.50	114	446
Aasheen	Brinjal, Papaya, Moulabi Kachu, Water taro	71.083	22.00	8.750	40.33	294	519
Kartik	Papaya, Moulabi Kachu, Water taro, Potato yam, Spinach	42.00	12.33	5.83	23.83	174	307
Agrahaon	Radish, Bottle gourd Papaya, Bean, Potato yam, Spinach, Elephant foot yam	56.00	24.83	9.67	21.83	339	613
Poush	Radish, Bottle gourd Papaya, Bean, Potato yam, Spinach, Elephant foot yam, Cabbage	80.5	38.0	17.5	25.0	216	696
Magh	Radish, Bottle gourd, Papaya, Bean, Spinach, , Cabbage, Tomato	72.633	38.96	12.166	21.5	17	594
Falgun	Bottle gourd, Data, Papaya, Bean, Spinach, , Cabbage, Tomato	67.33	32.33	14.66	20.66	133	433
Chaitra	Data	21.166	6.67	3.34	11.33	109	203
Total		565.69	259.62	109.59	197.47	1878	5424

Table 2c. Round the year vegetables production and utilization pattern of a marginal group farmer under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Bengali month	Name of vegetable	Total production (kg)	Vegetable utilization (kg)			Cash income (Tk.)	Total income (Tk.)
			Intake	Distribution	Sell		
Baishakh	Data, Indian spinach Brinjal, Lady's finger, Long yard bean, Moulobi Kachu	18.16	8.00	2.83	7.33	86	213
Jaistha	Indian spinach, Brinjal, Lady's finger, Long yard bean, Moulobi Kachu, Sweet gourd	9.00	7.33	1.67	-	-	135
Aashar	Indian spinach, Brinjal, Lady's finger, Long yard bean, Moulobi Kachu, Sweet gourd	18.33	15.33	3.00	-		229
Sraban	Indian spinach, Brinjal, Lady's finger, Moulobi Kachu, Water taro, Banana	20.00	12.83	5.1	20..	26	259
Bhadra	Indian spinach, Brinjal, , Moulobi Kachu, Water taro, Banana, Papaya	8.50	7.16	1.33	-	-	114
Aasheen	Brinjal, , Moulobi Kachu, Water taro, Banana, Papaya	23.16	6.50	5.33	13.33	97	169
Kartik	Moulobi Kachu Water taro, Papaya	4.00	3.67	0.33	-	-	29
Agrahaon	Radish, Spinach, Bottle gourd, Bean, Potato yam Elephant foot yam Papaya	25.00	21.00	4.00	-	-	274
Poush	Radish, Cabbage, Spinach, Bottle gourd, Bean, Potato yam Elephant foot yam Papaya	68.67	43.16	10.50	15.00	230	594
Magh	Radish, Cabbage Spinach, Bottle gourd, Bean, Papaya	54.00	34.83	9.00	10.17	83	442
Falgun	Data, Cabbage, Tomato, Bottle gourd, Papaya	43.33	24.00	9.00	10.33	66	279
Chaitra	Data, Tomato	22.00	11.00	4.33	6.67	64	211
Total		314.14	194.81	54.48	64.82	652	2948

Table 2d. Total vegetable production (round the year) and utilization pattern and net income of different groups of farmers (April 2007 to March 2008)

Farmers group	Total production (kg)	Vegetable utilization (kg)			Cash income (Tk.)	Total income (Tk.)	Total cost (Tk.)	Net income (Tk.)
		Intake	Distributed	Sold				
Medium	447.31	252.83	86.66	108.34	936.00	4168.00	515	3653
Small	565.69	259.62	109.59	197.47	1878	5424	651	4773
Marginal	314.14	194.81	54.48	64.82	652	2948	361	2587

Table 2e. Round the year mean vegetables production and utilization pattern of a farmer under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008.

Name of Group	Total production (Kg)	Vegetable utilization (kg)			Cash income (Tk.)	Total income (Tk.)	Total cost (Tk.)	Net income
		Intake	Distribution	Sell				
Inorganic	442.38	235.75	83.577	123.54	1155	4180	509	3671

Table 3a. Nutrient intake by a family of medium group farmer under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Bengali month	Protein (gm)	Iron (mg)	Carotene (microgram)	Vit-B_1 (mg)	Vit-C (mg)
Baishakh	413.03	1715.06	24779.30	10.57	3137.0
Jaistha	1003.56	4570.05	60110.85	258.17	4232.1
Aashar	889.05	4444.30	68595.83	2475.83	7083.4
Sraban	628.51	5362.50	19885.46	15.67	6438.1
Bhadra	474.00	4102.50	13172.50	12.75	2305.0
Aasheen	673.53	2525.78	7361.77	22.53	142.5
Kartik	364.50	214.00	3130.55	9.85	30.0
Agrahaon	1068.26	1161.70	11738.63	2419.81	9198.2
Poush	998.20	1199.65	2172.60	20.73	11627.4
Magh	763.50	615.09	14783.32	20.10	5083.6
Falgun	682.51	346.07	52658.50	27.70	4199.9
Chaitra	389.03	241.06	51668.00	12.62	4487.0
Total	8347.68	26497.76	330057.31	5306.33	57964.2

Table 3b. Nutrient intake by a family of small group farmer under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Bengali month	Protein(gm)	Iron(mg)	Carotene (microgram)	Vit-B_1(mg)	Vit-C(mg)
Baishakh	151.5	1644.5	22995.8	98.9	400.0
Jaistha	698.0	6255.0	46717.6	153.05	5305.0
Aashar	626.04	4559.55	34043.05	97.57	7459.7
Sraban	806.44	3801.76	2233.14	17.53	5995.92
Bhadra	499.75	751.0	648.2	14.82	1132.5
Aasheen	826.0	3322.25	7452.25	2.07	967.5
Kartik	507.0	228.5	5840.5	10.6	1695.0
Agrahaon	786.5	1169.0	16545.5	2788.05	10052.0
Poush	867.94	809.48	18918.62	18.4	8144.87
Magh	417.67	311.49	10926.0	18.67	2165.09
Falgun	988.83	54705	71867.2	33.91	7212.0
Chaitra	367.23	246.18	45593.85	12.86	4639.6
Total	7526.15	23645.76	312481.6	3290.43	55169.18

Table 3c. Nutrient intake by a family of marginal group farmer under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008

Bengali month	Protein (gm)	Iron (mg)	Carotene (microgram)	Vit-B_1 (mg)	Vit-C (mg)
Baishakh	313.0	1527.5	26955.7	101.22	2705.0
Jaistha	477.5	2990.5	31190.15	149.22	2530.0
Aashar	605.0	3883.75	43261.7	483.73	4812.5
Sraban	418.5	3906.25	14854.2	11.8	5017.5
Bhadra	329.5	34.75	7078.6	13.02	1712.5
Aasheen	382.5	197.25	5300.5	9.475	97.5
Kartik	246.0	143.0	2480.4	6.1	30.0
Agrahaon	866.71	1031.63	13863.7	16.58	8435.9
Poush	1146.29	1220.01	29050.6	82.57	13391.98
Magh	546.66	338.1	8140.5	98.68	3288.8
Falgun	470.71	352.62	33342.2	21.25	3222.7
Chaitra	185.23	143.68	40450.6	8.65	2517.6
Total	5987.6	16083.71	255968.85	1002.295	47761.98

Table 4. Percentage of nutrient supplied from a homestead on the basis per head requirements under inorganic system at the FSRD site, Pushpopara, Pabna during April 2007 to March 2008.

Farm group	% Protein	% Iron	% Vit-A	%Vit-B_1	%Vit C
Medium	9.14	85.41	28.71	264.54	105.87
Small	8.24	76.24	27.18	163.64	100.77
Marginal	6.56	51.83	22.26	49.99	87.23

Farmers' reaction

Farmers are more interested to economic crops with high cash return. They are less aware about nutritional need and the contribution of mini production unit (2-3 decimal unused) of homesteads. As the program was production based more motivation needed for them towards consumption and utilizing the potential contribution of the model and safe foods for their health and nutrition.

Year round vegetable production in the homestead area through Goyeshpur model was a successful approach for homestead resource utilization and family nutrition. Farmers in the site area are not conscious about their family nutrition. It is therefore imperative to carryout more motivational program with intensive vegetable production, food processing, cooking and quality maintain for ensuring nutritional requirement of the farm families.

B. SHYAMPUR, RAJSHAHI

From the result (Table 4) it was observed that highest amount of vegetables was collected from bottle gourd (46.0 kg) followed by Katuadata (26.0 kg). Katuadata is one at the most popular vegetable in Rajshahi region. The lowest amount of vegetables was collected from Okra (2.2 kg) followed by Indian Spinach (2.5 kg). Above data were collected up to1st week of May, 08. But these vegetables; Katuadata, Indian Spinach and Okra still on the bed and bottle gourd on the trellis and Papaya on homestead boundary and bitter gourd on fence. On the other hand, Radish, Tomato and Cabbage harvesting was completed. From the Table 5 it was found that highest distributed vegetables was bottle gourd (24.0 kg) followed by Katuadata (17.0 kg) and consumed bottle gourd (22.0 kg) followed by Radish (10.7 kg).

Table 4. Total production, utilization and distribution of homesteads vegetables at the MLT site, Shibpur, Rajshahi from Rabi season 2007-2008 to 1st week of May, 2008

Crop	Total production(kg)	Average homestead consumption (kg)	Average homestead distribution (kg)
Radish	16.2	10.7	5.5
Cauliflower	11.2	7.3	3.8
Tomato	8.6	6.3	2.3
Katuadata	26.0	9.0	17.0
Bottle gourd	46.0	22.0	24.0
Indian Spinach	2.5	2.5	0
Okra	2.2	2.2	0
Total	112.6	60.0	52.6

N. B. Each value is a mean of 4 observations i.e. four homestead

Farmers' reactions

- This homestead activity created a significant impact on the improvement of vegetables in the local area because the utilized homestead spaces were mostly fallow and under utilized previously.
- A good impact was created among the farmers to adopt the modern technologies need in homestead spaces utilization. It was observed that vegetable production technology (Goyeshpur vegetables production model) was spreading among the neighboring farmers.
- It was created a good impact with neighbors and side by side food habit of farm families is also changing day by day in a positive direction. Nutrient deficiency problems were reduced substantially due to intake of increased amount of fresh vegetables from their homestead.
- Before interaction the homestead activity, the family members were used in unproductive purpose (such as TV watch, gossiping etc). but now most of the lesser time of their family members including man, women, and children etc are used in their homestead garden.

C. BARIND, RAJSHAHI

Vegetables production per homestead during Rabi 2007-2008

In December, the maximum amount of vegetables (55.10 kg) was produced from each homestead. The second highest fresh vegetables was produced in November (50.34 kg) and sharply declined after December (Table 5). Six vegetable crops viz., brinjal, red amaranth, spinach, radish (with leaf), bush bean and China cabbage (*batishak)* grown in five beds of open sunny place produced 21.92, 22.90, 21.00, 21.80, 14.50 and 20.74 kg fresh vegetables, respectively during *rabi* season. However Brinjal and red amaranth were grown in same bed simultaneously. On the other hand, two-creeper vegetable crops viz., bottle gourd and country bean were grown on the farmers' cottage roof and trellis gave 18.44 and 15.50 kg fresh vegetables per homestead. It was observed that the highest amount of vegetable was produced in red amaranth (22.90 kg). Actually red amaranth is a quick growing and short duration vegetable. In *rabi* season, it was revealed that a total of 156.80 kg fresh vegetables were produced per homestead (Table 11).

Table 5. Vegetables production (kg) per homestead during rabi 2007-2008

Month	Vegetable production/bed (kg/5m^2)						B.gourd	Bean
	Brin.	R.ama.	Spin.	Rad.	B.bean	Batisak		
November	0	13.60	9.30	12.80	8.30	6.34	0	0
December	5.70	9.30	11.70	9.00	6.20	11.80	0	1.40
January	9.10	0	0	0	0	2.60	10.94	9.10
February	7.12	0	0	0	0	0	7.50	5.00
Total =	21.92	22.9	21	21.8	14.5	20.74	18.44	15.5

Vegetables intake per family during rabi 2007-08

The maximum amount of vegetables (40.20 kg) was consumed by each family in the month December, followed by November (34.94 kg) and after December it was declined (Table 8). The each farmer's family intake were 17.82, 14.30, 16.00, 15.00, 11.60, 15.74, 12.44 and 9.5 kg fresh brinjal, red amaranth, spinach, radish (with leaf), bush bean, China cabbage (*batishak*), bottle gourd and country bean, respectively from the month November to February. It was observed that each family (4 members) consumed a total of 112.40 kg fresh vegetables during *rabi* 2007-08. (Table 10).

Table 6. Vegetables intake per family during *rabi* 2007-2008

Month	Vegetable production/bed (kg/5m^2)						B. gourd	Bean
	Brinjal	R.ama	Spin.	Radish	B.bean	Batisak		
November	0	8.00	7.30	9.00	6.30	4.34	0	0
December	5.70	6.30	8.70	6.00	5.30	6.80	0	1.40
January	7.00	0	0	0	0	4.60	6.94	5.10
February	5.12	0	0	0	0	0	5.50	3.00
Total =	17.82	14.3	16	15	11.6	15.74	12.44	9.5

Vegetables distributed by a family

In November, the highest amount of vegetables (5.00 kg) was distributed to farmers' relatives and neighbors (Table 7). Each family distributed 1.00, 2.00, 1.00, 2.00, 0, 2.00, 1.00 and 2.00 kg fresh brinjal, red amaranth, spinach, radish (with leaf), bushbean, China cabbage (batishak), bottle gourd and country bean, respectively from November to February. During *rabi* season the total amount of distributed vegetables by a family was 11.00 kg.

Table 7. Vegetables distributed by a family during *rabi* 2007-2008

Month	Vegetable production/bed (kg/5m^2)						B. gourd	Bean
	Brinjal	R.ama	Spin.	Rad.	B.bean	Batisak		
November	-	2.00	1.00	2.00	-	-	-	-
December	-	-	-	-	-	2.00	-	-
January	-	-	-	-	-	-	1.00	1.00
February	1.00	-	-	-	-	-	-	1.00
Total =	1.00	2.00	1.00	2.00	-	2.00	1.00	2.00

Vegetables sold by a family

Each farmer's family sold 3.10, 6.60, 4.00, 4.80, 3.00, 3.00, 5.00, and 4.00 kg fresh brinjal, red amaranth, spinach, radish (with leaf), bush bean, China cabbage (batishak), bottle gourd and country bean, respectively from November to February. During rabi season there were 33.50 kg fresh vegetables were sold by a farmer family (Table 10).

Table 8. Vegetables sold by a family during *rabi* 2007-2008

Month	Vegetable production/bed (kg/5m^2)						B. gourd	Bean
	Brinjal	R.ama	Spin.	Rad.	B.bean	Batisak		
November	-	3.60	2.00	2.80	2.00	-	-	-
December	-	3.00	2.00	2.00	1.00	3.00	-	-
January	2.10	-	-	-	-	-	3.00	3.00
February	1.00	-	-	-	-	-	2.00	1.00
Total =	3.10	6.60	4.00	4.80	3.00	3.00	5.00	4.00

Table 9. Total vegetable production, intake, distributed and sold by a family during November 2007 to February 2008

Months	Vegetable production (kg)	Intake (kg)	Distributed (kg)	Sold (kg)
November	50.34	34.94	5.00	10.40
December	55.10	40.20	2.00	11.00
January	31.74	23.64	2.00	8.10
February	19.62	13.62	2.00	4.00
Total	156.8	112.4	11.00	33.50

Economic return per homestead

After implementation of the project during *rabi* season each farm family produced 21.92, 22.90, 21.00, 21.80, 20.74, 14.50, 18.44 and 15.50 kg fresh brinjal, red amaranth, spinach, radish (with leaf), China cabbage (*batishak*), bush bean, bottle gourd and country bean, respectively from November to February. During this period each family sold a portion of the products after fulfill their family nutrition requirements. Each farm family earned 1474.32 and 1294.32 Taka gross and net return, respectively in respect of local market value of the products during rabi season (Table 10).

Table 10. Economic return per homestead during rabi 2007-2008

Name of vegetables	Total vegetable production (kg/bed)	Vegetable price (Tk./kg)	Gross return (Tk.)	Total cost (Tk.)	Net return (Tk.)
Brinjal	21.92	12	263.04		
Red amaranth	22.90	6	137.40		
Spinach	21.00	10	210.00		
Radish	21.80	6	130.80		
Batishak	20.74	7	145.18		
Bush bean	14.50	15	217.50		
Bottle gourd	18.44	10	184.40		
Country bean	15.50	12	186.00		
Total	156.8	78	1474.32	180.00 (Without family labour)	1294.32

Intake of protein, vitamins and mineral

After intervention, the consumption of Protein as well as vitamins and minerals was increased remarkably because of increasing vegetable production at homestead area (Table 12). Before intervention the consumption of Protein, Iron, Calcium, Vit-A, Vit-B and Vit-C, of farmer for per person per day were 1.8 mg, 1.21 mg, 65 mg, 3.77 mg, 0.04 mg and 38.06 mg, respectively and after intervention these were increased as 6.63 mg, 9.41mg, 195.09 mg, 11.67 mg, 0.26 mg and 105.12 mg, respectively and requirements are sown in Table 11.

Table 11. Nutrition intake by a family of marginal farmer during rabi 2007-2008

Nutrient category	Per person/day (Before intervention)	Per person/day (After intervention)	Per person/day (Requirement)
Protein (mg)	1.8	6.63	55.50
Iron (mg)	1.21	9.41	19.00
Calcium (mg)	65	195.09	500.00
Vit A (mg)	3.77	11.67	7.50
Vit B complex (mg)	0.04	0.26	1.50
Vit C (mg)	38.06	105.12	30.00

B. Plantation of quick growing fruit trees and management of existing fruit trees

Existing fruit trees are also resources to the farmers. By performing different types of management practices these turned into fruit bearing condition and earn cash money as well as meet up the demand of family nutrition. There are a lot of wild jujubes plants from which farmer do not get economic benefit. Jujube budding were included under this program. The activities carried out as a development work with BARI recommended technologies that are given bellow-

1. **Budding of jujube.**

No. of Co-operator. 5
No. of tree . 8
Variety . BARI kul-1, BARI kul-2 and Apple kul

2. Distribution of fruit sapling.

No. of Co-operator. 5
No. of saplings . 35
Variety . Jujube (10), Papaya (10), Guava (10) and Lemon (5)

3. Fertilizer and Irrigation management.

No. of Co-operator. 5
No. of tree . 20
Variety . Mango and Jujube

Out put of the project during rabi 2007-2008

(i) Due to use of modern varieties the homestead vegetable production has increased.
(ii) Farmers are being familiar with the BARI released improved vegetable varieties.
(iii) Use of farmers' homestead resources like cowdung, poultry litter, compost, pond water, different fallow land, non-fruit tree and family labour have increased at homestead area.
(iv) Women employment has increased which ensure women participation in agricultural activities as well as made positive effect on equity within the family and in community.
(v) Consumption of fresh vegetables by the family has been increased and also has changed the consumption habit towards vegetables.
(vi) Farmers' dependency on local vegetable market has been decreased due to own homestead vegetable production.
(vii) Above all the nutrition demand of the farmer's family is fulfilled as well as they earn some money to sell the products in the local market.

Limitations during project implementation

i) Drought and high temperature hampered the program.
ii) Lack of sufficient water for growing vegetables in drought season especially in kharif-I.
iii) Most of the cowdung is being used as cooking fuel due to severe fuel crisis in the Barind area.

Opportunity

The program should be extended in other location of Barind area to ensure the family nutrition of the poor farmer's family.

D. COMILLA

Vegetable production and gross return of different homesteads in Daudkandi and Homna are presented in Table 11. It was observed that Jahanara Begum produced 155 kg. of different vegetables and earned about Tk.1412 from garden. Jahanara Begum is very happy with homestead. Vegetable production and gross return from small piece of land.

Farmers' reaction

Other few farmers of the village Kalakandi, of Homna upazila also started homestead gardening, inspired by Jahanara Begum's homestead.

Table 11. Vegetable Production and Gross Return of different homesteads in Daudkandi and Homna (Mid January to March 2008)

Name of farmers	Bed 1		Bed 2	Bed 3		Bed 4	Bed 5		Total Veg (Kg)	Gross return (Tk.)
	Red amaranth - Kangkong		Amaranth - amaranth	Spinach - Onion		Okra	Radish - Indian spinach			
Anwara khatun, Husband- Maharam Ali	5 Kg	3 Kg	12 kg	5 kg	Bulb forming stage	1 Kg	10 Kg	5 kg	41	339
Fatima Akter, Husband- Anwar Hossain	-	5 Kg	12 kg		Bulb forming stage	2 Kg	12 Kg	7 kg	38	320
Sharif uddin, Dekrikhola, Daudkandi	3 Kg		17 kg		Bulb forming stage	On-going	-	-	20	130
Jahanara Begum, Dudh mia, Homna	10 kg	30 kg	50 kg	8 kg	Maturity	32kg	-	25 kg	155	1412

Price (Tk./kg): Red amaranth, kangkong= 10, amaranth= 6, spinach, indian spinach and radish= 8, Okra= 14

E. NOAKHALI

Among the participated resources poor farmers (RPF), it was observed that dietary habit has been changed which was found more pronounced among landless and marginal farmers. They have developed tendency to take vegetables that are more nutritious. In addition, it created a very positive impact on family member, neighbors and visitors due to good performance and yield, which helped, in family nutrition and proper utilization of homestead area.

12. Performance of Homestead Production up to 31 March 2008 at Atkapalia, Noakhali

Vegetable	Qty (Kg) Harvested / Family	Consumption (Kg) / Family	Amount Distribution (Kg)/ Family	Amount Sold (kg) / Family	Value in Tk./ kg	Total Value in (Tk.)
1.Red Amaranth	12.47	8.58	1.66	2.23	12 /-	149.64/-
2. Batishak	20.52	11.07	3.29	6.16	8/-	164.16/-
3. Spinach	16.28	9.83	2.65	3.8	13/-	211.64/-
4. Radish	19.67	11.62	3.35	4.7	7.5/-	147.52/-
5. Tomato	22.44	13.5	3.49	5.45	8/-	179.52/-
6. Brinjal	16.59	10.0	2.67	3.92	7/-	116.13/-

- Total Homestead. 10

Extension Message

Vegetable production throughout the year in homestead garden following 'Atkapalia Model' was highly accepted by the resource poor and marginal farmers, extension and NGO personnel in the char areas of Noakhali because of its potentiality to meet up vegetables demand, supplying nutrition and providing extra income for the farm families throughout the year. If this technology is disseminated to each and every farm family of this area, the farmers will be benefited in future in respect of nutrition, economic and poverty alleviation.

F. PATUAKHALI

Yield of different vegetables of homestead are shown in Table 13. Most of its production was used for family consumption. Seed, fertilizer and fencing cost were approximately Tk.2250.00. Total income from vegetables was about Tk. 4574.00 from September 2007 to April 2008. Consumption was169 g/day/head considering 5 member families. In eight months total average production was 424 kg with family consumption 203 kg, distribution 48 kg and sell was 173 kg which generated Tk. 1743.00 net cash after consumption and distribution.

Table 13. Round the year vegetables production and utilization pattern of homestead (average of ten homesteads) at the FSRD site, Razakhali, Patuakhali from August 2007 to April 2008.

Month	Name of vegetables	Total production (kg)	Vegetables utilization (kg)			Cash income (Tk.)	Total income (Tk.)
			Intake	Distribution	sell		
Sept.	Bitter gourd, Summer onion, Sponge gourd	16	11	1	4	60.00	235.00
Oct.	Summer onion, Bitter gourd	11	10	1	-	-	162.00
Nov.	Bottle gourd, Bean, Bitter gourd, Red amaranth	44	25	5	14	140.00	442.00
Dec.	Bottle gourd, Bean, Bitter gourd, Red amaranth, Radish	54	30	7	17	170.00	545.00
Jan.	Radish, Bottle gourd, Bean, Bitter gourd, Red amaranth, Cabbage, Cor. leaf	88	32	12	44	440.00	924.00
Feb.	Tomato, Bush bean, Bitter gourd, Cabbage,	74	36	7	31	279.00	686.00
March	Tomato, Potato, Bitter gourd, Brinjal	86	35	10	41	420.00	996.00
April	Yard long bean, Stem amaranth, Bitter gourd, Brinjal	51	24	5	22	234.00	584.00
Total		**424**	**203**	**48**	**173**	**1743.00**	**4574.00**

G. RANGPUR

The participatory farmers are effectively utilizing the open space, partially shady places and boundary (ail) of the homestead, which were previously remained either unutilized or underutilized. After intervention through ICM project, target farm families (15-20 nos) are growing to cultivate different vegetables year round in their homestead area with modern variety and recommended management. They were grown vegetables like Lalsak, data, okra, gimakalmi, Indian spinach, snake gourd, ribbed gourd, ash gourd, cucumber etc, in summer and cabbage, tomato, radish, garlic, spinach, napasak, Brinjal, carrot, pepper, Corianders, country bean etc. during winter at their homestead area. They also cultivate bitter gourd, ribbed gourd as fenced crop and papaya as ail crop (homestead boundary) successfully. They were utilized partial shady place for zinger and turmeric (BARI hybrid 3) with proper management. Female members do most of the activities for homestead gardening but sometimes their husband and children support them. Even at present female members are selling their excess vegetables. ICM farmers are producing 640 kg different vegetables from 210 m^2 homestead area (Table 14). They profit Tk.4134 where production cost is Tk.884 from the homestead (Table 15).

Impact: After intervention no vegetables have to be purchased from the market for their own consumption, besides farm families' intake more vegetables, which lead them better calorie intake. The cooperator farmers used the farm waste effectively and utilized the compost in the vegetable and potato production. Now, neighbors of target farm families are influenced to grow more vegetables at their homestead area with modern varieties and proper management.

After intervention of ICM program the farmers were able to use modern technology developed by BARI in homestead, which increased their net income Tk. 3250 after intervention. Through the transfer of BARI technology, the livelihood of farmers can be increased as they can generate more income using their existing resource.

Table 14. Technology, number of farmers involved and area covered before and after intervention of ICM

Sunny/open place. 210 m^2					
Before intervention			After intervention		
Technology	Farmers (#)	Area (m^2)	Technology	Farmers (no.)	Area (m^2)
Fallow	04	140	Radish- Kangkong - Kangkong	06	40
Lalsak	02	45	Cabbage- Data- Lalsak	06	40
Napasak	-	60	Brinjal + Lalsak- Indian spinach- Data	06	36
Corianders	-	10	Tomato + Napasak- Okra- Lalsak	06	44
Data	-	25	Garlic- Patsak- Okra	06	40
Rooftop.06					
Fallow	02	-	Bottle gourd - Ash gourd	06	120
Bottle gourd - Fallow	02	40	Country bean - Sweet gourd	06	120
Fallow - Ash gourd	02	45	-	-	-
Trellis: 150 m^2					
Fallow	06	-	Bottle gourd - Ash gourd	06	80
			Country bean - Sweet gourd	06	72
Ail crop. 20 Pit					
. Fallow	06	-	Papaya	06	60 PS
Partial shady place. 520 m^2					
Fallow	06	-	Zinger (Improved)	06	240
			Turmeric (Improved)	06	280
Marshy land. 15m^2					
Fallow	06	-	Aroid	04	15
Plantation Crops.					
Mango (TM)	06	15	Mango (Fertilizer, spray, pruning. irrigation)	06	15
Jack fruit (TM)	06	10	Jack fruit (Fertilizer, spray)	06	10
Guava (TM)	06	06	Guava (Pruning. irrigation)	06	06

PS = Papaya Seedling, TM = Traditional Management

Table 15. Yield and economics of technologies before and after intervention

Sunny place. 210 m^2									
Before intervention					After intervention				
Crop	Total produc. (Kg)	GR (Tk.)	TPC (Tk.)	BCR	Crop	Total produc. (kg)	GR (Tk.)	TPC (Tk.)	BCR
Lalsak	10	50	20	2.5	Radish	30	120	62	1.93
Napasak	30	150	50	3.0	Cabbage	38	540	120	4.50
Corianders	02	50	10	5.0	Lalsak	12	84	25	3.36
Data	30	60	20	3.0	Brinjal	130	540	120	4.50
					Tomato	175	875	182	4.81
					Garlic	20	500	195	2.56
		Total=310/-	100	3.10			Total=2659	704	3.78
Rooftop. 06									
Bottle gourd	55	165	20	8.25	Bottle gourd	125	375	60	6.25
					Country bean	110	1100	120	9.17
					Ash gourd, Sweet gourd	*	-	-	-
		Total=165	20	8.25			Total=1475	180	8.19
Trellis									
Fallow	06	-	-	-	All vegetable	*	-	-	-
Ail crop.									
Before intervention					After intervention				
Fallow	06	-	-	-	Papaya	*	-	-	-
Marshy land. m^2									
Fallow	06	-	-	-	Aroid	*	-	-	-
Partial shady place									
Before intervention					After intervention				
Fallow	06	-	-	-	Zinger	*	-	-	-
	06	-	-	-	Turmeric	*	-	-	-
Plantation crop									
Before intervention					After intervention				
Fallow	06				Mango	*	-	-	-
					Jack fruit	*	-	-	-
					Guava	*	-	-	-
		Grand Total=475	120	3..90			Grand Total =4134	884	4.67

* = Crop not harvested

Prices of output (Tk./kg): Radish-4, Cabbage-6, Lalsak-7, Tomato-5, Garlic-25, Brinjal-8, Bottle gourd-4 and C. bean-10 (After intervention) and Bottle gourd-3, lalsak-5, napa-5, corinder-25 (before intervention)

Table 16. Economics of sector wise production in the farms (average of 06 farmers) at the FSRD site, Laharirhat Rangpur before and after intervention.

Resource	Before			After		
	GR (Tk..)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)
Sunny place	310	100	3.10	2659	704	3.78
Roof top	165	20	8.25	1475	180	8.19
P. Shady place	-	-	-	-	-	-
Marshy land	-	-	-	-	-	-
Trellis	-	-	-	-	-	-
Ail crop	-	-	-	-	-	-
Plantation crops	-	-	-	-	-	-
Total	475	120	355	4134	884	3250

H. TANGAIL

The model has been started from Kharif-1. Here only the production and consumption of vegetables from open sunny place are presented in Table 17. After completion of one cycle the total findings will be reported.

Table 17. Year round vegetables production (Palima model) at the MLT Site, Ghatail, Tangail during Kharif-1, 2007-08

Sl. No	Name of farmers	Family members	Name of vegetables	Date of sowing	Harvesting duration	Total Production kg/ 5 m^2	Consumption (kg)	Distribution (kg)	Sale (kg)	Vegetable requirement/ day (g)	% fulfilled of requirement/ day (g)
1.	Mrs. Roushanara W/O. Md. Shahjahan	6	Stem amaranth	20-02-08	19	30	15 (50%)	5 (17%)	10 (33%)	1500	1070 (71%)
			Indian spinach	20-02-08	25	10	5 (50%)	2 (20%)	3 (30%)		
			Gima kalmi	20-02-08	26	8	5 (63%)	0	3 (37%)		
			Okra	20-02-08	25	3	3 (100%)	0	0		
					Total	51	28	7	16		
2.	Mrs Shahera Khatun W/O. Md. Sobhan Ali	5	Stem amaranth	07-04-08	34	20	15 (75%)	0	5 (25%)	1250	760 (61%)
			Gima kalmi	02-04-08	39	10	6 (60%)	0	4 (40%)		
			Indian spinach	10-04-08	26	11	6 (55%)	0	5 (45%)		
			Okra	25-04-08	21	3	3 (100%)	0	0		
					Total	44	30	0	14		
3.	Mrs Nurun Naher W/O. Md. Saiful Islam	3	Stem amaranth	28-03-08	21	28	15 (54%)	3 (11%)	10 (35%)	750	1290 (172%)
			Gima kalmi	20-04-08	27	8	8 (100%)	0	0		
			Indian spinach	20-04-08	24	9	9 (100%)	0	0		
			Okra	20-04-08	25	3	3 (100%)	0	0		
					Total	48	35	0	0		
4.	Mrs Amina Begum W/O. Md. Abdul Goni	6	Stem amaranth	20-04-08	21	25	15 (60%)	0	10 (40%)	1500	1210 (80%)
			Gima kalmi	25-04-08	22	12	8 (67%)	0	4 (33%)		
			Indian spinach	20-04-08	28	12	6 (50%)	0	6 (50%)		
			Okra	25-04-08	21	5	5 (100%)	0	0		
					Total	54	34		20		
5.	Mrs Salina Akter W/O. Md. Humyan	5	Stem amaranth	20-04-08	26	26	15 (58%)	5 (19%)	6 (23%)	1250	1250 (100%)
			Gima kalmi	21-04-08	25	12	8 (67%)	0	4 (33%)		
			Indian spinach	20-04-08	28	16	7 (44%)	3 (19%)	6 (37%)		
			Okra	25-04-08	21	5	5 (100%)	0	0		
					Total	59	35	8	16		
6.	Mrs Dina Begum W/O. Md. Anwar Hossain	3	Stem amaranth	20-04-08	21	21	12 (57%)	3 (14%)	6 (29%)	750	1250 (167 %)
			Gima kalmi	25-04-08	21	6	5 (83%)	1 (17%)	0		
			Indian spinach	21-04-08	24	13	9 (69%)	0	4 (31%)		
			Okra	24-04-08	24	4	4 (100%)	0	0		
					Total	44	30	4	10		

Effect of Urea Super Granule (USG) as a Source of Nitrogen on Tomato

Abstract

The experiment was conducted at the MLT site, Gangni, Kushtia during 2006-07 to 2007-08, in Sylhet during 2005-06 to 2007-08 at Bharamara (Kushtia), Chuadanga and in Magura during 2007-08 to find out the effect of Urea Super Granule (USG) on tomato. Recommended dose of N as USG, 10 and 20% less than recommended dose of N as USG were tested along with recommended dose of N as prilled urea and farmers practice. Higher fruit yield of tomato and BCR were obtained from the application of N as recommended dose of USG in Kushtia and Chuadanga. In Sylhet, the highest yield was obtained from the application of N as recommended dose of USG in 2005-06 but it did not varied with 10% less N as USG in next two years. The highest yield was obtained with 10% less recommended dose of N as USG at Magura but it was identical to rec. dose of N as USG and 20% less recommended dose of N as USG treatment. Higher BCR was obtained with 10% less N as USG in Magura. The yield with 10% and 20% less recommended dose on N as USG were higher than prilled urea i.e. using USG at 10-20% less recommended dose instead of traditional prilled urea could save 10-20% nitrogenous fertilizer.

Introduction

Tomato is one of the widely grown vegetables in the world due to its wider adaptability to various agro-climatic conditions. Besides, being rich source of mineral and vitamins, it is used in many popular products of daily use like ketchup, paste, puree, juice and powder. The yield of tomato in Bangladesh is very low (7.26 t/ha) compared to other countries such as India (15.14 t/ha), China (30.34 t/ha), Japan (52.84 t/ha), USA (65.22 t/ha) respectively (FAO, 1997). The low yield of tomato in our country is mainly due to the use of poor yielding varieties and improper cultural practices followed. Proper nutrient management increases the yield, fruit quality, fruit size, keeping quality, colour and taste of tomato (Anon., 2006).

Nitrogen requirement of tomato is very high. Farmer's of Bangladesh grown tomato in different regions with prilled urea with other fertilizers. The efficiency of the prilled urea is very low (Choudhury and Khanif, 2001). Urea super Granule (USG) is one of the popular nitrogenous fertilizers which are now available in the market and the farmers are already using in rice culture. The efficiency of N fertilizer can be increased through deep placement in the form of USG (Sanvant *et al.*, 1991). Some research report on different crops revealed that by using of USG a substantial amount of urea fertilizer can be saved (Anon., 2003). But the information on the efficiency of USG on tomato compared to prilled urea is meager. Therefore, the experiment was designed to evaluate the efficiency of USG as a source of nitrogen on tomato.

Materials and Methods

The experiment was conducted at the MLT site, Gangni, Kushtia during rabi of 2006-07 and 2007-08 at the MLT sites of Bharamara, Kushtia, Chuadanga and Shalikha, Magura during 2007-08 in the medium highland of agro-ecological zone of High Ganges Rivers Floodplain (AEZ 11), at FSRD site, Jalalpur, Sylhet during 2005-06 to 2007-08 under Eastern Surma Kushyara Floodplain agro-ecological zone (AEZ-20). The experiment was laid out in a RCB design with six dispersed replications. The unit plot size was 5m x 6m. The variety was Sathi at Gangni, Uthshah at Bharamara, Surakha at Chuadanga, Hytom at Magura and Epok in Sylhet. Thirty five days old seedlings of tomato were transplanted with 60 cm × 40cm spacing. Seedlings were transplanted from 1-3 November 2007 at Gangni, Kushtia, 15 October 2007 in Chuadanga, 15 November 2007 at Bharamara, 4-7 November 2007 in Magura, 17 November 2007 in Sylhet. Five treatments were T_1: Recommended dose of nitrogen as prilled urea, T_2: Recommended dose of nitrogen as USG, T_3: 10% less recommended dose of nitrogen as USG, T_4: 20% less recommended dose of nitrogen as USG and T_5: Farmers practice. Other fertilizers were used as per recommended dose following FRG 2005. Entire amount of all fertilizers except K were applied as basal. Half of K was applied at 15 DAT and remaining half at 30 DAT. Urea super granules (USG) was applied at 15 DAT as ring method, 9-10 cm apart from plant stalk and 7-8 cm depth covering with soil. Prilled urea was applied in 3 equal splits at 15, 30 and 45 DAT. Plant protection measures were taken as required. The crop was harvested from 30 December 2007 to 10 February 2008 at Gangni, Kushtia, 9 January to 20 February 2008 at Chuadanga, 14 February to 10 March 2008 at Bharamara, Kushtia and13 February to 23 March 2008 at Shalikha Magura. The data on yield and different yield contributing characters were recorded from 10 randomly selected plants in each plot and plot-yield was also estimated. Data were analyzed statistically using MSTATC package.

Results and Discussion

Gangni, Kushtia

In 2006-07, yield of tomato increased due to application of USG over prilled Urea (Table 1). The highest yield was obtained from treatment of recommended dose of N as USG (115.50 t/ha) as compared to other treatments. The second highest yield was obtained from the treatment of USG 10% less recommended dose (103.75 t/ha). Higher gross return, net return and BCR were obtained from the treatment of recommended dose of N as USG followed by 10% less recommended dose of nitrogen as USG (Table 1).

In 2007-08, although higher yield was obtained from the treatment of recommended dose of N as USG but it was statistically identical with 10% less recommended dose of nitrogen as USG. Statistically similar yield was found from the application of nitrogen as prilled urea and 20% less recommended dose of nitrogen as USG in both years, i.e. 20% N could be saved if urea is applied as USG instead of prilled urea. Higher BCR was obtained from the treatment of recommended dose of N as USG (Table 2).

Chuadanga

Significantly highest yield was obtained from recommended dose of N as USG followed by 10% less recommended dose of nitrogen as USG and 20% less recommended dose of nitrogen as USG. Gross return, net return and BCR were also followed the same trend (Table 3).

Bharamara, Kushtia

Higher yield was obtained from the treatment of recommended dose of N as USG but it was statistically identical with the other treatments. Gross return, net return and BCR were higher in recommended dose of N as USG followed by 10% less recommended dose of nitrogen as USG.

Magura

Significant variations of yield attributes were found due to application of different fertilizers. Yield of tomato was increased significantly due to application of USG over prilled urea. Significant yield variation was not found among the treatments using USG although higher yield was obtained from the 10% less recommended dose of N as USG (90.97 t/ha) followed by recommended dose of N as USG (88.85 t/ha) and 20% less recommended dose of N as USG (85.19 t/ha). Lower yield of tomato (71.44 t/ha) was obtained in farmers practice due to lower yield attributing characters. Higher BCR was found in10% less recommended dose of N as USG (Table 5).

Sylhet

In 2007-08, significantly higher yield (t/ha) was found from recommended dose of N as USG (81.56) and 10% less recommended dose of N as USG (79.06). Even application of 20% less recommended dose of N as USG also produced significantly higher yield over recommended dose of N as prilled urea. The trend was almost same in 2006-07 but slightly different in 2005-06. Regarding economics, the higher gross return, net return and BCR were also obtained from same treatments. The yield with 10% and 20% less recommended dose on N as USG were higher than prilled urea. Therefore, using USG instead of traditional prilled urea could save 10-20% nitrogenous fertilizer. Results obtained from the experiment, it was found that due to deep placement of urea as USG and nitrogen use efficiency was increased for continuous supply of N_2 as a slow released N material.

Farmers' reactions

Kushtia: Farmers are satisfied with higher yield of tomato by using USG. But they expressed their concern regarding the high application cost and unavailability of USG in local market.

Magura: Farmers are interested to cultivate tomato with USG. They opined that USG is more effective and profitable than that of normal prilled urea. The growth is uniform and quality is better than that of normal prilled urea but unavailability of USG in the local market is a problem.

Sylhet: Farmers opined that USG is more effective and profitable than that of normal prilled urea, less labour intensive as USG is placed only once and weed infestation is also less, the growth is uniform and quality is better than that of normal prilled urea. Farmers' are interested to apply USG as if it is available in the market.

Conclusion

Application of N as USG was found more effective in terms of yield and economic return than that of N as prilled form. If USG were available to the farmers, they would willingly use it.

References

Anonymous, 2003. Annual Research Report 2003-04. On-Farm Research Division, BARI, Gazipur pp: 195-208.

Anonymous, 2006. Annual Research Report 2005-06. Horticulture Research Centre, BARI, Gazipur pp: 129-135.

BARC, 2005. Fertilizer Recommendation Guide. Bangladesh Agricultural Research Council, Farmgate, Dhaka-1215, 260 p.

Choudhury, A.T.M.A. and Khanif, Y.M. 2001. Evaluation of effects of nitrogen and magnesium fertilization on rice yield and fertilizers nitrogen efficiency using 15 N tracer techniques. J. Plant Nutr. 24: 855-871.

FAO, 1997. FAO Production year book. 1996. Basic data unit. Statistics Division. FAO, Rome, Italy. 51: 125-127.

Savant, N.K., Dhane, S.S. and Talashikar, S.C. 1991. Fertilizer News. International Fertilizer Development Centre, Muscle Shoals Albama and ISA. 36(3): 19-25.

Table 1: Yield and yield components and cost and return of Tomato as influenced by USG at Gangni, Kushtia during 2006-07

Treatment	Fruit wt. /m^2 (kg)	Fruit wt. /plant kg)	Yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	9.32	3.80	93.25	746000	75920	670080	9.82
USG (Rec)	11.55	4.71	115.5	924000	77170	846830	11.97
USG(10%<Rec)	10.37	4.28	103.75	830000	76720	753280	10.81
USG(20%<Rec)	9.82	4.06	98.25	786000	76270	709730	10.30
Farmers practice	8.62	3.56	86.25	690000	73540	61460	9.38
LSD (0.05)			4.46				
CV (%)			2.38				

Note: Tomato 8 Tk/kg

Table 2: Yield and yield components and cost and return of Tomato as influenced by USG at Gangni, Kushtia during 2007-08

Treatment	Fruit wt. /m^2 (kg)	Fruit wt. /plant (kg)	Yield (t/ha)	Gross return (Tk/ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	7.90	67.66	75.66	3,78,330	69,000	309,330	5.48
USG (Rec)	7.13	80.66	85.33	4,26,665	72,000	354,665	5.93
USG(10%<Rec)	8.56	75.33	80.33	4,01,665	70,500	331,165	5.70
USG(20%<Rec)	8.08	70.66	76.66	3,83,330	70,250	313,080	5.46
Farmers practice	7.41	65.66	71.83	3,59,165	66,000	293,165	5.44
LSD (0.05)	2.15	1.87	6.19				
CV (%)	6.50	2.95	4.22				

Note: Tomato 5 Tk/kg

Table 3: Yield and yield components and cost and return of Tomato as influenced by USG at Chuadanga during 2007-08

Treatment	Fruit wt. /m^2 (kg)	Fruit wt. /plant kg)	Yield (t/ha)	Gross return (Tk/ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	9.15	3.77	91.50	455000	80475	374525	5.65
USG (Rec)	11.85	4.68	118.50	587500	85875	501625	6.84
USG(10%<Rec)	10.57	4.25	105.75	537500	83625	453875	6.42
USG(20%<Rec)	9.95	4.09	99.50	495000	81787	413213	6.05
Farmers practice	8.67	3.60	86.75	430000	75975	354025	5.65
LSD (0.05)	3.50	0.10	2.54				
CV (%)	5.04	1.39	6.34				

Table 4: Yield and yield components and cost and return of Tomato as influenced by USG at Bharamara, Kushtia during 2007-08

Treatment	Fruit wt. /m^2 (kg)	Fruit wt. /plant kg)	Yield (t/ha)	Gross return (Tk/ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	9.10	2.36	91.00	364000	72000	292000	5.05
USG (Rec)	10.20	2.70	101.66	408000	77250	330750	5.28
USG(10%<Rec)	9.60	2.47	96.30	385200	75000	310200	5.13
USG(20%<Rec)	9.23	2.40	92.00	368000	73500	294500	5.00
Farmers practice	9.00	2.33	90.30	361200	67000	292200	5.23
LSD (0.05)	3.90	0.44	17.86				
CV (%)	6.50	9.68	10.05				

Table 5: Effect of urea super granule (USG) on the yield and yield attributes of tomato at the MLT site, Shalikha, Magura during 2007-08

Treatments	Plant height (cm)	Fruits/plant (no)	Fruits weight/ plant (kg)	Yield (t/ha)
Prilled urea (Rec.)	99.4c	38.46ab	3.43b	78.72b
USG (Rec.)	119.05a	40.58a	4.09a	88.55ab
USG (10% <Rec.)	107.4b	42.13a	4.25a	90.97a
USG (20% <Rec.)	101.5c	40.18a	3.97a	85.13ab
Farmers practice	113.0a	34.50b	3.33b	71.45c
CV (%)	5.04	11.99	7.91	7.17

Table 6: Effect USG on cost and return of tomato at Shalikha, Magura during 2007-08

Treatments	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec.)	629760	125530	504230	5.02
USG (Rec.)	708400	125704	582696	5.64
USG (10% <Rec.)	727760	125460	602300	5.80
USG (20% <Rec.)	681040	125217	555823	5.74
Farmers practice	571600	126523	445077	4.52

Market price (Tk./kg): Tomato-8.00, Urea-6.50, USG-7.00, TSP-30.0, MP-30.00, Gypsum-5.0, Zinc sulphate-120.0 and Boric acid-110.0

Table 7**.** Effect of urea super granule (USG) on the yield and yield attributes of Tomato (Epok) at the FSRD site, Jalalpur, Sylhet, 2007-08

Treatment	Plant height (cm)	Branch/ plant (no.)	Cluster/ plant (no.)	Fruit/ plant (no.)	No. of Fruit/kg	Yield (t/ha)		
						2007-08	2006-07	2005-06
Prilled urea (Rec.)	87.00b	4.77c	9.76c	36.23c	13.00	63.78c	77.29	85.39
USG (Rec.)	94.33a	5.93a	12.36a	43.10a	12.52	81.56a	92.10	101.36
USG(10%<Rec.)	93.92a	5.53ab	11.75ab	41.79a	12.09	79.06a	97.85	88.12
USG(20%<Rec.)	91.34a	5.17bc	11.27b	39.57b	12.38	74.36b	90.71	75.14
Farmers practice	84.13b	4.76c	10.07c	34.07d	12.98	59.65d	75.98	47.14
LSD (0.05)	3.733	.4612	0.8483	1.555	NS	3.863	9.145	
CV %	8.12	7.65	9.25	6.62	8.12	7.98	5.60	

Table 8. Effect of USG on yield and economics of Tomato (Epok) at Jalalpur, Sylhet during 2007-08

Treatment	Yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	63.78	637800	104205	533595	6.12
USG (Rec)	81.56	815600	104770	710830	7.78
USG(10% <Rec)	79.06	790600	101499	689101	7.79
USG(20%<Rec)	74.36	743600	100228	643372	7.42
Farmers practice	59.65	596500	103838	492662	5.74

Market price (Tk./kg): Tomato: 10.00, Urea: 6.00, USG: 6.30, TSP: 16.00, MP: 16.00, Gypsum : 6.00, $ZnSO_4$:45.00

Effect of Urea Super Granule (USG) as a Source of Nitrogen on Cabbage

Abstract

The experiment was conducted at the MLT site, Gangni of Kushtia and the FSRD site, Jalalpur of Sylhet during 2006-07 and 2007-08, at the MLT site, Chuadanga and Khudabazar, Jessore during 2007-08 to find out the effect of urea super granule (USG) on cabbage. Recommended dose of N as USG, 10 and 20% less than recommended of N as USG were tested along with recommended dose of prilled urea and farmers practice. Results revealed that significantly higher yield of cabbage was obtained with USG treatments even 10-20% less of N as USG also produced significantly higher yield over recommended dose of N as prilled urea almost in all the locations.

Introduction

The importance of cabbage (*Brassica oleracea*) as vegetable due to supply of adequate vitamins, carbohydrates and minerals is well known. It is the most important winter vegetable and is grown throughout the country. The farmers apply at least nitrogenous fertilizer to their crops for better yield (Rahman, *et al.*, 2005). They apply N is usually as prilled urea in broadcast method. The recovery of applied N as prilled urea under upland condition is about 40-50% (Anon., 2003). This low recovery percentages occur because of losses of applied urea in different forms and reasons. The most important reason of N loss under upland condition is through volatilization. The amount of N loss increased when it is broadcast. There are different types of nitrogenous fertilizers available in the market. Recently, urea super granule (USG) has become available in the market and used in wetland rice as well as upland crops (Anon., 2006). Efficiency of N utilization could be increased only application of improved technology. Broadcast application method of urea on the surface soil causes loss up to 50%, but point placement of USG in 10 cm depth may result in negligible loss (Crasswell and De Datta, 1980). It is also reported that 8-10 cm depth of placement of USG in rice field can save 30% nitrogen than prilled urea (Savant *et al.*, 1991). To minimize the loss, USG application may be a good technology to increase yield as well as reduction of production cost. This is why, the trial was undertaken with fulfill the objective to find out the efficiency of USG and compare the yield performance of cabbage with prilled urea and to find out the optimum and economic dose of USG for cabbage.

Materials and Methods

The experiment was carried out at the MLT site, Gangni of Kushtia and FSRD site, Jalalpur, Sylhet during 2006-2007 and 2007-08 and MLT sites of Chuadanga, Khudabazar of Jessore during 2006-2007 in medium highland. The experimental plots of Kushtia and Jessore were under the High Ganges Rivers Floodplain soil (AEZ 11) and the experimental plots of Sylhet were under Eastern Surma – Kushyara Floodplain agro-ecological zone (AEZ-20). The experiment was setup in a randomized complete block design with five dispersed replications. The unit plot size was 5m x 6m. Thirty five days aged seedlings cabbage (var. Autumn Queen at Gangni, Kushtia Atlas -70 in Chuadanga and Sylhet and Green-60 at Khudabazar, Jessore) were transplanted from 5 to 24 October 2007 in Kushtia, 8 November in Chuadanga, 19 to 24 October 2007 in Jessore and 18 November in Sylhet with spacing 50 cm x 40 cm. There were five treatments viz. T_1 : Recommended doses of N as prilled urea, T_2 : Recommended dose of N as USG, T_3 : 10% less than recommended dose of N as USG, T_4 : 20% less than recommended dose of N as USG and T_5 : Farmer's practice. Other fertilizers were used as per recommended dose of high yield goal following FRG' 2005. Entire amount of PKSZn and B were applied as basal. Prilled urea was applied in three installments at 15, 30 and 45 DAP. USG was applied at 20 DAP in 3-4 inches apart from plant and 2-3 inches depth of soil. Irrigation, plant protection measures and other intercultural operations were done as and when required. Harvesting was done on 8 to 17 January 2008 in Kushtia, 29 January in Chuadanga and 22 to 31 January 2008 in Jessore. Necessary data were collected and analyzed statistically.

Results and Discussion

Kushtia and Chuadanga

Head yield of cabbage increased significantly with the application of USG over prilled urea at Gangni during 2007-08 and higher yield was obtained with recommended dose of N as USG, but in the previous year, higher yield was obtained in farmers' practice which was statistically similar with recommended dose of N as USG and prilled urea (Table 1). In Chuadanga, higher yield and BCR were recorded from the recommended dose of N as USG (Table 3) followed by 10% less of recommended dose of N as USG.

Jessore

Head yield of cabbage increased significantly with the application of USG over prilled urea (Table 4). Higher yield was obtained from the recommended dose of N as USG (95.34 t/ha) followed by 10% less recommended dose of N as USG (93.0 t/ha) and 20% less recommended dose of N as USG (89.72 t/ha). It might be due to uniform N supply of USG on cabbage. Similar trend was followed in case of marketable head weight. The highest head yield (1.91 kg/plant) was obtained from treatment T_2 where recommended dose of nitrogen as a source of USG. Similar response was also observed in other yield attributes like head pericycle, head diameter and plant height. The result indicated encouraging performance of USG on cabbage yield. It revealed that cabbage yield obtained from 10% less and even 20% less N as USG were statistically identical with recommended USG but significantly differ recommended prilled urea and farmers practices. It is indicated that the efficiency of USG is better over prilled urea.

Regarding economic return, it was revealed that the highest gross return (Tk. 533990/ha), net return (Tk. 455637/ha) and benefit cost ratio (6.81) were obtained from recommended N as USG. It is also noted that even 10% and 20% less of recommended dos of N as USG showed higher economic benefits than recommended dose of N as prilled urea.

Sylhet

Higher yield was found from recommended dos of N as USG (92.04) which was identical with USG 10% less than recommended dose of N as USG (84.78) in 2007-08. Even the yield obtained with 20% less of recommended dose of N as USG was significantly higher over recommended dose of N as prilled urea. Regarding economics (Table 7), the higher returns were also obtained from USG treatments. The highest gross return, net return and BCR (10.73) was obtained from the recommended dos of N as USG followed by USG <10% rec. dose (10.32). 20% less recommended dos of N as USG also gave the higher economic benefits than prilled urea. Therefore, using USG instead of prilled urea could save 10-20% nitrogenous fertilizer. Results obtained from the experiment, it was found that due to deep placement of urea as USG form, nitrogen use efficiency was increased for continuous supply of N_2 as a slow released N material. The vegetative growth was uniform. Therefore using USG as a source of nitrogenous fertilizers could increase the farm income and also reducing the cost of the farmers effectively. In 2006-07, similar trend was observed in terms of yield and economic benefits.

Farmers' reactions

Kushtia and Chuadanga:

Farmers' are satisfied with the USG application for higher yield. They observe that they can be benefited from this technology. They also opine that rapid growth of the plant, more yields within short time, less weed infestation and one application is enough but it needs more cost and high labour cost for application.

Jessore

Farmers are satisfied with the USG application because the growth of cabbage is uniform. Compactness and quality is better than that of normal prilled urea. It would be less labour intensive, if USG could be placed only one time. The farmers are interested to apply USG, if it is available in the market.

Sylhet

Farmers opined that USG is more effective than normal prilled urea, less labour intensive, as USG is placed only one time and weed infestation is also less. The growth is uniform, compactness and quality is better than that of normal prilled urea. Farmers are interested to apply USG if it is available in the market.

Conclusion

It was evident that urea super granule had significant positive effect on the growth and yield of cabbage. The farmers could save up to 10-20% urea by using USG in cabbage cultivation. Economic benefits were also higher in USG over prilled urea.

References

Anonymous, 2003. Application of urea super granule (USG) in vegetable crops: A profitable technology. On-Farm Research Division, BARI. 10 p.

Anonymous, 2006. Annual Research Report 2005-06. Horticulture Research Centre, BARI, Gazipur pp: 129-135.

BARC, 2005. Fertilizer Recommendation Guide. Bangladesh Agricultural Research Council, Farmgate, Dhaka-1215, 260 p.

Crasswell, E.T. and DeDatta, S.K. 1980. Recent development in research on nitrogen fertilizers for rice. International Rice Research Institute, Res. Paper Series No. 49: 1-11.

Rahman, M., Nazrul, M.I., Choudhury, D.A., Quayyum, M.A. and Khan, M.A.H. 2005. Effect of USG application at variable depths and times for higher use efficiency and better growth and yield of tomato. Bangladesh J. Agric. and Environ. 1(2): 33-37.

Savant, N.K., Dhane, S.S. and Talashikar, S.C. 1991. Fertilizer News. International Fertilizer Development Centre, Muscle Shoals Albama and ISA. 36(3): 19-25.

Table 1. Yield and yield components of Cabbage as affected by USG at Gangni, Kushtia during 2006-07 and 2007-08

Treatment	Wt. of head /m^2(kg)		Wt. of head(kg)		Head yield (t/ha)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Prilled urea (Rec)	11.88	6.05	2.97	1.22	107.99	60.53
USG (Rec)	12.42	7.80	3.10	1.56	112.89	78.08
USG(10%<Rec)	10.70	6.66	2.67	1.35	100.10	66.68
USG(20%<Rec)	9.73	6.34	2.70	1.28	88.47	63.50
Farmers practice	12.99	5.43	3.43	1.09	118.14	54.35
LSD (0.05)		5.25	0.34	0.12	11.02	17.16
CV (%)		7.00	5.70	4.68	5.55	5.15

Table 2. Effect of different form of urea cost and return of cabbage at Gangni, Kushtia during 2006-07 and 2007-08

Treatment	Gross return (Tk./ha)		TVC (TK/ha)		Gross margin (Tk/ha)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Prilled urea (Rec)	385925	363200	45480	47250	340445	315950
USG (Rec)	476295	468500	45350	51000	430945	417500
USG(10%<Rec)	451110	400099	45050	49000	406060	351099
USG(20%<Rec)	442220	380990	44775	48000	397445	332999
Farmers practice	374075	326100	44950	46000	329125	280100

Market price (Tk./kg): Cabbage: 6.00

Table 3. Yield and yield components of cabbage as affected by USG in Chuadanga during 2007-08

Treatment	Wt. of head /m^2 (kg)	Wt. of head (kg)	Head yield (t/ha)	Gross return (Tk/ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	8.14	2.26	81.43	244296	75750	168546	3.22
USG (Rec)	9.96	2.77	99.63	298890	80750	218140	3.70
USG (10%<Rec)	9.16	2.54	91.58	274752	78750	196002	3.49
USG (20%<Rec)	8.93	2.48	89.33	268002	77750	190252	3.45
Farmers practice	8.16	2.27	81.56	244674	76750	167924	3.19
LSD (0.50)	3.90	0.08	0.42				
CV (%)	6.85	1.70	6.25				

Note: Cabbage 3 Tk/kg

Table 4: Effect of urea super granule (USG) on the yield and yield attributes of cabbage at the MLT site, Khuadabazar, Jessore during 2007-08

Treatments	Plant height (cm)	Head pericycle (cm)	Head diameter (cm)	Marketable head weight (kg)	Head yield (t/ha)
Prilled urea (Rec.)	13.13	53.80bc	16.19b	1.70bc	84.78b
USG (RD)	13.39	55.71a	16.88a	1.91a	95.34a
USG (10% <RD)	13.37	55.02ab	16.50ab	1.86ab	93.0a
USG (20% <RD)	13.34	54.58abc	16.40ab	1.80abc	89.72ab
Farmers practice	13.09	53.15c	16.07b	1.64c	78.44b
CV (%)	3.95	5.09	4.26	7.81	9.92

Table 5: Effect of USG on cost and return of cabbage at Kuadabazar, Jessore during 2007-08

Treatments	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec.)	474768	78125	396643	6.08
USG (RD)	533990	78353	455637	6.81
USG (10% <RD)	520800	77829	442971	6.69
USG (20% <RD)	502768	77533	425235	6.48
Farmers practice	439264	77984	361280	5.63

Price (Tk./kg): Cabbage-6.60, Urea-6.50, USG-7.0, TSP-30, MP-30, Gypsum-5.0, Zinc sulphate-120.0 and Boric acid-110.0

Table 6. Effect of different form of urea on the yield and yield attributes of Cabbage at the FSRD site, Sylhet 2007-08

Treatment	Plant height (cm)	Head diameter (cm)	Wt. of whole plant (kg)	Wt. of head (kg)	Yield (t/ha)	
					2007-08	2006-07
Prilled urea (Rec.)	28.79cd	20.17d	2.81c	2.28c	70.49c	77.19
USG (Rec.)	35.01a	24.77a	3.43a	3.05a	92.04a	95.26
USG (10%<Rec.)	32.84ab	23.26b	3.24ab	2.80ab	84.78ab	90.22
USG (20%<Rec.)	30.94bc	21.97c	3.09b	2.63b	79.51b	88.44
Farmers practice	27.03d	19.37d	2.55c	2.06c	63.07c	74.82
LSD(0.05)	2.427	0.8911	0.2663	0.2663	7.431	10.22
CV %	7.78	8.23	5.71	8.56	10.06	8.95

Table 7. Effect of different form of urea on yield and economics of cabbage at Jalalpur, Sylhet during 2007-08

Treatment	Yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	70.49	563920	67550	496370	8.34
USG (Rec)	92.04	736320	68650	667670	10.73
USG (10%<Rec)	84.78	678240	65750	612490	10.32
USG (20%<Rec)	79.51	636080	65220	570860	9.75
Farmers practice	63.07	504560	65720	438840	7.67

Market price (Tk./kg): Cabbage: 8.00, Urea: 6.00, USG: 6.30, TSP: 16.00, MP: 16.00, Gypsum: 6.00, $ZnSO_4$*:45.00*

Effect of Urea Super Granule (USG) as a Source of Nitrogen on Cauliflower

Abstract

The experiment was conducted at the MLT site, Gangni, Kushtia during 2006-07 to 2007-08, in Chuadanga Jhikargacha, Jessore and Jalalpur, Sylhet during 2007-08 to find out the effect of Urea Super Granule (USG) on cauliflower. Recommended dose of N as USG, 10 and 20% less than recommended dose of N as USG were tested along with recommended dose of prilled urea and farmers practice. Results revealed that yield of cauliflower increased due to application of USG over prilled Urea. Except Sylhet, significantly highest yield of cauliflower was found with applications of recommended dose of N as USG in all the locations. Gross margin was higher in that same treatment. In Sylhet, the yield of the application of N as USG was at par with the 10% less N as USG.

Introduction

The importance of cauliflower as vegetable due to supply of adequate vitamins, carbohydrates and minerals is well known. It is the most important winter vegetable and is grown throughout the country. Cauliflower is very popular winter crop to the farmers and they grow it as a commercial crop in some regions of Bangladesh But the farmers are not getting satisfactory yield due to lack of awareness about recommended fertilizer dose, method of application and other cultural management. Urea Super Granule (USG) is one of the popular nitrogenous fertilizers which are now available in the market and the farmer's are already using in rice culture (Uddin *et al.*, 2005). As a slow releasing urea fertilizer, USG can effectively be used in vegetable crops (Anon, 2006). Some research report on different upland crops revealed that a substantial amount of urea fertilizer can be saved by using USG (Rahman *et al.*, 2005). Keeping this view in mind, the experiment was undertaken to find out the optimum and economic dose of USG for cauliflower in the locality.

Materials and methods

The experiment was conducted at the MLT sites of Gangni, Kushtia during rabi season of 2006-2007 to 2007-08, at MLT sites of Chuadanga and Jhikargacha, Jessore and at FSRD site, Jalalpur, Sylhet during 2007-08. The experiment was laid out in RCB design with five dispersed replications. The unit plot size was 5m x 6m. Thirty days old seedlings of cauliflower (var. white marble in Kushtia, Kashmir in Chuadanga, Snow white in Jessore and White Diamond in Sylhet) were transplanted from 4-11 October 2007 in Kushtia, 6 November 2007 in Chuadanga and 25-29 October 2007 in Jessore and 18 November 2007 in Sylhet with spacing of 60 cm x 40 cm. Treatments were T_1: Recommended doses of nitrogen as prilled urea, T_2: Recommended dose of nitrogen as USG, T_3: 10% less recommended dose of nitrogen as USG, T_4: 20% less recommended dose of nitrogen as USG and T_5: Farmers practice. Other fertilizers were used as per recommended dose for high yield goal following FRG'2005. Entire amount of PKSZn and B were applied as basal. Prilled urea was applied in two installments at 16 and 35 DAP. USG was applied at 18 DAP in 3-4 inches apart from plant and 2-3 inches depth of soil. Irrigation, pesticide application, plant protection measures and other intercultural operations were done as and when required. The crop was harvested from 24 December 2007 to 4 January 2008 in Kushtia, 22 January to 3 February 2008 in Chuadanga and 21 to 31 January 2008 in Jessore. The data on yield and different yield components were recorded from 10 randomly selected plants in each plot and plot yield was also measured and data were analyzed statistically using MSTATC package.

Results and Discussions

Kushtia and Chuadanga

It was revealed that yield of cauliflower increased due to application of USG over prilled Urea. The highest yield was obtained from the T_2 where USG (Rec. dose) was applied. The yield from 10 and 20% less than recommended dose of N as USG was higher than the application of N as prilled urea i.e.10%-20% nitrogenous fertilizer could be save by using USG instead of prilled urea (Table 1 & 3). Higher gross margin was found from USG as recommended dose in both locations.

Jessore

The card yield of cauliflower increased markedly due to USG application over prilled urea (Table 4). The highest card yield was obtained from the plot receiving recommended dose of USG (36.97 t/ha) followed by USG 10% less recommended dose (34.82 t/ha). However, identical yield was recorded from 20% less recommended dose, farmers practice and prilled urea recommended dose. The yield from 10% less than recommended dose of N as USG was higher than the application of N prilled urea i.e.10% nitrogenous fertilizer could be save by using USG instead of prilled urea. The similar response was also observed in major yield attributes like plant height, card height, weight/card, breath of card and pericycle of card. Maximum edible card yield was obtained from recommended N as USG and it was statistically significant to all other treatments. Prilled urea at recommended dose and farmers practice gave the identical edible card yield. Probably higher length, breath and marketable weight attributed to increased yield in recommended N as USG treatment. The result indicated encouraging performance of USG on cauliflower yield. It is indicated that the efficiency of USG is better over prilled urea. Higher gross return (Tk.332730/ha), net return (Tk.234252/ha) and BCR (3.38) were obtained from the treatment of recommended dose of N as USG followed by USG 10% less recommended dose.

Sylhet

From Table 6, it was revealed that yield of cauliflower increased significantly with the application of USG over prilled urea. Higher yield was obtained from the USG rec. dose (47.77 t/ha) which was statistically similar with 10% less recommended dos of N as USG (43.33 t/ha) followed by 20% less recommended dos of N as USG (37.67 t/ha). The yield contributing characters like plant height, periphery of curd, curd length, curd breadth and curd wt. were significantly differ among the USG treated plots from the prilled urea and farmers practice plots. It may be due to uniform N supply of USG to the plants. Regarding economics (Table 7), the higher returns were also obtained from USG treatments. The highest gross return and gross margin were obtained from the USG recommended dose followed by 10% less recommended dose of N as USG. So, it was found that, 10-20% nitrogenous fertilizer could be saved by using USG instead of prilled urea. It was found that due to deep placement of urea as USG form, nitrogen use efficiency was increased because of continuous N supply of USG to the plants as a slow releasing N material. The growth was uniform, curd colour, compactness and quality was also better than that of normal prilled urea application.

Farmers' reaction

Kushtia & Chuadanga:

Farmers are satisfied with the USG application for higher yield. They found that they could be benefited from this technology. They also opine in favour of USG for rapid growth of the plant, more yield within short time, less weed infestation and single application of USG. But it needs high labour cost for its application.

Jessore

Farmers of that location are highly pleased with the higher yield and positive effect of USG. They opine that USG is more effective than prilled urea. They also opine that the market price of USG should be reasonable.

Sylhet

Farmers opine that USG is more effective than prilled urea, less labour intensive, as USG is placed only one time and weed infestation is also less. They also opine that the growth is uniform, curd compactness and quality is better than that of prilled urea. Farmers are interested to apply USG, if it is available in the market.

Conclusion

Higher yield and economic return were obtained from USG recommended treatment than that of prilled urea. By applying 10-20% less recommended dose of N as a source of USG on cauliflower, the farmers can obtained more yield and economic return than recommended N as prilled urea. USG should be available to the farmers.

References

Anonymous, 2006. Annual Research Report 2005-06. On-Farm Research Division, BARI, Gazipur pp: 62-125.

BARC, 2005. Fertilizer Recommendation Guide. Bangladesh Agricultural Research Council, Farmgate, Dhaka-1215, 260 p.

Rahman, M., Nazrul, M.I., Choudhury, D.A., Quayyum, M.A. and Khan, M.A.H. 2005. Effect of USG application at variable depths and times for higher use efficiency and better growth and yield of tomato. Bangladesh J. Agric. and Environ. 1(2): 33-37.

Uddin, M.M., Eunus, M., Mannan, M.A. and Ahmed, M.F. 2005. Effect of urea super granule of boro rice. Bangladesh J. Agric. and Environ. 1(1): 1-6.

Table 1. Yield and yield components of Cauliflower as affected by USG at Gangni, Kushtia during 2006-07 and 2007-08

Treatment	Average wt. of cauliflower /m^2 (kg)		Average wt. of each cauliflower (kg)		Yield (t/ha)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Prilled Urea (Rec.)	3.19	4.13	0.64	0.74	31.88	41.27
USG (Rec.)	4.66	5.08	0.93	0.86	46.45	50.76
USG (10% less Rec.)	4.16	4.40	0.83	0.80	41.63	43.97
USG (20% less Rec.)	3.92	4.17	0.78	0.77	39.24	41.67
Farmers practice	3.32	3.90	0.66	0.71	33.19	39.05
LSD (0.05)	-	6.50	0.12	NS	6.92	4.98
CV (%)	-	9.00	8.98	1.21	9.55	6.11

Price (Tk./kg): Cauliflower 17.50 in 2006-07 and 7 Tk/kg in 20007-08

Table 2. Yield and yield components of Cauliflower as affected by USG at Gangni, Kushtia during 2007-08

Treatment	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
Prilled Urea (Rec.)	288913	40,500	2,48,413
USG (Rec.)	355320	45,000	3,10,320
USG (10% less Rec.)	307790	43,000	2,64,790
USG (20% less Rec.)	291676	42,000	2,49,676
Farmers practice	273350	40,000	2,33,350

Table 3. Yield and yield components of Cauliflower as affected by USG in Chuadanga during 2007-08

Treatment	Wt. of cauliflower /m^2 (kg)	Wt. of each cauliflower (kg)	Yield (t/ha)	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk./ha)
Prilled urea (Rec)	7.60	1.58	76.01	456048	60675	395373
USG (Rec)	8.49	1.77	84.91	509472	65675	443797
USG (10% less Rec)	7.94	1.65	79.37	476208	63675	412533
USG (20% less Rec)	7.78	1.62	77.83	466992	62675	404317
Farmers practice	7.57	1.58	75.70	454176	61765	392501
LSD (0.05)	0.76	0.05	0.36	-	-	-
CV (%)	0.35	1.90	5.41	-	-	-

Price (Tk./kg): Cauliflower: 6

Table 4: Effect of urea super granule (USG) on the yield and yield attributes of cauliflower at the MLT site, Jhikargacha, Jessore during 2007-08

Treatments	Plant height (cm)	Card height (cm)	Weight of card (kg)	Edible weight of card (kg)	Card pericycle (cm)	Yield (t/ha)
Prilled urea (Rec.)	67.72b	26.94b	1.12c	0.77c	48.31	32.19c
USG (Rec.)	73.96a	28.35a	1.35a	1.02a	52.26	36.97a
USG (10% <Rec.)	67.34b	26.98b	1.24b	0.95b	49.0	34.82b
USG (20% <Rec.)	66.72b	26.78b	1.22b	0.88b	48.72	32.64c
Farmers practice	66.45b	26.67b	1.04c	0.73c	48.24	32.26c
CV (%)	3.60	3.46	6.39	9.86	6.72	7.30

Table 5: Effect of USG on cost and return of cauliflower at Jhikargacha, Jessore during 2007-08

Treatments	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec.)	289710	98305	191405	2.95
USG (Rec.)	332730	98478	234252	3.38
USG (10% <Rec.)	313380	98235	215145	3.19
USG (20% <Rec.)	293760	97992	195768	3.00
Farmers practice	290340	99292	191048	2.92

Market price (Tk./kg): Cauliflower-9, Urea-6.50, USG-7, TSP-30, MP-30, Gypsum-5, Zinc sulphate-120 and Boric acid-110

Table 6. Effect of different form of urea on the yield and yield attributes of cauliflower at the FSRD site, Sylhet 2007-08

Treatment	Plant height (cm)	No. of leaves	Periphery of curd (cm)	Curd length (cm)	Curd breadth (cm)	Curd wt. with leaves (kg)	Curd Wt. (kg)	Yield (t/ha)
Prilled urea (Rec.)	51.00b	18.67	48.00bc	14.33bc	8.67ab	1.82d	1.23d	35.22b
USG (Rec.)	61.00a	21.00	53.67a	19.67a	11.00a	2.59a	1.68a	47.77a
USG(10%<Rec.)	60.00a	20.00	50.33b	17.0ab	10.0ab	2.33b	1.53b	43.33a
USG(20%<Rec.)	60.67a	20.33	49.67b	17.32a	8.66ab	2.07c	1.35c	37.67b
Farmers practice	47.00c	17.67	45.00c	13.67c	8.00b	1.39e	1.04e	28.63c
LSD (0.05)	2.12	NS	3.08	2.69	2.27	0.06	0.08	4.86
CV (%)	8.54	8.77	6.32	8.69	12.99	9.77	10.04	9.7

Table 7. Effect of different form of urea on yield and economics of cauliflower at the FSRD site, Jalalpur, Sylhet during 2007-08

Treatment	Yield (t/ha)	Gross return (Tk./ha)	TVC (TK/ha)	Gross margin (Tk/ha)
Prilled urea (Rec)	35.22b	422640	62240	360400
USG (Rec)	47.77a	573240	66650	506590
USG(10%<Rec)	43.33a	519960	62760	457200
USG(20%<Rec)	37.67b	452040	61630	390410
Farmers practice	28.63c	343560	60950	282610

Market price (Tk./kg): Cauliflower: 12.00, Urea: 6.00, USG: 6.30, TSP: 16.00, MP: 16.00, Gypsum: 6.00, $ZnSO_4$:45.00

Effect of Urea Super Granule (USG) as a Source of Nitrogen on Maize

Abstract

An experiment was conducted at the MLT site Kaligonj, Jhenaidah during 2007-08 to observe the efficiency of USG on maize and to find out the optimum and economic dose of USG for maize. Recommended dose of USG, 10 and 20% less than recommended dose of N as USG were tested along with recommended dose of prilled urea and farmers practice. Significant variation was observed in different treatments. Higher seed and stover yield were obtained from recommended dose of N as USG followed by 10% less of recommended dose of N as USG. It indicated the better use efficiency of N from USG. Significant higher yield was obtained from the application of 10% less N as USG than prilled urea. Maximum net return (Tk.47640/ha) and BCR (1.58) were recorded in recommended dose of N as USG followed by 10% less recommended dose of N as USG.

Introduction

Total N uptake by maize plant per hectare varies among the maize varieties. Most of the maize soils of the world are deficient in N. Fertilizer N application is thus necessary to meet the crops demands. Generally urea is the most convenient N source for maize. The recovery of applied N as prilled urea under upland condition is about 40-45% (Anon., 2003). The low N-use efficiency is attributed mainly to ammonia volatilization, de-nitrification, leaching and runoff losses (Cho 2003; Freney *et al.* 1990; Ponnamperuma 1972; Sign *et al*, 1995). However, the magnitude of N loss by different ways varies depending on environmental conditions and management practices.

Deep placement of N fertilizers into the anaerobic soil zone is an effective method to reduce volatilization loss (Mikkelsen, De Datta, and Obcemca 1978). Choudhury and Bhuiyan (1994) reported deep placement of nitrogen fertilizer in rice field culture showed the superiority of urea application over the conventional split broadcast method. Different sources and forms of N fertilizer are now available in the market for commercial use. The most commonly used N fertilizer for crops is prilled urea (PU). Urea super granule is a modified from of urea. The superiority of USG over PU in rice culture has been found in many investigations (Craswell *et al.* 1985; Kannaiyan 2002; Roy 1988). Volatilization loss of prilled urea is very high and farmers loss a huge amount of money for nitrogenous fertilizer. To minimize this loss USG application may be a good technology to increase yield as well as reduction of production cost. This is why; the trial was under taken to find out the efficiency of USG and compare the yield performance of maize with USG and prilled urea and to find out the optimum economic dose of USG for maize.

Materials and Methods

The experiment was carried out at the MLT site, Kaligonj, Jhenaidah during 2007-08 in the agro-ecological zone of High Ganges Rivers Floodplain Soil (AEZ 11). The experiment was laid out in a RCB design with six dispersed replications. The unit plot size was 6m x 5m. Treatments were T_1: Recommended doses of nitrogen as prilled urea, T_2: Recommended dose of nitrogen as USG, T_3: 10% less recommended dose of nitrogen as USG, T_4: 20% less recommended dose of nitrogen as USG and T_5: Farmers practice. Other fertilizer were used as per recommended dose for high yield goal @ 60-100-40-3-1 kg PKSZn and B/ha (BARC, 2005). Entire amount of P, K, S, Zn and B were applied at the time of final land preparation. Prilled urea was applied in three equal installments at 20, 35 and 55 DAS. USG was applied at 20 DAS in 3-4 inches apart from plant and 2-3 inches depth of soil. The seed of maize (BARI Hybrid maize 3) was sown on 1-2 December 2008 maintaining a spacing of 75 cm between row to row and 25 cm between plant to plant. Irrigation, plant protection measures and other intercultural operations were done as and when required. The crop was harvested from 29 April to 30 April 2008. The data on yield and different yield components were recorded from 10 randomly selected plants in each plot and plot yield was also measured and data were analyzed statistically.

Result and Discussion

The seed yield of maize increased markedly due to USG application over prilled urea (Table 1). Higher seed yield (8.27 t/ha) was obtained from the plot receiving recommended dose of USG which was statistically identical with 10% less recommended dose of USG (8.19 t/ha). Identical yield was found from farmers practice, prilled urea recommended dose and 20% less recommended dose of USG. Recommended dose of N as USG produced higher stover yield (10.63 t/ha) followed by 10% less N as USG treatment (10.31 t/ha). Prilled urea of recommended dose produced the lowest stover yield. The similar response was also obtained in major yield attributes like plant height, seeds/cob was obtained from recommended dose of N as USG and it was statistically similar with 10% less N as USG treatment but differed to other treatments. The highest plant height was obtained from the treatment recommended dose of N as USG which was statistically superior all other treatments.

The result indicated encouraging performance of USG on maize yield. Result revealed that maize yield obtained from 10% less of recommended dose of N as USG was statistically identical with recommended dose of N as USG but significantly differ from recommended prilled urea, 20% less of N as USG and farmers practice. It is indicated that the efficiency of USG is better over prilled urea. Higher gross return (Tk. 129365/ha), net return (Tk. 47640/ha) and BCR (1.58) were obtained from the treatment of recommended dose of N as USG followed by 10% less recommended dose of N as USG (Table 2).

Farmers' reaction

Farmers are highly pleased with the higher yield and positive effect of USG. They opined that USG is more effective than prilled urea but unavailability of USG in the local market is a problem.

Conclusion

Urea super granule (USG) had significant positive effect on the growth and yield of maize. Farmers can save at least 10% of N by using USG in maize cultivation. The experiment should be continued in the next year for confirmation of the result.

Table 1. Effect of USG on yield and yield attributes of maize at the MLT site, Kaligonj, Jhenaidah during 2007-08

Treatments	Plant height (cm)	Seed/cob (no)	100 seed wt. (g)	Seed yield (t/ha)	Stover yield (t/ha)
Prilled urea (Rec)	214.68d	451b	39.93	7.23b	9.22b
USG (Rec)	227.60a	491a	41.22	8.27a	10.63a
USG (10% <Rec)	223.17b	488a	41.20	8.19a	10.31a
USG (20% <Rec)	214.53d	457b	40.83	7.39b	9.41b
Farmers practice	217.37c	460b	40.52	7.43b	9.56b
CV(%)	3.60	4.12	2.62	5.92	7.02

Table 2. Effect of USG on cost and return on maize at Kaligonj, Jhenaidah during 2007-08

Treatments	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Prilled urea (Rec)	112610	81443	31167	1.38
USG (Rec)	129365	81725	47640	1.58
USG(10% <Rec)	128005	81333	46672	1.57
USG (20% <Rec)	115555	80934	34621	1.41
Farmers practice	116230	81722	34508	1.42

Market price (Tk./ha) : Maize seed:15.00, Maize stover:0.50, Urea:6.50, USG:7.00, TSP:30.00, MP:30.00, Gypsum:5.00, Zinc sulphate:120.00 and Boric acid:110.00

Effect of Urea Super Granule (USG) as a Source of Nitrogen on Banana

Abstract

The experiment was carried out at the MLT site, Shibganj, Bogra during 2006-07 to observe the efficiency of USG on banana. Five treatments viz. Recommend (100%) dose of N as prilled urea, Recommend (100%) dose of N as urea super granules (USG), 10% less than recommend dose of USG, 20% less than recommended dose as USG and Farmer's practice were tested on the banana cultivar Rangin meher sagar. No significant variation of yield and yield contributing characters were found among the treatments. However, the yield was a little bit higher in USG treatment compared to prilled urea.

Introduction

In our country different types of fertilizer materials are becoming available in the market. Urea super granule (USG) is one of the nitrogenous fertilizers. The farmer's are already using it in Boro rice and also using it in different vegetable and fruit crops such as brinjal cabbage cauliflower banana etc. Banana is an important fruit in Bangladesh. Banana is cultivated more or less all over the country. It is a delicious and nutritious fruit. In Bangladesh Banana occupies a total of 97465 acres of land producing 561770 metric ton (BBS, 1999). Nitrogen is the most deficit nutrient element in Bangladesh soil. In general, farmers' apply at least nitrogenous fertilizer to their crops for better yield. It is said that urea super granule (USG) is more efficient than that of prilled urea in supplying N to the crops USG minimizes the loss of N by leaching and volatilization. It is mostly used by rice growers and it is also reported that 20-30% nitrogen could be saved by using USG over prilled urea. During the last couple of years farmer's are applying USG an upland vegetable crops like brinjal, cabbage cauliflower, tomato, potato, and on quick growing fruits like papaya, banana etc. However, there is no recommendation of USG for upland crops and research findings in this regard are very scanty. Environment of rice under in wetland rice is quite different from upland condition. Again efficiency of USG on upland crops is yet to be ascertained. In this context the experiment was undertaken to see the efficiency of USG on banana and to find out the optimum and economic dose of USG for that crop.

Materials and Methods

The experiment was carried out at the MLT site, Shibganj, Bogra during 2006-07 in the medium highland under AEZ-4 with pH 6.3. The experiment was laid out having RCBD design with six (6) dispersed replications. The unit plot size was 4m x 6m with spacing 2m x 2m. The variety Rangin meher sagar was used in this experiment. The suckers were planted in 50cm x 50cm x 50cm size of pit on October 20, 2006. The five treatments were considered as T_1: Recommend (100%) dose of N as prilled urea applied in three equal splits, a total of 300g/plant, T_2: Recommend (100%) dose of N as urea super granules (USG) applied in three equal splits (a total 300g/plant, about 111 number of mega sized UGS), T_3: 10% less than recommend dose of USG applied in three equal splits (a total of 270g/plant about 100 number of USG and T_4: 20% less than recommended dose as USG applied in three equal splits (a total of 240g/plant, about 89 number of USG). T_5: Farmer's practice (205-54-111-58 kg/ha of NPKS and 666kg/ha of Oil cake, respectively. Here recommended 100% N (345kg/ha) as urea was 750kg/ha and unit weight of mega sized USG was 2.7g. Prilled urea was applied in three equal splits and broadcasted around the plant. While USG as per treatments were applied first by making holes, at 6-8cm depth, following ring method, 25cm apart from the base of the plant. Similarly second and third applications of USG were made at 35 and 45cm apart respectively. After placing USG the hole was covered with soils. Urea alone was applied firstly at 30 days after planting (DAP) while second and third applications were made at 165 and 220 DAP respectively. Blanket dose of 100, 312, 90, 4 and 1 Kg/ha of P, K, S, Zn and B, were applied respectively. Full dose of Cowdung, TSP, Boric acid Zinc sulphate half of MOP and Gypsum were applied in the pit. Again rest amount of MOP were applied in two equal splits at second and third top dressing, after top dressing light spading and mulching were made followed by irrigation. While there was rainfall no irrigation were made.

Pesticide Furadan 10kg/ha, were applied for land preparation. Titl, Dithane-M-45 was sprayed 3 times against sigatoka and panama disease and Dursban was sprayed 3 times against Bettle. Crops were irrigated four times at, 45, 90, 141, and 162 days after planting (DAP). Other intercultural operations were done when necessary. Crops were harvested on 7 -30 October 2007. Necessary data were collected and analyzed statistically.

Results and Discussion

The yield contributing characters viz. number of clusters/bunch, length of peduncle/plant, number of banana per cluster, length of banana and yield were not varied among the different treatments. However, higher banana yield (70.36 t/ha) was obtained from recommended dose of N as USG. While the lowest yield (68.25 t/ha) which was found from farmers practice.

Farmers' reaction

Farmer opined that the application of USG is quite labour intensive compare to prilled urea. They are happy to get satisfactory yield from recommended dose of N as USG.

Conclusion

As most of the farmer are ignorant about USG so counting of the same will be tedious job to ensure proper number/plant. So, prior recommendation further study on method and time of application of USG is a must.

Table 1. Yield and yield contributing characters of banana at Goneshpur, Shibgonj during 2006-07

Treatments	No. of clusters/ bunch	Length of peduncle/ plant (cm)	No. of banana/ cluster	length of banana (cm)	Yield (t/ha)
Rec. N as prilled Area	9.6	94.8	13.3	25.9	68.53
Rec. N as USG	9.9	96.6	13.6	26.6	70.36
10% less of rec N as USG	9.8	96.5	13.5	26.4	69.45
20% less of rec. N as USG	9.6	96.3	13.3	26.1	69.07
Farmers' practice	9.4	94.5	13.1	25.7	68.25
LSD (0.05)	NS	NS	NS	NS	NS
CV (%)	10.2	5.5	5.9	3.9	2.23

Integrated Nutrient Management for Sustaining Soil Fertility and Yield of Mustard - Mungbean-T.Aman Cropping Pattern

Abstract

The experiment was carried out at the MLT site Pakshi, Pabna during 2005-06 to 2006-07 at Tularampur, Narail during 2005-06 to 2007-08 to estimate the requirement of individual nutrient for maximizing the yield for year round production plan on AEZ basis. Four different fertilizer doses along with absolute control were tested on Mustard-Mungbean-T.Aman cropping pattern in the study. Result revealed that seed yield of mustard was highest with the application of higher dose of N (T_2) in 2006-07 but the yield did not varied among the treatments in the previous year in Pabna. There was no variation of seed yield of mustard due to the treatments in Narail. Significantly highest seed yield of mungbean was obtained in T_1 treatment in Pabna but yield variation due to treatments was not found in Narail. Higher grain yield of T.Aman was obtained from the treatment T_2 in both locations.

Introduction

Soil fertility is a dynamic property, which varies with crops, cropping intensity and input use. More than 50% of our cultivated soil contains organic matter below the critical level. Annual depletion of plant nutrients in the intensively cropped area ranges from 180 to more than 250 kg/ha. High and medium highland comprising 60% of total cultivation land which is in most cases deficient in essential nutrients such as nitrogen, phosphorus, potassium and sulfur. The low organic matter content, higher cropping intensity, improper cropping sequence and faulty management practices are the major causes of depletion of soil fertility. Imbalance use of fertilizers is another serious problem for the country. Previous survey revealed that farmers in many areas in Bangladesh applied nitrogenous fertilizer higher than the recommended dose for some crops. They usually did not use any organic manure along with inorganic fertilizers as an integrated approach Nutrients present in soil, added as inorganic and organic sources and the nutrient harvested by crops should be considered to develop a cropping pattern based fertilizer recommendation. Remarkable amount of micronutrient is added in soil system when 15-20 t/ha biomass of mungbean is ploughed down after grain harvest. However, on farm verification of this technology is required to document its performance at different agro-ecological zones of the country where Mustard-Mungbean-T.Aman is a practiced cropping pattern. Present study was therefore conducted with the following objectives: 1) To find out the efficiency of individual nutrient for maximizing the yield of the cropping pattern. 2) To estimate the requirement of individual nutrient for maximizing the yield for year-round production plan of AEZ basis.

Materials and Methods

The experiment was carried out at the MLT site Pakshi, Pabna during 2005-06 to 2006-07 and at Tularampur, Narail during 2005-06 to 2007-08 under High Ganges River Flood Plain Soil (AEZ-11). The experiment was laid out in randomized complete block (RCB) design with four replications. The unit plot size was 6 m × 5 m. The seed of mustard (BARI sarisha 9) was sown on 20-21 November in Pabna and 15-22 November in Narail maintaining a spacing of 30cm between rows. Intercultural operations were done as per requirement. The crop was harvested on first week of February in Pabna and 12-22 February in Narail. After harvest of mustard, mungbean seed (BARI mung 5) was sown on 9-12 March in Pabna and 7-20 March in Narail and the crop was harvested on Mid May in Pabna and last week of May in Narail. Seedling of T.Aman (BRRI dhan-32) was transplanted on last week of July and harvested on 22-24 October in Pabna. Seedlings of BRRI dhan 39 were transplanted on 3rd-4th week of July and harvested on Last week October to 1st week of November in Narail. Standard crop management practices were used for maintain the productivity of the pattern. All necessary data were collected and analyzed statistically.

Treatment combinations:

Treat.	(N-P-K-S-Zn-B kg/ha)					
	Pabna			Narail		
	Mustard	Mungbean	T.Aman	Mustard	Mungbean	T.Aman
T_1	120-36-70-40-3-1	25-10	100-36-70-10	120-36-70-40-3-1	25-10-70-40-3-1	120-36-70-10
T_2	160-36-70-40-3-1	25-10	120-36-70-10	160-36-70-40-3-1	25-10-70-40-3-1	160-36-70-10
T_3	120-54-70-40-3-1	25-10	100-36-70-10	120-54-70-40-3-1	25-10-70-40-3-1	120-54-70-10
T_4	120-36-105-40-3-1	25-10	100-36-105-10	120-36-105-40-3-1	25-10-105-40-3-1	120-36-105-10
T_5	0-0-0-0-0-0	0-0	0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0	0-0-0-0

Results and Discussions

Pabna

The effect of different nutrient packages on yield contributing characters of mustard is presented in the Table 1. The highest seed yield of mustard was obtained from T_2 nutrient packages and T_1, T_3 and T_4 nutrient packages showed statistically similar yield response in 2006-07. In the previous year, similar yield was obtained in different nutrient packages. The yield contributing characters and yield of mungbean were significantly responded due to nutrient packages (Table 2).. The highest seed yield of mungbean was attained in T_1 nutrient packages. The cumulative effect of pods per plant and 1000 seed weight might have significant contribution to increased yield in T_1 nutrient package. Fresh biomass was higher in T_2 nutrient packages. Higher grain yield of T.Aman was recorded in T_2 nutrient packages which were followed by T_3 and T_4 nutrient packages (Table 3). The similar trend of response was observed in straw yield. The lowest performance of yield contributing characters and yield were recorded in control. Optimum nutrient doses applied in T.Aman and the residual effect of mungbean biomass might be attributed to maximum grain yield in T.Aman rice. Regarding economic return of the pattern, it revealed that the highest gross margin was recorded in T_2 nutrient packages followed by T_1 nutrient packages (Table 4).

Narail

The yield and yield component of mustard influenced by different nutrient levels are shown in the Table 5-7. Significant differences were observed in plant height, pods/plant and seeds/pod. Thousand seed weight due to different treatments differed significantly from the control in the first year but the following years it was insignificant. Seed yield did not varied among the different nutrient packages in the three consecutive years. However, on average of three years, higher yield was obtained from T_3 and lower from the control. Different nutrient packages showed higher seed yield than control in 2006-07 but identical yield was found among the nutrient packages. Similarly, in mungbean no significant yield difference was observed among the nutrient package except control. Average of two years data found that yield was comparatively higher T_1 but stover yield was maximum in T_3 nutrient package. Effect of fertilizer on the yield and yield contributing characters of T.Aman rice are presented in the Table 7-9. Higher grain yield 4.42 t/ha (average of 2 years) of T.Aman was observed in T_2 nutrient packages. In the first year grain and straw yield was insignificant but in the 2nd year it was significantly different only with control.

Farmers' reaction

Pabna

- Yield was higher than farmers local practice
- Farmers came to know how much fertilizer is required for our land
- All varieties of those 3 crops were short duration which was suitable for our pattern but for earlier ripening T.Aman was affected by rat.
- Farmers thought T_2 treatment is better for our cropping pattern
- Yield was comparatively less due to weed infestation

Conclusion

The crops in the pattern were responsive to different nutrient packages. The yield performance of mustard and T.Aman treated with T_2 nutrient package was pronounced over other nutrient packages in Pabna where as T_3 nutrient package for mustard and T_2 nutrient package for T.Aman were pronounced in Narail. Treatment T_1 packages contributed to maximum yield of mungbean in both the locations. It was also indicated the incorporation of mungbean biomass showed positive influence on yield of T.Aman rice.

Recommendation

From the two years experimentation T_2 nutrient package can be recommended for sustainable production of mustard-mungbean-T.Aman cropping pattern in Pabna under High Ganges River Floodplain Soil.

Crop	Nutrient rate (kg/ha)					
	N	P	K	S	Zn	B
Mustard	160	36	70	40	3	1
Mungbean	25	-	10	-	-	-
T.Aman	120	36	70	10	-	-

*stover of mungbean incorporated in the soil

Table 1. Yield and yield contributing characters of Mustard under Mustard-Mungbean-T.Aman cropping pattern as affected by different treatments at the MLT site, Pakshi, Pabna during the year of 2006-07 and 2005-06

Treatments	No. of Siliqua /plant		No. of seeds /Siliqua		1000 seed wt. (g)		Seed yield (t/ha)	
	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06
T_1	36.00 a	85.43	15.60 a	14.71	2.15 a	2.50	1.13 b	1.52
T_2	35.87 a	89.70	15.85 a	14.42	2.30 a	2.60	1.29 a	1.31
T_3	34.40 a	84.58	14.20 a	14.53	2.30 a	2.60	1.12 b	1.38
T_4	28.10 a	92.55	14.90 a	14.50	2.30 a	2.70	1.11 b	1.34
T_5	11.13 b	16.73	10.23 b	14.46	2.15 a	2.30	0.29 c	0.37
LSD (0.05)	6.070	11.03	3.119	NS	0.330	NS	0.128	0.51
CV (%)	13.54	9.72	14.30	9.81	9.54	5.60	8.40	28.45

T_1 : $N_{120}P_{36}K_{70}S_{40}Zn_3B_1$, T_2 : $N_{160}P_{36}K_{70}S_{40}Zn_3B_1$, T_3 : $N_{120}P_{54}K_{70}S_{40}Zn_3B_1$, T_4 : $N_{120}P_{36}K_{105}S_{40}Zn_3B_1$, T_5 : Absolute control

Table 2. Effect of different nutrient management on yield and yield attributes of Mungbean underMustard-Mungbean-T.aman cropping pattern at the MLT site, Pakshi, Pabna during the year of 2007

Treatments	Pod/plant (no.)		Seeds/Pod (no.)		1000-seed wt. (g)		Seed yield (t/ha)		Fresh biomass	
	2007	2006	2007	2006	2007	2006	2007 (t/ha)	2006 (kg/ha)	2007 (t/ha)	2006 (kg/ha)
T_1	22.77 a	13.70	11.25 b	10.88	42.04a	46.05	1.64a	1218	5.00ab	4875
T_2	23.27 a	12.93	12.02 a	10.82	39.57ab	43.58	1.28b	1168	5.75a	5875
T_3	23.17 a	12.83	10.82 b	10.76	40.46ab	44.47	1.18b	1143	4.00b	4125
T_4	19.42 b	13.10	11.18 b	11.02	40.99a	45.00	1.31b	1158	4.75ab	4313
T_5	12.18 c	11.05	11.18 b	10.38	37.43b	41.44	0.90c	1093	2.88c	3250
LSD	1.68	0.72	0.63	0.55	3.23	3.23	0.21	43.21	1.05	1698
CV (%)	5.39	3.70	3.64	3.28	5.88	4.76	10.74	2.43	15.35	24.56

Table 3. Effect of different nutrient management on yield and yield attributes of T.Aman under Mustard-Mungbean-T.Aman cropping pattern at the MLT site, Pakshi, Pabna during the year of 2007

Treatments	Effective tiller (no.)		Filled grains/ panicle (no.)		1000-grain wt. (g)		Grain yield (t/ha)		Straw yield (t/ha)	
	2007 (per hill)	2006 (per $m^{2)}$	2007	2006	2007	2006	2007	2006	2007	2006
T_1	9.00a	178.10	86.30a	75.13	22.85ab	23.90	3.62b	3.31	4.18b	3.69
T_2	9.68a	200.80	88.55a	77.13	23.00ab	24.05	4.10a	3.72	4.60a	4.11
T_3	9.20a	199.20	77.22ab	71.95	23.60a	23.90	3.96ab	3.43	4.44ab	3.82
T_4	9.48a	185.70	86.93a	76.20	23.35ab	24.00	3.88ab	3.42	4.49ab	3.85
T_5	6.75b	131.00	59.65b	51.00	22.45b	22.50	2.95c	1.50	3.65c	1.71
LSD (0.05)	1.089	29.71	18.31	17.04	1.007	0.386	0.395	1.055	0.413	1.124
CV (%)	8.02	10.78	14.91	15.74	2.38	2.06	9.53	12.28	8.22	11.24

T_1 : $N_{100}P_{36}K_{70}S_{10}$, T_2 : $N_{120}P_{36}K_{70}S_{10}$, T_3 : $N_{100}P_{54}K_{70}S_{10}$, T_4 : $N_{100}P_{36}K_{105}S_{10}$, T_5 : Absolute control

Table 4. Cost and return analysis of Mustard-Mungbean-T.Aman cropping pattern at the MLT site, Pakshi, Pabna during 2006-07

Treatments	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)
T_1	172152	69138	103014
T_2	175192	70049	105143
T_3	162752	73426	89326
T_4	165740	71203	94537
T_5	105042	49970	55072

Price of input (Tk/kg) : Urea 6.50, TSP 16.50, MP 15.00, Gypsum 05.00, Zinc sulphate 60.00, Borax 60.00
Price of output (Tk/kg) : Mustard seed 31.25, Mustard straw 1, Mungbean 34.25, T.Aman grain 20, T.Aman straw 1.50

Table 5: Effect of different nutrient management on the yield of mustard under mustard-mungbean-T.Aman rice cropping pattern at the MLT site, Tularampur, Narail during 2005-08

Treatments	2005-06		2006-07		2007-08		Mean	
	Seed yield (t/ha)	Stover yield (t/ha)	Seed yield (t/ha)	Stover yield (t/ha)	Seed yield (t/ha)	Stover yield (t/ha)	Seed yield (t/ha)	Stover yield (t/ha)
T_1	1.93a	2.33a	1.53a	2.10ab	1.56a	3.14a	1.67	2.52
T_2	2.18a	2.57a	1.67a	2.63a	1.58a	3.26a	1.81	2.82
T_3	1.95a	2.22a	1.85a	2.37a	1.69a	3.26a	1.83	2.62
T_4	1.89a	2.37a	1.71a	2.67a	1.57a	3.41a	1.72	2.82
T_5	0.92b	1.39b	0.73b	1.52b	0.44b	1.19b	0.70	1.35
CV (%)	15.42	18.35	15.32	20.13	9.21	14.35	-	-

Table 6: Effect of different nutrient management on pods /plant and seeds pod^{-1} of mustard under mustard-mungbean-T.Aman rice cropping pattern at MLT site Tularampur, Narail during 2005-08

Treat-ments	2005-06		2006-07		2007-08		Mean	
	Pods/plant	Seeds/ pod	Pods/ plant	Seeds/ pod	Pods/ plant	Seed/ pod	Pods/ plant	Seeds/ pod
T_1	74.98b	14.45ab	46.43a	12bc	62.25a	12.4a	61.22	12.95
T_2	100.55a	14.88ab	55.60a	14ab	65.70a	12.4a	73.95	13.76
T_3	78.78b	13.70bc	55.60a	14ab	65.80a	12.6a	66.73	13.43
T_4	93.10ab	15.45a	56.78a	15a	65.55a	12.4a	71.48	17.28
T_5	33.13	13.10c	28.00b	12c	24.70b	10.9b	28.61	12.0
CV (%)	15.12	5.37	11.10	8.72	10.96	3.52	-	-

Table 7: Effect of different nutrient management on plant height and 1000-seed weight of mustard under mustard-mungbean-T.Aman rice cropping pattern at the MLT site Tularampur, Narail during 2005-08

Treat-ments	2005-06		2006-07		2007-08		Mean	
	Plant height (cm)	1000-seed wt. (g)	Plant height (cm)	1000-seed wt. (g)	Plant height (cm)	1000-seed wt. (g)	Plant height (cm)	1000-seed wt. (g)
T_1	77.93b	3.18a	77.18a	2.74	111.78a	3.18	88.96	3.03
T_2	87.43a	3.08a	83.25a	2.77	121.48a	3.15	97.39	3.00
T_3	84.23ab	3.35a	85.10a	2.70	117.80a	3.25	95.71	3.10
T_4	86.70a	3.35a	85.33a	2.79	121.45a	3.15	97.83	3.10
T_5	58.58c	2.15b	59.33b	2.68	84.30b	3.13	67.40	2.65
CV (%)	6.06	9.25	7.92	5.44	5.32	4.49	-	-

Table 8: Effect of different nutrient management on the yield of mungbean under Mustard-Mungbean-T.Aman rice cropping pattern at the MLT site Tularampur, Narail during 2005-07

Treat-ments	2005-06		2006-07		Mean	
	Seed yield (t/ha)	Stover yield (t/ha)	Seed yield (t/ha)	Stover yield (t/ha)	Seed yield (t/ha)	Stover yield (t/ha)
T_1	1.67	2.80	1.43a	2.20	1.55	2.5
T_2	1.23	2.85	1.42a	2.30	1.33	2.58
T_3	1.30	3.00	1.46a	2.41	1.38	2.71
T_4	1.21	2.83	1.42a	2.49	1.32	2.66
T_5	1.20	2.40	1.07b	2.05	1.14	2.23
CV (%)	14.66	12.64	11.07	10.84	-	-

Table 9: Effect of different nutrient management on the no. of pods/plant and seed/pod of mungbean under Mustard-Mungbean-T.Aman rice cropping pattern at the MLT site Tularampur, Narail during 2005-07

Treatments	2005-06		2006-07		Mean	
	Pods/plant	Seeds/pod	Pods/plant	Seeds/pod	Pods/plant	Seeds/pod
T_1	28.6	11.85	25a	11.70	26.8	11.78
T_2	32.6	11.80	24a	11.68	28.3	11.74
T_3	27.7	11.85	26a	12.23	26.85	12.04
T_4	28.9	11.85	25a	12.22	26.95	12.04
T_5	27.5	11.10	20b	11.10	23.75	11.10
CV (%)	8.72	7.98	5.29	6.63	-	-

Table 10: Effect of different nutrient management on plant height and 1000-seed weight of mungbean under Mustard-Mungbean-T.Aman rice cropping pattern at the MLT site Tularampur, Narail during 2005-07

Treat-ments	2005-06		2006-07		Mean	
	Plant height (cm)	1000-seed wt. (g)	Plant height (cm)	1000-seed wt. (g)	Plant height (cm)	1000-seed wt. (g)
T_1	52.20a	33.85	57.30a	32.58	54.75	33.22
T_2	45.83b	33.70	58.68a	32.89	52.26	33.30
T_3	51.18b	33.45	59.78a	33.50	55.48	33.48
T_4	56.78a	33.05	60.79a	33.03	58.79	33.04
T_5	50.53ab	33.00	51.39b	32.73	50.96	32.87
CV (%)	7.93	7.98	6.06	3.44	-	-

Table 11: Effect of different nutrient management on the yield of T.Aman rice under Mustard-Mungbean-T.Aman rice cropping pattern at the MLT site Tularampur, Narail during 2005-07

Treatments	2005-06		2006-07		Mean	
	Grain yield (t/ha)	Straw yield (t/ha)	Grain yield (t/ha)	Straw yield (t/ha)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	3.70	4.95	4.73a	5.67a	4.22	5.31
T_2	3.85	4.43	4.98a	5.88a	4.42	5.16
T_3	3.95	4.18	4.82a	5.97a	4.39	5.08
T_4	3.70	4.90	4.59a	5.86a	4.15	5.38
T_5	2.40	3.63	2.47b	3.62b	2.44	3.63
CV (%)	20.11	17.75	8.05	10.67	-	-

Table 12: Effect of different nutrient management on grains/panicle and 1000-grain weight of T.Aman rice under Mustard-Mungbean-T.Aman rice cropping pattern at the MLT site Tularampur, Narail during 2005-07

Treatments	2005-06		2006-07		Mean	
	Grains/ panicle	1000-grain wt. (g)	Grains/ panicle	1000-grain wt. (g)	Grains/ panicle	1000-grain wt. (g)
T_1	86.43	23.70	87.65a	23.03	87.04	23.37
T_2	71.18	22.95	86.35a	23.75	78.77	23.35
T_3	80.60	23.65	86.85a	23.43	83.73	23.54
T_4	81.20	23.60	89.03a	23.25	85.12	23.43
T_5	78.53	23.25	74.13b	22.85	76.33	23.05
CV (%)	15.31	6.44	9.65	4.69	-	-

Table 13: Effect of different nutrient management on plant population m-2 and plant height of T.Aman rice under Mustard-Mungbean-T.Aman rice cropping pattern at the MLT site Tularampur, Narail during 2005-07

Treat-ments	2005-06		2006-07		Mean	
	Plant population/m^2	Plant height (cm)	Plant population/m^2	Plant height (cm)	Plant pop^n/m^2	Plant height (cm)
T_1	269	86.20	311a	88.55a	290	87.38
T_2	270	86.68	318a	88.60a	294	87.64
T_3	265	84.25	314a	86.85a	290	85.56
T_4	277	86.55	319a	89.35a	298	87.95
T_5	233	83.20	210b	82.15b	222	82.68
CV (%)	12.62	5.32	7.64	4.08	-	-

Integrated Nutrient Management for Tomato Production in High Barind Tract

Abstract

A study was undertaken at the FSRD site Kadamshahar, Godagari, Rajshahi during 2006-2007 and 2007-2008 to find out an optimum and economic fertilizer dose for tomato production in High Barind Tract. The soil of the experimental field was analyzed and levels of the fertilizers were selected on the basis of target yields as per Fertilizer Recommendation Guide' 2005.The treatments combinations were T_1 : $N_{140}P_{40}K_{90}S_{30}Zn_4$ kg/ha (Based on soil test for HYG), T_2: T_1 + cowdung 5 t/ha, T_3: N_{124} P_{33} K_{74} S_{30} Zn_4 kg/ha + cowdung 5 t/ha (IPNS for high yield goal), T_4: $N_{135}P_{37}K_{50}S_8Zn_{1.5}$ kg/ha (According to FRG' 2005), T_5: T_4 + cowdung 5 t/ha, T_6: N_{80} P_{30} K_{55} S_{20} kg/ha (Farmers practice) and T_7: Native fertility (Control). The yield and yield components of tomato were significantly influenced by the different nutrient management packages in both the years. The IPNS treatment (T_3) produced the maximum fruit yield of tomato (43.05 t/ha in 2006-07 and 58.36 t/ha in 2007-08) which was 155 and 217% increased over control in 2006-07 and 2007-08, respectively. The highest gross margin Tk.290020/ha was obtained in T_3 treatment followed by Tk.260760/ha in T_2 treatment. The highest MBCR over control (13.94) was obtained from T_3 treatment. So, the fertilizers dose $N_{124}P_{33}K_{74}S_{30}Zn_4$ kg/ha + cowdung 5 t/ha was optimum for maximizing the yield as well as economically profitable and viable for tomato production in the High Barind Tract soil.

Introduction

Tomato (*Lycopersicon esculentum*) is one of the most popular and nutritious vegetable crop in Bangladesh. At present, tomato ranks third next to potato and sweet potato in terms of world vegetable production (FAO, 2002). It is the dependable source of vitamin A, B, C and minerals Ca, P and Fe (Islam, 1996). In Bangladesh it is cultivated as winter vegetable, which occupies an area of 14906 ha of land with annual production of about one lac tons (BBS, 2004). In High Barind Tract, farmers are produced early tomato after harvest of T. aus rice. Early tomato cultivation is increasing day by day in this area. The average yield of tomato in High Barind Tract is low compared to other parts of the country. The factors responsible for this gap are variety, seed quality, soil climate and nutrient management (Elias *et al.* 1991). The basic concept underlying the integrated plant nutrition system (IPNS) is to provide an ideal nutrition for a crop through a proper combination of various nutrient resources and their optimum utilization along with maintenance of soil productivity. The sustainable crop production might be possible through the integrated use of organic manure and chemical fertilizer. A judicious application of nutrients from both organic and inorganic sources might be helpful in obtaining higher yield of tomato in Barind soil. Rahman *et al.* (1998) reported that the highest yield of tomato was obtained by the application of organic and inorganic fertilizer. A suitable combination of organic and inorganic sources of nutrients is necessary for a sustainable agriculture that will provide a good economic return with good soil health. Soil test and judicious application of fertilizers for target yield of crops is one of the approaches to over come the problem of nutrient mining from soils. Bangladesh Agricultural Research Council (BARC) developed a national Fertilizer Recommendation Guide'2005. This will help in judicious application of fertilizers for target yield. Farmers of Barind area used different fertilizer dose for tomato production. It may be possible to increase the yield of tomato by evolving a proper combination of organic and inorganic fertilizer. But no work has been done in respect of nutrient management to improve and sustain production and yield of tomato in Barind Tract of Bangladesh. Therefore, it is very necessary to develop a fertilizer recommendation for tomato production in HBT soil. Considering the above facts the present research work was undertaken to find out an optimum and economic fertilizer dose for tomato production in High Barind Tract.

Materials and Methods

A Field experiment was conducted at the FSRD site, Kadamshahar, Godagari, Rajshahi during 2006-07 and 2007-08 to find out an optimum and economic fertilizer dose for tomato production in High Barind Tract. Before conducting the experiment, soil of the experimental field was chemically analyzed in the SRDI laboratory, Rajshahi. The soil of the experimental plots belongs to Amnura series under AEZ 26 having a pH value of 5.5, 0.92% organic matter, 0.09% total N, 6.45 ppm available P, 0.26 me% exchangeable K, 16 ppm available S and 0.86 ppm available Zn. The levels of the fertilizers were selected on the basis of target yields as per Fertilizer Recommendation Guide' 2005. The experiment was designed with seven treatments; lay out in a randomized complete block design with three replications. The description of the treatments is stated in the following table.

Table 1. Description of the treatments and nutrient rates for tomato

Treatment	Description of the treatments	Nutrient rate (kg/ha)					CD (t/ha)
		N	P	K	S	Zn	
T_1	HYG (Based on soil test)	140	40	90	30	4	-
T_2	T_1 + Cowdung	140	40	90	30	4	5
T_3	IPNS	124	33	74	30	4	5
T_4	FRG'2005	135	37	50	8	1.5	-
T_5	T_4 + Cowdung	135	37	50	8	1.5	5
T_6	Farmer's practice	80	30	55	20	-	-
T_7	Control	0	0	0	0	0	0

Note: HYG: High yield goal, IPNS: Integrated plant nutrition system

Fertilizer recommendations for high yield goal (HYG) were determined from soil test values according to Fertilizer Recommendation Guide'2005. The fertilizer levels used by the farmers were considered as farmers practice (FP). This was the average of the fertilizer doses used by the farmers of the village Kadamshahar during 2005-2006. The sources of nutrients were urea for N, TSP for P, MP for K, Gypsum for S and Zinc oxide for Zn. Cowdung had 0.96% N, 0.27% P, 0.82% K. Full doses of cowdung, one fourth of urea and all other inorganic fertilizers were applied according to individual plot and mixed with soil at the time of final land preparation The rest urea was top dressed at 21, 35 and 45 days after transplanting. The unit plot size was 3 m x 2 m. Thirty days old seedlings of tomato (Variety: Surrokha) were transplanted on 16 September 2006 and 27 Sept. 2007 with the spacing of 60cm x 50cm. Tomato was harvested on 1st December 2006 to 15 January 2007 and 8 December 2007 to 2 Feb. 2008. Intercultural operations viz. weeding, irrigation, fungicide and insecticide spray were done in order to support normal plant growth. Data on yield and yield contributing characters were recorded. Observations were made on yield components from 10 randomly selected plants per plot**.** The data were analyzed statistically and the mean differences were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984). The economic analysis was done for gross return, marginal benefit cost ratio and marginal rate of return (MRR) for different nutrient management packages following the method suggested by Perrin *et al.* (1979).

Results and Discussion

Yield components

Yield components of tomato responded significantly to different nutrient management packages (Table 2 & 3). In 2006-2007, the height of tomato plant increased from 66.54 cm in the control treatment to 85.42 cm in treatment T_2. The highest plant height 85.42 cm was found in the treatment T_2 due to higher doses of nitrogen and cowdung. The maximum number of plants/m^2 (4) and primary branch/plant (15) were found in treatment T_3 (IPNS). The maximum number of fruits/plant (30) was found in integrated plant nutrition system (T_3), which was at per with treatment T_1 and T_2 followed by treatment T_5. The minimum number of fruits/plant (20) was found in control treatment due to lower fertility. The highest fruit length (4.59 cm) and diameter (4.98 cm) were also found in IPNS treatment (T_3). This might be due to proper combination of organic and inorganic fertilizer. The highest fruit yield/plant (2.02 kg) was found in treatment T_3 that was statistically identical with T_1, T_2 and T_5 and lowest (0.98 kg) in control treatment.

Yield components of tomato responded significantly to different nutrient management packages in 2007-08. The highest plant height 84.4 cm was found in the treatment T_2 due to higher doses of nitrogen and cowdung. The result is in agreed with Kuksal *et al.* (1997) who reported that nitrogen application at higher rates increased plant height. The maximum primary branch/plant (19) was found in treatment T_3 (IPNS). The maximum number of fruits/plant (40) was found in integrated plant nutrition system (T_3), which was at per with treatment T_2 followed by treatment T_1. The minimum number of fruits/plant (18) was found in control treatment due to lower fertility. The highest fruit length (5.72 cm) and diameter (5 cm) were also found in IPNS treatment (T_3). This might be due to proper combination of organic and inorganic fertilizer. Combined application of organic and inorganic fertilizers improved soil health and made better environmental condition for plant growth and development resulted in increased fruit diameter. The result is in agreement with Islam *et al.* (1997) who reported that the length and breath of individual fruit of tomato was increased with proper combination of organic and inorganic fertilizer. There was a linear relationship between number of fruits/plant and fruit yield (Fig.1).

The regression equation Y: 0.532x + 7.426 and the straight line plotted in the figure indicate that there was a linear relationship between number of fruits/plant and fruit yield of tomato. It was observed that with the increase of number of fruits/plant, the fruit yield was found to be increased.

Fruit yield

There was a significant effect of different nutrient management packages on the fruit yield of tomato (Table 2 & 3). The application of fertilizer on the basis of integrated plant nutrition system for HYG (T_3) increased the fruit yield of tomato compared to the other nutrient management practices. In 2006-2007, the highest fruit yield (43.05 t /ha) was obtained from T_3 (IPNS) showing an increase of 155% over control and was significantly different from all other treatments. The next highest fruit yield (39 t/ha) was observed in treatment T_2 and lowest yield (16.86) in control plot (T_7). Similar trend was observed in 2007-08. In the year of 2007-08, the highest fruit yield (58.36 t /ha) was obtained from T_3 (IPNS) showing an increase of 217% over control and was significantly different from all other treatments. The next highest fruit yield (53.33 t /ha) was observed in treatment T_2 and lowest yield (19.38) in control plot (T_7). Treatment T_3 (IPNS) and T_2 produced higher fruit yield due to higher number of fruits/plant. This result is in agreement with the findings of Prezotti *et al.* (1988) who stated that combined application of organic and inorganic fertilizer increased total productivity by 48% of tomato.

Cost and return analysis

Gross return, variable cost, gross margin and marginal benefit-cost ratio (over control) of different fertilizer treatment for tomato has been shown in Table 5. The economic analysis of the experiment exhibited that treatment T_3 (IPNS) produced the maximum gross margin of Tk.290020/ha, although its variable cost was Tk.14240/ha. The second highest gross margin, Tk.260760/ha was recorded from treatment T_2 and the lowest Tk.108720/ha in control plot (T_7). This variation occurred due to the variation of fruit yield of tomato. On the other hand, the highest MBCR over control (13.94) was found in treatment T_3 that was closely followed by treatment T_2 (10.57). Karim *et al.* (1994) reported that farmers always try to maximize their returns up to the point where returns to investment are the highest as the capital is scarce. So, farmers of the area may be advised to go for treatment T_3 that supplies sufficient balanced nutrients. The marginal farmers who are unable to afford necessary cost may choose T_4. Considering MBCR, treatment T_3 (IPNS for HYG based on soil test value) was found economically profitable and viable among the nutrient management treatments for the cultivation of tomato in the High Barind Tract soil.

Conclusion

From two years result of this investigation, it may be concluded that the integrated plant nutrition system (IPNS) for high yield goal (T_3) was found economically profitable and viable for tomato production in the High Barind Tract soil. So, the fertilizer dose $N_{124}P_{33}K_{74}S_{30}Zn_{14}$ kg/ha + cowdung 5 t/ha was optimum for growing as well as economic benefit of tomato in the High Barind Tract soil.

Farmers' reaction

Farmers own desire before implementation	Farmers achievement after implementation
1. Higher yield 2. Higher profit 3. Minimum disease 4. Larger fruit size	1. Farmers were pleased to get higher fruit yield compare to control 2. Farmers were pleased to get higher benefit 3. Minimum disease observed 4. Farmers were pleased to get larger fruit size

References

BARC (Bangladesh Agricultural Research Council). 2005. Fertilizer Recommendation Guide' 2005. Published by the Bangladesh Agricultural Research Council, Farmgate, New Airport Road, Dhaka. 41: 182-186.

BBS. 2004. Statistical Year Book of Bangladesh. Stat. Div. Minis. Planning. Govt. Peoples Repub. Bangladesh, Dhaka: pp. 553.

FAO (Food and Agriculture Organization). 2002. FAO production Year Book 1996. Basic Data Unit. Statistics Division FAO, Rome, Italy, 54: 139-141.

Gomez K A. & A A Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd edn. John Wiley and Sons. New York. : 680.

Elias, M., M.J. Hossain, A. Quasem, M.S. Islam and M.M. Rashid. 1991. Effect of phosphorus fertilization on the growth and yield of potato. Bangladesh J. Agril. Res. 16(2): 153-156.

Islam, M.A. Faraque A.M., Siddiqua A, and Siddique A, and Siddiquea A. 1997. Effect of planting patterns and different nitrogen levels on yield and quality of tomato Bangladesh J. Agril. Sci. 24 (1) ; 9-15.

Islam. M.A. Farooque A.M. Siddiqua A and Siddique A. 1997. Effect of Planting patterns and different nitrogen levels on yield and quality of tomato. Bangladesh J. Agril. Sci., 24 (1): 9-5.

Karim, M.R. and S.M. Elias. 1992. Application of partial budget technique of fertilizer response data on T.Aman and mustard. Bangladesh J. Agric. Res. 17(1): 24-28.

Kuksal R.P., R.D. Singh and N. Yadar .1997. Effect of different levels of nitrogen and phosphorus on fruit and seed yield of tomato. Prog. Hort. 9 (2):13-20.

Nasreen, S. and M.S. Islam. 1990. Response of tomato to different fertilizer elements and organic manures. Bangladesh Hort. 18 (1 and 2) 17-23.

Perrin, R.K., D.L. Winkelman, E.R. Moseardi and J.R. Anderson. 1979. Farm agronomic data to farmer's recommendations. Information Bulletin 27, CIMMYT, MEXICO.

Prezotti L.C., Balbine J.M.D, Stock. L. A. and Ferria L.R. 1988. Effect of organic matter, nitrogen, phosphors and calcium on the productivity of tomato. EMCAPA, Brazil. 45: p9 (Cited from Hort. 58 (8): 4964: 1988)

Rahman, M.A., J. Haider. U.K. Shaha, A.R. Chowdhury and M.M.U. Chowdhury. 1998. Economically viable rates of fertilizers and manure for mercerizing growth and yield of year round tomato. Bangladesh J. Agril. Res. 23 (3): 551-559.

Table 2. Yield components of tomato as influenced by different nutrient management at the FSRD site Barind, Rajshahi during 2006-07

Treatments	Plant height (cm)	No. of plants/m^2	Primary branch/ plant	No. of fruits/ plant	Fruit length (cm)	Fruit diameter (cm)
T_1	80.39ab	4.24a	12abc	27.00ab	3.42bcd	4.28ab
T_2	85.42a	3.74ab	14ab	28.30ab	4.00ab	4.50ab
T_3	83.36a	4.28a	15a	30.20a	4.59a	4.98a
T_4	79.49ab	3.60ab	11bc	24.80b	3.69bc	4.08ab
T_5	82.60a	3.66ab	13ab	25.03b	3.90abc	4.16ab
T_6	76.23b	3.52b	9cd	20.00c	3.28cd	3.88bc
T_7	66.54c	3.12b	6d	15.94c	2.96d	3.02c
LSD (0.05)	6.07	0.714	12.23	4.48	0.72	1.03
CV (%)	4.08	7.66	3.48	7.35	5.27	12.01

Note: Figures in a column having same letter do not differ significantly at 1% level by DMRT

Table 3. Yield components of tomato as influenced by different nutrient management at the FSRD site Barind, Rajshahi during 2007-08

Treatments	Plant height (cm)	Primary branch/ plant	No. of fruits/ plant	Fruit length (cm)	Fruit diameter (cm)
T_1 (HYG)	79.55	13	31b	4.08	4.74
T_2 (T_1 + CD)	84.40	16	36a	4.85b	4.92
T_3 (IPNS)	79.65	19	40	5.72	5.00
T_4 (FRG'2005)	81.20	14	32	4.36	4.71
T_5 (T_4 + CD)	82.32	16	33	5.24	4.77
T_6 (FP)	77.81	11	25	4.16	3.79
T_7 (Control)	62.60	8	18	4.00	3.46
LSD (0.05)	8.31	8.96	5.91	0.73	0.6867
CV (%)	5.98	9.65	10.80	8.98	8.60

Table 4. Yield of tomato as influenced by different nutrient management packages at the FSRD site Barind, Rajshahi during 2006-07 and 2007-08

Treatments	2006-2007		2007-2008	
	Fruit yield (t/ha)	% Yield increase over control	Fruit yield (t/ha)	% Yield increase over control
T_1 (HYG)	34.01	101	46.33	152
T_2 (T_1 + CD)	39.00	131	53.33	190
T_3 (IPNS)	43.05	155	58.36	217
T_4 (FRG'2005)	29.70	76	42.50	131
T_5 (T_4 + CD)	31.88	89	49.65	178
T_6 (FP)	27.31	62	40.56	98
T_7 (Control)	16.86	-	19.38	-
LSD (0.05)	5.72	-	7.46	-
CV (%)	8.27	-	10.23	-

Table 5. Partial budget analysis for fertilizer use in tomato production at the FSRD site Barind, Rajshahi during 2006-07 and 2007-08 (Average of 2 years)

Treatments	Gross return (Tk/ha)	Variable cost of fertilizers (Tk/ha)	Gross margin (Tk/ha)	MBCR (Over control)
T_1 (HYG)	241020	15100	225920	8.96
T_2 (T_1 + CD)	276960	16200	260760	10.57
T_3 (IPNS)	304260	14240	290020	13.94
T_4 (FRG'2005)	216600	11900	204700	9.31
T_5 (T_4 + CD)	244560	13600	230960	10.20
T_6 (FP)	203610	11450	192160	7.67
T_7 (Control)	108720	0	108720	-

Note: Input: Urea: 6 Tk/kg, TSP: 36 Tk/kg, MOP: 33 Tk/kg, gypsum: 5 Tk/kg, zinc oxide: 80 Tk/kg, Cow dung: 300 Tk/ton. Output: Tomato: Av. 6 Tk/kg.

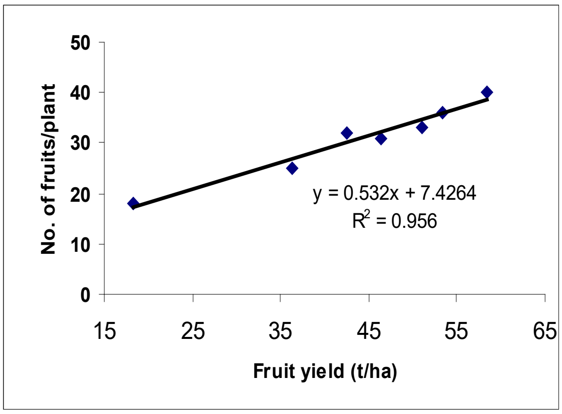

Fig.1: Regression between number of fruits/plant and fruit yield of tomato

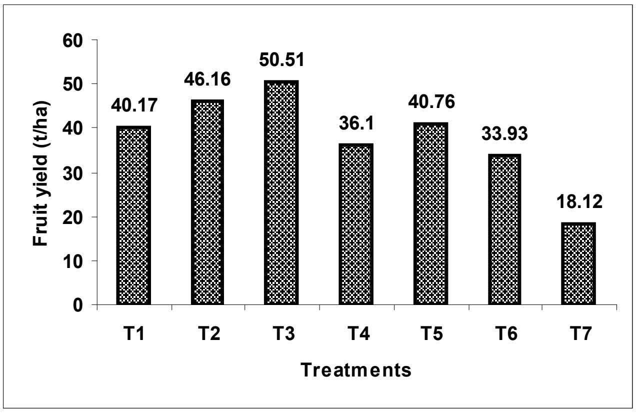

Fig. 2: Yield of tomato as influenced by different nutrient management packages (Average of 2 years)

Effects of Different Levels of Nitrogen and Sulphur on the Yield and Storability of Summer Onion

Abstract

Effect of nitrogen and sulphur on the yield and yield contributing characters of summer onion (Var. BARI Peaj-2) for the High Barind Tract were studied in farmers' field at the Farming System Research and Development (FSRD) site, Kadamshahar, Godagari, Rajshahi during 2006-07 and 2007-08. Four levels of nitrogen (0, 50, 100 and 150 kg/ha) and four levels of sulphur (0, 20, 40 and 60 kg/ha) were used as treatment variables. The results showed that the highest bulb yield (10.3 t/ha in 2006-2007 and 14.43 t/ha in 2007-2008) was recorded from 100 kg N/ha that was 77% and 121% increased over control. Sulphur dose @ 40 kg/ha gave the highest bulb yield (9.27 t/ha in 2006-2007 and 15.02 t/ha in 2007-2008) than other S levels and lowest from control (S_0). Regarding combined effect, the highest bulb yield 12.05 t/ha and 16.23 t/ha were obtained from 100 kg N/ha with 40 kg S/ha in the year of 2006-2007 and 2007-2008, respectively but the lowest from control (N_0S_0). The higher percent of rotten bulbs (34.87%) after 90 days of storage was found from 150 kg N/ha with no sulphur whereas the lowest percent of rotten bulbs (12.56%) was found for the control treatment (N_0S_0). Therefore, summer onion can be produced by the application of 100 kg N/ha with 40 kg S/ha for maximizing yield as well as economic benefit of summer onion in the High Barind Tract of Bangladesh.

Introduction

Onion (*Allium cepa* L.) is an important spice crop grown in all over Bangladesh. Onion is used in almost all food preparation. It is grown more or less all over the country but the average yield being about 4 t/ha (BBS, 2004). There is an acute shortage of onion in relation to its requirement. Due to limitation of land, it is not possible to raise the area and production of the crop horizontally. The high demand of onion can only be meet up by increasing its per hectare yield. This can be done by many ways of which the most important are the judicious application of fertilizer and introduction of high yielding varieties. Pathak (1994) reported a significant response of onion to N and S fertilization. It can be cultivated both in rabi and kharif seasons. Its high demand can only be meet up by growing in summer season. For proper growth and development onion requires sufficient amount of nitrogen and sulphur. Nitrogen increases the vegetative growth, gives a deep green colour to the leaves and produces good quality foliage and promotes carbohydrate synthesis. Nitrogen is essential for building up of protoplasm and protein which induce cell division and initiate meristematic activity when applied in optimum quantity. The soil of high Barind tract contains very low amount nitrogen (<0.006% of total N). It can not provide proper amount of nitrogen to onion plant which resulted in stunted growth and reduce the yield of summer onion. Onion is a sulphur loving crop. In addition to NPK nutrients, sulphur has been found to be very beneficial for onion. It is essential for proper vegetative growth and bulb development in onion. Sulphur has a great influence in increasing the yield of onion and improving the quality especially pungency and flavors. Sehnug (1990) reported that sulphur compounds as the key development of quality of onion. Inadequate supply of sulphur nutrient caused slow crop growth at any stage resulting in yield reduction. Rahim *et al.* (1983) reported that in some exotic cultivars, storage loss is even 100%. Storage of onion bulbs in the country is a serious problem for both growers and consumers. More than 90% of the locally grown onion is stored under ordinary conditions at the ambient temperature (Mondal *et al.* 1990). It is therefore necessary to emphasize both on the yield and storage for the production of onions to meet the increasing demand for increasing population of our country form the limited land resource. Considering the above factors, the present study has been undertaken to observe the effect of nitrogen and sulphur on the yield and storability of summer onion varieties.

Materials and Methods

The experiment was conducted at the FSRD site Kadamshahar, Godagari, Rajshahi during 2006-07 and 2007-2008.The soils of the experimental plots were analyzed in the laboratory of SRDI, Rajshahi before conducting the experiment. The soil belongs to Amnura series under AEZ 26 and composed of silty clay loam in texture with having a pH value of 5.8. The soil contained 0.98% organic matter, 0.11% total N, 9.0 ppm available P, 0.25 me% exchangeable K, 14.89 ppm available S and 1.3 ppm available Zn. The treatments comprised three levels each of N (0, 50, 100 and 150 kg/ha as urea) and four levels of S (0, 20, 40 and 60 kg/ha as gypsum). Phosphorus @ 40 kg/ha as triple super phosphate, potassium @ 100 kg/ha as muriate of potash and cowdung 10 t/ha were applied as a blanket dose of all the plots. Full doses of cowdung and all other inorganic fertilizers except urea were applied to individual plot and mixed with soil at the time of final land preparation. The urea was top dressed at 15, 35 and 45 DAT. The experiment was laid out in a factorial randomized complete block design with three replications. The unit plot size was 3m x 2m. Forty days old seedlings of onion (Variety BARI Peaj-2) were transplanted on 25 September 2006 and 26 September 2007. The seedlings were transplanted at the spacing of 20cm x 10cm. Intercultural operations viz. mulching, weeding, irrigation, fungicide and insecticide sprays were done in order to support normal plant growth. The onion was harvested at maturity on 18 January 2007 and 25 January 2008. Bulb of onion was stored in bag made by nylon net. Data for percent of rotten loss was collected after 15 days interval. Data on yield and yield contributing characters of onion were recorded. Observations were made on yield components from 10 randomly selected plants per plot. The data were analyzed statistically and the mean differences were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Effect of nitrogen

Plant height, bulb diameter, average bulb weight and bulb yield were significantly influenced by nitrogen except bulb length (Table 1). In 2007-2008, 150 kg N/ha produced highest plant height (48.89 cm) and it was significantly differ from other N level. This might be due to higher doses of nitrogen. The result is in conformity with Kuksal *et al.* (1997) reported that nitrogen application at higher rates increased plant height. The maximum average weight of single bulb (98.36 g), bulb diameter (4.98 cm) were found from 100 kg N/ha. There was no significant effect of the nitrogen on the bulb length of onion. The highest bulb yield (14.43 t/ha) was obtained from 100 kg N/ha that was significantly different from all other N levels and it was 131% higher over control. The lowest bulb yield (6.52 t/ha) was found in control (N_0). The result supports the findings of Gaushal *et al.* (1991) stated that increasing nitrogen levels increased the bulb yield.

Effect of sulphur

Plant height, bulb diameter, average bulb weight and bulb yield were significantly influenced by sulphur except bulb length (Table 2). In 2007-2008, the tallest plant (43.39 cm) was obtained from 60 kg S/ha where as, no sulphur (S_0) produced the shortest plant (35.32 cm). The highest bulb diameter (4.98 cm) and average single bulb weight (102.3 g) was obtained from 40 kg S/ha that was significantly differed from other levels of sulphur. Bulb yield was significantly influence by the different levels of sulphur. Forty kg S/ha produced the highest bulb yield (15.02 t/ha) due to the highest bulb diameter and average single bulb weight but the lowest (7.02 t /ha) from zero kg S. This result is in agreement with the findings of Singh *et al.* (1996).

Interaction between nitrogen and sulphur levels

The effect of interaction between nitrogen and sulphur levels showed significant variation in respect of plant height, bulb diameter, average bulb weight and bulb yield except bulb length (Table 3). The tallest plant (53.36 cm) was produced from 150 kg N/ha with 60 kg S/ha that were statistically identical to 100 kg N/ha with 40 kg S/ha (53 cm). But the shortest plant (28.69 cm) was produced from zero N and S. This result is in agreement with the findings of Harun-or-Rashid (1998). There was no significant effect of interaction between N and S levels on the bulb length of onion. The highest bulb diameter (4.99 cm) and average single bulb weight (99.63 g) was obtained from 100 kg N/ha with 40 kg S/ha that was significantly differed from other levels of N and S. Bulb yield was significantly influence by the interaction of N and S levels. The highest bulb yield (16.23 t/ha) was produced from 100 kg N with 40 kg S due to the highest bulb diameter and average single bulb weight. The lowest bulb yield (6.05 t/ha) was found from the control treatment (N_0S_0). This result is in agreement with the findings of Singh *et al.* (1996) who reported that combined addition of N + S significantly increased yield. The minimum bulb yield (6.05 t /ha) was produced from zero N and S.

Percent of rotten bulbs of onion at different period of storage was significantly influenced by N and S fertilization (Table 4). The higher percentage of rotten bulbs (34.87%) after 90 days of storage was found for 150 kg N/ha with no sulphur whereas the lowest percentage of rotten bulbs (12.56%) was found for the control treatment (N_0S_0). This might be due to higher dose of nitrogen. The results are in agreement with the findings of Ahmed *et al.* (1988). The lowest rotting percentage for crops harvested at 90 days was perhaps due to the fact that this crop was harvested in optimum matured stage. The lowest rotten loss was obtained from the onion bulbs of the control plots. It may be due to the control plots did not receive any fertilizers that kept the bulbs less succulent and also due to less attack of bacteria and fungi.

Farmer's reaction

Farmers own desire before implementation	Farmers achievement after implementation
1. Higher yield	1. Farmers were pleased to get higher yield compare to control
2. Higher profit	2. Farmers were pleased to get higher benefit
3. Minimum disease	3. Minimum disease was observed
4. Larger bulb size	4. Farmers were pleased to get larger bulb size

Conclusion

From two years results, it may be concluded that summer onion (Var. BARI Peaj-2) can be produced with 100 kg N/ha and 40 kg S/ha for maximizing the yield and economic benefit of summer onion in the High Barind Tract soil.

References

Ahmed, M. K., D. K. Aditya and M. A. Siddique. 1988. Effect of nitrogen and sulphur application on the growth and yield of onion. Bangladesh Hort. 16(1): 36-41.

BBS. 2004. Statistical Year Book of Bangladesh. Stat. Div. Minis. Planning. Govt. Peoples Repub. Bangladesh, Dhaka: pp. 553.

Gaushal, M. H., N.N. Shinde and M.B. Sonatakke 1991. Effect of irrigation and nitrogen on bolting and bulb yield in onion (allium cepa L), Allium improvement News letter, 1: 94-98.

Gomez K A. & A A Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd edn. John Wiley and Sons. New York. : 680.

Kuksal R.P., R.D. Singh and N. Yadar.1997. Effect of different levels of nitrogen and phosphorus on fruit and seed yield of tomato. Prog. Hort. 9 (2):13-20.

Nehra, B. K. M. L. pandita and K. Singh, 1988. Effect of bulb size, spacing and nitrogen on plant growth and yield of onion, Harayana J. Hort. Sci, 17 (1-2) : 106-110.

Parent L.E., A.F. Makenzie and Y. Perron. 1994. Rate of uptake by onions compared with organic soils. Canadian Journal of Plant Science. Soils and Fertilizers. 49 – 502.

Perrin, R.K., D.L. Winkelman, E.R. Moseardi and J.R. Anderson. 1979. Farm agronomic data to farmer's recommendations. Information Bulletin 27, CIMMYT, MEXICO.

Rahim. M., A.A. Husain and M.A. Siddique 1983. Production of bulb and storage ability of three cultivars of onion (Allium cepa L.) Punjab Vegetable grower, 17/18 : 13-20.

Schnug. E. 1990. Sulphur nutrion and quality of vegetables. Sulphur in Agric. 14 : 2-7.

Singh, H., S. Singh and V. Singh. 1996. Response onion to nitrogen and sulphur Ann. Agric. Res. 17 : 441-444.

Table 1. Effect of different nitrogen levels on the yield and yield attributes of summer onion (Var. BARI Peaj-2) during 2007-08

Nitrogen levels	Plant height (cm)	Bulb length (cm)	Bulb diameter (cm)	Av. bulb weight (g)	Bulb yield (t/ha)	
					2007-08	2006-07
N_0	34.25	4.08	3.45	56.68	6.52	5.84
N_{50}	43.23	5.06	4.36	72.46	9.65	8.17
N_{100}	44.25	5.73	4.98	98.36	14.43	10.34
N_{150}	48.89	5.63	4.45	84.98	12.55	9.32
LSD (0.05)	3.65	NS	0.09	0.98	0.56	0.56
CV (%)	12.23	8.69	3.30	4.08	1.12	9.95

Table 2. Effect of different sulphur levels on the yield and yield attributes of summer onion (Var. BARI Peaj 2) during 2007-08

Sulphur levels	Plant height (cm)	Bulb length (cm)	Bulb diameter (cm)	Av bulb weight (g)	Bulb yield (t/ha)	
					2007-08	2006-07
S_0	35.32	4.65	3.55	50.12	7.02	6.46
S_{20}	40.22	4.98	4.56	81.98	9.98	8.62
S_{40}	41.44	5.23	4.98	102.30	15.02	9.27
S_{60}	43.39	5.16	4.82	96.15	13.88	9.00
LSD (0.05)	3.65	NS	0.09	0.98	0.56	0.56
CV (%)	12.02	8.69	6.30	4.08	10.12	9.95

Table 3. Interaction effect between nitrogen and sulphur levels on the yield and yield attributes of summer onion (Var. BARI Peaj 2) during 2007-08

N x S levels	Plant height (cm)	Bulb length (cm)	Bulb diameter (cm)	Av bulb weight (g)	Bulb yield (t/ha)	
					2007-08	2006-07
N_0S_0	28.69	4.02	3.65	42.25	6.05	4.33
N_0S_{20}	32.02	4.63	3.89	45.26	6.36	6.20
N_0S_{40}	33.00	4.88	4.05	54.45	8.78	6.98
N_0S_{60}	33.02	4.25	4.25	50.98	9.63	6.95
$N_{50}S_0$	39.84	4.66	4.18	69.98	8.00	7.00
$N_{50}S_{20}$	41.65	4.99	4.36	78.56	10.26	8.19
$N_{50}S_{40}$	45.10	4.98	4.55	82.25	11.22	9.33
$N_{50}S_{60}$	45.00	5.00	4.68	85.32	12.88	9.40
$N_{100}S_0$	38.49	4.99	4.26	83.25	9.63	8.04
$N_{100}S_{20}$	49.12	5.06	4.62	86.55	14.05	11.48
$N_{100}S_{40}$	49.15	5.15	4.99	99.63a	16.23	12.05
$N_{100}S_{60}$	50.01	5.12	4.85	85.98	14.98	11.52
$N_{150}S_0$	49.63	4.92	4.28	65.02	8.44	8.14
$N_{150}S_{20}$	50.02	5.02	4.68	74.25	11.69	9.28
$N_{150}S_{40}$	53.00	5.16	4.82	81.21	12.88	9.55
$N_{150}S_{60}$	53.36	5.18	4.90	85.98	13.12	9.60
LSD (0.05)	5.63	NS	0.12	1.45	0.85	0.96
CV (%)	8.56	6.35	10.25	5.65	7.56	8.95

Table 4: Cumulative rotten loss of onion bulbs at different periods of storage as influenced by nitrogen and sulphur levels during 2007-08

N × S levels	Rotten loss at different days during storing (%)					
	15	30	45	60	75	90
N_0S_0	3.47	8.29	9.66	11.02	13.00	12.56
N_0S_{20}	3.06	8.33	10.39	14.53	16.69	16.98
N_0S_{40}	2.54	6.89	10.66	12.55	14.78	18.32
N_0S_{60}	2.78	6.77	999	13.66	16.89	16.24
$N_{50}S_0$	4.89	8.55	14.22	18.99	20.22	22.25
$N_{50}S_{20}$	4.44	12.33	12.14	16.44	18.68	20.98
$N_{50}S_{40}$	4.34	10.36	10.77	14.82	20.36	18.44
$N_{50}S_{60}$	3.67	8.89	12.88	14.48	16.54	18.63
$N_{100}S_0$	6.77	14.55	16.66	14.98	21.58	25.98
$N_{100}S_{20}$	4.32	12.22	20.33	20.36	20.98	22.58
$N_{100}S_{40}$	4.66	12.98	14.11	16.47	18.77	21.25
$N_{100}S_{60}$	3.33	6.44	10.88	14.89	16.36	18.78
$N_{150}S_0$	8.87	12.66	22.69	25.89	29.33	34.87
$N_{150}S_{20}$	5.56	9.88	14.14	19.88	24.55	28.77
$N_{150}S_{40}$	2.44	8.99	14.56	18.25	20.99	22.92
$N_{150}S_{60}$	4.78	12.77	12.78	16.98	18.54	22.02
CV (%)	6.36	5.44	5.21	3.49	4.48	3.52
LSD (0.05)	0.98	1.23	1.25	1.36	2.56	3.21

On-Farm Verification of Fertilizer Trial for Garden Pea Production

Abstract

The experiment was conducted at the FSRD site, Ellenga, Tangail during rabi season of 2006-2007 and 2007-08 at MLT site, Gobindaganj, Gaibandha during 2007-08 and at Ovirampur village, Rangpur Sadar during 2006-07 to evaluate the performance of different fertilizer treatment on garden pea varieties (BARI motorshuti 1& BARI motorshuti 3 in Tangail and BARI motorshuti 1 & BARI motorshuti 2 in Gaibandha) under farmer's field condition. Among the varieties, BARI motorshuti 1 gave the higher yield in Tangail but yield variation due to varieties was not found in Rangpur or Gaibandha. Fertilizer treatment N_{50}, P_{26} K_{42} S_{12} and 1 kg/ha of Mo. B and Zn showed the highest yield in all the locations.

Introduction

Garden pea is a protein rich vegetable grown during the winter. It's per hectare yield is very low because the crop is rain fed, exposed to biotic and abiotic stress, lack of high yielding varieties and use of imbalance fertilizers. The yield, however, can be increased by using high yielding variety and adopting judicious nutrient management. Among the different fertilizer nutrients, the importance of N, P and K on garden pea yield have been reported by several researches (Singh *et al.*1992, Yadav *et al.,* 1992). The application of S also has been found effective in increasing yield of garden pea (Shivran *et al* 1996). A significant response of vegetable pea in application of Mo, B and Zn were also reported by singh *et al.* (1992). Therefore, a balanced fertilizer can play a key role in increasing production of garden pea. As such the present study was under taken to verify the combined effect of fertilizer nutrients on the performance of garden pea.

Materials and Method

The experiment was conducted at the FSRD site, Ellenga, Tangail during rabi season of 2006-2007 and 2007-08 at the MLT site, Gobindaganj, Gaibandha during 2007-08 and at Ovirampur village, Rangpur Sadar during 2006-07 in the farmer's field condition. The design of the experiment was factorial RCBD having four replications. Two tested variety were BARI Motorshuti-1 and BARI Motorshuti-2 in Rangpur and BARI Motorshuti-1 and BARI Motorshuti-3 in Tangail were considered as the first factor. Three fertilizer doses viz. T_1: $N_{50}P_{26}K_{42}S_{12}$ kg/ha, T_2: $N_{50}P_{26}K_{42}$ $S_{12}B_1Mo_1Zn_1$ kg/ha and T_3: Farmer practice were considered. The unit plot size was 4.2 m x 5 m. The seeds were sown at 30cm x 15cm spacing. Weeding, pests control and other cultural managements were done as per recommendation of HRC, BARI. In Tangail, the seeds were sown on 26 November 07 and that of BARI Motorshuti-3 during 15-25 January 2008 and harvested during 3-12 March 2008. In Gaibandha, seeds were sown on December 9-10, 2007 and were harvested during 1-6 March, 2008. The data on different plant characters and yield components were collected from 10 plants randomly selected in each plot and yield was recorded plot wise. Data were analyzed statistically using MSTATC package.

Results and Discussion

Tangail

Effects of variety: BARI motorshuti-1 gave superior plant height (92.3cm), pods per plant (9), seeds per pod (6) and the highest fresh pod yield (8.11 t/ha) over that of BARI motorshuti-3 (Table 1).

Effect of fertilizer: Table 2 reveals that all the parameters of garden pea significantly varied due to fertilizer levels applied. Treatment T_2 (N_{50} P_{26} K_{42} S_{12} & 1 kg/ha of each Mo, B and Zn) performed better over T_1 ($N_{50,}$ $P_{26,}$ $K_{42,}$ S_{12} kg/ha) treatment. The highest number of pods per plant (8) and seeds per pod (6) were obtained in plants treated with T_2 (N_{50} P_{26} K_{42} S_{12} and 1 kg/ha of Mo. B and Zn). The highest fresh pod yield (7.27 t/ha) was also obtained from the same plots.

Interaction of variety and fertilizer dose: Table 3 showed that the BARI motorshuti-1 along with N_{50} P_{26} K_{42} S_{12} and 1 kg/ha of each Mo, B and Zn provided the highest pod yield (8.51 t/ha).

Gaibandha

Pod yield (t /ha), pods/plant and seeds/pod are present in Tables 4 and 5. The highest pod yield (9.26 t/ha) was recorded from T_2 treatment which was statistical different from T_1 and T_3 treatments. The highest pod/plant and seeds/pod was obtained from T_2 Treatment. It may be due to the addition of micronutrient. The pod yield of BARI Motorshuti-2 was higher than BARI motorshouti-1 in all treatments. From the interaction (Table 6) showed that significantly higher pod yield was obtained with BARI motorshuti-1 and BARI motorshuti-2 with T_2 fertilizer dose.

Rangpur

The highest pod yield (11.50 t/ha) was recorded from T_2 treatment which was statistically different from T_1 and T_3 Treatments. The highest pod/plant and seeds/pod was obtained from T_2 Treatment. It may be due to the addition of micronutrient. The pod yield of BARI motorshuti-2 was higher than BARI motorshouti-1 in all treatments. Table 9 showed that significantly higher pod yield was recorded with BARI motorshuti-1 and BARI motorshuti-2 with T_2 fertilizer dose.

Farmers' reaction

Tangail: Farmers' opined that BARI Motor shuti-1 is better over BARI Motor shuti-3 regarding yield and market accessibility. But BARI Motor shuti-3 is better due to short duration and early market.

Conclusion

Yield of garden pea increased due to use of micronutrient (M_0, B & Zn).But this is the first year experiment, so the experiment should be continued in 2^{nd} year for confirmation of the result.

Table 1. Effect of variety on yield and yield parameters of garden pea at the FSRD site, Ellenga, Tangail during 2007-08

Variety	Days to maturity	Plant height (cm)	Pods/plant (no.)	Seeds/pod (no.)	Yield (t/ha)	
					2007-08	2006-07
BARI motorshuti 1	85.37	92.3	9	6	8.11	10.68a
BARI motorshuti 3	61.37	51.5	6	5	5.84	9.86b
LSD (0.05)	0.50	3.12	0.40	0.26	0.50	
CV (%)	1.61	3.8	5.0	4.2	6.3	8.75

Table 2. Effect of fertilizer dose on yield and yield parameters of garden pea at the FSRD site, Ellenga, Tangail during 2007-08

Treatments (N-P-K-S-Zn-Mo-B kg/ha)	Days to maturity	Plant height (cm)	Pods/plant (no)	Seeds/pod (no)	Yield (t/ha)	
					2007-08	2006-07
T_1 : 50-26-42-12-0-0-0	72.25	68.7	7	6	6.68	10.40b
T_2 : 50-26-42-12-1-1-1	74.50	75.0	8	6	7.27	11.91a
LSD (0.05)	0.503	3.126	0.403	0.263	0.499	
CV (%)	1.61	3.4	5.0	4.2	6.3	8.75

Table 3. Interaction effect of variety and fertilizer dose on yield and yield parameters of gardenpea at the FSRD site, Ellenga, Tangail during 2007-08

Variety x Treatments	Days to maturity	Plant height (cm)	Pods/plant (no.)	Seeds/pod (no.)	Yield (t/ha)
BARI motorshuti 1 x T_1	83.75	88.25	8	6	7.70
BARI motorshuti 1 x T_2	87.00	96.08	9	6	8.51
BARI motorshuti 3 x T_1	60.75	49.13	5	5	5.65
BARI motorshuti 3 x T_2	62.00	53.83	6	6	6.03
LSD (0.05)	0.712	4.421	0.570	0.371	0.706
CV (%)	2.27	3.8	5.0	4.2	6.3

T_1: N_{50} P_{26} K_{42} S_{12} kg/ha, T_2: N_{50} P_{26} K_{42} S_{12} and 1 kg/ha of each Mo B & Zn

Table 4. Effect fertilizer on yield and yield attributes of garden pea at the MLT site, Gobindaganj, Gaibandha during 2007-08

Variety	Pods/plant (no)	Seeds/pod (no)	Fresh pod yield (t/ha)
BARI motonshuti-1	26.97	5.45	8.28
BARI motonshuti-2	27.06	5.63	8.44
CV (%)	6.5	7.4	6.01

Table 5. Effect of fertilizer on yield and yield parameters of garden pea at the MLT site, Gobindaganj, Gaibandha during 2007-08

Treatments (N-P-K-S-Zn-Mo-B kg/ha)	Pods/plant (no)	Seeds/pod (no)	Fresh pod yield (t/ha)
T_1 : 50-26-42-12-0-0-0	26.20b	5.39b	8.38 b
T_2 : 50-26-42-12-1-1-1	29.50a	6.41a	9.26 a
T_3 : Farmer practice	25.36b	4.84b	7.45 b
CV (%)	6.5	7.4	6.01

Table 6. Interaction effects of variety and fertilizer dose on yield and yield parameters of garden pea at the MLT site, Gobindaganj, Gaibandha during 2007-08

Treatment	Pods/plant (no)	Seeds/pod (no)	Fresh yield (t/ha)
BARI motonshuti-1 x T_1	26.72b	5.42ab	8.31b
BARI motonshuti-1 x T_2	29.49a	6.29a	9.14a
BARI motonshuti-1 x T_3	24.71b	4.65b	7.38b
BARI motonshuti-2 x T_1	25.67b	5.35b	8.44b
BARI motonshuti-2 x T_2	29.51a	6.52a	9.37a
BARI motonshuti-2 x T_3	25.36b	5.02b	7.51b
CV (%)	6.5	7.4	6.91

T_1 : N_{50}, P_{26}, K_{42}, S_{12} (kg/ha), T_2 : N_{50}, P_{26}, K_{42}, S_{12} & 1 kg/ha of Mo. B and Zn, T_3 : Farmers practice

Table 7. Effect fertilizer on yield and yield attributes of garden pea at Ovirampur, Rangpur during 2006-07

Variety	Pods/plant (no)	Seeds/pod (no)	Fresh pod yield (t/ha)
BARI motonshuti-1	25.22 b	5.23	10.05
BARI motonshuti-2	26.48 b	5.31	10.87
CV (%)	4.0	8.3	6.91

Table 8. Effect of fertilizer on yield and yield parameters of garden pea at Ovirampur, Rangpur during 2006-07

Treatments (N-P-K-S-Zn-Mo-B kg/ha)	Pods/plant (no)	Seeds/pod (no)	Fresh pod yield (t/ha)
T_1 : 50-26-42-12-0-0-0	26.69 b	5.18 b	10.36 b
T_2 : 50-26-42-12-1-1-1	29.99 a	6.13 a	11.50 a
T_3 : Farmer practice	25.85 b	4.57 b	9.51 b
CV (%)	4.0	8.3	6.91

Table 9. Interaction effects of variety and fertilizer dose on yield and yield parameters of garden pea at Ovirampur, Rangpur during 2006-07

Treatment	Pods/plant (no)	Seeds/pod (no)	Fresh yield (t/ha)
BARI motonshuti-1 x T_1	27.23 b	5.20 a b	9.78 b
BARI motonshuti-1 x T_2	30.00 a	6.07 a	11.36a
BARI motonshuti-1 x T_3	25.22 b	4.43 b	9.01b
BARI motonshuti-2 x T_1	26.15 b	5.03 b	10.94 b
BARI motonshuti-2 x T_2	29.99 a	6.20 a	11.65 a
BARI motonshuti-2 x T_3	26.48 b	4.7 b	10.01 b
CV (%)	4.0	8.3	6.91

Response of Lentil to Newly Developed Bio-fertilizer in the Farmers' Field

Abstract

The experiment was conducted at the MLT site, Gangni, Kushtia during 2007-08 to evaluate the response of lentil to newly developed bio-fertilizer under farmers' field condition. Three different fertilizer treatments along with farmers' dose were studied to observe the response on lentil. The highest pod yield was obtained with bio-fertilizer treating plot (T_3) which was identical to T_1. Economic benefits were also higher in T_3.

Introduction

Lentil is the most important pulse crop in Bangladesh and it occupies relatively more lands than other pulse crops. Bio-fertilizer tends to produce nodule at the root of leguminous crops like lentil which minimize the requirements of N fertilizer. New *Rhizobium* bio-fertilizer has been developed for lentil. The strain was found to perform better in the research stations. Seed yield of lentil increased by 10-20% over control at different locations with the use of the bio-fertilizer. Performance of the newly developed strain needs to be verified in the farmer's field. Therefore, the present investigation was undertaken with objectives of i) to observe the response of lentil to newly developed bio-fertilizer under farmers' field condition and ii) to reduce the use of N-fertilizer in lentil cultivation.

Materials and Methods

The experiment was conducted at the MLT, Gangni, Kushtia during 2007-08. The experiment was laid out in RCBD with six replications. Unit plot size was 4m x 5m. Seeds of BARI masur 4 were sown on 9 November 2007 as with 30cm rows spacing continuous seeding and seed rate was 35 kg/ha. *Rhizobium* inoculum strain named RLc-640 was used @ 50g kg^{-1} seed for the experiment. There were four treatments viz. T_1: 24-22-42-20-5 kg N-P-K-S-Zn/ha (BARC, 2005), T_2: 50-22-42-20-5 kg P-K-S-Zn/ha (SSD, BARI Recommendation), T_3: 22-42-20-5 kg P-K-S-Zn/ha+ Inoculum and T_4: Farmers' Practice (20-12-17 kg NPK/ha). All fertilizers were applied as basal and other intercultural operations were done as and when necessary. The crops were harvested on 3 March 2008. Yield and yield attributes were recorded and analyzed statistically.

Results and Discussion

Effect of different doses of fertilizer on yield and other parameters are shown in Table 1. Plant height was the highest in T_2 followed by T_3. Pods/plant and seeds/pod was significantly higher in T_3. The highest pod yield was obtained with T_3 which was statistically similar to T_1. A positive response of yield to bio-fertilizer was evident in the study. Similarly, the highest gross return as well as gross margin was found in T_3 followed by T_1.

Farmers' reaction

Farmers are expressed their satisfaction to bio-fertilizer for higher yield without use of urea fertilizer.

Conclusion

A positive response to bio-fertilizer was observed in terms of yield and economic benefits. It was also found that bio-fertilizer could save N fertilizer.

Table 1. Yield and yield components of lentil as affected by bio-fertilizer at the MLT site, Gangni Kushtia during 2007-08

Treatment	No. of plants/m^2	Plant height (cm)	No. of pods/plant	No. of seeds/ pod	No. of branches/ plant	100-seed wt (g)	Seed yield (t/ha)	Stover yield (t/ha)
T_1	58.00	42.50	25.29	1.70	6.00	1.77	1.75	2.71
T_2	58.00	46.25	22.75	1.63	7.00	1.61	1.64	3.03
T_3	58.00	44.00	27.25	1.78	6.25	1.82	1.86	2.78
T_4	58.25	39.50	21.00	1.63	4.75	1.70	1.56	2.38
LSD (0.05)	1.93	1.14	3.66	0.07	1.14	NS	0.28	0.15
CV (%)	2.07	1.65	9.26	2.44	8.15	3.37	4.04	3.51

Table 2. Economic performance of fertilizer doses with lentil at the MLT site, Gangni, Kushtia during 2007-08

Treatment (NPKS kg/ha)	Gross return (Tk./ha)	Variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: 24-22-42-20	107712	20968	86744
T_2: 50-22-42-20	101737	21335	80402
T_3: 0-22-42-20 + Bio-fertilizer	114532	20630	93902
T_4: 20-12-17-0 (Farmers practice)	96137	19933	76204

Price: Mashur : 60 Tk/kg

Response of Garden pea to Bio-fertilizer in the Farmers' Field

Abstract

A field experiment was conducted at the MLT site, Gobindaganj, Gaibandha during rabi season of 2007-2008 to evaluate the response of gardenpea to newly developed bio-fertilizer under farmers' field condition and to reduce the uses of N-fertilizer for gardenpea cultivation. Four fertilizer treatments viz. T_1: 24-22-42-20-5 kg N-P-K-S-Zn/ha, T_2: 50-22-42-20-5 kg N-P-K-S-Zn/ha, T_3: 22-42-20-5 kg P-K-S-Zn/ha + Inoculum and T_4: Farmers' practice (36-20-40-10-0 kg N-P-K-S-Zn/ha) was studied. BARI Motorshuti-1 and peat based rhizobial inoculum (strain BARI RPs-502) @ 1.5 kg /ha were used in this experiment. Experimental result revealed that application of biofertilizer along with PKSZn fertilizers produced significantly higher nodule number and nodule weight but higher pod yield was recorded with full doses of chemical fertilizers.

Introduction

Gardenpea (*Pisum sativum* L.) is a protein rich vegetable grown in Bangladesh. It belongs to the family Fabaceae and is capable of fixing atmospheric nitrogen. However, per hectare yield of gardenpea in Bangladesh is very low. High demand of pea can only be meet up by increasing it's per hectare yield. This can be done by many ways of which the most important are the introduction of high yielding varieties and judicious application of fertilizer along with bio-fertilizer. Gardenpea is one of the winter beans in Bangladesh. Though the cultivated area is small but it has a wide scope for cultivation in Bangladesh (BBS, 2004). At present, Vegetable Section of BARI has released two varieties of gardenpea and some are on the way to release. It is cultivated during rabi season in Bangladesh. There is a great possibility to increase its production by exploiting better colonization of their root and rhizosphere through rhizobial inoculation which can fix atmospheric nitrogen and protect nature from pollution but there is still lacking of sufficient, effective and resistant *Rhizobium* strains for gardenpea. Experimental evidences showed that P and K were very much beneficial for boosting up production of pea (Pershak and Tishchenko, 1987 and Singh *et al.*, 1992). BARI has developed rhizobial strains for gardenpea. These strains were performed better results at research stations of BARI. Their performance need to be verified at farmers' field in different locations of Bangladesh. So, the present study was undertaken, i) to evaluate the response of gardenpea to newly developed biofertilizer under farmers' field condition and ii) to reduce the uses of N-fertilizer for gardenpea cultivation.

Materials and Methods

The experiment was conducted at the MLT site, Gobindaganj, Gaibandha during rabi season of 2007-08 in randomized complete block design having four replications with four treatments. The unit plot size was 5 m × 4 m with a row to row distance of 30 cm and plant to plant spacing of 10 cm. There were four treatments viz. T_1: 24-22-42-20-5 kg N-P-K-S-Zn/ha (BARC, 2005), T_2: 50-22-42-20-5 kg N-P-K-S-Zn/ha (SSD Recommendation), T_3: 22-42-20-5 kg P-K-S-Zn/ha + Inoculum and T_4: Farmer's practice. Farmers' practice was: 36-20-40-10-0 kg N-P-K-S-Zn/ha. Rhizobial inoculum (strain BARI RPs-502) was used @ 1.5 kg/ha. Peat based rhizobial inoculum was used containing about 10^7 cells g^{-1} inoculum. Chemical fertilizers i.e. P, K, S and Zn were applied @ 22 kg P/ha from TSP, 42 kg K/ha from MP, 20 kg S/ha from gypsum and 5 kg Zn/ha from zinc oxide. In T_1 treatment, N was applied @ 24 kg N/ha in T_2 treatment @ 50 kg/ha. All fertilizers were applied at the time of final land preparation. BARI motorshuti-1 was sown on 21 November 2007. Other cultural management like irrigation, weeding, mulching and crop protection measures was taken. Data on different parameters were recorded from each plot. During the course of the experiment, growth and development of plants in the field were carefully observed. Plants along with roots were collected at 50% flowering stage from each unit plot and dry weight of roots, shoots and nodules including nodule numbers were recorded. The plants were harvested on last week of February 2008. Data on plant height, 1000-seed weight (g), stover yield and pod yield (t /ha) and other yield attributes were also taken. All data were analyzed statistically.

Results and Discussion

Results of rhizobial inoculation on number of nodules/plant, nodule weight (mg /plant), root weight (g /plant), shoot weight (g/plant), plant height (cm), 100-seed weight (g), stover yield (t/ha), pod yield (t/ha), pods /plant, seeds/pod and percent yield increase over control have been presented in Tables 1 and 2. The treatment, PKSZn + Inoculum produced the highest nodule number and nodule weight which was significantly higher over other two treatments including farmers' practice. Shoot weight was also found to be highest in the same treatment. Root weight was insignificant. The highest pod yield (8.42 t/ha, 47.5% higher over farmers' practice) was recorded in T_2 treatment where full dose of chemical fertilizers were applied. Inoculated plants along with chemical fertilizers except urea N recorded the second highest pod yield (7.94 t/ha, 39.1% higher over farmers practice) which was identical to T_1 treatment ($N_{24}P_{22}K_{42}S_{20}Zn_5$ kg/ha). Farmers practice recorded the lowest pod yield. The results are in agreements with the results of Bhuiyan *et al.* (2001), Singh *et al.* (1992) who worked on chickpea, mungbean and gardenpea.

Conclusion

This is second year result; the highest yield was obtained from the recommended dose of inorganic fertilizers used with BARI Motorshuti-1 at farmers' field. Similar results were obtained in the previous year. However, a considerable yield increased was observed in bio-fertilizer inoculated plot over existing farmers practices.

Table 1. Effect of rhizobial inoculum and chemical fertilizers on nodulation and dry matter production of gardenpea at the MLT site, Gobindaganj, Gaibandha during 2007-08

Treatment	Nodule no./plant	Nodule weight (mg/plant)	Root weight (g/plant)	Shoot weight (g/plant)
$N_{24}P_{22}K_{42}S_{20}Zn_5$	16.1b	19.4b	0.53	7.36a
$N_{50}P_{22}K_{42}S_{20}Zn_5$	15.2b	18.6b	0.54	8.70a
$P_{22}K_{42}S_{20}Zn_5$+Inoc	24.3a	35.3a	0.59	9.36a
FP ($N_{36}P_{20}K_{40}S_{10}$)	13.8b	18.3b	0.49	6.73b
CV (%)	18.2	15.5	16.8	19.9

Table 2. Effect of rhizobial inoculum and chemical fertilizers on yield and yield attributes of gardenpea at the MLT site, Gobindaganj, Gaibandha during 2007-08

Treatment	Plant height (cm)	No. of pods/ plant	No. of seeds/pod	Stover yield (t/ha)	100-seed weight (g)	Pod yield (t/ha)	Yield increase over farmers practice
$N_{24}P_{22}K_{42}S_{20}Zn_5$	55.7b	42.7ab	6.18b	4.30ab	216.3b	7.67b	34.3
$N_{50}P_{22}K_{42}S_{20}Zn_5$	63.3a	46.2a	7.28a	4.72a	233.8a	8.42a	47.5
$P_{22}K_{42}S_{20}Zn_5$+Inoc	56.5b	41.1bc	5.90b	4.42ab	217.3b	7.94b	39.1
FP ($N_{36}P_{20}K_{40}S_{10}$)	50.3c	37.8c	4.68c	3.99b	209.5b	5.71c	-
CV (%)	4.8	5.6	5.8	7.6	4.3	3.8	-

Response of Mungbean to Newly Developed Bio-fertilizer in the Farmers' Field

Abstract

A field experiment was carried out at the FSRD Site, Hatgobindapur, Faridpur during 2006-07 and 2007-08 and at MLT site, Bharamara, Kushtia and at FSRD Site, Razakhali, Patuakhali during 2007-08 to evaluate the response of mungbean to newly developed bio-fertilizer under farmers' field condition and to reduce the uses of N-fertilizer for mungbean cultivation. Four fertilizer treatments viz. T_1: 50-22-42-20-5 kg P-K-S-Zn/ha, T_2: 0-22-42-20 kg P-K-S-Zn/ha +Inoculum T_3: 24-22-42-20-5 kg N-P-K-S-Zn/ha and T_4: Farmers' practice was studied. Result revealed that application of 50 kg nitrogen along with NPK fertilizer produced highest seed yield in Faridpur during 2007-08 but yield was not varied significantly among the treatment in the previous year in Kushtia. A positive response of biofertilizer to mungbean was found in Patuakhali

Introduction

Nitrogen deficiency of crop is common in Bangladesh. Farmers usually use urea as a source of nitrogen to produce their crops. But the price and its availability sometimes go beyond the capacity of the farmers. As such bio-fertilizer may be used as a cheaper substitute for urea in the production of the food legume crops. New *Rhizobium* (BARI RPs-402) bio-fertilizer has been developed for mungbean. The strain was found to perform better in the research stations but it needs to verify at the farmer's field. The present investigation was undertaken to observe the response of mungbean to newly developed bio-fertilizer under farmer's condition and to reduce the use of N-fertilizer in mungbean cultivation.

Materials Methods

The trial was conducted at the FSRD Site, Hatgabindopur, Faridpur during kharif I season, 2006-07 and 2007-08, MLT site, Bharamara, Kushtia and at FSRD site, Razakhali, Patuakhali during 2007-08. The BARI mung-5 and BARI mung-6 were tested with rhizobium BARI RPs-402 in Faridpur and Kushtia, respectively. In Patuakhali, RVr 404 was tested in BARI mung 5.The experiment was laid out in RCB design with four replications. The unit plot size was 5 m x 4 m with 30 cm wide rows. Seeds were sown on 08 March 2007 as first year and 28 February 2008 as second year in Faridpur, 5 March 2008 in Kushtia and 17 February 2008 in Patuakhali. Four treatments were used : T_1 (By SSD, BARI recommendation): 50-22-42-20-5 kg NPKSZn/ha, T_2:0-22-42-20-5 kg NPKSZn/ha + inoculum, T_3 (FRG'05): 24-22-42-20-5 kg NPKSZn/ha and T_4 (FP)-25-20-30-15 kg NPKS/ha (for Faridpur) 20-12-17 kg NPK/ha (for Kushtia). All fertilizers were applied before final land preparation. Intercultural operations were done when necessary. The crop was harvested on 8 May 2007 as first year and 9 to 26 May 2008 as second year in Faridpur, 14 May to 5 June 08 in Kushtia and 19 April 2008 in Patuakhali. The yield and yield contributing characters data of mungbean was collected and analyzed statistically.

Result and discussion

Faridpur: The yield and yield contributing characters of mungbean are presented in Table 1. The yield and yield contributing characters were significantly influenced by different fertilizer treatments except plant population/m^2, plant height and 1000 seed weight. In 2007-08, treatment T_1 gave the highest yield (1537 kg/ha) due to higher yield-contributing character like pods/plant followed by treatment 3 where nitrogenous fertilizers were applied. The highest number of pods/plant (19.2) was obtained from the treatment T_1 that was statistically similar to T_3. The highest thousand seed weight (41.3g) was obtained from the treatment T_4. The lowest yield (1320 kg/ha) was obtained from inoculum plot without nitrogenous fertilizer. It may be due to the lower performance of yield contributing characters. But in 2006-07, the highest seed yield was obtained with T_2 (inoculum + recommended dose of PKS) but it was identical to other treatments. Finally it may be concluded that some inorganic fertilizers (N) may be used with inoculum for better yield in mungbean cultivation.

Kushtia: Results revealed that seed yield of mungbean did not vary significantly among the fertilizer treatments. However, plant height and pods/plant influenced significantly. Stover yield was also insignificant.

Patuakhali: The highest yield was recorded from T_2 which was identical to T_1 treatment. A positive response of mungbean to biofertilizers was observed. But other parameters did not vary significantly.

Farmers' reaction: Farmers expressed their satisfaction for higher yield without use of N fertilizer and they are interested to cultivate mungbean with inoculum if it is available in the market.

Conclusion

Bio-fertilizer is not available in the local market. If it is available, farmers will use it instead of N-fertilizer because of its low cost. They showed their interest to biofertilizer.

Table 1. Yield and yield attributes of mungbean as affected by inoculum and chemical fertilizers at the FSRD site Hatgobindpur, Faridpur during 2006-07 and 2007-08

Treatments	No. of pods/plant		No. of seeds/pod		1000-seed wt. (g)		Seed yield (kg/ha)	
	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07
T_1	19.2	19.72	10.8	9.40	41.1	56.60	1537	1560
T_2	16.9	19.20	10.6	9.25	39.8	57.0	1320	1588
T_3	18.5	19.17	10.6	8.82	40.4	54.28	1474	1537
T_4 (FP)	17.7	17.17	10.7	8.45	41.3	53.55	1434	1368
LSD (0.05)	1.15	1.42	0.73	0.78	ns	2.51	122	ns
CV (%)	4.00	4.71	4.28	5.40	5.12	2.83	5.85	9.44

T_1: (50-22-42-20-5 kg NPKSZn /ha), T_2 : (0-22-42-20-5 NPKSZn/ha + Inoculum), T_3: (24-22-42-20-5 kg NPKSZn/ha) , T_4: (FP) (25-20-30-15 kg NPKS/ha)

Table 2.Yield and yield components of Mungbean as affected by bio-fertilizer at the MLT site Bharamara, Kushtia during 2007-08

Treatment	No. of plants/m^2	Plant height (cm)	No. of pods/plant	No. of seeds/pod	1000-seed wt (g)	Seed yield (t/ha)	Stover yield (t/ha)
T_1	39.75	50.52 a	46 a	11.0	54	1.63	2.07
T_2	37.5	49.35 b	44 a	10.8	53	1.58	2.10
T_3	42.25	47.75 c	42 ab	9.8	52	1.52	2.00
T_4 (FP)	37.5	44.77 a	38 b	10.6	49	1.50	1.80
CV (%)		3.6	5.9	11.4	2.2	9.7	9.5

Table 3: Economic performance of fertilizer doses with BARI Mung-6 (Inoculum) at the MLT site Bharamara, Kushtia during 2007-08

Treatment	Gross return (Tk)	Variable cost (Tk)	Gross margin (Tk)
T_1	57050	23514	33536
T_2	55300	22864	32436
T_3	53200	23150	30050
T_4	52500	20092	32408

Price: Mung : 35 Tk/kg

Table 4. Yield and yield contribution characters of BARI mung-5 as affected by *Rhizobium* strain at the FSRD site Razakhali, Patuakhali during 2007-08

Treatment	No. of plants/m^2	Plant height (cm)	No. of pods/plant	No. of seeds/pod	1000-seed wt (g)	Seed yield (kg/ha)
T_1	31	42.5	15	9	32	1430 a
T_2	29	43.8	16	9	32	1450 a
T_3	32	40.6	14	8	32	1310 b
T_4	30	35.9	12	7	31	824 c
CV (%)	-	-	-	-	-	9.85

Response of Chickpea to Newly Developed Bio-fertilizer in the Farmers' Field

Abstract

A field trial was conducted at the FSRD site Hatgabindapur, Faridpur, FSRD site, Kadamshahar, Godagari, Rajshahi and MLT site, Bharamara, Kushtia during rabi season of 2006-07 and 2007-08 to evaluate the response of chickpea to newly developed bio-fertilizer under farmers' field condition and to reduce the uses of N-fertilizer for chickpea cultivation. The variety BARI Chola-5 of chickpea and peat based rhizobial inoculum (BARI RCa-203) were used for the experiment. Four fertilizer treatments viz. T_1: 24-22-42-20 kg N-P-K-S /ha, T_2: 50-22-42-20 kg P-K-S/ha T_3: 22-42-20 kg P-K-S/ha + Inoculum and T_4: Farmers' practice were studied. Farmers' practice was 25-18-20-20 kg N-P-K-S /ha. Except Kushtia during the 2006-07, application of biofertilizer along with PKS produced higher nodulation and seed yield in other locations.

Introduction

Chickpea (*Cicer arietinum* L.), commonly known as gram, is the third major pulse crop in Bangladesh but second in consumption priority (BBS, 1998). In Bangladesh, it stands 5th in respect of area (13915 ha) and production (10380 t) among the pulse crop (BBS, 2004). The average yield of chickpea is low (600-700 kg/ha) compared to other neighboring countries (ICRISAT, 1990). Bangladesh has developed a good number of varieties of chickpea. Some of these varieties are waiting for cultivation in the farmers' level but were not screened in respect to nodulation, nitrogen fixation and as well as yield. There is a great possibility to increase its production by exploiting better colonization of the roots and rhizospheres through the application of effective nitrogen fixing bacteria to the seed or to the soil. This can minimize uses of nitrogenous fertilizer, which is very costly in our country. Using high yielding varieties/advanced lines of chickpea in combination with effective rhizobial strains along with management practices including manures and fertilizers can enhance the yield. Few indigenous *Rhizobium* strains were collected from different AEZs of Bangladesh and were screened, tested at research stations. Now their efficiency in crop production needs to be tested at farmers' level. The present study was, therefore under taken i) to evaluate the response of chickpea to biofertilizer under farmers' field condition, and ii) to reduce the uses of N-fertilizer for lentil cultivation.

Materials and Methods

A field trial was conducted at the Farming System Research & Development site, Hatgobindpur, Faridpur FSRD site, Kadamshahar, Godagari, Rajshahi and MLT site Bharamara, Kushtia during rabi season of 2007-2008.The experiment was laid out in randomized complete block design having four replications with four treatments. The unit plot size was 4 m × 5 m. The variety BARI Chola-5 of chickpea and peat based rhizobial inocula BARI RCa-203 were used for the experiment. There were four treatments viz. T_1: 24-22-42-20-5 kg N-P-K-S-Zn/ha (BARC, 2005), T_2: 50-22-42-20-5 kg P-K-S-Zn/ha (SSD, BARI Recommendation), T_3: 22-42-20-5 kg P-K-S-Zn/ha+Inoculum and T_4: Farmers' Practice (25-18-20-20 kg NPKS/ha in Faridpur, 0-8-0-0 kg NPKS/ha in Rajshahi and 20-12-17 kg NPK/ha in Kushtia).The above peat based rhizobial inoculum was used @ 1.5 kg/ha. Peat based rhizobial inoculum was used containing 10^8 cells/g inoculum. Chemical fertilizers i.e. P, K and S were applied in all treatments as basal dose @ 22 kg P/ha from TSP, 42 kg K /ha from MP and 20 kg S/ha from gypsum but in farmers' practice, the above fertilizers were used as per locations. The crop was sown on 27 November 2006 as first year and 06 December 2007 as second year in Faridpur, 21-22 November in Rajshahi and 21-26 November in Kushtia. During the course of the experiment, growth and development of plants in the field were carefully observed. Plants along with roots were collected at 50% flowering stage from each unit plot and dry weight of roots; shoots and nodules including nodule numbers were recorded. The plants were harvested on 31 March 2007 as first year and 03 April 2008 as second year in Faridpur, 28 March in Rajshahi and last week of March in Kushtia. Data on plant height, 1000-seed weight, stover yield and seed yield were also taken.

Results and Discussion

Faridpur

The highest nodule number (20.9 per plant in 2006-07 and 27.4 per plant in 2007-08) and nodule weight (49.2 mg/plant in 2006-07 and 102.5 mg/plant in 2007-08) were recorded in PKSZn + Inoculum treated plot which was statistically different from all other treatments (Table 1 & 2). All the uninoculated plants gave identical nodule number and nodule weight. Root, shoot weight, plant height, 1000-seed weight was found insignificant in 2006-07 and root weight and 1000-seed weight in 2007-08 was found insignificant in 2007-08. The highest stover and seed yield (1.56 t/ha, 14.7% higher over farmers' practice in 2006-07 and 1.28 t/ha, 20.8% higher over farmers practice in 2007-08)) was also recorded in the same treatment which was significantly higher over farmers practice. The lowest yield was obtained from farmers' practice (1.36 t/ha in 2006-07 and 1.06 t/ha in 2007-08). Inoculum with chemical fertilizers showed better performance against only inorganic fertilizers. Application of inoculum gave 185 kg higher yield than application of 50 kg N/ha in 2006-07 and 120 kg higher in 2007-08. The results are in agreement with the findings of Bhuiyan *et al.* (2001) and Khanam *et al.* (1999) who worked on chickpea in recent years.

Cost benefit analysis revealed that the highest MBCR (5.72) was recorded in T_3 treatment where inoculum was used instead of applying urea N (Table 3).

Rajshahi

Results of rhizobial inoculation on nodule number /plant, nodule weight (mg /plant), root weight (g/plant), shoot weight (g/plant), plant height (cm), 1000-seed weight (g), stover yield (t/ha), seed yield (t/ha) and percent yield increase over farmers' practice have been presented in Tables 4-5. The highest nodule number (26.0 in 2006-07 and 23.3 in 2007-08) and nodule weight (76.1 mg/plant in 2006-07 and 71.9 mg/plant in 2007-08) were recorded in PKSZn + Inoculum treated plot which was significantly higher over all other treatments. All the parameters except nodule number and nodule weight were found to be insignificant. The highest seed yield (1.34 t /ha in 2006-07, 18.0% higher over farmers practice and 1.45 t /ha in 2007-08, 16.9% higher over farmers' practice) was recorded in the T_3 treatment ($N_{24}P_{22}K_{42}S_{20}$ + Inoculum) which was identical with all other treatments. The lowest yield was obtained from farmers' practice (1.36 t /ha in 2006-07 and 1.06 t /ha in 2007-08).

It revealed that gross return as well as gross margin was obtained from T_3 followed by T_1 and T_2 where inoculum was used instead of applying urea. The results are in agreement with the findings of Bhuiyan *et al.* (2001) and Khanam *et al.* (1999).

Kushtia

In 2006-07, nodules/plant, nodule weight/plant, pods/plant and seed yield were significantly influenced by different fertilizer treatments. Pods/plant was higher in treatment T_1 followed by T_2. The highest yield (1.63 t/ha) was obtained from treatment T_2.

In 2007-08, the highest nodule number (19.7 /plant) and nodule weight (51.2 mg/plant) were recorded in PKSZn + Inoculum treated plot which was statistically different from all other treatments. Root weight, plant height, stover yield and 1000-seed weight was found to be insignificant. The highest seed yield (1.43 t/ha) was recorded in T_2 treatment which was identical to T_3 treatment where inoculum was used instead of urea. Regarding cost and return analysis, higher gross return (Tk.14681/ha) and gross margin (Tk.10473/ha) were obtained from treatment T_2 (Table 9). In the field, pod borer infestation was high, some plants were died after yellowing, and flowers were also damaged.

Conclusion

It is evident from the experiment application of biofertilizer instead of applying nitrogenous fertilizer can achieve the higher yield of chickpea in Faridpur and Rajshahi. However, the response of chickpea to biofertilizer was not evident in Kushtia.

References

Bangladesh Bureau of Statistics. 2004. Statistical Yearbook of Bangladesh. 21th Edition. Bangladesh Bureau of Statistics. Ministry of Planning, Govt. People's Republic of Bangladesh.

Bhuiyan, M.A.H., D. Khanam, A. Khatun, A.K.M. Hossain and M.S. Islam. 2001. Nodulation, dry matter weight and grain yield of chickpea as influenced by *Rhizobium* inoculation. Bangladesh J. Agril. Res. 26(3): 463-466.

Khanam, D., M.A.H. Bhuiyan, M.H.H. Rahman and A.K.M. Hossain. 1999. On-farm experience of the application and adoption of biological nitrogen fixation technology in Bangladesh. Bangladesh J. Agril. Res. 24 (2): 375-382.

Table 1. Effect of rhizobial inoculum and chemical fertilizers on nodulation, dry matter production and yield of chickpea at the FSRD site, Hatgobindpur, Faridpur during 2006-07

Treatment	Nodule Number/ plant	Nodule weight (mg /plant)	Root weight (g /plant)	Shoot weight (g/plant)	Plant height (cm)	1000-seed weight (g)	Seed yield (t/ha)	Yield increase over FP (%)
$N_{24}P_{22}K_{42}S_{20}Zn_5$	11.9b	28.4b	0.07	1.31	38.7	118	1.49a	8.0
$N_{50}P_{22}K_{42}S_{20}Zn_5$	8.7b	24.3b	0.08	1.35	43.7	116	1.38ab	1.5
$P_{22}K_{42}S_{20}Zn_5$+Inoc	20.9a	49.2a	0.08	1.61	40.8	119	1.56a	14.7
FP ($N_{25}P_{18}K_{20}S_{20}$)	10.5b	27.1b	0.07	1.42	39.2	118	1.36b	-
CV (%)	16.5	16.8	8.0	10.3	10.3	3.9	13.3	

Means followed by common letter are not significantly different at 5% level by DMRT

Table 2. Effect of rhizobial inoculum and chemical fertilizers on nodulation, dry matter production and yield of chickpea at the FSRD site, Hatgobindpur, Faridpur during 2007-08

Treatment	Nodule number /plant	Nodule weight (mg/plant)	Root weight (g /plant)	Shoot weight (g /plant)	Plant height (cm)	1000-seed weight (g)	Seed yield (t/ha)	Yield increase over FP (%)
$N_{24}P_{22}K_{42}S_{20}Zn_5$	19.5b	80.8b	0.29	2.59a	40.8b	116	1.22a	15.1
$N_{50}P_{22}K_{42}S_{20}Zn_5$	17.7b	39.2b	0.31	2.71a	43.6a	115	1.16ab	9.4
$P_{22}K_{42}S_{20}Zn_5$+Inoc	27.4a	102.5a	0.30	2.87a	39.3b	116	1.28a	20.8
FP ($N_{25}P_{18}K_{20}S_{20}$)	19.3b	64.2b	0.24	2.04b	38.9b	115	1.06b	-
CV (%)	13.5	12.8	15.3	12.2	3.4	0.76	6.9	

Means followed by common letter are not significantly different at 5% level by DMRT

Table 3. Benefit and cost analysis for chickpea to biofertilizer at the FSRD site, Hatgobindpur, Faridpur during 2006-07 to 2007-08 (average of two years)

Treatments	Yield (t /ha)	Variable cost (Tk./ha)	Gross return (Tk/ha)	Gross margin (Tk/ha)	MBCR over FP
T_1:$N_{24}P_{22}K_{42}S_{20}Zn_5$	1.355	5948	81300	75352	3.59
T_2: $N_{50}P_{22}K_{42}S_{20}Zn_5$	1.270	6348	76200	69852	1.28
T_3:$P_{22}K_{42}S_{10}Zn_5$+Inoc.	1.420	5728	85200	79472	5.72
T_4: FP($N_{25}P_{18}K_{20}S_{20}$)	1.210	3525	72600	69075	-

Urea: Tk. 7.00 kg^{-1}, TSP: Tk. 17.00 kg^{-1}, MP: Tk. 18.00 kg^{-1}, Gypsum: Tk. 8.00 kg^{-1}, $ZnSO_4$: Tk. 95.00 kg^{-1}, Chickpea: Tk. 60.00 kg^{-1}

Table 4. Effect of rhizobial inoculum and chemical fertilizers on nodulation, dry matter production and yield of chickpea at the FSRD site, Kadamshahar, Godagari, Rajshahi during 2007-08

Treatment	No. Nodule /plant	Nodule weight (mg /plant)	Root weight (g /plant)	Shoot weight (g /plant)	Plant height (cm)	Stover yield (t /ha)	1000-seed weight (g)	Seed yield (t /ha)	Yield increase over FP (%)
$N_{24}P_{22}K_{42}S_{20}$ Zn_5	12.0c	42.3b	0.15	2.07	40.8	1.89	124	1.36	9.7
$N_{50}P_{22}K_{42}S_{20}Zn_5$	11.4c	35.7b	0.17	2.22	36.0	1.81	124	1.38	11.3
$P_{22}K_{42}S_{20}Zn_5$+Inoc	23.3a	71.9a	0.17	2.35	39.0	1.87	127	1.45	16.9
FP ($N_0P_8K_0S_0$)	17.7b	45.2b	0.14	2.06	39.1	2.20	124	1.24	-
CV (%)	17.8	24.1	2.8	3.2	5	7.7	7	1.0	-

Means followed by common letter are not significantly different at 5% level by DMRT

Table 5. Effect of Rhizobial inoculum and chemical fertilizers on nodulation, dry matter production and yield of chickpea at the FSRD site, Kadamshahar, Rajshahi during 2006-07

Treatment	Nodule /plant	Nodule weight (mg /plant)	Root weight (g /plant)	Shoot weight (g /plant)	Plant height (cm)	Stover yield (t /ha)	TSD weight (g)	Seed yield (t /ha)	Increase over FP (%)
$N_{24}P_{22}K_{42}S_{20}$ Zn_5	13.9b	41.0c	0.21	2.02	41.8	1.69	137	1.34	18.0
$N_{50}P_{22}K_{42}S_{20}Zn_5$	12.0b	43.3c	0.23	2.31	40.9	1.52	137	1.29	16.2
$P_{22}K_{42}S_{20}Zn_5$+Inoc	26.0a	76.1a	0.22	2.34	41.1	1.45	138	1.34	18.0
FP ($N_0P_8K_0S_0$)	17.0b	56.5b	0.19	1.98	39.0	1.65	136	1.11	-
CV (%)	19.5	14.7	15.5	18.7	6.3	10.8	2.2	16.6	-

Means followed by common letter are not significantly different at 5% level by DMRT

Table 6. Benefit cost ratio analysis for chickpea at Barind, Rajshahi

Treatments	Yield (t/ha)	Gross return (Tk./ha)	Variable cost (Tk. /ha)	Gross margin (Tk./ha)
T_1:$N_{24}P_{22}K_{42}S_{20}Zn_5$	1.350	81000	5948	75052
T_2: $N_{50}P_{22}K_{42}S_{20}Zn_5$	1.335	80100	6348	73752
T_3:$P_{22}K_{42}S_{10}Zn_5$+Inoc.	1.395	83700	5728	77972
T_4: FP($N_0P_0K_0S_0$)	1.175	70500	680	69820

Urea: Tk. 7.00 kg^{-1}, TSP: Tk. 17.00 kg^{-1}, MP: Tk. 18.00 kg^{-1}, Gypsum: Tk. 8.00 kg^{-1}, $ZnSO_4$: Tk. 95.00 kg^{-1}, Chickpea: Tk. 60.00 kg^{-1}

Table 7: Yield and yield components of chickpea as affected by Bio-fertilizer at the MLT site, Bharamara, Kushtia during 2006-07

Treatment	Plant pop^n $/m^2$	Nodule no./plant	Pods/ plant)	Nodule wt. (mg/plant)	100-seed wt. (g)	Shoot wt. (g/plant)	Seed yield (t/ha)	Stover yield (t/ha)
T_1	38.66	13.5b	27.33	30.2b	15.36	2.39b	1.00	2.39
T_2	39.00	12.8b	26.33	25.6b	15.13	2.50a	1.63	2.50
T_3	38.33	17.4a	18.66	41.2a	15.26	2.52a	1.30	2.30
T_4	38.66	14.0b	23.00	23.3b	14.46	2.42b	1.20	2.40
LSD(0.05)	NS	4.52	6.14	1.14	NS		0.11	0.13
CV (%)	4.88	9.3	13.69	20.3	7.05	1.7	4.79	3.41

Table 8: Yield and yield components of chickpea as affected by Bio-fertilizer at the MLT site, Bharamara, Kushtia during 2007-08

Treatment	Plant pop^n $/m^2$	Nodule no./plant	Pods/ plant)	Nodule wt. (mg/plant)	1000seed wt. (g)	Shoot wt. (g/plant)	Seed yield (t/ha)	Stover yield (t/ha)
T_1	38	13.2b	23.00	31.5b	161	3.11	1.25	1.90
T_2	40	12.9b	24.33	30.2b	146	3.50	1.43	2.03
T_3	38	19.7a	25.33	51.2a	149	3.59	1.32	1.93
T_4	40	13.0b	22.00	30.0b	148	3.00	1.18	1.85
LSD(0.05)	1.49		2.60				0.26	0.26
CV (%)	1.90	19.2	5.50	20.8	8.30	10.50	7.50	6.76

Table 9: Economic performance of fertilizer doses with BARI Chola-5 varieties at the MLT site, Bharamara, Kushtia during 2007-08

Treatment	Gross return (Tk./ha)	Variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: 24-22-42-20 - kg NPKS /ha	12662	4159	8503
T_2: 50-22-42-20 – kg NPKS /ha	14681	4208	10473
T_3: 0-22-42-20 –kg NPKS /ha. + Bio-fertilizer	13517	4114	9403
T_4: 20-12-17kg NPK/ha Farmers practice	12183	3821	8362

Price : 70 Taka per kg

Dry Matter Yield and Seed Yield of Chickpea as Affected by Molybdenum Seed Soaking

Abstract

An experiment was carried out at the FSRD site, Kadamshahar, Godagari, Rajshahi during the rabi season 2007-08 to find out the optimum dose of Molybdenum for higher yield of chickpea in High Barind Tract. Two seed soaking (priming and non-priming) and six levels of molybdenum (0, 40, 60, 80, 100 and 120 g Mo/ha) were tested in the study. Comparatively higher total dry matter (TDM) was found in priming treatment and TDM increased with the increasing rate of Molybdenum up to 100 g/ha at all date of observation. The experimental results showed that higher seed yield (1.46 t/ha) was produced in priming. All the crop characters increased with the increasing rate of molybdenum up to 100 g/ha and thereby slightly declined. The highest seed yield (1.56 t/ha) was found at 100 g Mo/ha.

Introduction

Chickpea is the fourth most important pulse crop grown in Bangladesh. The potentiality of this crop is about 2 t/ha. However, the national average yield is only 757 kg/ha. Several factors are responsible for the yield reduction of chickpea. Molybdenum has manifold advantages in crop growth and development. It helps in amino acid synthesis. It also increased the rate of starch and carotene synthesis in plant and necessary to increase the yield of legume crop (Satter and Ahad, 1988). It can increase the yield of chickpea by 47% (Farid *et al.,* 2003). Now, intensive cropping exhausted micronutrient from the soil. In many cases, application of Mo gave good result to the farmers particularly at the Barind tract. The recommended dose of Mo is 1-2 kg/ha. However, it is a costly nutrient element (Tk. 12000-15000/- kg). On this basis per hectare cost of Mo stands for Tk.18000-22500/- which tremendously increased the production cost. Molybdenum (Sodium molybdate) is generally broadcasted during final land preparation but it was reported that seed priming in Mo (Sodiym molybdate) solution before sowing gave good result than broadcasting. Very little amount of Mo is needed for seed priming solution. So, application of Mo through seed priming needs to be validated. It is, therefore, an urgent need to find out the effect of Mo on the growth and yield of chickpea. Therefore, the present study was undertaken with view to find out the optimum dose of Molybdenum for higher yield of chickpea in High Barind Tract

Materials and Methods

The experiment was conducted at the Farming System Research and Development (FSRD) site, Kadamshahar, Godagari, Rajshahi during Rabi season of 2007-08 to find out the optimum dose of Molybdenum for higher yield of chickpea in High Barind Tract. The soil of the experimental plots belongs to Amnura series under AEZ 26 and composed of grey terrace soils of silty loam to silty clay loam in texture with a pH value of 5.9. The variety of chickpea was BARI chola-5. The experiment consisted of seed soaking (priming and non-priming) and six Molybdenum levels (0, 40, 60, 80, 100 and 120 g Ammonium Molybdate/ha) were used in the experiment. Incase of priming seeds were soaked in Ammonium Molybdate solution for 8 hours and just mixed with seed for non-priming. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 3 m × 4 m. The plots were fertilized uniformly with nitrogen, phosphorus and potassium as basal during final land preparation at the rate of 20 kg N, 30 kg P_2O_5 and 20 kg K_2O per hectare in the form of urea, TSP and MP, respectively as per recommendation. The seeds were sown in the field on November 22, 2007 at a rate of 45 kg/ha continuously in lines at 30 cm apart. Intercultural operations such as weeding, thinning, and pesticide application were done for normal growth. The crop was harvested on March 28, 2008 at full maturity stage. The data on different parameters viz. total dry matter/plan (g), plant population, plant height (cm), pods/plant, seeds/pod, 100-seed weight (g), seed yield (t/ha), straw yield (t/ha) were recorded. Total dry matter was recorded 20 days interval from 20 days after germination to maturity stage by destructive sampling method. Observations were made on yield components from 10 randomly selected plants per plot. The data were analyzed statistically and the mean differences were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Effect of seed soaking

There was no significant effect of seed soaking on total dry matter (TDM) at all dates of observation except 80 days after emergence (DAE). Higher TDM was found in priming at all dates of observation (Table 1).

Seed soaking had significant effect on the seed yield of chickpea (Table 2). Among two treatments of seed soaking, priming produced higher number (32) of plant per meter squire, plant height (40.07 cm), no. of branch/plant (5.48), no. of pod/plant (44.34), no. of seeds/pod (1.75) and hundred seed weight (12.76 g). Higher seed yield (1.46 t/ha) was obtained from priming which was significantly different from non-priming. Straw yield (2.16 t/ha) was also found higher in priming treatment.

Effect of molybdenum

Effect of Molybdenum on total dry matter was significant at 80, 100 and 120 DAE (Table 3). Total dry matter increased with the increasing rate of Mo up to 100 g Mo/ha and thereafter it was slightly decreased.

Molybdenum had a significant effect on the yield and yield component of chickpea except plant population/m^2, plant height, seeds per pod and straw yield (Table 4). Seed yield increased with the increase in molybdenum rate up to100 g/ha and the yield slightly declined with the next higher dose. The highest seed yield (1.56 t/ha) was found with the application of 100 g Mo/ha that was similar to 120 g Mo/ha (1.50 t/ha) and the lowest (1.17 t/ha) at control. Application of 100 g Mo/ha showed an increase yield of 33.33% over control.

Interaction between priming level and varieties

There was no significant interaction effect between seed soaking and molybdenum rate on the yield and yield attributes of chickpea was found.

Farmers' reaction

- Farmers are pleased to get high yield by using molybdenum
- Bold and weighty seed are found from treatment priming and application of molybdenum

Conclusion

From the first year results it is concluded that response of chickpea to different molybdenum levels was evident. Chickpea can be produced with priming and 100 g Mo/ha used as seed treating in High Barind Tract. For further recommendation the experiment should be continued in the next year.

Reference

Gomez, K.A. and A.A. Gomez. 1984. Statistical procedures for agricultural research (2nd Edition). An International Rice Research Institute Book. John Wiley and Sons, New York, USA.680 p.

Table 1. Total dry matter (g/pl) of chickpea as influenced by seed soaking of different DAE at the FSRD site, Kadamshahar, Barind, Rajshahi during 2007-08

Seek soaking	20 DAE	40 DAE	60 DAE	80 DAE	100 DAE	120 DAE
Priming	0.15	0.54	1.36	2.59a	7.33	14.80
Non priming	0.14	0.54	122	2.33b	6.78	14.39
CV (%)	20.82	16.53	16.83	12.49	17.04	14.58

Table 2. Yield components of chickpea as influenced by Seed soaking at the FSRD site, Kadamshahar, Barind, Rajshahi during 2007-08

Seed soaking	Plant pop./m^2	Plant height (cm)	Branch /plant	Pod/ plant	Seeds/ pod	1000-seed wt. (g)	Seed yield (t/ha)	Straw yield (t/ha)
Priming	32.00	40.07	5.48	44.34	1.75	12.76	1.46a	2.16
Non priming	30.67	38.53	5.06	42.32	1.64	12.70	1.29b	2.08
CV (%)	8.62	6.88	14.88	8.83	9.82	3.32	7.26	13.87

Table 3. Total dry matter (g/pl) of chickpea as influenced of different Mo at different DAE at the FSRD site, Kadamshahar, Barind, Rajshahi during 2007-08

Molybdenum dose(g/ha)	20 DAE	40 DAE	60 DAE	80 DAE	100 DAE	120 DAE
0	0.16	0.51	1.13	1.96 c	5.54 c	11.63 b
40	0.14	0.48	1.15	2.19 bc	6.11 bc	12.44 b
60	0.15	0.55	1.24	2.38 bc	7.00 abc	14.27 ab
80	0.16	0.57	1.37	2.64 ab	7.41 abc	14.70 ab
100	0.17	0.59	1.49	3.01 a	8.59 a	17.83 a
120	0.15	0.56	1.34	2.58 ab	7.69 ab	16.67 a
CV (%)	20.82	16.53	16.83	12.49	17.04	14.58

Table 4. Yield components of chickpea as influenced by different Molybdenum levels at the FSRD site, Kadamshahar, Barind, Rajshahi during 2007-08

Molybdenum dose(g/ha)	Plant pop./m^2	Plant height (cm)	Branch /plant	Pod/ plant	Seeds/ pod	1000-seed wt. (g)	Seed yield (t/ha)	Straw yield (t/ha)
0	29.00	41.46	4.48 c	37.26 c	1.56	12.40 c	1.17 d	1.90
40	31.33	38.90	4.73 bc	40.10 bc	1.68	12.54b bc	1.20 cd	2.12
60	31.50	38.33	5.36 abc	33.63abc	1.70	12.55 bc	1.35 bc	2.06
80	33.00	38.80	5.65 ab	44.43 ab	1.73	13.01 a	1.45 b	2.14
100	33.00	40.06	6.06 a	47.90 a	1.76	13.21 ab	1.56 a	2.38
120	30.16	38.18	5.33 abc	46.63 ab	1.71	12.64 bc	1.50 ab	2.14
CV (%)	8.62	6.88	14.88	8.83	9.82	3.32	7.26	13.87

Fertilizer Management Options for Groundnut Intercropping with Onion

Abstract

An experiment was conducted at the MLT site, Hossainpur, Kishoreganj during rabi season of 2007-08 to determine the optimum and economic dose of fertilizer for groundnut+ onion intercropping system. T_2 (120-40-75-20-5-1 kg/ha of NPKSZnB) treatment produced higher groundnut yield (2.15 t/ha), onion yield (3.77) as well as groundnut equivalent yield (4.04 t/ha) with higher gross return (Tk.121050/ha). Groundnut yield was higher due to higher number of pods/plant, seeds/pod and 100 kernel weight.

Introduction

Groundnut is a long duration slow growing crop especially in rabi season. It is grown with wide row spacing, which allows long term fallowing of interspaced. Onion is the most popular and economic spices which need much shorter duration for their maturity. The inter row spaces of groundnut could be utilized for growing short duration crops. Oilseed Research Centre, BARI has developed a intercropping technology of groundnut + onion with suitable row arrangement. This intercropping technology was found agronomically feasible and economically profitable at on-farm trial in Kishoreganj. But in the farmers' field this technology is need to be verified against different fertilizer management options. Thus, an experiment was designed to determine the optimum and economic dose of fertilizer for groundnut + onion intercropping system.

Materials and Methods

The experiment was conducted at the MLT site, Hossainpur Kishoreganj during rabi season of 2007-08. The experiment was laid out in RCB design with six dispersed replications. The unit plot size was 5.0 m x 4.0 m. There was three treatments viz. T_1: 30-45-85-30-4-1 kg/ha of NPKSZnB (Sole groundnut dose), T_2: 120-40-75-20-5-1 kg/ha of NPKSZnB (Sole onion dose) and T_3 : 90-44-83-30-4 kg/ha of NPKSZn (FRG'2005). Groundnut spacing was maintaining at 40 cm x 10 cm and in between two rows of groundnut, two rows of onion was planted maintaining 20 cm x 05 cm spacing. All fertilizer was applied as basal except 2/3rd of N at 20 and 40 days after sowing. The variety of groundnut was BARI badam-6. Seeds of groundnut and seedlings of onion were sown/transplanted on 01 and 09 December 2007, respectively and harvested on 14-15 May and 07 April 2008, respectively. Some onion seedlings were damaged and were re-transplanted on 10 January 2008. Data of yield components were collected from 10 plants selected at random in each plot and yield was recorded plot wise. The collected data were analyzed statistically. Economic analysis was done on the basis of prevailing market price of input and output.

Results and Discussion

Except seed/pod all the yield contributing characters and nut yield were statistically insignificant in different treatments (Table 1). Significantly the higher number of seeds/pod was recorded from treatment T_2 which followed by T_1 but seeds/pod was statistically identical to treatment $T_1$and T_3. Yield of groundnut decreased with the introduction of intercropped onion but higher groundnut equivalent yield was recorded from treatment T_2 followed by T_1 with the higher gross return (Tk.121050/ha) and gross margin (Tk. 77396/ha) (Table 3).

Farmers' reaction

Farmers opined that fertilizer dose for sole onion (two rows of onion in between two rows of groundnut) was more suitable combination due to moderate yield of groundnut with additional higher yield of onion. They also opined that if they sow onion bulb directly instead off onion seedling then it might be more profitable.

Conclusion

From one year study, it may be concluded that the treatment T_2 (sole onion dose) is superior to other treatments. Gross return and gross margin were also found higher in T_2. Considering the yield and economic return, T_2 (sole onion dose) may be recommended for higher groundnut equivalent yield. The experiment needs to be repeated further one year for final recommendation.

Table 1. Yield and yield components of groundnut as influenced by different fertilizer management options at the MLT site, Hossainpur Kishoreganj during 2007-08

Treatment*	Population /m^2	Maturity (days)	Plant height (cm)	Pods/plant (No.)	Seed/pod (No.)	100-kernel wt. (g)	Nut yield (t/ha)
T_1	22	160	51	21	1.53	34	2.07
T_2	22	164	50	25	1.60	37	2.15
T_3	21	166	51	23	1.43	35	2.06
LSD (0.05)	NS	NS	NS	NS	0.13	NS	NS
CV (%)	6.25	7.34	9.01	9.22	7.06	8.95	6.32

*T_1: 30-45-85-30-4-1 kg/ha of NPKSZnB (Sole groundnut dose), T_2: 120-40-75-20-5-1 kg/ha of NPKSZnB (Sole onion dose), T_3: 90-44-83-30-4 kg/ha of NPKSZnB (FRG 2005)

Table 2. Yield of groundnut, onion and groundnut equivalent yield at different fertilizer management options at the MLT site, Hossainpur Kishoreganj during 2007-08

Treatment	Yield (t/ha)		Groundnut equivalent yield (t/ha)
	Groundnut	Onion	
T_1	2.07	3.33	3.74
T_2	2.15	3.77	4.04
T_3	2.06	3.27	3.70

Table 3. Cost and return analysis of groundnut intercropping with onion at different fertilizer management options at the MLT site, Hossainpur Kishoreganj during rabi 2007-08

Treatment	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)
T_1	112050	43253	68797
T_2	121050	43654	77396
T_3	110850	43308	67542

Price of inputs (Tk/kg): Urea : 6.00, TSP : 28.00, MP : 24.00, Gypsum :7.00, Zinc sulphate 65.00, Alpha Boron : 190.00, Groundnut seed : 120.00, Onion seedling : 40.00.
Price of inputs (Tk/kg): Groundnut : 30.00, Onion : 15.00

Effect of Nutrient Management on Garlic under Zero Tillage Condition

Abstract

The experiment was carried out during 2007-08 at the MLT site, Atghoria, Pabna to find out optimum nutrient management for maximizing garlic yield under zero tillage condition and to increase economic return. The experiment was laid out in randomized complete block (RCB) design with three treatments and six dispersed replications. The highest bulb yield was attained in recommended fertilizer dose (T_2) which was significantly different to soil test based (T_1) and farmers practice (T_3). The highest gross return (Tk. 280500/ha) and gross margin (Tk. 217741/ha) were also recorded in recommended fertilizer dose.

Introduction

Garlic is one of the important spices crop in Bangladesh. In Pabna region, it is mainly grown on upland condition with intensive management. But in the past few years, farmers of the northern upazilas of Pabna are growing garlic with zero tillage condition just after receding of flood water especially in the low lying areas. The area coverage under this practice is increasing day by day. But farmers harvest smaller bulbs and are not getting optimum production probably due to lack of proper nutrient and agronomic management. Optimum fertilization may provide necessary nutrients to the plants for better bulb growth and development resulted higher yield of garlic. Keeping these views, the experiment was carried out with following objectives.

i) To find out optimum nutrient management for maximizing garlic yield under zero tillage condition
ii) To increase economic return
iii) To see farmers reaction

Materials and Methods

The experiment was carried out during 2007-08 at the MLT site, Atghoria, Pabna. Before starting the experiment, initial composite soil samples (0-15 cm depth) were collected from the experimental plots and were analyzed. The analytical result indicated that the soil was clay loam with very low organic matter content (0.57%) and neutral (pH-6.8) in nature. Nitrogen (0.18%) was low and P (13.0 $\mu g\ g^{-1}$ soil), K (0.22 meq/100g) and B (0.40 $\mu g\ g^{-1}$) was medium. S (48.0 $\mu g\ g^{-1}$) and Zn (6.0$\mu g\ g^{-1}$) content of the soil was very high. The experiment was laid out in randomized complete block (RCB) design with six dispersed replications. The unit plot size was 6m × 5m. Three different nutrient managements viz. T_1: Soil test based for high yield goal (60-28-43-105-0-0 kg NPKSZnB/ha), T_2: Recommended dose (161-50-130-27-3-0 kg NPKSZnB/ha + CD 5 t /ha), T_3: Farmers practice (70-63-76-41-4-0 kg NPKSZnB/ha) were tested for the crop. The bulb of garlic (var. local) was sown on October 27, 2007. Two times irrigation were applied at first week of December and January. Fungicide was applied two times for the control of purple blotch diseases. Standard crop management practices were used for maintain the productivity of the crop. The crop was harvested on March 24, 2008. All necessary data were collected and analyzed statistically.

Results and Discussion

The parameters like plant height and plant population were found statistically identical (Table 1).The bulb diameter was obtained significant difference among the treatments. The highest bulb diameter was observed in recommended fertilizer dose (T_2). The highest bulb yield was attained in recommended fertilizer dose (T_2) which was significantly different to soil test based fertilizer dose for high yield goal (T_1) and farmers practice (T_3). This highest yield may be obtained due to balance supply of nutrient from organic and inorganic source of recommended fertilizer dose. However, STB fertilizer dose gave identical yield with farmers practice.

Maximum gross return as well as gross margin were was recorded from recommended fertilizer dose (T_2) which was followed by soil test based fertilizer dose for high yield goal fertilizer dose and farmers' dose (Table 2).

Farmers' reaction

Pre expectations	Post implementation achievements
Higher yield	Farmers achieved comparatively large sized bulb and higher yield than traditional production
Lower cost of cultivation	More or less similar

Farmers learned from this research work that less seed is required for cultivation if they maintain line sowing and it could reduce cultivation cost. In addition to that, proper fertilizer management and line sowing produced comparatively large bulb and higher yield and economic return.

Conclusion

The result revealed that among the tested fertilizer management, recommended dose attributed to the highest garlic yield. Probably balanced nutrient uptake from organic and inorganic sources and line sowing promoted bulb growth and development resulted in bigger sized bulb and the maximum bulb yield. It also indicated that garlic grown with recommended fertilizer management under zero tillage condition found economically viable.

Table 1. Yield contributing characters and yield of garlic affected by nutrient management under zero tillage condition at the MLT site, Atghoria, Pabna during 2007-08

Treatments	Plant height (cm)	Plant population /m^2 (no.)	Diameter (cm)	Bulb yield (t/ha)
T_1: HYG (soil test based)	73.92	59.40	3.62	8.68
T_2 : Recommended dose	74.28	61.60	3.76	9.35
T_3 : Farmers' dose	73.68	62.40	3.54	8.36
LSD (0.05)	NS	NS	0.12	0.51
CV (%)	7.57	8.47	5.30	9.93

Table 2. Cost and return analysis of garlic as affected by different dose at the MLT site, Atghoria, Pabna during 2007-08

Treatments	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)
T_1: HYG (soil test based)	260400	56895	203505
T_2 : Recommended dose	280500	60759	219741
T_3 : Farmers' dose	250800	59949	190851

Effect of Bio-slurry as of Organic Manure on Tomato

Abstract

A field experiment was conducted at the MLT site, Pakshi, Pabna, Jessore sadar and the FSRD site, Rangpur during 2007-08 to see the performance of bio-slurry and inorganic fertilizer on tomato. Three nutrient management packages viz. inorganic fertilizer, IPNS with cowdung/poultry manure and IPNS with cowdung slurry/poultry slurry along with farmers' dose and native fertility were tested on tomato. The yield and yield components of tomato were significantly influenced by the different nutrient management packages. The highest yield was obtained from IPNS with cowdung slurry in Jessore. Significant yield variation was not found between poultry slurry and poultry manure in Pabna and Rangpur. Higher economic return was recorded from the treatment where slurry (cowdung or poultry) was used.

Introduction

Depletion of soil organic matter is a major constraint for higher crop productivity in Bangladesh. A good soil should have an organic matter content of at least 2.5% (FRG 2005). But in Bangladesh, most soils have less than 1.7% percent, and some soils have even less than 1% organic matter. The average organic matter content of top soils has decline by 20-46% over past 20 years due to intensive cropping without inclusion of legume crops, imbalance use of fertilizer, use of modern varieties and scanty use of manure. So gradually degradation of soil fertility status of the country is now becoming a critical issue. Bhuiyan (1991) reported yield of several crops are declining in some soils. So the maintenance of organic matter is a burning issue both for the farmers and agricultural scientists. Biogas is going to be popular in Bangladesh due to high cost of fuel. Huge amount of bio-slurry may come out from this plant and it can be used as an excellent organic fertilizer. Bio-slurry improved the physical and biological quality of soil besides providing both macro and micro-nutrients to crops. These improve in water holding capacity, cation exchange capacity, lesser soil erosion and provision of nutrients to plants and soil micro-flora including fixing and phosphorous solublizing organisms. In addition, bio-slurry is free of weed seeds.

Balanced fertilization is a prerequisite for exploiting optimum yield potentials of high yielding vegetable. The beneficial effect of organic manure in vegetables production has been demonstrated by many workers (Joshi et. al. 1994; Batsai et al 1979; Singh *et al.*, 1970 and Subhan, 1991). Research work on the bio-slurry is lacking in our country. Tomato is one of the important and popular vegetables in winter. Therefore, it is very important to evaluate the effect of bio-slurry on tomato.

Materials and Methods

A field experiment was conducted at the MLT site, Pakshi, Pabna, Jessore sadar and at the FSRD site, Rangpur during 2007-08. The soil of the experiment field was analyzed in the laboratory. Nutritional status of the initial soil of different locations is presented in Appendix Table 1. The experiment was conducted with randomized complete block design with three dispersed replications. Treatments were T_1: Soil test based fertilizer dose for high yield goal, T_2: IPNS basis fertilizer dose for HYG with 5 t/ha cowdung or 3 t/ha poultry manure T_3: IPNS basis fertilizer dose for HYG with 5t/ha cowdung slurry or 3 t/ha poultry slurry, T_4: Farmers practices and T_5: Native fertility. The detailed treatments are presented in the following table. Nutritional status of cowdung/poultry manure and cowdung/ poultry slurry is presented in the Appendix Table 2. The levels of the fertilizers were selected on the basis of high yield goal as per Fertilizer Recommendation Guide, 2005. Full doses of cowdung/ poultry manure or cowdung/poultry slurry, and all other inorganic fertilizers were applied according to individual plot and mixed with soil at the time of find land preparation. Urea was top dressed at 15, 30 and 42 DAS. The unit plot size was 5 m x 4 m. Tomato variety were planted on last week of November to 2nd week of December 2007. Intercultural operations viz. earthling up, weeding, irrigation, fungicide and insecticide spray were done in order to support normal plant growth. Data on yield and yield contributing characters of tomato were recorded. All the data were statistically analyzed.

Table 1. Fertilizer dose (kg/ha) for tomato in different locations

Treatment	(N-P-K-S-Zn-B + CD/PM manure or CD/PM slurry)		
	Pabna	Rangpur (cowdung based)	Rangpur (poultry based)
T_1	107-34-31-11-2-0.4	150-40-140-30-4-1	150-40-140-30-4-1
T_2	77-15-10-11-2-0.4+3000 PM	144-38-138-30-4-1-5000	144-38-138-30-4-1-3000
T_3	77-3-10-11-2-0.4+3000 PS	137-33-115-30-4-1-5000	115-8.5-119-30-4-1-3000
T_4	173-72-90-32-12-2.3	101-34-62-9-2000	101-34-62-9-2000
T_5	0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0-0

PM : Poultry manure, PS : Poultry slurry, CD : Cowdung, CDS : Cowdung slurry

Results and discussions

Pabna

The yield and yield contributing characters were significantly differed among the treatments (Table 2). Higher tomato yield was attained in IPNS with 3 t/ha poultry slurry (T_3) which is statistically similar with IPNS with 3t/ha poultry manure (T_2). The cumulative effect of fruit/plant, weight/fruit and fruit weight/plant might have significant contribution to attain the yield. The second highest yield was obtained from IPNS with 3 t/ha poultry manure (T_2). The lowest yield obtained from native fertility plot.

From economic analysis, it is revealed that the highest gross margin and MBCR were obtained from IPNS with 3 t/ha poultry slurry (T_3) due to higher gross return and less variable cost, which was followed by T_2 nutrient packages (Table 3).

Jessore

Yield components of tomato responded significantly to different fertilizer treatments (Table 4). Different nutrient options did not influenced on the plant height of tomato. The highest number of fruits/plant (101.4) was found in treatment T_3 where IPNS based fertilizer dose with cowdung slurry used. Higher fruits weight per plant was obtained from T_3 treatment which was significantly differ with all other treatments. Higher fruit yield/plant (2.37kg) was recorded in T_3 which was statistically identical to that of T_1 but differed with all other treatments. Second highest tomato yield was observed in treatment T_2. Higher yield was obtained due to higher number of fruits/plant and fruit weight/plant. This might be due to proper combination of organic and inorganic fertilizer. The result is in agreement with Islam *et al.* (1997) who reported that fruit yield of tomato was increased with proper combination of organic and inorganic fertilizer. The efficiency of cowdung slurry found superior than cowdung.

The economic analysis of the experiment exhibited that treatment T_3 produced the highest net return Tk. 326321/ha. The second highest gross margin, Tk. 292940/ha was recorded from treatment T_2 and the lowest Tk. 60,000/ha in control. This variation occurred due to the variation of fruit yield of tomato. The highest BCR was found in T_3 that was followed by T_2 and T_1, respectively.

Rangpur

Significant effect of cowdung slurry was found on tomato (Table 5). The highest yield was obtained from the application of IPNS based fertilizer with cowdung slurry (T_3) followed by IPNS with cowdung manure (T_2). Statistically similar yield was found in inorganic fertilizer and farmers' practice. The variation of yield was due to yield contributing characters (fruits/plant) and fruit weight per plant. In case of poultry based treatments. Significant variation was not found between the applications of IPNS with poultry slurry (T_3) and IPNS with poultry manure (T_2) in terms of yield and yield contributing characters of fruit/plant, weight/fruit and fruit weight/plant. However higher yield was obtained from IPNS with poultry slurry.

Gross return, gross margin and BCR were higher in the treatment T_3 where slurry (cowdung/poultry) was used

Farmers' reaction

Pabna: Farmers are happy to have a good yield and good fruit quality.

Jessore: Farmers are very satisfied with the higher yield and positive effect of cowdung slurry. They agreed that, they could be benefited from this technology. They also opined that in future they will be use cowdung slurry for tomato cultivation.

Rangpur: Farmers are satisfied with higher yield with slurry low fertilizer cost of slurry treatment compare to chemical treatment. Healthy plant and long duration of green colour was found from bio slurry treated plots.

Conclusion

IPNS based fertilizer options (both cowdung/poultry manure and cowdung/poultry slurry) showed better than inorganic fertilizer. Usually slurry remained unused, if it promotes to use in crop production like other manure they could use and buy it in future. That was first year result, further investigation is needs in the next year.

References

Batsai, S.T., Polyakev, A.A. and Nedbal, R.F. 1979. Effect of organic and mineral fertilizes on the yield and quality of irrigated late white cabbage in the steppe region of the Crimea. Hort. Abst. 49(11):730.

Bhuiyan, M.I. 1991. Issuer concerning declining stagnating productivity in Bangladesh Agriculture. A paper presented at the National workshop on Risk Management in Bangladesh Agriculture, held BARC, Dhaka. Bangladesh. August, 1991. 24-27.

Islam, M.A., Farooque, A.M., Siddiqua, A. and Siddiquea, A. 1997. Effect of planting patterns and different nitrogen levels on yield and quality of tomato. Bangladesh J. Agril. Sci. 24(i): 9-15. Joshi, J.R., Moncrief, J.F., Swan, J.B. and Malzer, G.L. 1994. Soil Till. Res. 31:225.

Robin, C.M. 1949. Poultry manure as a fertilizer for vegetable crops. Dept. Agril. Expt. Stn. Bull. 281.

Singh, K., Gill, J.S. and Verma, O.P. 1970. Studies on poultry manure in relation to vegetables production. Indian. J. Hort. 27:42-47.

Subhan, 1991. Effect of organic materials on growth and production of cabbage. Soils and Fert. Vol. 54 (4): pp 587.

Table 2. Effect of bio-slurry as organic manure on yield and yield contributing characters of Tomato at the MLT site, Pakshi, Pabna during 2007-08

Treatments	Fruits/plant (no.)	Fruits wt. /plant (kg)	Weight/fruit (g)	Fruit yield (t/ha)
T_1: STB inorganic fertilizer for HYG	21.09	1.48	70.29	44.47
T_2: IPNS with 3 t/ha PM	29.31	2.09	71.50	62.80
T_3: IPNS with 3 t/ha PS	29.37	2.21	75.31	66.34
T_4: Farmers practice	23.91	1.80	75.31	54.03
T_5: Native fertility	14.49	1.05	74.34	31.66
LSD (0.05)	2.82	0.29	NS	9.03
CV (%)	6.35	9.16	5.49	9.25

Table 3. Cost and return analysis of Tomato as influenced by bio-slurry at the MLT site, Pakshi, Pabna during 2007-08

Treatments	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over native fertility)
T_1 : STB inorganic fertilizer for HYG	155645	54030	101615	4.60
T_2 : IPNS with 3 t/ha PM	219800	53744	166056	11.51
T_3 : IPNS with 3 t/ha PS	232190	50433	181757	19.71
T_4 : Farmers practice	189105	67807	121298	3.33
T_5 : Native fertility	110810	44275	66535	-

Price of input (Tk/kg) : Urea 6.50, TSP 28.00, MP 35.00, Gypsum 08.00, Zinc oxide 70.00, Borax 65.00, Poultry manure 1.50, Poultry slurry 1.00

Price of out put (Tk/kg) : Tomato 3.50

Table 4. Effect of bio-slurry on yield and yield attributer of tomato at Jessore during 2007-08

Treatments	Plant height (cm)	Fruits/ plant (no)	Fruits weight/ plant (kg)	Yield (t/ha)
T_1: STB inorganic fertilizer for HYG	101.03a	83.0b	1.93b	67.08b
T_2 : PNS with 5t/ha CD	105.0a	87.8b	2.19a	69.51b
T_3: T_3 IPNS with 5t/ha CD slurry	105.3a	101.4a	2.37a	74.87a
T_4: Farmers practice	100.4a	85.9b	1.93b	62.52b
T_5: Native fertility	55.20b	41.2c	0.65c	27.50c
CV(%)	5.46	9.10	6.71	9.63

Table 5. Cost and return analysis of tomato as influenced by bio-slurry at Jessore during 2007-08

Treatments	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1: STB inorganic fertilizer for HYG	402480	125860	276620	3.20
T_2 : PNS with 5t/ha CD	417060	124120	292940	3.36
T_3: T_3 IPNS with 5t/ha CD slurry	449220	122899	326321	3.66
T_4: Farmers practice	375120	139500	235620	2.68
T_5: Native fertility	165000	105000	60000	1.57

Price of input (Tk/kg) : Tomato-6.0, Urea-6.5.0, TSP-30.0, MP-30.0, Gypsum,-5.0, Zinc sulphate- 120.0, Boric acid-110.0, Cowdung-1.0 and cowdung slurry-1.0.

Table 6. Effect of Bio-slurry on yield of tomato production at the FSRD site, Lahirirhat, Rangpur during 2007-08

Treatment	Fruit/plant (no)		Fruit wt./plant (kg)		Yield (t/ha)	
	Cow dung based	Poultry Based	Cow dung based	Poultry Based	Cowdung based	Poultry Based
T_1: STB inorganic fertilizer for HYG	38.4c	23.5b	2.85c	2.35b	85.89c	78.3b
T_2 : PNS with 5t/ha CD	43.7b	31.9a	2.91b	3.08a	96.83b	102.5a
T_3: T_3 IPNS with 5t/ha CD slurry	48.8a	31.4a	3.14a	3.15a	104.67a	105.0a
T_4: Farmers practice	37.9c	21.4b	2.43c	2.35b	80.88c	67.2b
T_5: Native fertility	26.8d	12.5c	1.59d	1.23c	52.95d	36.2c
CV (%)	6.2	13.8	6.1	5.6	6.1	11.3

Table 7: Cost and return of bio-slurry on yield of potato production at the FSRD site Lahirirhat, Rangpur during 2007- 08

Treatment	Gross return (Tk/ha)		Total production Cost (Tk/ha)		Net return (Tk/ha)		Benefit Cost Ratio	
	CDB	PB	CDB	PB	CDB	PB	CDB	PB
T_1: STB for HYG	429450	391500	109786	108521	319664	282979	3.91	3.61
T_2: IPNS with CD/PM	484150	512500	118383	116574	365767	395926	4.09	4.40
T_3: IPNS with CD/PM slurry	523350	525000	115097	110808	408253	414192	4.55	4.74
T_4: Farmers practice	404500	336000	102155	99875	302345	236125	3.96	3.36
T_5: NF	264750	181000	80565	77773	184185	103227	3.29	2.33

CD: Cowdung Based, PB: Poultry Based, STB: Soil Test Based Fertilizer Dose, IPNS: Integrated Plant Nutrient System Based Fertilizer Dose, FP: Farmer Practice and NF: Native Fertility, HYG : High yield goal, PM: Poultry manure, PS : Poultry slurry

Effect of Bio-slurry as a Source of Organic Manure on Cabbage

Abstract

The experiment was carried out at the MLT site, Dhirashram, Gazipur, Tangail sadar, Pakshi, Pabna and Jessore sadar during the rabi season of 2007-08 to see the comparative performance of bio-slurry with inorganic fertilizer on cabbage. Three nutrient management packages viz. inorganic fertilizer, IPNS with cowdung/poultry manure and IPNS with cowdung/poultry slurry along with farmers' dose and native fertility were tested on cabbage significant yield variation was not found between the cowdung manure and cowdung slurry in Tangail and Jessore. Nutrient packages showed similar yield in Gazipur. The yield from inorganic fertilizer was statistically similar with cowdung manure in Pabna. Higher economic return was recorded in the treatment where slurry was used in all locations.

Introduction

In Bangladesh, major food crops remove about 2.98 m tons of nutrients annually against a total addition of 0.72 m ton. According to an appraisal report of Bangladesh soil resources, soils of about 6.10 m ha contain very low (less than 1%) organic matter, 2.15 m ha contain low (1-2%) organic matter and the remaining 0.90 ha contain more than 2 % organic matter (Mondal, 2000).

The organic matter content as well as the fertility status of Bangladesh soil is low. Now it is well agreed that depleted soil fertility is a major constrain for higher crop production in Bangladesh and indeed, yield of several crops are declining in some soils (Bhuiyan, 1991). Maintenance of soil fertility is a prerequisite for long term sustainable agriculture and it is certain that organic manure (cowdung, poultry manure and their slurry) can play a vital role in the sustainability of soil fertility and crop production. Bio-slurry can be used as an excellent organic fertilizer. Fertilizer crisis is a burning issue across the country. Use of bio-slurry can play a vital role to minimize the fertilizer crisis. Moreover as organic manure bio-slurry may help soil fertility in the long run. Research work on the bio-slurry is lacking in our environment. Therefore, it is very important to evaluate the efficiency of bio-slurry on performance on cabbage. Keeping the above point in view the present study was undertaken with the objectives i) to see the effect of bio-slurry on the performance of cabbage, ii) To compare performance of bio-slurry or slurry compost with inorganic fertilizer and iii) to find out the optimum and economic dose of bio-slurry for cabbage.

Materials and Methods

The experiment was carried out at the MLT site, Dhirashram, Gazipur, Tangail sadar, MLT site, Pakshi, Pabna and Jessore sadar during the rabi season of 2007-2008. The experiment was laid out in RCB design with three replications. Unit plot size was 5m x 8m.

Five different treatments were:
T_1: Soil test based (STB) inorganic fertilizer for high yield goal
T_2: IPNS with cowdung manure or poultry manure for high yield goal
T_3: IPNS with cowdung slurry or poultry slurry for high yield goal
T_4: Farmers dose
T_5: Native fertility (no fertilizer used)

The detailed treatments are presented in the Table 1. Fertilizers were applied as per treatment based on soil analysis and BARC fertilizer recommendation guide 2005.The seedling of cabbage (var. autumn queen) was planted on 7-15 November 2007 in Gazipur, 30 November 2007 in Pabna and 4 November 2007 in Tangail. The entire amount of CD, PM, PM slurry, P, S, B and one half of K were applied during final land preparation. Total amount of urea and remaining one half of K were applied as top dress in three equal splits at 7-10, 25-30 and heading formation stage. Thirty five days old seedlings of cabbage were transplanted at a spacing of 60cm x 60cm. Intercultural operations such as weeding, irrigation and pest control measures were done in order to maintain the normal crop growth. Irrigation was given six times. The crops were harvested on 20-25 February 2008 in Gazipur, 5-6 March 2008 in Pabna and 1-8 February 2008 in Tangail 31 January to 24 February 2008 in Jessore. Data on yield and yield attributes along with other parameters were collected properly and subjected to statistical analysis.

Table 1. Fertilizer dose (kg/ha) for in different locations

Treatment	(N-P-K-S-Zn-B + CD/PM manure or CD/PM slurry)		
	Gazipur	Tangail	Pabna
T_1	218-12-137-31-1	74-8-40-5-0.5	161-98-25-23-4-0.53
T_2	186-12-116-31-1+ 3000 PM	53-6-25-3-0.37+ 5000 CD	146-93-10-23-4-0.53+ 3000 CD
T_3	181-12-116-31-1 + 3000 PS	53-6-25-3-0.37+ 5000 CDS	139-91-0-23-4-0.53+3000 CDS
T_4	98-62-47-19-0 + 8000 CD	42-4-15-2-0.3	242-72-90-32-12-2.3
T_5	0-0-0-0-0-0	0-0-0-0-0	0-0-0-0-0-0

PM : Poultry manure, PS : Poultry slurry, CD : Cowdung, CDS : Cowdung slurry

Results and Discussion

Gazipur

Yield attributes characters like head length, head breath, weight per plant were higher in the treatment where poultry slurry was used (T_3) but it was statistically similar to the other two nutrient management packages inorganic fertilizer (T_1) and IPNS with PM (T_2) and even farmers dose (T_4) (Table 2). Same trend was found in marketable weight per plant. The yield contributing characters influenced on the yield. Although yield did not varied significantly among the nutrient packages and farmers dose but the yield of the treatment T_3 was about 15 % higher than treatment T_1, T_2 and T_4. The entire nutrient management packages and farmers dose showed significantly higher yield than the native fertility.

Gross return was associated with the total production (Table 3). Higher gross return was found in the treatment T_3 due to higher yield. Due to application of huge amount of phosphorus and higher amount of cowdung the variable cost was higher in farmers' dose (T_4). Net return and BCR were higher in the treatment T_3 where poultry slurry was used and less fertilizer cost involved.

Tangail

Table 4 reveals that the highest individual head weight. (2633 g) was recorded from the plant treated with IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry, which was at par with IPNS base fertilizer dose for HYG with (5 t/ha) cowdung (2477 g). The lowest individual head weight (870 g) was recorded from the plots received no fertilizer (native fertility). Higher yield (87.77 t/ha) was obtained from the plot treated with IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry (T_3) and it was at par with the plots treated with fertilizer dose for HYG with 5 t/ha cowdung (82.55 t/ha). The lowest yield (29.00 t/ha) was recorded from plants of native fertility (T_5). Similar trend was also obtained in cost and return analysis (Table 4.). The highest gross return (175533 Tk/ha) and MBCR (3.88) were obtained from plants treated with IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry (T_3). The lowest gross return and BCR was from native fertility plot.

Pabna

The yield and yield contributing characters were significantly difference among the treatments (Table 5). Higher cabbage yield was attained in IPNS with 3 t/ha cow dung manure (T_2) followed by high yield goal (T_1). The cumulative effect of plant height, head length, head breath and weight/cabbage might have significant contribution to achieve highest yield. Integrated plant nutrient systems with 3 t/ha cowdung slurry and farmers practice gave statistically similar yield. Because in farmers practice they used about 80 kg and 65 kg higher N and K/ha, respectively than high yield goal treatment. The lowest yield obtained from native fertility plot.

From economic analysis, it was revealed that the highest net return was obtained from IPNS with 3t/ha cow dung manure (T_2) due to higher gross return, which was followed by T_1 and T_3 nutrient packages. Though the farmer practice gave similar yield with T_3 treatment but the MBCR was lower than T_3 treatment due to its higher total variable cost.

Jessore

Head yield of cabbage was significantly influenced by different treatments (Table 7). Application of organic manure, from cowdung slurry with inorganic fertilizer increased the yield of cabbage significantly. Higher yield was obtained from T_3 treatment which was identical to T_2 treatment. The efficiency of cowdung slurry proved superior to other treatments. The highest head height was recorded from T_3 treatment which was identical with T_2 treatment but significantly differ other treatments. The lowest head height was recorded from T_5 i.e., absolute control plot. Cowdung slurry exhibited better response than other treatments it may be attributed to the release of nitrogen, the first limiting essential nutrient, which was readily available to the plants through cowdung slurry.

The highest net return (Tk 232750/ha) and benefit cost ratio (3.49) was also obtained by T_3 treatment due to higher yield followed by T_2 treatment and it was lowest in T_5 (net return 37500 Tk./ha and benefit cost ratio 1.47) treatment (Table 8).

Farmers' reaction

Gazipur: Farmers are highly pleased with the higher yield and positive effect of poultry slurry

Tangail: Farmers' showed their keen interest regarding the use of Bio-slurry as organic manure. But they opined that biogas plants are not easy available due to its higher cost involvement in establishment.

Pabna: Farmers are pleased to bio-slurry treatment comparing chemical fertilizer. Usually slurry remained unused, farmers are ready to bye if it use as manure.

Jessore: Farmers are highly pleased with the higher yield and positive effect of cowdung slurry. They opined that in future they will use cowdung slurry for their crops production

Conclusion

Fertilizer crisis is a burning issue across the country. Use of bio-slurry can play a vital role to minimize the fertilizer crisis. Moreover as organic manure bio-slurry may help soil fertility in the long run. As one year experiment, it needs to repeat in the second year for further conclusion.

References

Bhuiyan, N. I. 1991. Issues concerning declining/stagnating productivity in Bangladesh Agriculture. A paper presented at the National workshop on Risk Management in Bangladesh Agriculture, held at BARC, Dhaka. Bangladesh, August, 1991. 24-27.

FAO, 1986. A resource manual on fertilizer use, Field document No. 4. DAE-FAO, Dhaka, 1986. P. 48.

Mondal, M. H. 2000. Agricultural Research in Bangladesh in the 21st century: Challenges and opportunities. Shoronika, BARISHA. 2000. P. 24.

Robin, C. M. 1949. Poultry manure as a fertilizer for vegetable crops. Dept. Agril. Expt Stn. Bull. 281.

Singh, K., J. S. Gill and O. P. Verma. 1970. Studies on poultry manure in relation to vegetable production. Indian J. Hort. 27: 42-47.

Subhan. 1991. Effect of organic materials on growth and production of cabbage (*Brassica oleracea* L.). Soils and Fert. 54(4): 587.

Table 2. Yield and yield attributes of cabbage as influenced by different treatments at MLT site, Dhirashram, Gazipur during 2007-08

Treatment	Plant ht. (cm)	No. of leaves per plant	Head length (cm)	Head breath (cm)	Weight/ plant (kg)	Marketable weight/ plant (kg)	Yield (t/ha)
T_1	42.22b	16.30b	13.64ab	23.54a	3.13a	2.68a	85.52a
T_2	42.52b	16.7 4ab	13.74ab	24.30a	3.14a	2.70a	84.95a
T_3	46.27a	17.81a	14.01a	24.67a	3.57a	3.06a	98.10a
T_4	41.34b	17.25ab	12.88b	23.86a	3.10a	2.67a	84.80a
T_5	18.17c	7.16c	5.35c	6.56b	0.89b	0.54b	13.69b
CV (%)	7.18	6.91	6.54	8.38	0.89	9.61	8.69

T_1 : STB basis HYG, T_2 : IPNS with 3 t/ha Poultry manure, T_3 : IPNS with 3 t/ha poultry slurry, T_4 : Farmers practices, T_5 : Native fertility

Table 3. Cost and return analysis of cabbage as influenced by different treatments at MLT site, Dhirashram, Gazipur during 2007-08

Treatment	Gross return (Tk./ha)	Total cost of production (Tk./ha)	Cost of fertilizer (Tk./ha)	Net return (Tk./ha)	BCR
T_1	342080	79133	10133	262947	4.32
T_2	339800	79919	10919	259881	4.25
T_3	392400	78507	9507	313893	4.99
T_4	339200	81748	12748	257452	4.14
T_5	54760	69000	0	-14240	0.79

Table 4. Yield, cost and return analysis of cabbage as influenced by bio-slurry (cowdung) at Tangail sadar during 2007-08

Treatments	Individual head wt. (g)	Yield (t/ha)	Gross return (Tk./ha)	Variable cost (Tk./ha)	Gross margin (Tk./ha)	MBCR
T_1	2162	72.05	144113	61108	86933	3.63
T_2	2477	82.55	165107	67700	97407	3.53
T_3	2633	87.77	175553	67700	107853	3.88
T_4	1625	54.17	108340	59460	48880	2.28
T_5	870	29.00	58000	37400	20600	-
LSD (0.05)	212	7.07				
CV (%)	5.8	5.8				

T_1 : STB basis HYG, T_2 : IPNS with 5 t/ha cowdung manure, T_3 : IPNS with 5 t/ha cowdung slurry, T_4 : Farmers practices, T_5 : Native fertility

Price of in put (Tk/kg): Urea 6.00, USG 6.50, MP 35.00, TSP 40.00, Gypsum 7.00, Cowdung 1.50, Bio-slurry 2.00

Price of output (Tk/kg): 3.50

Table 5. Effect of bio-slurry as organic manure on yield and yield contributing characters of cabbage at the MLT site, Pakshi, Pabna during 2007-08

Treatments	Plant height (cm)	Leaves plant (no.)	Head length (cm)	Head breath (cm)	Weight cabbage (kg)	Cabbage yield (t/ha)
T_1 : HYG	32.00ab	7.17a	14.78a	23.95a	3.15ab	119.90a
T_2 : IPNS with 3 t/ha CD manure	32.57a	7.00a	14.98a	24.07a	3.33a	120.31a
T_3 : IPNS with 3 t/ha CD slurry	28.83c	6.67a	15.28a	23.22a	2.95b	111.93b
T_4 : FP	30.07bc	6.93ab	14.83a	23.27a	2.94b	111.34b
T_5 : Native fertility	23.90d	5.93b	12.97b	19.43b	1.94c	74.07c
CV (%)	3.53	8.32	3.37	4.53	5.39	8.79
LSD	1.96	1.06	0.92	1.95	0.29	2.91

Table 6. Cost and return analysis of cabbage as influenced by bio-slurry at the MLT site, Pakshi, Pabna during 2007- 08

Treatments	Gross return (Tk/ha)	Total production cost (Tk/ha)	Net return (Tk/ha)	MBCR (over native fertility
T_1 : Inorganic fertilizer for HYG	209825	87057	122768	3.95
T_2 : IPNS with 5 t/ha CD manure	210542	87539	123003	3.90
T_3 : IPNS with 5 t/ha CD slurry	206377	86355	120022	3.92
T_4 : FP	194845	91424	103421	2.65
T_5 : Native fertility	129622	66767	62855	

Price of input (Tk/kg) : Urea 6.50, TSP 28.00, MP 35.00, Gypsum 08.00, Zinc oxide 70.00, Borax 65.00
Cowdung compost (CD): 0.50, Cowdung slurry (CDS) : 0.50
Price of out put (Tk/kg) : Cabbage 1.75

Table 7. Effect of bio-slurry on yield and yield attributes of cabbage in Jessore during 2007-08

Treatments	Head height (cm)	Head pericycle (cm)	Head wt. (kg/plant)	Marketable head wt. (kg/plant)	Yield (t/ha)
T_1: Inorganic fertilizer for HYG	13.53b	52.59a	1.42b	1.21a	55.73b
T_2 :IPNS with 5 t/ha CD manure	13.78ab	53.10a	1.53a	1.28a	63.78a
T_3 : IPNS with 5 t/ha CDS	14.60a	54.30a	1.57a	1.36a	65.21a
T_4: Farmers practice	13.60b	52.40a	1.38b	1.18a	57.55b
T_5:Native fertility	8.80c	30.20b	0.65c	0.50b	23.50d
CV(%)	5.41	6.60	7.32	5.89	11.18

Table 8. Cost and return analysis of cabbage as influenced by bio-slurry at Jessore during 2007-08

Treatments	Gross return (Tk./ha)	Production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1: Inorganic fertilizer for HYG	278650	95827	182823	2.91
T_2 :IPNS with 5 t/ha CD manure	318900	94246	224654	3.38
T_3 : IPNS with 5 t/ha CDS	326050	93300	232750	3.49
T_4: Farmers practice	285250	101975	183275	2.80
T_5:Native fertility	117500	80000	37500	1.47

Price (Tk./kg) : Cabbage-5.0, Urea-6.5.0, TSP-30.0, MP-30.0, Gypsum,-5.0, Zinc sulphate- 120.0, Boric acid-110.0, Cowdung-1.0 and Cowdung slurry-1.0.

Effect of Bio-slurry as of Organic Manure in Cauliflower

Abstract

An experiment was conducted in the medium highland irrigated situation at the MLT site, Dhirashram, Gazipur, Tangail sadar, MLT site, Pakshi, Pabna during rabi 2007-08 to evaluate the efficiency of biogas-slurry in cauliflower production under farmers' field condition. Five nutrient management packages such as T_1: Soil test based fertilizer dose for high yield goal, T_2: IPNS basis fertilizer dose for HYG with 5 t/ha cowdung or 3t/ha poultry manure, T_3: IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry or 3t/ha poultry slurry, T_4: Farmers practices, T_5: Native fertility were considered. The highest yield was recorded from IPNS with 3t/ha poultry manure in Pabna. Yield variation was not found among the inorganic fertilizer, IPNS with 3t/ha poultry manure and IPNS with 3t/ha poultry slurry in Gazipur. Cowdung slurry could not show better performance over cowdung manure in Tangail. However, better economic performance was found in the treatment where slurry was used in all the locations.

Introduction

The gradual degradation of soil fertility status of the country is now becoming a crucial issue. More than 60% of our cultivated soil contains organic matter at low level (<1.7%). So, the maintenance of organic matter is a burning issue both for the farmers and agricultural scientists. Recycling of organic matter is essential for maintaining soil fertility. Recently government and different NGO established biogas plant in different parts of the country, Bio-slurry can be used as an excellent organic fertilizer. Cauliflower is one of the most profitable vegetable crops at Tangail. It requires high amount of organic manure. Research work on this crop with bio-slurry has not yet done. Therefore, a trial was conducted to evaluate the efficiency of bio-slurry on the performance of cauliflower.

Materials and Methods

The experiment was conducted under irrigated condition at the MLT site, Dhirashram, Gazipur, Tangail sadar and MLT site Pabna during rabi 2007-08. The experiment was laid out in RCB design with 3 replications. The unit plot size was 6m x 5m and planting spacing was 60 cm x 45 cm. Five different fertilizers packages were considered as treatments. They were T_1: Soil test based fertilizer dose for high yield goal (HYG) T_2 : IPNS basis fertilizer dose for HYG with 5 t/ha cowdung or 3 t/ha poultry manure T_3 : IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry or 3t/ha poultry slurry, T_4 : Farmers practices, T_5 : Native fertility (no fertilizer). Detailed treatments are presented at the following table. The seedling of the cauliflower variety Shiragiku were transplanting during 7th November to 15th November 2007 in Gazipur, 3 November 2007 in Tangail and 24 November 2007 in Pabna. Intercultural operations such as weeding, gap filling, irrigation, disease and other pest management were done as and when necessary. The crop was harvested during 20-25 February 2008 in Gazipur, 29 January to 10 February 2008 in Tangail and 11-13 February 2008 in Pabna. The data on different plant characters and yield component were recorded from selected and yield was recorded. Data were analyzed statistically. Cost and return analysis was also done.

Table 1. Fertilizer dose (kg/ha) for in different locations

Treatment	(N-P-K-S-Zn-B + CD/PM manure or CD/PM slurry)		
	Gazipur	Tangail	Pabna
T_1	163-12-102-24-1	74-10-30-5-0.57	107-56-49-18-3-0.4
T_2	133-12-81-24-1+ 3000 PM	67-7-21-3-0.4 + 5000 CD	77-37-28-18-3-0.4 + 3000 PM
T_3	128-12-81-24-1+ 3000 PS	67-7-21-3-0.4 + 5000 CDS	73-25-28-18-3-0.4 + 3000 PS
T_4	98-62-47-19-0+ 8000 CD	46-4-15-2-0.3	242-72-90-32-12-2.3
T_5	0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0-0

PM : Poultry manure, PS : Poultry slurry, CD : Cowdung, CDS : Cowdung slurry

Results and Discussion

Gazipur

Curd length and curd breadth did not vary among the nutrient management packages and farmers dose but significantly higher than native fertility (Table 2). Weight per plant did not varied among the treatment of T_1, T_2 and T_3 but those were statistically higher than farmers' dose and native fertility. Weight per plant was influenced on the yield. Higher yield was obtained in the treatment T_3 where poultry slurry was used. The yield of the treatment T_3 was 16, 9 and 14% higher than T_1, T_2 and T_4, respectively.

Total variable cost was similar among the nutrient management packages (Table 3). But it was higher in the farmers' dose due to application of huge amount of phosphorus and higher amount of cowdung that resulted less BCR. Net return as well as BCR was higher in the treatment T_3 where poultry slurry was used.

Tangail

Table 4 reveals that the highest individual head weight (1308 g) was recorded from the plant treated with (T_3) IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry, which was at per with (T_2) IPNS base fertilizer dose for HYG with (5 t/ha) cowdung (1289 g). The lowest individual head weight (628 g) was recorded from plots received no fertilizer (native fertility). The highest yield (43.61 t/ha) was obtained from the plot treated with IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry (T_3) and it was at par with the plots treated with fertilizer dose for HYG with 5 t/ha cowdung (42.98 t/ha). The lowest yield (20.94 t/ha) was recorded from plants of native fertility (T_5). Similar trend was also obtained in cost and return analysis (Table 4). The highest gross return (174440 Tk/ha) and gross margin (Tk 108551/ha) were obtained from plants treated with IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry (T_3). But MBCR was higher in treatment with inorganic fertilizer for high yield goal (T_1) due to less variable cost.

Pabna

The yield and yield contributing characters were significantly difference among the treatments (Table 5). The highest curd yield was attained in IPNS with 3 t/ha poultry manure (T_2) which is statistically different with rest of the treatments. The cumulative effect of weight/curd, curd length and curd breath might have significant contribution to attain highest yield. The second highest yield obtained from IPNS with 3 t/ha poultry slurry (T_3). The lowest yield obtained from native fertility plot.

From economic analysis, it was revealed that the highest marginal benefit cost ratio (5.30) was obtained from IPNS with 3 t/ha poultry slurry (T_3) due to lower variable cost, which was followed by T_2 nutrient package (Table 6). The T_2 nutrient package gave highest gross margin due to its higher yield.

Farmers' reaction

Gazipur: Farmers' showed their keen interest to poultry slurry.

Tangail: Farmers' showed keen interest regarding the use of bio-slurry as organic manure. But they opined that biogas plants were not easy available due to its higher cost involvement in establishment.

Pabna: Farmers' showed their positive attitude towards the bio-slurry as because slurry remained unused, if it promote to use in crop production like other manure they could use and buy it in future.

Conclusion

Biogas plant can be supplied simultaneously biogas and slurry. From economic point of view slurry is effective for cauliflower cultivation. The trial may be repeated in next year for concrete conclusion.

Table 2. Yield and yield attributes of cauliflower as influenced by different treatments at the MLT site, Dhirashram, Gazipur during 2007-08

Treatment	Plant height (cm)	No. of leaves per plant	Curd length (cm)	Curd breath (cm)	Whole plant weight (kg)	Marketable weight (kg)	Yield (t/ha)
T_1	60.08b	18.01b	14.15a	20.5ab	2.40ab	1.84b	59.66ab
T_2	61.10b	18.95b	14.87a	21.67ab	2.41ab	1.99ab	63.32ab
T_3	64.67a	20.82a	15.27a	22.52a	2.64a	2.18a	69.24a
T_4	60.10b	19.31b	13.48a	20.85a	2.36b	1.92b	60.77b
T_5	26.28c	7.72c	5.31b	5.50c	0.60c	0.37c	15.00c
CV (%)	7.44	5.40	7.46	5.47	6.5410.99	10.25	10.11

T_1 : STB basis HYG, T_2 : IPNS with 3 t/ha Poultry manure, T_3 : IPNS with 3 t/ha poultry slurry
T_4 : Farmers practices, T_5 : Native fertility

Table 3. Cost and return analysis of cauliflower as influenced by different treatments at Gazipur MLT site, Gazipur during 2007-08

Treatment	Gross return (Tk./ha)	Total cost (Tk./ha)	Fertilizer cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1	298300	77604	8604	220696	2.84
T_2	316600	77932	8932	238668	3.06
T_3	346500	77867	8867	268333	3.45
T_4	303850	82609	13609	221241	2.68
T_5	75000	69000	0	75000	1.09

Table 4. Yield and cost and return of cauliflower as influenced by bio-slurry cowdung at sadar MLT site, Tangail during 2007-08

Treatments	Individual curd wt. (g)	Yield (t/ha)	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR
T_1	1168	38.94	155760	60622	100138	4.61
T_2	1289	42.98	171920	65889	106031	4.22
T_3	1308	43.61	174440	65889	108551	4.34
T_4	937	31.22	124880	57180	67700	3.38
T_5	628	20.94	83760	45000	48760	-
LSD (0.05)	59.92	2.00				
CV (%)	3.0	3.00				

T_1: Soil test based fertilizer dose for high yield goal, T_2: IPNS basis fertilizer dose for HYG with 5 t/ha cowdung,
T_3: IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry, T_4: Farmers practices T_5: Native fertility

Price of in put (Tk/kg) **:** Urea 6.00, USG 6.50, MP 35.00, TSP 40.00, Gypsum 7.00, Cowdung 1.50, Bio-slurry 2.00,
Price of output (Tk/kg) : 6.00

Table 5. Effect of bio-slurry as organic manure on yield and yield contributing characters of cauliflower at the MLT site, Pakshi, Pabna during 2007-08

Treatments	Plant height (cm)	Curd length (cm)	Curd breath (cm)	Weight /curd (kg)	Curd yield (t/ha)
T_1: High yield goal (HYG)	46.67a	11.08a	17.96b	1.46b	55.77c
T_2: IPNS with 3 t/ha poultry manure	52.33a	11.75a	19.65a	1.74a	66.32a
T_3: IPNS with 3 t/ha poultry slurry	46.77a	11.23a	19.03a	1.60ab	60.98b
T_4: Farmer practice	47.67a	11.62a	18.83ab	1.52ab	58.06c
T_5: Native fertility	38.67b	9.28b	16.07c	1.08c	41.16d
LSD (0.05)	5.70	0.82	0.94	0.27	10.35
CV (%)	6.52	3.94	2.72	9.74	8.19

Table 6. Cost and return analysis of Cauliflower influenced by bio-slurry as organic manure at the MLT site, Pakshi, Pabna during 2007-08

Treatments	Gross return (Tk/ha)	Variable cost (only fertilizer) (Tk/ha)	Gross margin (Tk/ha)	Marginal benefit cost ratio over native fertility
T_1: High yield goal (HYG)	195195	14605	180590	2.50
T_2: IPNS with 3 t/ha PM	232120	14319	217801	5.15
T_3: IPNS with 3 t/ha PS	213430	11008	202422	5.30
T_4: Farmer practice	203210	24657	178553	1.40
T_5: Native fertility	144060	0	144060	-

Price (Tk/kg): Urea : 6.50, TSP : 28.00, MoP : 35.00, Gypsum : 08.00, Zinc oxide : 70.00, Borax: 65.00, Poultry manure (PM): 1.50, Poultry slurry (PS): 1.00Cauliflower : 3.50,

Effect of Bio-slurry as a Source of Organic Manure in Potato

Abstract

The experiment was conducted in Comilla sadar and the FSRD site, Lahirirhat, Rangpur during 2007-08 to observe the effect of bio- slurry on the potato production. Three nutrient management packages viz. inorganic fertilizer, IPNS with cowdung/poultry manure and IPNS with cowdung/poultry slurry along with farmers' dose and native fertility were tested on potato. The significant impact of poultry slurry on the yield of potato was found in Rangpur. In case of cowdung based treatments, no yield variation among the fertilizer options was found in Comilla. In Rangpur, the higher yield of cowdung based slurry was statistically similar with the framers' practice.

Introduction

Declining in soil fertility is a common scenario in Bangladesh though magnitudes vary in different Agro-Ecological Zones (AEZ). Decline soil fertility is used as deterioration in physical, chemical and biological properties. It occurs through a combination of lowering of soil organic matter and loss of nutrients. In Bangladesh, depletion of soil fertility is mainly due to exploitation of land without proper replenishment of plant nutrients in soils. A good soil should have an organic matter content of more than 3.5 per cent. But in Bangladesh, most soils have less than 1.7 percent and some soils have even less than 1% organic matter. The average organic matter content of top soils has decline by 20-46% over past 20 years due to intensive cultivation. To arrest further declination of soil fertility proper use of bio-slurry alone or in combinations with inorganic fertilizers may be good options. Proper utilization of bio-slurry in maintaining soil fertility needs research attention. Bio-slurry for its good quality plant nutrient value can be used successfully for crop production. But its effectiveness depends on cropping systems, crop variety to be used, soil types and agro-ecological regions. Neither slurry nor inorganic fertilizer alone is enough to meet demand of soil-crop systems. To find out most suitable combinations of slurry and inorganic fertilizers for major crops and cropping patterns grown in major AEZs needs on-farm research and verification. The area and production of potato is increasing over the years. So, the experiments were under taken to know the effect of bio- slurry on the potato yield and soil fertility.

Materials and Methods

The experiment was conducted in Comilla sadar and Lahirirhat, Rangpur during 2007-08. The Experiment was conducted in RCB design with three replications in each farmers plot. There were five treatments calculated by initial soil status and manure and bio-slurry nutrient supplement There were five treatments namely T_1: Inorganic fertilizer for high yield goal T_2: IPNS basis fertilizer dose for HYG with 5 t/ha cowdung or 3 t/ha poultry slurry, T_3: IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry or 3 t/ha poultry slurry, T_4: Farmers practice and T_5: Native fertility were tested. The unit plot size was 6mx 5m. Potato seed was planted 28 November in Comilla and 1st week of Dec. 07 in Rangpur with maintaining spacing 60 cm x 30 cm. Fertilizers were applied as per FRG 2005 of BARC and Thana Nirdeshika of SRDI. Half of N and all the fertilizer with cowdung, cowdung slurry applied as basal, remaining N was side dressed 30 DAS. Other management practices- plant protection measures, weeding, irrigation, earthing up and other intercultural operations were taken as and when necessary. The crops were harvested 1st week of March. Data on the yield and other yield attributes were recorded and analyzed statistically means were separated using statistical methods.

Table 1. Fertilizer dose (kg/ha) for in different locations

Treat-ment	(N-P-K-S-Zn-B + CD/PM manure or CD/PM slurry)		
	Comilla	Rangpur (Cowdung based)	Rangpur (Poultry manure based)
T_1	128-26-120-14-3-1	135-25-140-17-15-3-1.5	135-25-140-17-15-3-1.5
T_2	120-25-110-13-3-1+ 5000 CD	129-20-132-17-15-3-1.5+5000 CD	129-23-138-17-15-3-1.5+3000 PM
T_3	118-25-107-13-3-1+5000 CDS	112-18-115-17-15-3-1.5+5000 CDS	100-0-119-17-15-3-1.5+3000 PS
T_4	200-75-115-0-0-0 + 10000 CD	110-48-160-20-0-4-1+7500	110-48-160-20-0-4-1+7500 CD
T_5	0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0-0

PM : Poultry manure, PS : Poultry slurry, CD : Cowdung, CDS : Cowdung slurry

Results and Discussion

Comilla

There was no significant effect of the organic fertilizer (cowdung and cowdung slurry) on the potato (Table 1). Different three nutrient options along with farmers' practice did not show the variation of yield contributing characters like number of tuber and tuber weight in potato. Due to the yield contributing characters, yield did not varied among nutrient options.

Rangpur

Results revealed that higher tuber yield (29.10 t/ha for cowdung slurry and 19.36 t/ha for poultry slurry) was recorded from T_3 treatment of both slurry. The yield (28.89 t/ha) of T_4 (FP) was identical to T_3 on based of cowdung slurry due to the use of higher fertilizer dose (Table 2) in their practice in potato field. These results have been supported by the yield contributing results. The lowest yield was observed from T_5 treatment due to zero fertilizer. The highest returns and Benefit Cost Ratio (BCR) Tk.212324/ha & 2.74 at Cowdung Based (CDB) and Tk. 96215/ha & 1.96 at Poultry Based (PB) have come from T_3 treatment (Table 3). In case of cowdung based treatments, in spite of higher gross return in T_3 and T_4, higher variable cost resulted comparatively lower BCR than the inorganic treatments. In both slurry treatments, scab disease was not found; vigor crop growth and evergreen were found.

Farmers' reaction

Comilla: Use of bio-slurry was a new idea for the framers but they were not informed through the experiment to see the effect of bio-slurry on the potato yield.

Rangpur: Framers are satisfied on bio-slurry due to higher yield and low cost involvement. The plants from bio-slurry treated plots were healthy.

Conclusion

Bio-slurry treatment of cowdung and poultry were showed better performance but it was first year observation, so it should be repeated next year to do.

Table 1. Effect of different nutrient packages on the yield of potato production at Comilla sadar during 2007-08

Treatment	Plant height (cm)	No. of shoot/ halum	No. of tuber/ halum	Tuber weight/halum (g)	Yield (t/ha)
T_1: Inorganic fertilizer for HYG	62.53	1.91	4.93	307.09	15.20
T_2: IPNS+ CD (5t/ha)	65.11	1.91	4.87	350.02	16.75
T_3: IPNS+ CD Slurry (5t/ha)	68.58	2.02	5.76	391.36	17.33
T_4: FP	74.16	1.89	5.42	377.80	17.05
T_5: Native fertility	31.80	1.64	3.02	142.38	6.66
CV (%)	6.92	18.95	24.78	23.91	11.04
LSD (5%)	7.92	NS	2.14	167.80	2.82

Table 2: Effect of different nutrient packages on the yield of potato production at the FSRD site Lahirirhat, Rangpur during 2007- 08

Treatment	Tuber/plant (no.)		Wt. of tuber/plant (gm)		Tuber yield (t/ha)	
	Cowdung based	Poultry based	Cowdung based	Poultry based	Cowdung based	Poultry based
T_1: Inorganic fertilizer for HYG	7.13a	7.87a	478a	295a	25.74b	14.13b
T_2: IPNS for HYG with manure	7.10a	7.83a	484a	318a	26.64b	15.39b
T_3: IPNS for HYG with slurry	7.05a	7.67a	498a	370a	29.10a	19.36a
T_4: FP	7.06a	7.03ab	480a	323a	28.89a	15.88b
T_5: NF	5.67b	6.43b	247b	177b	15.32c	7.97c
CV (%)	13.7	8.0	9.0	5.2	6.1	6.4

Table 3: Cost and return of bio-slurry on yield of potato production at the FSRD site Lahirirhat, Rangpur during 2007- 08

Treatment	Gross return (Tk/ha)		Production Cost (Tk/ha)		Net return (Tk/ha)		Benefit Cost Ration	
	CDB	PB	CDB	PB	CDB	PB	CDB	PB
T_1: Inorganic fertilizer for HYG	268830	141000	93916	89589	174914	51411	2.86	1.57
T_2: IPNS for HYG with manure	282160	153900	102108	97407	180062	56493	2.76	1.58
T_3: IPNS for HYG with slurry	315330	196000	103006	99785	212324	96215	2.74	1.96
T_4: FP	317000	158800	112290	107482	204710	51318	2.82	1.48
T_5: NF	162160	79700	78940	72495	83220	7205	2.05	1.10

CDB: Cowdung Based, PB: Poultry Based, STB: Soil Test Based Fertilizer dose, IPNS: Integrated Plant Nutrient System Based Fertilizer Dose, FP: Farmer Practice and NF: Native Fertility

Effect of Bio-slurry as a Source of Organic Manure on Maize

Abstract

The experiment was carried out during the rabi season of 2007-2008 at MLT site, Atghoria, Pabna and at FSRD site, Lahirirhat Rangpur to see the comparative performance of bio-slurry with inorganic fertilizer and find out the optimum and economic dose of bio-slurry for maize. There nutrient packages viz. inorganic fertilizer for high yield goal, IPNS with 5 t/ha cowdung or 3 t/ha poultry manure, IPNS with 5 t/ha cowdung or 3 t/ha poultry slurry along with farmers, practice and native fertility were tested on maize. Higher maize yield was attained in inorganic fertilizer and IPNS with 3 t/ha poultry slurry management packages and the maximum MBCR was recorded in IPNS with 3t/ha poultry slurry followed by inorganic fertilizer for high yield goal and farmer's fertilizer management packages in Pabna. The highest yield was recorded for the treatment where slurry was used in Rangpur.

Introduction

The gradual degradation of soil fertility status of the country is now becoming a critical issue. More than 60% of our cultivated soil contains organic matter at low level (<1.7%). So, the maintenance of organic matter is a burning issue both for the farmers and agricultural scientists. Recently government and different NGO established biogas plant in different parts of the country to meet up the fuel as well as electricity demand of the rural households. The bi-product of the biogas plant i.e. bio-slurry can be used as an excellent organic fertilizer to reduce the use of chemical fertilizer. Research work and data on the bio-slurry is meager in our country. Therefore, an experiment was conducted with the following objectives;

i) To see the effect of bio-slurry on the performance of maize crop
ii) Comparative performance of bio-slurry with organic and inorganic fertilizer.
iii) To find out the optimum and economic dose of bio-slurry for the crops.

Materials and Methods

The experiment was carried out during the rabi season of 2007-08 at the MLT site, Atghoria, Pabna and FSRD site, Lahirirhat, Rangpur. Before starting the experiment, initial composite soil samples (0-15 cm depth) were collected from the experimental plots and were analyzed. The experiment was laid out in RCB design with three replications. Unit plot size was 5m x 6m. Five fertilizer treatments viz. T_1: Soil test based high yield goal, T_2: Integrated plant nutrient systems with 3 t/ha poultry manure or 5 t/ha cowdung T_3: Integrated plant nutrient systems with 3 t/ha poultry slurry as 5 t/ha cowdung slurry, T_4: Farmers practice T_5: Native fertility were employed for the experiment. The detailed treatments are presented in the following table. Maize seed (var. NK 40) was sown on last November 2007 maintaining spacing of 75 cm x 20 cm. One third Urea and the full amount of TSP, MP, Gypsum, zinc sulphate, borax and organic manure were applied as basal as per treatment specification. Remaining urea was applied as top dressed equally at 8-10 leaves and tasseling stage, respectively. During sowing time there was limited residual soil moisture, so one irrigation was applied to ensure seed germination at four days after sowing of seed. Additional two irrigations were applied at 38 and 78 days after sowing for optimum growth of the plant. Other management and pest control measure were taken when required. The crop was harvested on last April 2008. Necessary data were collected and analyzed statistically.

Table 1. Fertilizer dose (Kg/ha) for wheat in different locations

Treatment	(N-P-K-S-Zn-B + CD/PM manure or CD/PM slurry)		
	Pabna	Rangpur (Cowdung based)	Rangpur (Poultry based)
T_1	189-32-40-29-1-1	220-18-37-12-5-2	220-18-37-12-5-2
T_2	159-13-19-29-1-1 + 3000 PM	211-13-29-12-5-2+ 5000 CD	214-16-35-12-2-2+ 3000 PM
T_3	155-1-19-29-1-1 + 3000 PS	198-11-12-12-5-2+ 5000 CDS	186-0-16-12-5-2+ 3000 PS
T_4	136-23-38-21-3	104-19-65-11-3-1	104-19-65-11-3-1
T_5	0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0-0

PM : Poultry manure, PS : Poultry slurry, CD : Cowdung, CDS : Cowdung slurry

Results and Discussion

Pabna

Yield and yield contributing characters of maize differed significantly due to different nutrient packages (Table 2). The highest grain yield of maize was obtained from high yield goal inorganic fertilizer management which was identical to IPNS with 3t/ha poultry slurry. Probably the cumulative effect of number of grains and grain weight/cob and weight of 100 grain might be contributed to increased yield in high yield goal fertilizer management. The crop performance with poultry slurry management appeared better over poultry manure probably because of readily available of different nutrients to the plants. Maximum water retention in poultry slurry probably has made the environment for easily uptake of nutrients by the crop plants. The highest straw yield was attained from IPNS with 3t/ha poultry manure which was statistically identical to IPNS with 3t/ha poultry slurry. The lowest performance of maize was observed in native fertility (control).

Regarding economic performance, the maximum MBCR was recorded in IPNS with 3t/ha poultry slurry followed by high yield goal and farmer's fertilizer management packages (Table 3).

Rangpur

The results have been presented in Table 4. The highest grain yield was obtained from the IPNS with slurry (5t/ha cowdung slurry or 3t/ha poultry slurry) followed by manure (cowdung or poultry). The yield was varied due to yield contributing characters.

Farmers' reaction

Pabna: Farmers showed their keen interest to bio-slurry due to higher yield and good health of the crop.

Rangpur: Farmers are satisfied to use of bio-slurry due to-higher yield and low cost of fertilizer, healthy plant and green colour stay for long time and remaining long time of soil moisture.

Conclusion

Bio-gas slurry appeared well regarding the yield performance of maize under IPNS based fertilizer management. But its residual effect and impact on soil health is deemed important. In addition to that its method of application is also to be determined. Being high water content it is quite difficult to carry from the source to the application field.

Table 2. Effect of bio-slurry as organic manure on yield and yield contributing characters of Maize at the MLT site, Atghoria, Pabna during 2007-08

Treatments	Plant height (cm)	Plant pop^n. plot (no.)	Grains cob (no.)	Grain weight cob (g)	100-grain weight (g)	Grain yield (t/ha)	Stover yield (t/ha)
T_1 : Inorganic fertilizer for HYG	172.1	162.0	419.3	166.3	36.47	8.98	7.28
T_2: IPNS with 3t/ha PM	171.2	166.3	367.3	153.7	35.63	8.32	7.53
T_3 : IPNS with 3t/ha PS	172.4	165.7	392.5	162.3	34.67	8.89	7.45
T_4: FP	170.9	164.7	361.9	148.3	33.50	7.76	7.13
T_5: Native fertility	152.8	162.0	296.3	84.3	25.10	4.58	4.19
LSD (0.05)	1.39	2.81	52.25	4.97	0.96	0.19	0.13
CV (%)	5.44	6.91	7.55	6.85	5.55	6.08	5.10

PM: Poultry manure, PS : Poultry slurry

Table 3. Cost and return of maize by different treatment at the MLT site Atghoria, Pabna during 2007-08

Treatments	Gross return (Tk /ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over native fertility)
T_1 : Inorganic fertilizer for HYG	120380	8891	111489	6.61
T_2: IPNS with 3t/ha PM	111925	10893	101032	4.62
T_3 : IPNS with 3t/ha PS	119295	8412	110883	6.85
T_4: FP	104445	6541	97904	6.54
T_5: Native fertility	61635	-	61635	-

Price (TK/kg) : Urea 6.00, TSP : 15.00, MP 15.00 Gypsum 8.00, Zinc sulphate 120.00 Borax 120.00. Poultry manure 1.50, Poultry slurry, 1.00, Maize grain 13.00 Maize straw 0.50

Table 4. Effect of Bio-slurry on yield of maize production at the FSRD site Lahirirhat, Rangpur during 2007-08

Treatment	Plant height (cm)		Plant population (cm)		Cob/plant (no)	
	Cow dung based	Poultry Based	Cowdung based	Poultry Based	Cow dung based	Poultry Based
T_1 : Inorganic fertilizer for HYG	175b	181a	3.3b	3.2b	1.44a	1.36a
T_2: IPNS with 3t/ha PM	180a	180a	3.3b	3.4a	1.39a	1.40a
T_3 : IPNS with 3t/ha PS	184a	182a	3.5a	3.4a	1.42a	1.43a
T_4: FP	176b	175b	3.3b	3.2b	1.37a	1.38a
T_5: Native fertility	170c	171c	3.3b	3.2b	1.28b	1.32b
CV (%)	2.0	1.5	1.9	2.2	3.5	4.2

Table 4 Contd.

Treatment	Grain/Cob (no)		1000 grain wt. (g)		Grain yield (t/ha)	
	Cowdung based	Poultry Based	Cow dung based	Poultry Based	Cowdung based	Poultry Based
T_1 : Inorganic fertilizer for HYG	441ab	439ab	266c	276c	4.57d	5.47c
T_2: IPNS with 3t/ha PM	480ab	510a	284bc	286bc	5.69b	6.19b
T_3 : IPNS with 3t/ha PS	512a	512a	323a	325a	6.24a	6.76a
T_4: FP	426b	436b	293b	290b	5.09c	5.58c
T_5: Native fertility	349c	346c	228c	230c	3.85e	4.15d
CV (%)	10.2	9.5	4.3	4.9	5.0	5.4

Effect of Bio-slurry as a Source of Organic Manure on Boro rice

Abstract

The experiment was carried out at the MLT site, Atghoria, Pabna, Phulpur, Mymensingh and Tangail sadar during the year of 2007-2008 to see the comparative performance of bio-slurry and inorganic fertilizer and find out the optimum and economic dose of bio-slurry for the crop. Three nutrient management packages viz. inorganic fertilizer, IPNS with cowdung manure and IPNS with cowdung slurry along with farmers' dose and native fertility were tested on Boro rice. The significantly highest rice yield was attained in IPNS with 5 t/ha cowdung manure management option in Pabna and from farmers' practice in Tangail. Higher yield from IPNS with 5 t/ha cowdung slurry was statistically similar with the IPNS with 5 t/ha cowdung manure in Mymensingh.

Introduction

The gradual degradation of soil fertility status of Bangladesh is now becoming a critical issue. A good soil should have at least 2.5% organic matter, but in Bangladesh most of the soils have less than 1.5%, and some soils even less than 1% organic matter (BARC, 2005). Maintenance of organic matter is a burning issue both for the farmers and agricultural scientists. Recycling of organic matter is essential for maintaining soil fertility. It is agreed that the organic sources of nutrients applied to preceding crop can benefit the succeeding crop (Singh *et al.*, 1996 and Hedge, 1998) and the system productivity becomes sustainable through integrated use of organic and inorganic sources of nutrients (Singh and Yadav, 1992). Recently, Govt. and different NGO established biogas plant in different parts of the country. Bio-slurry can be used as an excellent organic fertilizer. The bi-product of the biogas plant i.e. bio-slurry can be used as an excellent organic fertilizer to reduce the use of chemical fertilizer. Research work and data on the bio-slurry is meager in our country. Boro rice is the main crop in our country. There is an ample scope to use bio-slurry as organic manure in Boro rice. Therefore, it is very important to evaluate the efficiency of bio-slurry on the performance of Boro rice.

Materials and Methods

The experiment was carried out at MLT site, Atghoria, Pabna, MLT site, Phulpur, Mymensingh and Tangail sadar during the year of 2007-2008. Before starting the experiment, initial composite soil samples (0-15 cm depth) were collected from the experimental plots and were analyzed. The experiment was laid out in RCB design with three compact replications, which was also replicated in three dispersed farmer's field. Unit plot size was 5m x 6m. Five fertilizer treatments viz. T_1 : Soil test based inorganic fertilizer high yield goal, T_2: Integrated plant nutrient systems with 5 t/ha cowdung, T_3: Integrated plant nutrient systems with 5 t/ha cowdung slurry, T_4: Farmers practice, T_5: Native fertility were employed for the experiment (Table 1). Thirty eight days old rice seedling (var. BRRI dhan 29) was transplanted on 6 February 2008 in Pabna, 7-16 January 2008 in Mymensingh and 14 February 2008 in Tangail maintaining spacing of 20 cm x 20 cm. Entire amount of TSP, Gypsum, Zinc sulphate, organic manure and half MP were applied as basal as per treatment specification. Total prilled urea was applied in three installments at 15, 35 and 45 DAT. Rest half MP was applied at 45 DAT. During the grain filling stage there was scarcity of irrigation water due to unavailable of soil water layer. Other management and pest control measures were taken as and when required. The crop was harvested on 18 May 18 2008 in Pabna, 21 May 2008 in Tangail and 6-18 May 2008 in Mymensingh. Necessary data were collected and analyzed statistically.

Table 1. Fertilizer dose (Kg/ha) for Boro rice in different locations

Treatment	(N-P-K-S-Zn-B + CD manure/CD slurry)		
	Pabna	Mymensingh	Tangail
T_1	144-26-25-4-2	156-24-144-26	120-15-40-10-0-1
T_2	129-21-10-4-2+ 5 t/ha CD	141-18-127-26 + 5 t/ha CD	105-10-25-10-0-1 + 5 t/ha CD
T_3	121.5-18.5-0-4-2+ 5 t/ha CD slurry	137-17-119-26 + 5 t/ha CD slurry	98-8-15-10-0-1+ 5 t/ha CD slurry
T_4	103-14.2-30-11.3-2.7kg	134-21-40-7	154-31-52
T_5	0-0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0

Results and Discussion

Pabna

Yield and yield contributing characters of Boro rice differed significantly due to different nutrient packages (Table-2). The highest grain yield of rice was obtained from IPNS with 5t/ha CD manure management. Probably the cumulative effect of number of grains/panicle and weight of 100 grain might be contributed to increased yield in T_2 fertilizer management. The second highest yield attained in high yield goal fertilizer management (T_1). The crop performance with IPNS with poultry slurry management (T_3) gave third highest yield and showed better performance over farmers practice. Maximum water retention in poultry manure probably has made the environment for easily uptake of nutrients by the crop plants. The highest straw yield was attained from IPNS with 5 t/ha cowdung manure which was statistically significant different from all other treatments. The lowest performance of maize was observed in native fertility (control).

Regarding economic performance, the highest gross return and margin were recorded in IPNS with 5 t/ha cowdung manure. The highest MBCR was recorded IPNS with 5 t/ha cowdung slurry management packages due to lower variable cost.

Mymensingh

The effect of organic fertilizer (cowdung or cowdung slurry) on the yield of Boro rice was found (Table 4). Higher yield was obtained from the application of IPNS with 5t/ha cowdung slurry but it was statistically similar with the application of IPNS with 5t/ha cowdung manure. The variation of straw yield of was not found in the IPNS and inorganic fertilizer.

Tangail

The highest plant height (90.80 cm) was recorded from the plant treated with farmers practice. The lowest plant height (70.70 cm) was recorded from the plants who received no fertilizer (native fertility). The highest number of panicle (14) per hill was recorded from the plant treated with farmers practice. The lowest panicle (9) per hill was recorded from the plants who received no fertilizer (native fertility). The highest 1000-grain weight (21.1 g) was recorded from the plan treaded with farmers practice. The lowest 1000-grain weight (20.1 g) was recorded from the plan treated with IPNS basis fertilizer dose for HYG with 5 t/ha cowdung. The highest yield (7.14 t/ha) was obtained form the plant treated with farmer practice. The lowest yield (4.29 t/ha) was obtained form the plot treated with native fertility. The highest gross return was (Tk. 116025/ha) obtained from the treatment of farmers practice. MBCR was higher in T_1 where only inorganic fertilizer was used due to lower variable cost.

Farmers' reaction

Pabna: Farmers' showed their keen interest regarding the use of Bio-slurry as organic manure. At present slurry is unused, if it promote to use in crop production like other manures we shall use and buy it in future

Mymensingh: Farmers' are interested to use bio-slurry in their crop field. They also mentioned that it is also useful as fish meal

Tangail: Farmers' showed their keen interest regarding the use of Bio-slurry as organic manure. But they opined that biogas plants are not easy available due to its higher cost involvement in establishment.

Conclusion

The yield performance of Boro rice under IPNS with cowdung manure fertilizer management was better. But its residual effect and impact on soil health is deemed important. Integrated plant nutrient management with cowdung manure systems could be suggested for the production of Boro. It was the results of first year trial. The trial may be repeated in the next year for further verification.

References

BARC (Bangladesh Agricultural Research Council). 2005. Fertilizer Recommendation Guide'2005. Bangladesh Agril. Res. Council, New Airport Road, Farmgate, Dhaka-1215, p.48.

Hedge D M. 1998. Long-term sustainability of productivity in Rice (*Oryza sativa*)- Wheat (*Triticum aestivum)* system in subhumid ecosystem through integrated nutrient supply. Indian J. Agron. 43(2): 189-198.

Jayakumar, M. and R. Elangovan. 1993. Effect of bio-slurry on salinity-induced changes in growth and yield of sunflower. Indian J. Agril. Sci. 63 (10): 655-657.

Joshi, J. R., J. F. Moncrief, J. B. Swan and G. L. Malzer. 1994. Soil Till. Res. 31: 225.

Manna, M. C. and J. N. Hazra. 1996. Comparative performance of cowdung slurry, microbial inoculum and inorganic fertilizers on maize. Indian J. Soc.Soil Sci. 44: 526-528.

Reddy T. Y. and G. H. S. Reddi. 1992. Principles of Agronomy. Kalyani Publishers. New

Delhi-110 002, India, p. 423.

Singh G B and Yadav D V. 1992. INSS in sugarcane and sugarcane based cropping system. Fertilizer News 37 (4): 15-22.

Singh Y, Chaudhary D C, Singh S P, Bhardwaj A K and Singh D. 1996. Sustainability of rice (*Oryza sativa*) - wheat (*Triticum aestivum*) sequential cropping through manure crops in the system. Indian J. Agron. 41 (4): 510-514.

Table 2. Effect of bio-slurry as organic manure on yield and yield contributing characters of Boro rice at the MLT site, Atghoria, Pabna during 2007-08

Treatments	Plant height (cm)	Effective tiller /hill (no.)	Filled grains /panicle (no.)	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1 : Inorganic fertilizer	80.31	13.76	96.62	21.78	5.95	6.12
T_2 : IPNS with 5 t/ha CD manure	76.83	11.58	102.72	22.78	6.28	7.09
T_3 : IPNS with 5 t/ha CD slurry	77.67	11.45	105.30	22.00	5.66	5.19
T_4 : FP	78.34	12.78	87.80	21.33	5.40	5.73
T_5 : Native fertility	66.60	10.84	54.87	20.56	2.95	4.15
LSD (0.05)	1.47	0.73	7.52	0.53	0.16	0.11
CV (%)	8.07	6.83	9.28	4.54	6.95	7.58

Table 3. Cost and return analysis of Boro rice as influenced by different nutrient packages at the MLT site, Atghoria, Pabna during 2007-08

Treatments	Gross return (Tk/ha)	Total Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over native fertility)
T_1 : Inorganic fertilizer for HYG	105868	36870	68998	10.40
T_2 : IPNS with 5 t/ha CD manure	112685	38350	74335	9.07
T_3 : IPNS with 5 t/ha CD slurry	99760	37765	61995	7.77
T_4 : FP	96345	36869	59476	8.49
T_5 : Native fertility	54163	31900	22263	

Price of input (Tk/kg): Urea 6.00, TSP 15.00, MP 15.00, Gypsum 04.00, Zinc oxide 120.00, Cowdung compost 0.50, Cowdung slurry 0.50

Price of out put (Tk/kg): Rice 16.25, Straw 1.50

Table 4. Yield and yield contributing characters of Boro rice as influenced by bio-slurry at Phulpur, Mymensingh during 2008

Treatments	Plant height (cm)	No. of tillers/hill	No. of filled grains/ panicle	No. of unfilled grains/panicle	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	92.43	11.58	106.73	25.11	25.43	7.43	6.73
T_2	93.27	11.76	109.10	27.85	25.60	7.76	6.98
T_3	94.30	12.22	111.97	26.67	26.00	8.36	7.26
T_4	89.63	10.73	106.17	17.15	26.00	6.76	6.16
T_5	73.83	7.11	85.00	10.55	24.77	3.55	3.10
LSD (0.05)	4.05	0.99	12.77	3.02	NS	0.81	0.58
CV (%)	2.91	4.88	6.59	7.55	6.18	6.33	5.05

Table 5. Grain and straw yields and economic performance of boro rice as influenced by bio-slurry at Phulpur, Mymensingh during 2008

Treatments	Grain yield (t/ha)	Straw yield (t/ha)	Gross return (Tk/ha)	Variable cost* (Tk/ha)	Gross margin (Tk/ha)	MBCR (over native fertility)
T_1	7.43	6.73	118180	16621	101559	3.72
T_2	7.74	6.98	123080	19206	103874	3.47
T_3	8.19	7.26	130110	18419	111691	4.00
T_4	6.86	6.16	109060	8299	100761	6.35
T_5	3.55	3.10	56350	0	56350	-

* Variable cost includes only cost of fertilizer, cow dung and slurry.

Price of input and output: Rice grain Tk. 15.00/kg, Rice straw Tk. 1.00/kg, Urea Tk. 6.15/kg, TSP Tk. 35.00/kg, MOP Tk. 32.00/kg, Gypsum Tk. 7.00/kg, Cowdung Tk. 1.00/kg and Cowdung slurry Tk. 1.00/kg

Table 6. Yield of boro rice as influenced by bio-slurry (CD) at MLT site, Madhupur, Tangail during 2007-08

Treatments	Plant height (cm)	No. of panicle/ hill	Filled grain/ panicle	Unfilled grain/ panicle	1000 grain wt. (g)	Yield (t/ha)
T_1	89.89	13	125	24	20.2	6.40
T_2	89.69	13	123	23	20.1	6.31
T_3	88.30	13	126	23	20.4	6.65
T_4	90.80	14	130	32	21.1	7.14
T_5	70.70	9	106	13	20.7	4.29
LSD (0.05)	5.21	1.01	17.98	5.6	1.06	0.55
CV (%)	3.2	4.4	7.8	13.0	2.7	4.8

T_1: Soil test based fertilizer dose for high yield goal, T_2 : IPNS basis fertilizer dose for HYG with 5 t/ha cowdung, T_3 : IPNS basis fertilizer dose for HYG with 5 t/ha cowdung slurry, T_4 : Farmers practices, T_5 : Native fertility

Table 7. Cost and return analysis of Boro rice at MLT site, Madhupur, Tangail during 2007-08

Treatments	Gross return (Tk/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)	MBCR (over native fertility)
T_1	104000	59847	44153	4.20
T_2	102537	65102	37435	2.45
T_3	108062	63777	44285	3.17
T_4	116025	63574	52451	3.89
T_5	69712	51682	18030	-

Price of input (Tk/kg) : Urea 6.00, USG, 6.50, TSP 40.00, MP 35.00, Gypsum 7.00, CD 1.50, Bio-slurry 1.50
Price of output (Tk/kg) : Boro rice 16.25

Effect of Bio-slurry as Organic Manure on Wheat

Abstract

Field experiments were conducted in three villages of Faridpur district and FSRD site, Lahirirhat, Rangpur during rabi 2007-08 to find out the performance of bio-gas slurry on wheat. Five treatments, namely Soil test based fertilizer dose for high yield goal, IPNS basis fertilizer dose for HYG with manure (5 t/ha cowdung or 3t/ha poultry manure), IPNS basis fertilizer dose for HYG with slurry (5 t/ha cowdung or 3t/ha poultry slurry), Farmers practice and Native fertility were used in the trial. It was found that higher yield was obtained from soil test based inorganic fertilizer dose for high yield goal in two villages and IPNS basis fertilizer dose for HYG with 3 t/ha slurry in another village under Faridpur district. In Rangpur, significant yield was found from the application of cowdung slurry but the similar yield was found with poultry slurry and poultry manure.

Introduction

Declining in soil fertility is a common scenario in Bangladesh though magnitudes vary in different Agro-Ecological Zones (AEZ). Decline in soil fertility is used as deterioration in physical, chemical and biological properties. It occurs through a combination of lowering of soil organic matter and loss of nutrients. In Bangladesh, depletion of soil fertility is mainly due to exploitation of land without proper replenishment of plant nutrients in soils. A good soil should have an organic matter content of more than 3.5 per cent. But in Bangladesh, the most soils have less than 1.7 per cent, and some soils have even less than 1% organic matter. The average organic matter content of top soils has decline by 20-46% over past 20 years due to intensive cultivation. To arrest further declination of soil fertility proper us of bio-slurry alone or in combinations with inorganic fertilizers may be good options. Proper utilization of bio-slurry in maintaining soil fertility needs research attentions. An experiment was conducted to evaluate the performance of bioslurry on wheat.

Materials and Methods

The experiment was conducted in triplicate set in medium high land under irrigated condition at the farmer's field of Badarpur; Komorpur and FSRD site, Hatgobindpur, Faridpur and FSRD site, Lahirirhat, Rangpur during rabi 2007-08. The experiment was conducted in RCB design with three replications in each set. The treatments are detailed in the following table.

In all the trials poultry manure and its slurry was used as organic manure. The unit plot size was 5m x 4m. Shatabdi variety of wheat was used as test crop and sown in line with 30 cm apart. Two-third urea and all other fertilizers were applied as basal and rest urea as top dress after first irrigation at 19 days after sowing. A second irrigation was applied at 50 days after sowing. Seeds were sown on 25 to 27 November 2007 in Faridpur and 2nd week of December 2007 in Rangpur. Two hand weeding was done at 17 and 44 DAS. The crop was harvested on 12 to 15 March, 2008 in Faridpur and 1st week of April 2008 in Rangpur.

Table 1. Fertilizer dose (kg/ha) for wheat in different locations

Treatment	(N-P-K-S-Zn-B + CD/PM manure or CD/PM slurry)		
	Faridpur	Rangpur (Cowdung based)	Rangpur (Poutry based)
T_1	100-35-50-10-1	130-20-80-30-1.5-4	130-20-80-30-1.5-4
T_2	70-15-30-10-2 + 3000 PM	124-15-72-24-1.5-4 + 5000 CD	124-18-78-30-1.5-4+ 3000 PM
T_3	65-4-20-10-2 + 3000 PS	108-13-55-30-1.5-4 + 5000 CDS	96-0-59-30-1.5-4 + 3000 PS
T_4	105-21-26-14	70-23-32-12-0-0.7	70-23-32-12-0-0.7
T_5	0-0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0-0

PM : Poultry manure, PS : Poultry slurry, CD : Cowdung, CDS : Cowdung slurry

Results and Discussion

Faridpur

In Badarpur site, the highest grain yield (3.27 t/ha) was found from T_1 where soil test based fertilizer dose for high yield goal was applied which was at par with other fertilized plots but significantly highest from the native fertilization (Table 2). In this site, yield contributing characters like number of spike per square metre and number of grain per spike also differed significantly among the treatment. The highest plant height and number of spike per square metre was given by T_1. The spike length and 1000 grain weight did not show any significant difference among the treatment. The highest straw yield was also found in T_1.

In Hatgobindpur site, similar trend of results were also observed. T_1 gave significantly highest yield (3.22 t/ha) followed by T_3 where 3 ton poultry slurry was used (2.86 t/ha) but at par with T_2 and T_4. The lowest yield (0.71 t/ha) was found from native fertility. In this site, all the yield contributing characters except spike length differed significantly among the treatments. The highest number of grain per spike and 1000 grain weight was produced from treatment 1.

In Komorpur site, no significant yield difference was observed among all the treatments. The highest yield was produced from T_2 (3.05 t/ha) where 3 t/ha poultry manure was applied followed by farmers practice (3.02 t/ha). Native fertilizer gave 2.90 t/ha grain yield. The reason for this higher yield in T_2 is the higher native fertility of the soil as the farmer is using poultry slurry in this plot for a long time. Application of high dose of fertilizer causes lodging of the wheat plants. All the characters are insignificant in this set.

Rangpur

In cowdung based, significant yield was found in the treatment where 5t/ha cowdung slurry was used (Table 3). Yield variation was not found from cowdung manure (T_2) and the fully inorganic fertilizer (T_2). In case of poultry based, yield variation was not found between the poultry slurry and poultry manure, although higher yield was found from the same treatments. Higher gross margin was obtained from IPNS with slurry (Table 4).

Farmers' reactions

Farmers' showed their positive attitude towards bio-slurry in Rangpur but not in Faridpur. They also opined that the dose of bio-slurry should be increased in Faridpur condition.

Conclusion

Bio-slurry treatment of cowdung and poultry were showed better performance in Rangpur but the response was observed in the following jute crop in Faridpur. So it is better to conduct the trial in pattern wise. It was first year observation, so it should be repeated next year for better confidence of these results.

Table 2: Yield and yield contributing characters of wheat as influenced by bio-slurry at Badarpur, Hatgobindpur and Komorpur, Faridpur during 2007-08

Treatment	Plant height (cm)	No. of spike/m^2	Spike length (cm)	No. of grain/spike	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
Location: Badarpur							
T_1	98.5a	293.9a	9.03	31.43b	48.33	3.27a	3.82a
T_2	96.3a	252.0bc	8.91	33.20a	48.73	2.75a	3.18b
T_3	96.1a	256.7c	9.66	35.53a	46.86	2.96a	3.19b
T_4	97.0a	264.1ab	9.89	34.83a	47.93	3.04a	4.12a
T_5	72.6b	148.2d	7.63	23.83c	47.06	0.87b	1.74c
CV (%)	1.71	8.43	6.12	6.05	3.48	9.98	6.15
Location: Hatgobindpur							
Treatment							
T_1	91.6ab	309.3b	9.00	30.86a	44.80a	3.22a	3.43b
T_2	89.1b	286.3b	8.75	27.23b	43.46ab	2.77b	3.16b
T_3	92.1ab	296.7c	9.05	31.00a	44.26ab	2.86b	3.18b
T_4	93.9a	284.3a	9.45	31.50a	42.12bc	2.76b	3.98a
T_5	75.7c	161.0d	7.60	21.87c	41.60c	0.71c	1.31c
CV (%)	2.75	5.16	8.25	6.31	1.95	5.57	9.37
Location: Komorpur							
Treatment							
T_1	103.4	305.6	9.9	32.4	49.3	2.83	3.25
T_2	104.0	305.7	10.1	32.9	47.8	3.05	3.62
T_3	105.8	307.2	10.3	33.8	47.7	2.94	3.32
T_4	107.8	311.2	10.2	34.7	48.3	3.02	3.45
T_5	103.1	301.5	9.8	30.5	47.5	2.90	3.4
CV (%)	10.83	4.91	8.21	8.75	3.18	7.71	9.16

T_1: Soil test based fertilizer dose for high yield goal
T_2: IPNS basis fertilizer dose for HYG with 3 t/ha poultry manure or 5 t/ha cowdung manure
T_3: IPNS basis fertilizer dose for HYG with 3 t/ha poultry slurry 5 t/ha cowdung slurry
T_4: Farmers practice
T_5: Native fertility

Table 3: Effect of Bio-slurry on yield of wheat production at the FSRD site Lahirirhat, Rangpur during 2007-08

Treatment	Plant population/m^2 (no.)		Plant height (cm)		Grains/spike (no.)	
	Cowdung based	Poultry Based	Cowdung based	Poultry Based	Cowdung based	Poultry Based
T_1	202b	163a	98a	82a	38.2a	31.9a
T_2	194bc	160a	95a	82a	37.7a	31.9a
T_3	219a	161a	97a	81a	38.9a	32.2a
T_4	190b	153b	93a	80a	37.2a	29.2b
T_5	180c	135c	82b	77b	32.1b	26.9c
CV (%)	6.0	2.3	4.8	1.5	7.2	2.4

Table 3 contd.

Treatment	100 seed wt. (g)		Grain yield (t/ha)		Straw yield (t/ha)	
	Cow dung based	Poultry Based	Cow dung based	Poultry Based	Cow dung based	Poultry Based
T_1	40.4b	33.0b	1.84b	1.65b	3.78a	3.55a
T_2	41.0a	33.0b	1.64bc	1.71a	3.80a	3.55a
T_3	40.6ab	34.0a	2.28a	1.74a	3.86a	3.46a
T_4	36.5c	32.2c	1.53c	1.40c	2.41b	2.25b
T_5	35.5d	32.1c	1.25d	1.33d	2.00c	1.80c
CV (%)	1.1	1.0	11.4	1.9	2.4	2.7

Table 3: Cost and return of bio-slurry on yield of Wheat production at the FSRD site Lahirirhat, Rangpur during 2007-08

Treatment	Gross return (Tk/ha)		Total Variable Cost (Tk/ha)		Gross margin (Tk/ha)	
	Cow dung based	Poultry Based	Cow dung based	Poultry Based	Cow dung based	Poultry Based
T_1	55200	52200	32310	32310	22890	19890
T_2	49200	51300	39150	36980	10050	14320
T_3	68400	49500	33290	33775	35110	15725
T_4	45900	42000	35660	27856	16240	14144
T_5	37500	39900	20800	18946	16700	20954

Appendix Table 1. Initial soil status of the experimental site

Location	pH	O.M (%)	Total N (%)	K (m.eq./100g soil)	P	S	Zn	B
					ppm			
Mymensingh	5.22	1.14	0.11 (L)	0.0.048 (VL)	11.74 (L)	6.52 (VL)	2.41 (H)	
Gazipur	5.7	1.162	0.0614 (VL)	0.132 (L)	51.8 (VH)	12.2 (L)	3.04 (VH)	0.194 (L)
Pabna	7.7	2.13	0.12 (L)	0.25 (M)	9.00 (L)	13.00 (L)	0.50 (L)	0.25 (L)
Rangpur	6.03	1.25	0.06 (VL)	3.11 (VH)	30.66 (VH)	33.30 (H)	0.82 (L)	0.52 (O)
Jessore	7.8	1.05	0.081(VL)	0.31 (O)	15 (M)	16 (M)	1.00 (M)	0.20 (L)
Tangail	5.9	2.60	0.137 (L)	0.14 (L)	12(M)	25(O)	4.3(VH)	0.57(O)

VL: Very low, L: Low, M: Medium, H: High, VH: Very High, O: Optimum

Appendix Table 2. Nutrient supply from different manure and Bio-slurry

Organic material	Nutrient supply (%)		
	N	P	K
Poultry slurry	1.15	1.05	0.70
Poultry manure	1.00	0.65	0.70
Cowdung slurry	0.45	0.15	0.50
Cow dung	0.30	0.10	0.30

A. PLAIN LAND

Performance of Intercropping Hybrid Maize with Garden Pea

Abstract

The experiment was conducted at the Farming Systems Research and Development (FSRD) site, Pushpapara, Pabna and Rangpur during the year of 2007-08 to evaluate the agro-economic performance of intercropping garden pea with maize. Two intercrop treatment combinations (garden pea with maize) and sole maize were tested. Grain yield of maize obtained from different treatments were statistically identical at both the locations. But green pod yield was higher in two rows of pea intercropped with maize in normal row at Pabna and Rangpur. Similar trend was followed in maize equivalent yield and gross margin.

Introduction

Intercropping is one of the techniques of vertical expansion of crop production. It increases total productivity per unit area than sole cropping. Maize is a cereal crop which is used as food, feed and fodder. It requires high amount of chemical fertilizer for exploiting its maximum yield potentiality. Garden pea being a leguminous crop needs lower fertilizer dose for its cultivation. Farmers often desire quick return from their crops. As maize is a long duration crop, intercropping with short duration vegetables could help the farmers to earn a quick return. Moreover, after harvesting of green pod plant biomass can be incorporated in the maize field, which may increase the soil fertility and also uplift soil organic matter content. With this view the experiment was carried out to verify the suitable intercrop combination of maize and garden pea for higher yield and better economic return in the farmer's field.

Materials and Methods

The experiment was carried out at the FSRD site, Pushpapara, Pabna and Rangpur during the rabi season of 2007-08. Three treatments viz. T_1: Sole maize (75 cm x 25 cm), T_2 : Maize normal row + 2 rows BARI motorshuti-3 and T_3: Maize paired rows + 4 rows BARI motorshuti-3 were employed for the study. The experiment was laid out in RCB design with 3 dispersed replications. Unit plot size was 4.5 m x 4 m. Fertilizers were applied 250-55-140-50-5-1 kg N-P-K-S-Zn-B ha^{-1} for sole maize and intercrop treatments. One third of N and all other fertilizers were applied as basal. Remaining ⅓ N was applied at 8-10 leaves stage after harvesting of garden pea and ⅓ N at tasseling stage. No additional fertilizer was added for garden pea in the intercrop treatments. Seeds of maize (var. NK-40) were sown on 5-6 December 2007 maintaining the spacing of 75 cm x 25 cm. In case of paired row, the spacing was 37.5cm x 150cm x 25 cm. Seeds of garden pea were sown in between the rows of maize on same date as per treatment specification. Irrigation, weeding and other intercultural operation were done as and when necessary. At the initial stage, maize plants were infested with cut worm which was controlled with recommended insecticide. Dithan M-45 was sprayed two times for fungal disease of garden pea. Other intercultural operations for maize and garden pea were done when required. Garden pea was harvested on 5-10 February. After harvesting of pod the green biomass was incorporated in to the soil. Maize was harvested on 12-13 May 2008. Data on different parameters of pea and maize were collected and analyzed statistically.

Results and Discussions

FSRD site, Pushpapara, Pabna

Green pod yield of garden pea was higher in Maize normal row + 2 rows BARI Motorshuti-3 (T_2) treatment. It is mainly the cumulative effect of higher plant population and pod weight (Table 1). Due to higher plant population, green biomass yield was also higher in same treatment.

In case of maize, yield and yield attributes were insignificant among the treatments (Table 2). However, days required for attaining maturity was little less in intercropping treatment than sole maize. Plant height was found little higher in sole maize followed by maize normal row and maize paired rows. Higher grains/cob and 100-seed weight were obtained from maize normal row intercropping treatment followed by maize paired rows intercropping treatment and maize sole treatment, which might be causes higher grain yield in maize normal row treatment followed by maize paired rows and maize sole treatment. Yield and yield attributes were found lower in maize paired rows than maize normal row intercropping system and it might be due to the cumulative effect of maize-maize competition between the paired rows and little bit less nutrient uptake from one side of the paired rows. Yield contributing characters and yield obtained from different treatments were statistically identical. The highest maize equivalent yield was obtained from T_2 followed by T_3. This result indicated that an additional short duration legume crop can be successfully grown with maize with retaining at least similar maize yield as sole crop or higher. The highest gross return and gross margin was achieved with T_2 treatment where paired rows gardenpea were grown in between normal maize row and it was followed by 4 rows garden pea grown between paired maize rows. Gross margin obtained from two intercrop treatments was higher than maize sole crop and maize normal row performed little better than paired rows system (Table 3). This revealed that short duration pea grown with maize as intercrop was found agronomically feasible and economically viable.

FSRD site, Rangpur

The yield of green pod and numbers of plants/m^2 varied significantly in garden pea. The highest green pod yield 4.30 t/ha was obtained from two rows of pea in between two normal rows of maize (T_2), which was significantly higher than 4 rows of garden pea in between two pair rows of maize (T_3). The highest number of plants/m^2 was also recorded in T_2, which resulted the highest yield in T_2 (Table 4). Yield and yield contributing characters of maize did not varied significantly due to intercropping treatments (Table 5). The highest maize equivalent yield (14.01) was recorded in T_2 followed by T_3 (13.28) and the lowest yield was obtained from T_1 (9.97). The highest gross margin (Tk.145010/ha) was observed in Maize normal row + 2 rows BARI Motorshuti-3 in intercropping combination.

Farmer's reaction

Farmers showed their interest for growing garden pea with maize because they can get additional income earlier from sole maize. They opined that fresh pod of garden pea had good access as vegetable to nearby urban market with high price.

Conclusion

Garden pea grown in between maize normal row or paired rows exerted higher yield and economic returns over sole cropping of maize. Intercropping of maize with garden pea was found promising in the locality because of extra income within a short period of time.

Table 1. Performance of garden pea under intercropping with maize at FSRD site Pushpapara, Pabna 2007-08

Treatments	No. of plants/m^2	No. of pods/plant	50-green pods wt. (g)	Green pod yield (t/ha)	Green biomass yield (t/ha)
T_1: Sole maize (75 cm x 25 cm)	-	-	-	-	-
T_2: Maize normal row + 2 rows BARI Motorshuti-3	17.92	6.13	195	3.50	6.29
T_3: Maize paired rows + 4 rows BARI Motorshuti-3	15.83	6.15	190	3.13	5.91

Table 2. Performance of maize under intercropping with garden pea at FSRD site Pushpapara, Pabna during 2007-08

Treatments	Days to maturity (days)	Plant height (cm)	No. of grains/cob	100-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1: Sole maize (75 cm x 25 cm)	160	161.10	463.60	40.67	8.39	5.94
T_2: Maize normal row + 2 rows BARI Motorshuti-3	158	159.53	501.93	41.47	8.88	6.79
T_3: Maize paired rows + 4 rows BARI Motorshuti-3	158	152.90	477.60	41.17	8.50	5.86
CV (%)	-	4.48	5.48	6.54	4.64	11.49
LSD (0.05)	-	NS	NS	NS	NS	NS

Table 3. Economic performance of maize and garden pea intercropping systems at FSRD site, Pushpapara, Pabna during 2007-08

Treatments	Maize equivalent yield* (t/ha)	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)
T_1: Sole maize (75 cm x 25 cm)	9.42	108365	44615	63750
T_2: Maize normal row + 2 rows BARI Motorshuti-3	16.15	185700	54015	131685
T_3: Maize paired rows + 4 rows BARI Motorshuti-3	14.96	172070	54015	118055

*including maize stover, Price (Tk./kg): Green pod of pea = 20, Maize grain = 11.50, Maize straw = 2.00

Table 4. Performance of garden pea under intercropping with maize at FSRD site Rangpur during 2007-2008

Treatments	No. of plants/m^2	No. of pods/plant	100-green pod weight (g)	Green pod yield (t/ha)
T_1 Sole maize (75cm x 25 cm)	-	-	-	-
T_2 (Maize normal row + 2 rows pea)	15.78 a	18.8 b	198.33	4.30 a
T_3 (Maize paired row + 4 rows pea)	14.15 b	20.4 a	203.33	3.93 b
CV (%)	4.58	5.46	3.5	4.85

Table 5. Performance of maize under intercropping with garden pea at FSRD site, Rangpur during 2007-08

Treatments	No. of plants/m^2	No. of cobs/plant	No. of grains/cob	100-grain weight (g)	Grain yield (t/ha)
T_1 Sole maize (75cm x 25 cm)	4.92	1.35	555.1	258.75	9.97
T_2 (Maize normal row + 2 rows pea)	4.84	1.33	543.5	257.50	9.71
T_3 (Maize paired row + 4 rows pea)	4.90	1.28	554.3	250.00	9.35
CV (%)	3.7	5.2	6.2	6.1	8
LSD (0.05)	NS	NS	NS	NS	NS

Table 6. Economic performance of maize and garden pea intercropping systems at FSRD site, Rangpur during 2007- 08

Treatments	Yield (t/ha)		MEY (t/ha)	Gross return (Tk/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)
	Pea	Maize				
T_1 Sole maize (75cm x 25 cm)	-	9.97	9.97	99700	34520	65180
T_2 (Maize normal row + 2 rows pea)	4.3	9.71	14.01	183100	38090	145010
T_3 (Maize paired row + 4 rows pea)	3.93	9.35	13.28	172100	37150	134950

Price (Tk./kg): Maize after harvest 10, Garden pea after harvest = 20, Seed maize= 200, Seed pea= 30, Urea= 6, TSP= 28, MP= 24, Gypsum= 5, Zinc Sulphate = 4 and Boric acid= 90.

Intercropping Onion and Garlic with Chilli

Abstract

The experiment was conducted at the MLT site, Manikganj during 2007-08 to verify the performance of onion and garlic as intercrop with chilli. Respective sole crops (onion, garlic and chilli) showed higher yield but in intercrop 2 rows of onion or garlic with 100% chilli gave higher yield. Garlic intercropped as two rows with 100% chilli produced the highest gross return (Tk.214200/ha) and net return (Tk.94090/ha) with higher LER (1.52). The study revealed that all the intercropped treatments showed the highest gross returns and LER compared to sole crop of garlic, onion or chilli.

Introduction

In Bangladesh total spices production is about 4.5 lakh tons and 11.5 lakh tons are imported to fulfill the national demand. The farmers at Manikganj cultivate onion and garlic as sole crop and sometimes grow as mixed crop in the chilli field. They do not maintain the proper spacing, planting time and management practices in mixed/intercrop situation. The present study was, therefore, taken to find out the yield and economic return of onion and garlic with chilli as sole and intercrop combination.

Materials and Methods

The experiment was conducted at the MLT site, Manikganj during 2007-08. The soil of the experimental area belongs to AEZ-8 with sandy loam in texture. The experiment was laid out in randomized complete block design with five replications. It consisted of 7 treatments as T_1: Sole garlic, T_2: Sole onion, T_3: Sole chilli, T_4: one row onion with 100% chilli, T_5: one row garlic with 100% chilli, T_6: two row onion with 100% chilli and T_7 : two row garlic with 100% chilli. The seeds were sown / planted on 14 November 2007. The unit plot size was 3 m x 2 m. Spacing of chilli was maintained at 40 x 15 cm. The land was fertilized with 100- 60-30 kg N-P-K per hectare. The whole amount of P, K and $^1/_3$rd of N were applied at the time of final land preparation and remaining N was applied in two installments at 35 and 55 DAT. Garlic was harvested on 19 March, onion on 8 April and chilli was up to 30 May, 2008. Data on yield and yield contributing characters were recorded and statistically analyzed. The land equivalent ratio (LER) and equivalent yield (EY) of the intercropping system were also calculated according to Willey, (1979).

Results and Discussion

Yield, yield contributing characters, economic return and LER of chilli, onion and garlic as sole crop and intercrop were given below:

Chilli: The maximum plant height (82.21 cm) was obtained from T_3 but at par to T_4 whereas T_6 gave minimum plant height (75.54 cm). Branches/plant was also found higher in T_3 (6.26).The highest length of fruit (6.12) and number of fruit/plant (40.39) were recorded from sole chilli. The highest weight of fruits/plant (37.40g) was also obtained from same treatment. Dry fruit yield was statistically identical to all the treatments in 2007-08 but the highest yield was recorded from sole crop in 2006-07. On an average, sole chilli produced the highest yield (Table 1).

Intercropped yield: Onion and garlic were grown as intercrop in between chilli rows. There was significant reduction of onion and garlic yield in both intercropped treatments in compared to their respective sole crop. Between the two intercrop combinations, higher yield was obtained from 2 rows of onion with 100% chilli mainly due to higher plant population than one row onion with 100% chilli combination. Similar trend was followed in case of garlic (Table 2).

Chilli equivalent yield: From the two years results, it was observed that the highest chilli equivalent yield (2.14 t/ha) was found in T_7 where 2 rows of garlic was intercropped with 100% chilli. Sole chilli, sole onion and sole garlic failed to show higher equivalent yield than intercrop combination.

Cost and return analysis: The treatment T_7 where two rows garlic inter cropped with chilli gave higher gross return (Tk.214200/ha) as well as net return (Tk.94090/ha). All the intercropping treatments showed higher gross return than sole treatments. Same trend was observed in net return except T_1 and T_2. But BCR was found higher (1.94) from sole onion as because intercropped chilli with onion or garlic had involved higher production cost. Land equivalent ratio was also higher (1.52) in treatment T_7 which indicated that by inter cropping of garlic in between two rows chilli, farmers could produce 1.01 ton chilli and 5.66 ton garlic from one hectare of land instead of growing them separately in 1.52 hectare of land to obtain the same yield (Table 2 and 3).

Farmers' reaction

Farmers showed interest to grow two rows garlic in between 100% chilli intercropping system due to its higher return and net return though higher cost was involved. They are also interested to grow 2 rows onion as intercrop with chilli for higher yield and profit.

Conclusion

Two years result showed that two rows garlic in between 100% chilli intercropping system gave higher return and net return though higher cost was involved but onion could be feasible as intercrop for reasonable return.

Table 1. Yield and yield components of chilli in sole and intercropped situation at the MLT site, Manikganj during 2007-08 (average of 2 years)

Treatment	Plant height (cm)	No. of branches/ plant	Length of fruit (cm)	No. of fruits/plant	Wt. of fruit/plant (g)	Dry fruit yield (t/ha)	
						2006-07	2007-08
T_1	-	-	-	-	-	-	-
T_2	-	-	-	-	-	-	-
T_3	82.21	6.26	6.12	40.39	37.40	1.56	1.27
T_4	82.06	5.07	5.88	39.85	27.40	0.86	1.05
T_5	77.31	4.77	5.89	37.69	29.40	0.98	0.98
T_6	75.54	5.02	6.05	37.15	29.00	0.93	0.96
T_7	79.20	4.36	5.35	37.30	33.80	0.98	1.04
LSD (0.05)	3.76	1.05	0.40	1.54	2.78	0.39	NS
CV%	3.53	2.85	5.07	2.98	5.6	2.8	3.6

T_1: Sole garlic, T_2: Sole onion, T_3: Sole chilli, T_4: one row onion with 100% chilli, T_5: one row garlic with 100% chilli, T_6: two row onion with 100% chilli and T_7 : two row garlic with 100% chilli

Table 2. Yield of chilli, garlic, onion and chilli equivalent yield of intercropping garlic and onion with chilli at the MLT site, Manikganj during 2006-07 and 2007-08

Treatment	Dry fruit yield of chilli (t/ha) in average	Yield of onion/garlic (t/ha)			Chilli equivalent yield (t/ha)
		2006-07	2007-08	Mean	
T_1	-	5.93	8.09	7.01	1.402
T_2	-	7.06	12.26	9.66	1.449
T_3	1.42	-	-	-	1.420
T_4	0.96	2.62	4.79	3.71	1.517
T_5	0.98	3.29	3.57	3.43	1.666
T_6	0.95	5.23	7.46	6.35	1.903
T_7	1.01	4.98	6.33	5.66	2.142

Table 3. Cost and return analysis and LER in different intercropping system at the MLT site, Manikganj during 2007-08

Treatment	Gross return (Tk./ha)	Total production cost (Tk/ha)	Net return (Tk/ha)	BCR	LER
T_1: Sole garlic	140200	81641	58559	1.72	1.00
T_2: Sole onion	144900	74672	70228	1.94	1.00
T_3: Sole chilli	142000	91670	50330	1.55	1.00
T_4: 1 row onion with 100% chilli	151700	93510	58190	1.62	1.06
T_5: 1 row garlic with 100% chilli	166600	110470	56130	1.51	1.18
T_6: 2 row onion with 100% chilli	190300	98725	91575	1.93	1.41
T_7:2 row garlic with 100% chilli	214200	120110	94090	1.78	1.52

Relaying Hybrid Maize with Potato

Abstract

The experiment was carried out at the Farming System Research and Development (FSRD) site, Pushpapara, Pabna during the year of 2007-08 to find out appropriate relay cropping time of potato with maize. It was observed that the highest maize equivalent yield was obtained from maize sowing at 35 days after planting (DAP) of potato followed by maize sowing at 20 days after planting of potato. Considering economic return, the maximum gross margin was achieved from maize sown at 35 DAP of potato followed by maize sown at 20 DAP of potato.

Introduction

Maize is the third important cereal crop in our country. Now a day's maize is cultivating in a vast area and rapidly expanding in new area. Maize mainly used as feed, fodder, fuel and bakery industry. Maize is a long duration crop, intercropping of short duration potato cultivar could help the farmer to earn a quick return. However, to get maximum benefit from intercropping, time of planting and plant population should be optimized. Therefore, the experiment was undertaken to find out the appropriate intercropping time and to observe the effect of potato intercropping on maize yield

Materials and methods

The experiment was carried out at the FSRD site, Pushpapara, Pabna during the rabi season of 2007-08 in medium high land. The experiment was laid out in RCB design with 4 dispersed replications. The treatments viz. T_1: same day planting of maize and potato, T_2: Maize sowing at 20 DAP of potato, T_3: Maize sowing at 35 DAP of potato and T_4: Sole maize were employed for the study. The unit plot size was 10 m x 8 m. The variety of maize and potato used in the study was NK-40 and Diamant, respectively. The land was prepared accordingly following standard procedure and potato seeds were sown on December 13, 2007. Potato seeds were sown in between two maize rows having 20 cm spacing from tuber to tuber. Maize seeds were sown on December 13, 2007, January 02, 2008 and January 17, 2008, respectively as per treatment specification. The fertilizer doses were 550-280-280-187-17-12-kg Urea-TSP-MP-Gypsum-$ZnSo_4$-Boric Acid per hectare. One third of Urea and all other fertilizer were applied at final land preparation and rest amount of urea was applied in two equal split at 8-10 leaves stage and tasseling stage. No additional fertilizer was applied for potato cultivation. Earthing up was done after top dressing of fertilizer. At the early stage, the crop received one rainfall. One irrigation was applied at late vegetative stage. Other intercultural practices were done when required. Initially slight cut worm infestation was observed in maize field and recommended pesticide was applied to control the pest. Potato was harvested on March 4-6, 2008 and maize was harvested on May 09 ((T_2) and May 15 (T_1 and T_4), 2008 and April 25 (T_3), 2008, respectively. Other plant protection measures were done when required. The data on yield and yield contributing characters of potato and maize were collected and analyzed statistically.

Results and Discussion

Potato:

Performance of potato under relay cropping with maize is presented in Table 1. Weight/tuber and tuber yield was significantly responded due to treatment variation. The highest tuber yield was obtained from the treatment where maize was sown at 35 DAP of potato which was similar to maize sown at 20 DAP of potato. At the early stage of tuber, there was no competition with maize for nutrient and other growth promoting factors in T_3 and T_2 treatment which resulted better growth and development and finally enhanced yield. The lowest tuber yield was recorded in the treatment where maize seed sowing and potato tuber planting were done at the same day. The reason behind this lower tuber yield in T_1 treatment might be due to the competition between potato and maize for sharing nutrient, light, water and other yield influencing factors.

Maize:

The maximum days required for maturity were observed in the same day planting/sowing of two crops which were more or less similar to sole maize (Table 2). Maximum plant height was observed in maize sown at 35 DAP of potato which was similar with maize sown at 20 DAP of potato. The highest number of grains/cob was attained from same day planting/sowing of crops and sole maize. The weight of 100 grain was identical in all the treatments except maize sown at 35 DAP of potato. The highest grain yield was recorded from same day planting/sowing of crops. Probably the cumulative effect of number of grains/cob and the weight of 100 grains might have contribution to increased grain yield of maize. Sole maize showed lower yield than relay crop. The maximum maize equivalent yield was recorded in maize sown at 35 DAP of potato followed by maize sown at 20 DAP of potato (Table 3). The result indicated that inclusion of potato as an additional crop in maize contributed to more or less two times higher yield (maize equivalent yield) over maize sole yield. The highest straw yield was recorded in T_2 maize sown at 20 DAP of potato which was similar with other treatments except sole maize. Considering the economic return, the maximum gross margin was achieved from maize sown at 35 DAP of potato followed by maize sown at 20 DAP of potato (Table 3).

Farmers reaction

Higher production due to inclusion of potato as relay intercropping with maize. Due to growing of potato slightly reduces maize yield but total yield from two crops is very encouraging. More than double return is achieved from potato relaying with hybrid maize because no additional fertilizer is needed for potato cultivation

Conclusion

Relaying of potato with hybrid maize was found agronomically feasible and economically viable in this region. Maize sown at 35 days after planting of potato was promising for boosting up production and economic return in potato relaying with hybrid maize production system.

Table 1. Performance of potato (var. Diamant) with maize under relay cropping at the FSRD site, Pushpapara, Pabna during 2007-08

Treatments	No. of tuber /plant	Weight/tuber (g)	Tuber yield (t/ha)
T_1: Same day planting of maize and potato	5.28	43.5b	8.45b
T_2: Maize sowing at 20 DAP of potato	5.53	46ab	9.46ab
T_3: Maize sowing at 35 DAP of potato	5.88	48.5a	11.50a
T_4: Sole maize	-	-	-
CV (%)	13.03	5.90	12.79
LSD (0.05)	NS	3.11	2.68

Table 2. Performance of maize relaying with potato at the FSRD site, Pushpapara, Pabna during 2007-08

Treatments	Days to maturity (days)	Plant height (cm)	No. of grains/ cob	Cob length (cm)	100-grain wt. (gm)	Maize grain yield (t/ha)	Maize straw yield (t/ha)
T_1: Same day planting of maize and potato	155a	178.30bc	466a	18	41.23a	10.84a	6.67ab
T_2: Maize sowing at 20 DAP of potato	149b	184.00ab	438b	19	39.95a	10.21b	7.86a
T_3: Maize sowing at 35 DAP of potato	134c	185.8ab	433b	17	36.28b	9.44c	7.09ab
T_4: Sole maize	155a	177.30c	461a	19	39.73a	10.52a	6.25b
CV (%)	5.23	4.17	7.61	3.76	9.42	8.04	10.44
LSD (0.05)	0.53	6.29	18.72	NS	1.52	0.34	1.39

Table 3. Economic analysis of relaying of potato with maize at the FSRD site, Pushpapara, Pabna during 2007-08

Treatments	Potato yield (t/ha)	Maize yield (t/ha)	Maize equivalent yield (t/ha)	Variable cost (Tk./ha)	Gross return (Tk./ha)	Gross margin (Tk./ha)
T_1: Same day planting of maize and potato	8.45	10.84	19.66	62165	239430	177265
T_2: Maize sowing at 20 DAP of potato	9.46	10.21	20.08	62165	246640	184475
T_3: Maize sowing at 35 DAP of potato	11.50	9.44	21.44	62165	260740	198575
T_4: Sole maize	-	10.52	10.52	44615	133480	88865

Maize = Tk. 11.500/kg, Maize straw = Tk. 2.00/kg, Potato tuber = Tk. 12.00/kg

Performance of Intercropping Potato with Different Cucurbits

Abstract

An experiment was conducted at the MLT site, Modhupur, Tangail during 2007-08 in the medium high land situation under AEZ-28 to identify the suitable as well as profitable vegetable crops for intercropping with potato. There were five treatment combinations viz., T_1: Potato + Ash gourd, T_2: Potato + cucumber, T_3: Potato + Bitter gourd and T_4: Potato + Sweet gourd T_5: Potato (Sole). The highest tuber equivalent yield (51.57 t/ha) was obtained from the treatment T_4 (potato+ sweet gourd) but the highest gross return (Tk. 590040/ha) was found in T_3 (Potato + Bitter gourd) intercrop. The highest tuber yield (22.18 t/ha) was recorded from the sole potato.

Introduction

Cropping intensity as well as crop production can be increased by multiple cropping practices. Intercropping is one of the way of multiple cropping has long been recognized as a very common practice. It is suggested that intercropping can provide substantial yield advances compared to sole crop (Singh *et al.,* 1992). Potato (*Solanum tubersum*) is the third largest food crops in Bangladesh. It is also important source of carbohydrate. In Bangladesh, Potato occupies a total of 469105 acres of land producing 3298630 metric ton (BBS 2003-04). Potato is largely grown in Modhupur, Tangail which occupies 6045 acres of land producing 23015 metric tons (BBS, 2003-04). Potato is grown in well drained high land, which is also suitable for growing other cash crops. Most of the farmers of Modhupr, Tangail region grow different gourds viz. sweet gourd, ash gourd, cucumber and bitter gourd etc. as intercropped with potato having inadequate knowledge of agronomic practices as well as benefit of the crop. Intercrop should be selected such a way that there is no or little adverse affect on the main crop. The proper crop combinations of existing practices have not been standardized. Hence, it is necessary to find out the potential of intercropping in Potato with suitable vegetables to increase production as well as profitability of the farmers.

Materials and Methods

The experiment was carried out at the MLT site, Modhupur, Tangail during 2007-08 in the medium highland under AEZ-28. It was laid out in RCB design with six replications. The five treatments were considered as. T_1: Potato + Ash gourd, T_2: Potato + cucumber, T_3: Potato + Bitter gourd and T_4: Potato + Sweet gourd, T_5: Potato (Sole). The unit plot size was 6 m x 6m. The variety Diamant was used in the experiment. The potato tubers were planted in 10 December 2007 having planting spacing 60 cm x 20 cm. Urea, TSP, MP, gypsum and Zinc sulphate were applied at the rate of 250-125-250-120-8 kg /ha (FRG, 2005). All other fertilizers and 50% of urea were applied at the final land preparation. Remaining urea was applied at 20 days after sowing just before the 1st earthing up in potato. No additional fertilizer was applied for intercrops but plant protection measures and intercultural operations were taken as when necessary, straw mulch was used for intercropping plot. Three irrigations were applied after three times top dressed of fertilizer. Two times earthing up were done at 20 and 35 days after sowing (DAS). Ridomil gold (0.2%) was sprayed four times for preventing early and late blight of potato. Collected data were analyzed statistically.

Results and Discussion

The yield and yield contributing characters of potato were presented in Table 1. Results reveal that maximum tubers/plant (7.55) was counted in T_3 treatment (potato + bitter gourd), which was statistically identical to T_2 treatments. The highest weight of tuber (750 g) was recorded from the treatment sole potato. The tuber yield was significantly influenced by intercropping. The highest tuber yield (22.18 t/ha) was obtained from sole potato. Among the intercropped treatments, higher potato yield was recorded from treatment T_3 followed by T_2. Higher intercrop yield was obtained from sweet gourd with potato. The highest potato equivalent yield (51.57 t/ha) was obtained from the treatment combination potato + sweet gourd intercropping followed by potato + bitter gourd intercropping (Table 2) The highest gross return (Tk. 590040/ha) and net return (Tk. 450785/ha) was recorded from potato + bitter gourd intercrop combination which was about three times higher than sole potato. Potato+ sweet gourd also gave maximum yield and economic return.

Conclusion

In the economic point of view potato + bitter gourd is the suitable treatment combination for potato intercropping but potato + sweet gourd could be feasible. So the experiment may be repeated in the next year for final conclusion and recommendation.

Table 1. Performance of Potato as intercropped with different gourds at the MLT site, Modhupur, Tangail during 2007-08

Treatment	No. of plants/m^2	Plant height (cm)	No. of branches /plant	No. of tubers /plant	Tuber wt./plant (g)	Tuber yield (t/ha)
Potato + Ash gourd	7.67	62.32	2.30	6.60	560	18.35
Potato + Cucumber	7.00	65.60	2.37	7.35	630	19.18
Potato + Bitter gourd	7.15	63.30	2.32	7.55	670	19.54
Potato+ Sweet gourd	7.12	58.45	2.42	6.97	600	18.58
Potato(Sole)	7.15	64.47	2.41	4.47	750	22.18
LSD (0.05)	0.83	2.81	0.28	0.56	0.40	0.82
CV (%)	7.5	2.9	7.8	5.0	4.0	2.7

Table 2. Yield and equivalent yield of potato and intercrops at the MLT site, Modhupur, Tangail during 2007-08

Treatments	Intercrop yield (t/ha)	Potato equivalent yield (t/ha)
Potato + Ash gourd	15.56	33.39
Potato + Cucumber	10.83	27.48
Potato + Bitter gourd	22.22	49.17
Potato+ Sweet gourd	39.59	51.57
Potato sole	-	22.18

Table 3. Cost and return analysis of potato and intercrops at the MLT site, Modhupur, Tangail during 2007-08

Treatments	Gross return (Tk/ha)	Total production cost (Tk/ha)	Net return (Tk/ha)	BCR
Potato + Ash gourd	400680	149555	251125	2.64
Potato+ Cucumber	252816	137080	115736	1.84
Potato + Bitter gourd	590040	139255	450785	4.24
Potato+ Sweet gourd	515700	143505	372195	3.59
Potato sole	266160	105450	160710	2.52

Price of input (Tk/kg): Ash gourd =11.60, Bitter gourd = 16, Cucumber = 9.20, Sweet gourd = 10, Potato = 12

Performance of Different Mustard Varieties under Charland Situation

Abstract

An experiment was conducted in the charland area of the MLT site, Bhuapur, Tangail during rabi 2007-08 to evaluate the performance of BARI developed mustard varieties/lines under farmers' field condition. Tested variety/lines, were Tori-7, BARI Sarisha-9, BARI Sarisha-6, BARI Sarisha-11, BARI Sarisha-13, BARI Sarisha-15, BJDH-11, BJDH-18 and Daulat. Among the varieties/line tested BARI Sarisha-13 gave the highest seed yield (1917 kg/ha), which was at par with BJDH 18 (1863 kg/ha). The lowest yield was obtained from Tori-7 (1017 kg/ha). Tori-7 and BARI sharisha-9 took short duration (77 and 81 days) and maximum field duration was recorded in BJDH-18 (103 days).

Introduction

Bangladesh is to import a huge amount of vegetable oil and oil seed every year to meet up the demand. Mustard is the major oil seed crop in Bangladesh. It covers about 70% of the total oil seed production. The yield of this crop in Bangladesh is found much lower than the other countries due to lower yield potential of existing local varieties along with the poor management practices. The national average yield of mustard is 0.74 t/ha (Mondal and Wahab, 2001). Oil seed Research Centre (ORC) of BARI has developed some promising varieties/lines of mustard which are supposed to be high yielder, less disease susceptible and having higher oil content (44%). Developed mustard varieties (*Brassica camprestis*) has higher oil and protein contents and also well resistant to white rust (Woods-DL and Falk.KC, 2001). The varieties/lines needed to validate their performance under farmer's situation. Hence, the study was under taken to evaluate the performance of the variety/lines under farmers' field condition.

Materials and Methods

The trial was conducted in the charland area of the MLT site, Bhuapur, Tangail during rabi 2007-08 under farmers' field condition. It was laid out in RCB design with three dispersed replications. Tested varieties/lines, were Tori-7, BARI Sarisha-6, BARI Sarisha-9, BARI Sarisha-11, BARI Sarisha-13, BARI Sarisha-15, BJDH-11, BJDH-18 and Daulat. Unit plot size was 10m x 10m and the seed rate was 6-7 kg/ha. The seeds were sown on 2nd December 2007 having spacing 30cm x 5cm. Fertilizer dose used was as per Fertilizer Recommendation Guide/2005 (Urea 250-300 kg, TSP 170-180 kg, MP 85-100 kg, Gypsum 150-180 kg, Zn dose sulphate 5 kg & Boric acid 3 kg per ha). One weeding cum thinning was done 18 DAS. Irrigation, pests and other crop management practices were done as and when necessary. The crop was harvested during 15-20 March 2007. The data on different plant characters, yield components and seed yield were recorded from 10 plants randomly selected in each plot. Data were analyzed statistically.

Results and Discussion

The plant height, days to maturity, seed yield and yield attributes were significantly influenced by different lines/varieties (Table 1). The result shows that Tori-7 matured earlier (77 days) followed by BARI Sharisha-9 (81 days) while the maximum duration in maturity was recorded in line BJDH-18 (103 days). The BARI sharisha-6 and BARI sharisha-15 occupied the 3rd highest time in maturity (83 days). Significantly the highest plant height was obtained from BJDH-18 (182.3 cm) and the shortest plant was observed in Tori-7 (90.6 cm). The highest number of siliqua per plant (115) was obtained from BJDH-18, and Tori-7 produced the lowest number of siliqua per plant (48). Both the variety BARI Sharisha-13 and BARI sarisha-15 produced the highest number of seeds per siliqua (23). The line BJDH-11 and BJDH-18 produced the highest thousand seed weight (4.67 g, 4.38 g) and the lowest seed weight (1.80 g) was obtained from BARI Sharisha-6. The highest seed yield was recorded from BARI sarisha 13 which was identical to BJDH-18. The lowest yield was found in Tori-7. BARI sarisha-15 also produced satisfactory yield and matured earlier (83 days).

Farmers' reaction

Farmers are interested to cultivate BARI sarisha-9/ BARI sarisha-15 due to its short duration and comparatively higher yield. It can easily be fit in the existing cropping pattern mustard-Boro-T.aman. But BARI sarisha-13 could be fit for Mustard-B.Aus/Jute-T.Aman cropping pattern for its maximum yield.

Conclusion

BARI Sharisha-13 and line BJDH-18 gave higher yield. The later one took maximum field duration (103 day) but former one took 88 days which could be fit for Mustard-B.Aus/Jute cropping pattern. The experiment needs to be repeated.

References

Mondal, M.R.I and M. A. Wahab. 2001. Rape Seed and Mustard in; Production technology of oil crops, ORC, BARI, Gazipur. P.4.

Woods-DL and Falk.KC. 2001. Ac Sungold Summer turnip rape. Canadian Journal of Plant Science., 81:2., 285-87.

Table 1. Yield and yield contributing parameters of BARI developed mustard varieties and advance lines at the MLT site, Bhuapur during 2007-08

Variety	Days to maturity	Plant height (cm)	No. of branches/ plant	No. of siliqua/ plant	No. of seeds /siliqua	1000 seed wt (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
Tori 7	77	90.60	4	48	15	3.00	1017	3100
BARI sariha-6	83	122.83	6	50	18	1.80	1300	4433
BARI sariha-9	81	118.67	7	94	18	3.10	1345	3900
BARI sariha-11	98	124.57	4	116	13	3.50	1660	4500
BARI sariha-13	88	107.40	5	70	23	3.43	1917	4767
BARI sariha-15	83	123.63	6	65	23	2.23	1417	4267
BJDH-11	98	140.43	5	84	12	4.67	1677	5133
BJDH-18	103	182.33	6	115	13	4.38	1863	6400
Daulat	88	114.77	5	103	12	2.17	1400	5233
LSD (0.05)	3.06	5.61	0.78	3.12	1.25	0.24	139.13	277.12
CV (%)	2.0	2.6	8.5	2.0	4.4	4.4	5.3	6.0

Performance of Different Lentil Varieties in Char Land

Abstract

An experiment was conducted in the charland area of the MLT site, Bhuapur, Tangail during rabi 2007-08 to evaluate the performance of different varieties of lentil developed by BARI. Among the varieties tested BARI masur-6 gave the highest grain yield (984 kg/ha) which was identical to BARI masur-4. The lowest grain yield was obtained from local cultivar (641 kg/ha).

Introduction

Bangladesh is to import a huge amount of pulses every year to meet up the demand. Lentil is one of the major pulse crop grown in Bangladesh. Pulses are considered as the poor man's meat because of the cheapest source of protein (Miah, 1978). At present pulses are out of reach to poor people because of its high price. In Bangladesh, per capita consumption of pulse is only 12 g/day (BBS, 1998), while the world health organization (WHO) suggests 45 g/day/capita for a balance diet. Lentil is an important pulse crop grown in rabi season. The growing behaviour of lentil has made a great opportunity to fit well it in fallow period of the existing cropping pattern Aus/Jute-Fallow-Rabi crop under medium high and high land condition. The different varieties of lentil developed by BARI can be grown in charland situation where soil is comparatively fertile and well drained. Besides, lentil may be grown even under low soil fertility and management condition. As such, the experiment was conducted to identify the suitable lentil varieties for Jamuna charland situation.

Materials and Methods

The experiment was conducted in the charland area of the MLT site, Bhuapur, Tangail during Rabi 2007-08 in the farmers' field condition. It was laid out in RCB design with six (6) dispersed replications. The varieties were BARI Masur-4, BARI Masur-6 and local one. The seeds were sown on 20 November 2007. The unit plot size was 10m x 8m. Fertilizer was applied as per recommendation of BARI (Krishi Projokti hand book) (Urea 40-50 kg, TSP 80-90 kg, MP 30-40 kg per ha). Weeding, irrigation, pests and other crop management practices were done as and when necessary. The crop was harvested variety wise during 8-13 March 2008. The data on different plant characters and yield components were collected from 10 plants randomly selected in each plot. Data were analyzed statistically.

Result and Discussion

All the yield contributing parameters and yield were significantly influenced by varieties (Table1). The variety BARI Masur-6 and BARI Masur-4 flowered almost same time (64 and 63 days) while the local took the lowest time (57 days) in flowering. The highest plant height (33.4 cm) was obtained from BARI Masur-4 and the lowest (29.7 cm) were from BARI Masur-6. The highest number of pods per plant (51) and 100 seed weight (1.86 g) obtained from BARI Masur-4, which were at par with BARI Masur-6 (50 & 1.81 g) and the lowest (40 and 1.51 g respectively) were in the local one. BARI Masur-6 gave higher seed yield (984 kg/ha) though it was statistically similar to that of BARI Masur-4 (950 kg/ha). The lowest yield (641 kg/ha) was obtained from local one. Rainfall during 3rd week of November (after emergence) and last week of December (during flowering) drastically hampered the crop growth and development. That is why, yield of both the varieties were not satisfactory.

Conclusion

The trial should be repeated for another one year.

References

BBS.1998. Bangladesh Bureau of Statistics. Year Book of Agricultural Statistics of Bangladesh. Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Table 1. Yield and yield parameters of lentil varieties under charland situation of Bhuapur during 2007-08

Variety	No. of plants/m^2	Days to flowering	Days to Maturity	Plant height (cm)	No. pf pods/plant	100-seed wt. (g)	Seed yield (kg/ha)
BARI Masur-4	63	63	102	33.4	51	1.86	950
BARI Masur-6	67	64	105	29.7	50	1.81	984
Local	62	57	97	30.6	40	1.51	641
LSD (0.05)	4.41	2.81	1.91	3.6	3.99	0.14	116
CV (%)	3.9	2.6	1.1	6.7	4.9	4.5	7.8

Performance of Tomato Varieties Grown in Late Sowing Condition in Non-tidal Flood Plain Areas

Abstract

The experiment was carried out at the MLT site Bhola, Gournadi and Nazirpur during rabi season of 2007-08 to find out late planting potential of tomato varieties in southern region of Bangladesh. Three varieties of tomato i.e BARI tomato-2, BARI tomato-4 and BARI tomato-5 were planted in three different times viz. December 15, December 30 and January 15. The result revealed that BARI tomato- 5 performed better among the varieties irrespective of planting time in all the locations. BARI tomato-5 could be planted up to 15 January to obtain a profitable yield and performed better in all the locations.

Introduction

Tomato (*Lycopersion esculentum* L) is an important winter vegetable in Bangladesh. It is a good source of vitamin A and C, calcium and iron. Its vitamin C contents are 31mg per 100g of tomato (Matin *et al*.1996). It is also processed into different products for consumption. Due to its popularity in fresh market as well as for processing its demands is increasing day by day. Tomato is a photo neutral but thermo sensitive crop and is grown during the winter months of Bangladesh. (Bhuyan and Hoque.1983). Sowing the crop in time enables it to receive suitable climatic conditions favourable for its emergence, growth and development, which in turn influence the yield (Rahman *et al*.,1988). Ideal planting time of tomato is cool season of Bangladesh and has been recommended from mid September to mid October. Location specific research may be more useful for making any recommendation for a particular region. In rice based cropping system sowing time of tomato ranges from 2nd week of November till the 1st week of January, though delay in sowing reduced yield. Non saline part of the Ganges Tidal Floodplain of Southern Bangladesh (AEZ-13) comprises part of Barisal, Patuakhali and Barguna districts, which characterized by tidal flooding of field, high rainfall during monsoon and short winter . Rice is the main crop grown in kharif season (April – September). During rabi season land remains fallow in this region. Delay of harvest of transplanted aman rice and wetness of soil are the main reasons for remaining the land fallow in rabi season. Land becomes free and soil comes to working condition at the end of November to 1st week of January, which is not optimum time for sowing many rabi crops includes vegetables. Therefore, the present study was under taken to find out suitable tomato varieties for late planting potential for the Barisal region of Bangladesh.

Materials and Methods

The experiment was carried out at the MLT site Bhola, Gournadi and Nazirpur during rabi seasons of 2007-08. The experiment was laid out in split plot design with three replications. Three time of planting (December 15, December 30 and January 15) in the main plot and three varieties (BARI tomato-2, BARI tomato-4 and BARI tomato-5) in the sub plot were used. The unit plot size was 6 x 4m .The land was fertilized with cowdung @ 5 t/ha and NPK @ 230-85-102 kg/ha respectively in the form of Urea, Triple super phosphate and muriatre of potash in each planting dates. Seedlings were planted at 60 x 40 cm spacing. Half the cowdung and entire quantity of TSP were applied during final land preparation. Rest of cowdung was applied in the pits. Urea and MP were applied in two installments 21 and 35 days after transplanting. Thirty day old seedlings were transplanted in each planting dates. The crop was irrigated four times 21, 35, 45 and 50 days after planting. Plants were provided support by bamboo stick before flowering. Data in respect of plant height, and number and weight of fruits per plant were recorded from 10 randomly selected plants. Total fruit yield per plot was recorded to compute per hectare yield.

Results and Discussion

The interaction effect of planting time and variety on yield contributing characters and yield of tomato was significant in the three locations and the result are presented in Table1, Table 2 and Table 3. The highest yield 72.30, 81.26 and 86.24 t/ha were recorded in Bhola, Gournadi and Nazirpur MLT site, respectively when BARI tomato-5 variety planted in 15 December. The same treatment also showed the highest net return Tk. 141400, Tk.168280 and Tk.188220/ha in Bhola, Gournadi and Nazirpur MLT site, respectively. Among the planting times all varieties performed better on 15 December planting due to low temperature. Lowest yield was obtained from 15 January planting by all varieties probably due to high temperature during the flowering and thus setting of less number of fruit. Among the tested varieties of Tomato, BARI tomato-5 showed better yield performance under late planting situation irrespective of locations.

Farmers' reaction

- Farmers are not interested to cultivated tomato in small plot
- They are interest to cultivation of tomato if seed is available in proper time

Conclusion: The experiment needs to be conducted in the next year for final conclusion

References

Bhuyan , M. A. J and M. M. Hoque , 1983. Selection of tomato varieties for winter and summer production. *Bangladesh Horti.* 11 (1).:41.

Matin, M. A., A. S. M A. Huq, M. S. Hussain, M. R. Karim , and E. Bakash .1996. Farm level yield analysis of tomato cultivation in selected areas of Bangladesh. An economic profile .*Bangladesh J. Agril. Res* .**21** (1) : 50-57.

Rahman, M. A., M. U. Salam, M. G. Miah and M. S. Islam. 1988. Effect of sowing time on the performance of mustard (SS-75) . *Bangladesh J. Agril . Res.* **13** (1): 47.

Table 1. Yield and yield components of tomato as influenced by varieties and planting time at Bhola during 2007-08

Planting time	Variety	Plant height (cm)	Single fruit wt (g)	Fruits/plant (no.)	Fruit/plant (kg)	Fruit yield (t/ha)
15 December	BARI tomato-2	82.5	73.20	24.35	1.78	70.23
	BARI tomato -4	99.7	71.35	25.32	1.80	71.25
	BARI tomato-5	101.2	85.36	22.31	1.90	72.30
30 December	BARI tomato-2	82.7	71.26	23.10	1.64	64.23
	BARI tomato -4	98.7	70.23	23.0	1.61	63.24
	BARI tomato-5	100.0	85.21	20.8	1.77	68.69
15 January	BARI tomato-2	79.7	64.25	20.0	1.28	50.36
	BARI tomato -4	86.7	66.25	20.36	1.34	51.37
	BARI tomato-5	96.7	67.12	20.30	1.36	52.37
CV (%)		8.58	6.87	7.35	3.40	10.32
LSD (0.05)		10.23	15.23	9.54	5.6	13.3

Table 2. Yield and yield components of tomato as influenced by varieties and planting time at Gournadi during 2007-08

Planting time	Variety	Plant height (cm)	Single fruit wt (g)	Fruits/plant (no.)	Fruit /plant (kg)	Fruit yield (t/ha)
15 December	BARI tomato-2	82.7	70.2	25.5	1.79	70.59
	BARI tomato -4	99.7	71.5	25.0	1.78	70.69
	BARI tomato-5	101.2	92.2	23.0	2.12	81.26
30 December	BARI tomato-2	82.5	73.00	23.5	1.71	66.69
	BARI tomato -4	98.7	71.50	23	1.64	65.34
	BARI tomato-5	100.0	88.20	21.7	1.90	75.23
15 January	BARI tomato-2	75.7	71.00	20.5	1.45	56.32
	BARI tomato -4	80.7	72.50	20.0	1.45	57.62
	BARI tomato-5	90.7	85.00	18.5	1.57	61.37
CV (%)		6.8	8.6	9.3	4.5	11.35
LSD (0.05)		7.58	4.27	5.70	3.129	5.37

Table 3. Yield and yield components of tomato as influenced by varieties and planting time at Nazirpur during 2007-08

Planting time	Variety	Plant height (cm)	Single fruit wt (g)	Fruits/plant (no.)	Fruit weight /plant (kg)	Fruit yield (t/ha)
15 December	BARI tomato-2	82.5	72.30	23.54	1.70	67.25
	BARI tomato -4	99.7	73.21	26.0	1.90	75.24
	BARI tomato-5	101.2	91.34	24.0	2.19	86.24
30 December	BARI tomato-2	82.7	70.35	22.34	1.57	61.35
	BARI tomato -4	98.7	72.34	24.12	1.74	68.50
	BARI tomato-5	100.0	85.12	23.12	1.95	76.31
15 January	BARI tomato-2	79.7	66.35	20.13	1.33	5123
	BARI tomato -4	86.7	70.12	23.24	1.62	62.37
	BARI tomato-5	96.7	84.57	20.54	1.73	67.35
CV (%)		8.35	9.34	5.39	4.35	12.35
LSD (0.05)		9.87	7.34	8.34	5.37	13.64

Table 4. Economic performance of tomato varieties planted on different dates at Bhola during 2007-08

Treatment	Fruit yield (t/ha)	Gross return (Tk/ha)	Total production cost (Tk/ha)	Net return (Tk/ha)
T1V1	70.23	210690	75500	135190
T1V2	71.25	213750	75500	138250
T1V3	72.30	316900	75500	141400
T2V1	64.23	192690	75500	117190
T2V2	63.24	189720	75500	114220
T2V3	68.69	206070	75500	130570
T3V1	50.36	151080	75500	75580
T3V2	51.37	154110	75500	78610
T3V3	52.37	157110	75500	81610

Table 5. Economic performance of tomato varieties planted on different dates at Gournadi during 2007-08

Treatment	Fruit yield (t/ha)	Gross return (Tk/ha)	Total production cost (Tk/ha)	Net return (Tk/ha)
T1V1	70.59	211770	75500	136270
T1V2	70.69	212070	75500	136570
T1V3	81.26	243780	75500	168280
T2V1	66.69	200070	75500	124570
T2V2	65.34	196020	75500	120520
T2V3	75.23	225690	75500	150190
T3V1	56.32	168960	75500	93460
T3V2	57.62	172860	75500	97360
T3V3	61.37	184110	75500	108610

Table 6. Economic performance of tomato varieties planted on different dates at Nazirpur during 2007-08

Treatment	Fruit yield (t/ha)	Gross return (Tk/ha)	Total production cost (Tk/ha)	Net return (Tk/ha)
T1V1	67.25	201750	75500	126250
T1V2	75.24	225720	75500	150220
T1V3	86.24	258720	75500	183220
T2V1	61.35	184050	75500	108550
T2V2	68.50	205500	75500	130000
T2V3	76.31	228930	75500	153430
T3V1	51.23	153690	75500	78190
T3V2	62.37	187110	75500	111610
T3V3	67.35	202050	75500	126550

Tomato @ 3.00 Tk/kg in local market

Performance of Mustard Varieties Grown in Late Sowing Condition in Non-tidal Flood Plain Areas

Abstract

The experiment was carried out at the MLT site Gournadi and Bhola to evaluate late sowing potential of mustard varieties for getting profitable yield in Barisal region during rabi season 2007-08. The experiment include three sowing dates viz. 1 December 10 December and 20 December with four varieties i.e. Daulat, Rai-5, BARI sarisha-11 and BARI sarisha-14. The results revealed that the variety Daulat performed better in early sowing time (December 1) with seed yield of 1100 kg/ha in Gournadi and 1095 kg/ha in Bhola. But in late sowing condition (December 20), BARI sarisha-11 produced higher seed yield of 690 and 630 kg/ha at Bhola and Gournadi MLT site, respectively. The highest gross margin (Tk.23000/ha) was recorded when Daulat sown in December 1 at Gournadi and BARI sarisha -11 at Bhola with same date of planting.

Introduction

Rapes and Mustard (*Brassica* sp.) ranks first among the oilseed crops of Bangladesh. It covers about 61.2% of the total acreage under oil seed and 52.6% of the total oil seed production (BBS, 2005). Both acarage and production of the crop have been decreasing since the start of 1990 decade mainly due to ingression of cereal crops. Planting time plays a vital role in a country like Bangladesh, where climatic conditions vary throughout the country. Time of sowing determine the time of flowering and also it has great influence on dry matter accumulation, siliqua formation, seed set, seed yield and seed oil content (Scott.1973; Ali *et al*. 1985; Uddin *et al*. 1986). Hossain *et al.* (1984) and Uddin *et al.* (1986) concluded that the mid October was the most suitable time of sowing of rapeseed and mustard in Bangladesh. One of the main reasons for low yield of mustard in Bangladesh is delay sowing of seeds due to delay in recession of flood water and late monsoon rain especially in the low land areas (Sarker and Paul. 1993). Bangladesh Agricultural research Institute (BARI) has developed and recommended a few high yield potential as well as late sown varieties of rape and mustard. These varieties may differ in their response to sowing dates for yield and yield components. Non saline phase of the Ganges tidal flood plain of southern region of Bangladesh comprise part of Barisal, Patuakhali, and Barguna districts characterized by tidal flooding of field, high rainfall in monsoon and short winter. Rice is the main crops grown in the kharif season. During the rabi season, land mainly remain fallow. Delayed harvest of transplanted aman rice and wetness of soil are the main reason for this. Land becomes free and soils comes to working condition at the end of the November to first week of January which is the time not optimum for sowing of many rabi crops. Therefore, the present study was undertaken to find out a suitable variety of mustard for late sowing condition in Barisal region of Bangladesh.

Materials and Methods

The experiment was carried out at the MLT site Gournadi and Bhola during rabi season 2007-2008 under rainfed condition. The experiment was laid out in split plot design with 4 replications assigned three sowing date in the main plot (1 December, 10 December and 20 December) and four variety in sub plot (Daulat, Rai-5, BARI sarisha-11 and BARI sarisha-14). The unit plot size was 6m x 5m. The land was fertilized with NPKS @ 95-27-40-25 kg/ha. at final land preparation because crop was cultivated in rainfed condition. Seeds were sown continuous with 30 apart lines. One weeding and one thinning at 20-25 days after sowing were done to keep the crop weed free. The plants were sprayed with malathion for the control of aphid. Data were collected on plant height; branch/plant, siliqua/plant and seeds/siliqua recorded from 10 randomly selected plants from each plot. For seed yield estimation 3m x 3m area from the middle was harvested. All the collected data were statistically analyzed and means were adjudged by LSD test.

Results and Discussion

The interaction effect of planting time and variety on yield contributing characters and yield of mustard were significant in both the locations and the result are presented in Table1 and Table 3. The result revealed that in southern area the highest yield 1100 kg/ha was recorded when Daulat was sown in 1 December at Gournadi. But in Bhola, higher yield (1100 kg/ha) was recorded from BARI sharisha-11 when sown on 1 December followed by Daulat of same date. These results agreed with Razzaque *et al.* (2002). The higher yield of BARI sharisha-11 might be due to higher plants/m^2 and higher siliqua/plant. BARI sarisha-11 produced seed yield of 690 kg/ha at Bhola and 630 kg/ha at Gournadi even it was sown on 20 December. The highest gross margin (Tk.23000/ha) was recorded from Daulat sown in December 1 at Gournadi and BARI sarisha 11 at Bhola of same date. Reasonable yield could be obtained up to December 10 of all variety except Rai-5. BARI sarisha-11 showed better yield performance in late sowing condition (20 December) at both the locations.

Farmers' reaction

- Farmers were not interested to cultivated mustard in small plot
- They are interested to cultivated mustard in large plot if seed is available in proper time

Conclusion: The experiment needs to be repeated in next year for final conclusion

References

Ali , N., Shah S. A. H. and Rashid, A. 1985. Effect of sowing date on seed yield and yield components of Porbi Raya. *Pakistan Journal of Agricultural Research*. 6 : 97-100.

BBS, 2005. Bangladesh Bureau of Statistics. Statistical year book of Bangladesh. Government of Bangladesh, Dhaka.

Hossain, M . Arbinda, A. S. and Abedin, M. J. 1984. Effects of seed rate and time of sowing on the yield of mustard under rainfed condition. *Bangladesh J. Agril. Rse*. 9 : 54-57.

Razzaque, M. A., M. I. A. Howlader, S. Rafiquzzaman, M. Ashanullah and M. N. Uddin. 2002. Effect of time of sowing on the performance of mustard varieties in the southern region of Bangladesh. Bangladesh J. Agril. Res. 27(3): 479-484

Sarker , M. A. and Paul, N. K.; 1993. Physiological analysis of delayed sowing on yield of musturd.

Scott, R. K. , E. A. Ogungemi. E. A., Lvins. J. D. , and N. J. Mendham, N. J. 1973. The effect of sowing dates and season on growth and yield of oilseed rape (Brassica napus). *Journal of Agricultural Science* (Camb). 81 : 277-285.

Uddin, M. .M., . Samad A., Khan., M. R., Begum. S, and Salam, M .A. 1986. Effects of sowing dates on the yield and some of its components of mustard and rapeseed. *Bangladesh J. Sci. Ind. Res*. 21 (2) : 160-165.

Table 1. Yield and yield components of mustard as influenced by sowing time and varieties during 2007-08 at MLT site Gournadi, Barisal

Sowing time	Variety	No. of plants/m^2	Plant height (cm)	No. of siliqua/plant	No. of seeds/siliqua	1000-seed wt. (g)	Seed yield (kg/ha)
December 1	V1	55.20	120	78.12	12.00	2.15	1100
	V2	54.5	115	77.25	11.34	1.85	870
	V3	56.00	105	85.25	10.27	2.20	1070
	V4	56.00	110	80.7	11.24	2.0	1005
December 10	V1	55.20	104	77.25	11.02	2.00	925
	V2	54.20	110	73.10	10.57	1.74	720
	V3	55.00	100	82.24	10.25	2.14	970
	V4	54.00	103	79.37	11.04	1.98	910
December 20	V1	50.00	102	65.12	9.52	1.92	560
	V2	45.73	107	50.24	7.32	1.74	290
	V3	50.25	100	68.30	9.14	2.04	630
	V4	50.37	78	61.18	9.57	1.95	570
CV (%)		9.26	6.50	7.86	5.6	3.2	10.38
LSD (0.05)		8.7	11.03	9.65	7.54	5.34	25.34

V1 =Daulat, V2= Rai 5, V3= BARI sarisha 11, BARI sarisha 14

Table 2. Economic performance of mustard varieties of late sowing potential at the MLT site Gouranadi during 2007-08

Treatment	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)
T1V1	38500	15500	23000
T1V2	30450	15500	14950
T1V3	37450	15500	21950
T1V4	35175	15500	19675
T2V1	32375	15500	16875
T2V2	25200	15500	9700
T2V3	33950	15500	18450
T2V4	31850	15500	16350
T3V1	19600	15500	4100
T3V2	10150	15500	-
T3V3	22050	15500	6550
T3V4	19950	15500	4450

Mustard seed = Tk 35 /kg

Table 3. Yield and yield components of mustard as influenced by sowing time and varieties at the MLT site Bhola during 2007-08

Sowing time	Variety	No. of plants/m^2	Plant height (cm)	No. of siliqua/plant	No. of seeds/siliqua	1000-seed wt. (g)	Seed yield (kg/ha)
December 1	V1	52.50	110	80.12	12.00	2.20	1095
	V2	50.50	112	78.35	11.24	1.95	860
	V3	52.50	111	85.7	11.24	2.21	1100
	V4	51.50	105	82.25	10.27	2.20	1015
December 10	V1	52.15	106	76.25	11.02	2.12	915
	V2	49.50	108	71.10	10.57	1.84	680
	V3	52. 00	103	78.37	11.24	2.14	960
	V4	51.25	100	77.24	10.25	1.99	750
December 20	V1	50.00	103	67.12	9.52	1.93	580
	V2	45.73	105	51..24	7.32	1.74	279
	V3	52.25	98	70.30	9.14	2.10	690
	V4	48.37	78	62.18	9.57	1.95	530
CV (%)		9.26	10.50	7.86	5.6	3.2	10.38
LSD (0.05)		10.25	9.65	12.30	8.67	7.69	29.02

Table 4. Economic performance of mustard varieties of late sowing potential at the MLT site Bhola during 2007-08

Treatment	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
D1V1	38325	15500	22825
D1V2	30100	15500	14600
D1V3	38500	15500	23000
D1V4	35525	15500	20025
D2V1	32025	15500	16525
D2V2	23800	15500	8300
D2V3	33600	15500	18100
D2V4	26250	15500	10750
D3V1	20300	15500	4800
D3V2	9765	15500	-
D3V3	24150	15500	8650
D3V4	18550	15500	3050

D1= December 1, D2= December 10 & D3= December 20. Mustard seed =Tk. 35/kg

Time of Relaying Mukhikachu with Hybrid Maize

Abstract

The experiment was conducted at the MLT site Bharamara, Kushtia during 2007-08 to find out the appropriate relaying time of Maize with Mukhikachu. There were four treatments viz. T_1: Sole Maize, T_2: Maize + Mukhikachu planted on 21 February T_3: Maize + Mukhikachu planted on 3 March and T_4: Sole Mukhikachu. The highest Maize equivalent yield (24.34 t/ha) was obtained from T_2 treatment that means when Mukhikachu relaying in maize on 21 February. The highest gross return (Tk.316420/ha) was recorded from 21 February sowing but due to higher cost this treatment failed to show higher gross margin than sole mukhikachu.

Introduction

Maize is the third important cereal crop in our country. Now a day's Maize is cultivating about 300000 hectare in our country. Maize mainly used as feed, fodder, fuel and bakery industry. Mukhikachu (C*olocasia esculenta*) is an important edible aroid in Bangladesh and it contributes to the total supply of bulky vegetables during the late summer when the vegetable becomes scarce in the market. It also plays an important role in the daily diet in other countries of the world. It also compares favorably in terms of nutritional value with other root crops, such as cassava, yam, sweet potato and other edible aroids. Hence the study was undertaken to evaluate the suitable time of relaying Mukhikachu with Hybrid Maize for getting maximum benefit.

Materials and Methods

The experiment was conducted at the MLT site Bharamara, Kushtia during Rabi 2006-07. The experiment was laid out in RCB design with three replications. The treatments were T_1: Sole Maize, T_2: Maize + Mukhikachu planted on 21 February, T_3: Maize + Mukhikachu planted on 3 March and T_4: Sole Mukhikachu. The size of each unit plot was 8m x 4.5m. Maize seeds were sown in the field on 22 November, 2006. The seeds were sown with a spacing of 75 cm x 25cm. The trial was fertilized with 260-55-40-35-5-2.5 N-P-K-S- Zn and B kg/ha. One third Urea and all other fertilizers were applied as basal and rest urea was applied in 2 (two) equal Splits. First top dress was done at 8-10 leaf stage, and 2nd top dress was done at tasseling stage. The average moisture content of green maize was 14%. Mukhikachu was sown on 21 February 2007 (T_2) and on 3 March 2007 (T_3) with a spacing of 20cm x 45cm between maize rows as double row system. Additional 195 kg, Urea were applied in two equal splits as top dressed at 40 and 90 days after planting of Mukhikachu. Plant protection measures were taken as and when required. Maize was harvested on 18 April 2007 and Mukhikachu was harvested on 28 September 2007. Total field duration was 147 days for maize.

Results and Discussion

Yield and yield contributing characters of maize were insignificant except grain yield among the treatment and presented in Table 1. The highest grain yield (11.72 t/ha) was obtained from maize (sole) followed by Maize + Mukhikachu planted on 3 March. The yield and yield contributing characters of Mukhikachu were insignificant except number of secondary corm/plant (Table 2). The highest yield (24.0t/ha) was recorded from sole Mukhikachu but the highest maize equivalent yield (24.34t/ha) was obtained from T_2 treatment in which Mukhikachu relaying in maize on 21 February. The highest gross return Tk. 316420/ha and gross margin Tk. 218245/ha were found when Mukhikachu relaying in maize on 21 February. However, due to less production cost the gross margin was higher in sole mukhikachu treatment.

Farmers' reaction

The farmers' are very much interested to adopt relaying mukhikachu with maize. Because, two crops are cultivated in same land.

Conclusion

Relay cropping of mukhikachu with maize on 21 February planting gave higher cormel yield, maize equivalent yield and economic benefits. However, yield of maize was reduced in 21 February sowing compared to 3 March planting.

Table 1 Yield and yield contributing character of Maize with Maize Mukhikachu relaying at the MLT site Bharamara, Kushtia during 2007-2008

Treatment	Plant height (cm)	No. of plant/m^2	No. of cobs/m^2	No. of seeds/cob	100-seed wt. (g)	Grain yield (t/ha)
T_1: Sole maize	204	6.40	7.60	475	32	11.72
T_2: Maize + Mukhikachu planted on 21 February	203	6.33	7.40	470	32	9.30
T_3: Maize + Mukhikachu planted on 3 March	203	6.33	7.33	470	32	10.77
T_4: Sole Mukhikachu						
CV (%)	3.12	0.70	9.3	4.9	2.04	3.70
LSD (0.05)	NS	NS	NS	NS	NS	0.94

Table 2 Yield and yield contributing character of Mukhikachu with Maize Mukhikachu relaying at the MLT site Bharamara, Kushtia during 2007-2008

Treatment	Duration	No. of secondary corm/plant	No. of Carmel/ plant	Wt. of secondary corm/plant (g)	Wt. of cormel/plant (g.)	Cormel yield (t/ha)
T_1: maize						
T_2: Maize + Mukhikachu plated on 21 February	249	6	17	171	250	16.30
T_3: Maize + Mukhikachu planted on 3 March	239	10	15	244	206	12.0
T_4: Sole Mukhikachu	249	5	18	123	296	24.00
CV (%)		3.79	2.18	2.35	5.15	6.64
LSD (0.05)		19.26	NS	38.32	NS	NS

Table 3 Economic performance of relaying Mukhikachu with hybrid Maize at the MLT site Bharamara, Kushtia during 20 07-08

Treatment	Maize equivalent yield (t/ha)	Gross return (Tk./ha)	Variable cost (Tk./ha)	Gross margin (Tk./ha)
T_1: Sole maize	11.72	152360	44175	108185
T_2: Maize + Mukhikachu planted on 21 February	24.34	316420	98175	218245
T_3: Maize + Mukhikachu planted on 3 March	21.84	283920	98175	185745
T_4: Sole Mukhikachu	22.00	286000	54000	232000

Price: Maize = 13 Tk /kg, Mukhikachu =12 Tk/kg

On-Farm Verification Trial of Hybrid Maize-Sweet Potato Intercropping System at Farmers Field

Abstract

The experiment was conducted at the MLT site Bharamara, Kushtia during Rabi 2007-08 to evaluate the performance of hybrid maize intercropping with sweet potato. There were four treatment combinations viz. T_1: sole hybrid Maize (75 cm × 25 cm), T_2: sole sweet potato (60 cm × 30 cm), T_3: Maize Paired row (37.5cm /150 cm/37.5 cm × 25 cm) + 2 rows of sweet potato (60 cm × 30 cm) in between two maize paired row and T_4: Maize normal row (75 cm × 25 cm) + one row of sweet potato in between two maize rows. The highest maize equivalent yield (19.70 t/ha) was obtained from maize in paired row + 2 rows of sweet potato in paired row. The highest gross return 216700Tk. /ha and gross margin 172500 Tk./ha were recorded from maize paired row + 2 rows sweet potato paired row (T_2).

Introduction

Maize is the third important cereal crop in our country. Now a day's Maize is cultivating about 300000 hectare in our country. Maize mainly used as feed, fodder, fuel and bakery industry. Sweet potato plays an important role in the daily diet in other countries of the world. It also compares favorably in terms of nutritional value with other root crops, such as cassava, yam and other root crops. Hence the study was undertaken to show the performance of the system and to popularize it to the formers level.

Materials and Methods

The experiment was conducted at the MLT site Bharamara, Kushtia during Rabi 2007-08. The experiment was laid out in RCB design with three replications. There were four treatment combinations viz. T_1: Sole maize (75 cm × 25 cm), T_2: Maize paired row (37.5cm /150 cm/37.5 cm × 25 cm) + 2 rows of sweet potato (60 cm × 30 cm) in between two maize paired row, T_3: Maize normal row (75 cm × 25 cm) + one row of sweet potato in between two maize rows and T_4: Sole sweet potato (60 cm × 30 cm). The unit plot size was (3m × 4.5m). The hybrid maize variety Pacifice-11 and sweet potato BARI SP-6 were used in this trial.

Seeds of maize and cutting of sweet potato were sown/planted in the field on 28 November, 2007. The trial was fertilized with sole maize and intercrop were 250-60-130-30-4-1 kg NPKS Zn & B. /ha. Half of N and all other fertilizer were applied as basal. Rest N was top dressed in two equal splits at 35 and 65 DAS. Sole sweet potato was fertilized with 125-50-125-18-2-1 kg NPKS Zn & B/ha. Half of N and all others fertilizers were applied as basal. Rest N was top dressed at 35 DAS followed by earthing up and irrigation. Plant protection measures were taken as and when necessary. Total duration required for maize and sweet potato were 134 and 140 days, respectively. Maize was harvested on 10 April, 2008 and sweet potato on 16 April, 2008.

Results and Discussion

Yield and yield contributing characters of maize were significantly different among the treatments except plant/m^2 (Table 1). The highest gain yield (10.89 t/ha) was recorded from sole maize which was identical to maize paired row + 2 rows sweet potato in paired row (10.35 t/ha). The yield and yield contributing characters of sweet potato were significant except plant/m^2 and tubers /plant (Table 2). The highest tuber yield (14.66 t/ha) was recorded from sole sweet potato which was significantly differed from other treatments. The highest maize equivalent yield (19.70t/ha was found in maize paired row + 2 rows sweet potato paired row. The highest gross return Tk. 216700/ha and gross margin Tk.172500/ha were also recorded from the same treatment combination (T_3).

Farmers' reaction

Farmers' are interested to adopt intercropping sweet potato with hybrid maize for higher yield and profit.

Conclusion: It should be continued for the next year for final conclusion.

Table 1 Yield and yield contributing characters of hybrid maize in intercropping maize with sweet potato at the MLT site Bharamara, Kushtia during 2007-08

Treatment	No. of plant/m^2	No. of grains/cob	1000-grain wt. (g)	Grain yield (t/ha)
T_1: Sole Maize	6	596.7	329.7	10.89
T_2: Maize paired row + 2 rows sweet potato paired row	5	579.0	324.2	10.35
T_3: Maize normal row + 1 row SP in between two maize rows	5	573.7	322.0	9.44
LSD (0.05)	NS	8.18	2.29	0.83

Table 2 Yield and yield contributing characters of sweet potato in intercropping with maize with sweet potato at the MLT site Bharamara, Kushtia during 2007-08

Treatment	No. of plant/m^2	No. of tuber/plant	Weight of tuber/ plant (g)	Tuber yield (t/ha)
T_1: Sole Maize				
T_2:Maize paired row + 2 rows sweet potato paired row	2	4	170.80	10.13
T_3:Maize normal row +1 row SP in between two maize rows.	3	4	155.00	9.00
T_4:Sole sweet potato	5	5	350.00	14.66
LSD (0.05)	NS	NS	77.06	0.87
CV (%)		15.69	15.19	3.34

Table 3. Economic performance of hybrid Maize sweet potato intercropping system at the MLT site Bharamara, Kushtia during 2007-08

Treatment	Maize equivalent yield (t/ha)	Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)
T_1: Sole Maize	10.89	119790	39269	80521
T_2:Maize paired row + 2 rows sweet potato paired row	19.70	216700	44200	172500
T_3:Maize normal row +1 row SP in between two maize rows.	17.74	165140	43020	122120
T_4:Sole sweet potato	13.53	67650	15000	52650

Intercropping Potato with Sweet Gourd

Abstract

The experiment was conducted at the MLT site Debidwar, Comilla during the year of 2007-08 to find out the optimum sweet gourd plant population in potato field without disturbing of potato yield. Significant variation was not found among the different treatment in case of potato yield. The maximum net return (Tk. 427750/ha) and highest gross margin (Tk. 281690/ha) were found when potato was cultivated with 100% sweet gourd plant (T_5).

Introduction

Intercropping is very common practice throughout the country to utilize residual soil moisture and nutrient for crop establishment. It is the practice of two or more crops cultivated simultaneously in the same field. In Bangladesh population is increasing day by day but cultivable land is declining. To meet up the food demand of excessive population, it is necessary to utilize the available crop land more intensively to produce more food. Intercropping can provide substantial yield advantages compared to sole crop. Potato is the most important tuber crop of Bangladesh. It is starch rich food crop. Potato cultivated about 0.4 million hectare of land and produced more than 6 million tons. Sweet gourd is a good source of vitamin. Farmers of Comilla region grow sweet gourd as intercrop with potato and they get maximum return. But proper or optimum plant population of sweet gourd in potato field should be standardized. So, this experiment was undertaken to identify the optimum sweet gourd plant population in potato field.

Materials and Methods

The experiment was conducted at the MLT site Debidwar, Comilla during the year of 2007-08 to find out the optimum sweet gourd plant population in potato field without disturbing of potato yield. The experiment was laid out in Randomized Completely Block Design (RCBD) with three replications. The unit plot size was 6 m × 4 m. The potato tuber was planted on 27.11.2007 with the spacing of 60 cm × 25 cm. There were six treatments in this experiment T_1: Sole potato, T_2: potato + 40% sweet gourd, T_3: potato + 60% sweet gourd, T_4: potato + 80% sweet gourd, T_5: potato + 100% sweet gourd and T_6: sole sweet gourd. The field was fertilized with 150-45-130-15 kg of N, P, K and S in the form of urea, TSP, MP and Gypsum, respectively along with cow dung @10 ton per hectare. Half of the urea and all other fertilizers were applied at the time of final land preparation and rest amount of urea was side dressed at 35 days after planting (DAP). Irrigation and other intercultural operations were done as and when necessary. The 25 days aged sweet gourd seedling was transplanted on December 31 2007. Diathene M-45 was sprayed at 25 and 35 DAP and Secure was also sprayed at 45 and 60 DAP for the prevention of blight disease. The insecticide Admire was sprayed at two times for the controlling of viral vector. The potato tuber was harvested on 26 February 2008 at 90 DAP. The sweet gourd fruit was harvested on 17 April 2008. All the necessary data were recorded and analyzed.

Results and Discussion

The yield and yield contributing data of potato and yield of sweet gourd are presented in Table 1. Significant variation was not found in respect to tuber number/plant, tuber weight/plant and potato yield but shoot/plant showed significant difference. It indicates that tuber number per plant and yield of potato was not disturbed by the sweet gourd plant. The highest shoot/plant was recorded from T_1 (Sole potato) which was statistically different from T_5 (potato + 100% sweet gourd). Higher potato yield (36.94 t/ha) was found from T_1 (Sole potato) because of higher tuber number/plant (14.3) and higher tuber weight/plant (930 gm). The highest yield of sweet gourd (30.49 t/ha) was recorded from the treatment T_6 (sole sweet gourd) which was significantly different from other treatments. The lowest sweet gourd yield (8.47t/ha) was found from the treatment T_2 (potato + 40% sweet gourd), which was statistically similar with the treatments T_3 (potato + 60% sweet gourd), T_4 (potato + 80%

sweet gourd), T_5 (potato + 100% sweet gourd). The highest potato equivalent yield (42.78t/ha) and net return (Tk. 281690/ha) were found when potato was cultivated with 100% sweet gourd plant (T_5).

Farmers' reaction

Farmers showed their interest for growing sweet gourd with potato because they can get additional income from the potato field. They opined that sweet gourd had good access as vegetable to nearby urban market.

Conclusion

Potato cultivation with sweet gourd intercrop gave the maximum benefit from potato +100% sweet gourd. Farmers get highest return when they cultivate potato with 100% sweet gourd if they transplant sweet gourd 30 days after potato sowing.

Table 1. Performance of Potato as intercropped with sweet gourd at the MLT site Debidwar, Camilla during 2007-08

Treatments	No. of shoot/plant	No. of tuber/plant	Tuber weight/ plant (g)	Potato yield (t/ha)	Sweet gourd yield (t/ha)
T_1 Sole potato	6.0 a	14.3	930	36.94	-
T_2 Potato + 40% Sweet gourd	4.7 ab	13.3	868	35.00	8.47 b
T_3 Potato + 60% Sweet gourd	4.8 ab	11.2	913	35.00	13.68 b
T_4 Potato + 80% Sweet gourd	4.4 ab	12.1	837	34.86	14.58 b
T_5 Potato + 100% Sweet gourd	4.0 b	10.7	797	33.89	17.71 b
T_6 Sole sweet gourd	-	-	-	-	30.49 a
CV (%)	19.15	19.71	13.55	4.63	29.94
LSD (0.05)	1.727	NS	NS	NS	9.57

Table 2. Equivalent yield, Cost and return analysis of potato and sweet gourd at the MLT site, Debidwar, Camilla during 2007-08

Treatments	Potato equivalent yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
T_1 (Sole potato)	36.94	369400	131150	238250	2.81
T_2 (potato + 40% sweet gourd)	39.24	392350	142310	248790	2.75
T_3 (potato + 60% sweet gourd)	41.84	418400	143560	273590	2.91
T_4 (potato + 80% sweet gourd)	42.15	421500	144810	275440	2.91
T_5 (potato + 100% sweet gourd)	42.78	427750	146060	281690	2.93
T_6 (sole sweet gourd)	15.245	152450	87500	64950	1.74

Potato: 10 Tk./kg, Sweet gourd: 5 Tk./kg

Performance of Mungbean Varieties under Potato-Mungbean Cropping Pattern at Munshiganj

Abstract

The experiment was conducted at the MLT site Munshiganj during kharif I of 2008 to evaluate the performance of mungbean varieties viz. BARI mung 4, BARI mung 5, BARI mung 6, BINA mung 5, BINA mung 6 and local. Higher yield was obtained from BARI mung 6 (1125 kg/ha) followed by BINA mung 6 (1008). Pods per plant and 100-seed weight were higher in BARI mung 6 which resulted higher yield.

Introduction

Munshiganj is one of the leading potato growing areas of Bangladesh which covers about 36000 ha of land and produced 11 lakh metric tons that ranked first in the area and production of the country (DAE, 2008). Farmers of Munshiganj usually use three to four times more fertilizer than the recommended dose in potato (Hoque, 2005 and Choudhury, 2006) which is detrimental to the soil health. Inclusion of legume in the cropping system substantially contributes in nutrient supply. Legumes like mungbean can be fitted in potato based cropping systems owing to its short duration and adaptability in summer conditions i.e. grown after the harvesting of potato. There are some summer varieties of mungbean, but the farmers do not know which variety will perform better under Potato-Mungbean cropping pattern. Cultivation of suitable variety with proper management practices may contribute higher yield as well as economic return. Considering the fact in view the present study was carried out to find out the suitable variety of mungbean as succeeding crop of potato in Munshiganj situation.

Materials and Methods

The experiment was conducted at the MLT site Munshiganj during the kharif I of 2008. Six varieties of mungbean viz. BARI mung 4, BARI mung 5, BARI mung 6, BINA mung 5, BINA mung 6 and local were tested for evaluating their performance. The experiment was laid out in a RCB design with 3 replications. The unit plot size was 5m x 3m and plant spacing was 30 cm x 5 cm. The seeds were sown on 21 March, 2008. As high dose of fertilizers were applied in the potato, no additional fertilizer was applied in mungbean. All intercultural operations were done as and when necessary. The crop was harvested two times during May 2008. Data on yield and yield attributes along with other parameter were collected properly and subjected to statistically analysis.

Results and Discussion

Except BARI mung 6, plant height did not varied among the varieties (Table 1). BARI mung 6 was shorter palnt. The significant variations were found in the number of pods per plant, number of seeds per pod, weight of seeds and in the yield. The highest numbers of pods per plant were found in BARI mung 6, but it was similar with BARI mung 5, BINA mung 5 and BINA mung 6 and even with local variety. There was no variation about the seeds per pod among the varieties. Hundred seeds weight were significantly varied among the varieties. The highest seed weight was found in BARI mung 6 and the lowest from the local variety. Yellow mosaic virus was found in BARI mung 4 in some cases. Pods per plant and seed weight influenced on the yield. Except the local variety, similar yield was found among the varieties. Hassan *et. al.* (1995) and Choudhury *et. al.* (1985) also reported that seed yield had a positive and significant association with number of pods per plant.

Farmer's reaction

Farmers prefer BARI mung 6 for its higher yield.

Conclusion: The experiment may be continued in the next year for further confirmation

References

Anonymous, 2006. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics. Ministry of Planning. Govt. of Bangladesh, Dhaka. P. 143.

Choudhury, D. A., Quayyum, M. A., Hossain M. A. and Hasan. M. K. 2006. Project Completion Report SFFP II (1999-2006) (Edited). On Farm Research Division. Bangladesh Agricultural Research Institute, Joydebpur, Gazipur 1701. 383 p.

Choudhury, M. A., Mian, M. A. K. and Rahman, M. M. 1988. Variability and correlations among some yield contributing characters in mungbesn (*Vigna radiata* L). Bangladesh J. Plant Breeding and Genetics 1 (1&2) : 62-65.

DAE. 2008. Office of the Deputy Director, Khamarbari, Department of Agricultural Extension, Munshiganj.

Hasan, M.S., Siddique, A. K. M. A. R. and Malek, M. A. 1995. Correlation studies of mungbean. Bangladesh J. Agril. Res. 20 (2) : 126-131.

Hoque, M.A., Islam, M. R., Ahmed, S.U., Ali, M. S. and Khan, M. A. I. 2005. Integrated crop management practice and farmers' production practice of potato in farmers' field school. Bangladesh J. Agril. Res. 30 (4) : 667-675

Table 1. Yield and yield contributing characters of mungbean varieties at the MLT site, Munshiganj during 2008

Varieties	Plant height (cm)	No. of pods/plant	No. of seeds/pod	Wt. of 100-seed (g)	Seed yield (kg/ha)
BARI mung 4	45.20	11.17	7.87	3.51	934
BARI mung 5	48.80	13.13	8.33	3.87	985
BARI mung 6	38.27	15.87	8.90	4.15	1125
BINA mung 5	42.03	14.53	8.80	3.98	964
BINA mung 6	46.53	14.93	8.90	3.97	1008
Local	41.63	13.83	7.90	2.67	768
LSD (0.05)	7.36	3.94	NS	0.58	247
CV (%)	9.25	15.57	7.79	8.56	14.07

B. HIGH BARIND TRACT

Effect of Planting Date and Bulb Size on the Seed Yield and Seed Quality of Summer Onion in High Barind Area

Abstract

The experiment was carried out at the FSRD site, Kadamshahr, Godagari, Rajshahi during 2007-08 to investigate the effects of bulb size and planting date on the yield and quality of onion seeds of BARI piaz-2. Three bulb size (5±2g, 10±2g and 15±2g) and two planting date (6 Nov. and 21 Nov.) were considered for the experiment. Bulb size and planting date had significant effect on the yield and quality of onion seed. The higher seed yield (881.56 kg/ha) and the lower seed yield (782.22 kg/ha) were obtained when bulbs were planted on 21 November and 6 November, respectively. The highest seed yield (930.83 kg/ha) was produced by using large bulb (15±2g) that is identical to medium bulb (10±2g) and the lowest seed yield (720.5 kg/ha) was obtained by using small bulb (5±2g). The interaction effect of planting date and bulb size vary significantly. The maximum seed yield (995.33 kg/ha) was obtained by using large bulb (15±2g) planted on 21 November and lower seed yield was found from small bulb (5±2g) planted on 6 November. Higher percentage of germination (73.11%) was found when bulb was planted on 6 Nov. Large bulb (15±2g) produced significantly the highest percentage of germination (75.17%). Significantly the highest percentage of germination (76.67%) was produced by large bulb size (15±2g) when planted on 6 Nov. and the lowest percentage of germination (57.33%) was produced by small bulb size (5±2g) when planted on 21 Nov.

Introduction

Onion (*Allium cepa*) is one of the most important spices crop in Bangladesh. Among the spices crops, it ranks first with an annual production of 589 thousand metric tons that is very low compared to the estimated annual requirement of about 836 thousand metric tons (Krisi Dairy, 2007). Seed has a unique role to increase onion production. The average seed yield of onion in our country 370-500 kg/ha (HRDP, 1995) which is very low as compared to the other countries of the world 1000-1200 kg/ha (Brewster, 1994). Annually Bangladesh produced only 150 metric tones of onion seed as against the requirement of 300 metric tones (Rahim *et.al.*1993). Therefore, a great scarcity of onion seed is noticed every year. Different study revealed that planting time and bulb size are two important key factors for quality seed production. Brewster (1994) observed various differences in average seed yield as it depends on genotype, locality, season and method of seed production. Abedin *et. al.* (1999) reported that mother bulb size markedly influence the yield and quality of onion seed. Moreover planting date is a prime factor for yield and quality of onion seed. In case of early planting heavy dews adversely affect the seed crops and contrarily the late planted crop may also affect by early rain that lead to total crop failure. On the other hand, Barind is a potential area for quality seed production of its inherent environmental conditions. Usually less humid condition prevails throughout the whole rabi season and so comparatively less pest attack is occurred during that time. That is why; area under onion seed production in High Barind Tract (HBT) is increasing day by day. Therefore, considering above facts, the present study was undertaken to find out the optimum planting time and bulb size to grow good quality onion seeds.

Materials and Methods

The experiment was conducted at the Farming System Research and Development (FSRD) site, Kadamshahar, Godagari, Rajshahi during 2007-08 to find out the optimum planting date and bulb size to produce good quality seeds of summer onion in the High Barind Tract. The soil belongs to Amnura series under AEZ 26 and composed of silty clay loam in texture with having a pH value of 5.8. The treatments comprised three bulb size (5±2g, 10±2g and 15±2g) and two planting date (6th Nov. and 21st Nov.). The two factor experiment was laid out in the randomized complete block design with three replications. Onion variety BARI piaz-2 was used in the study. The unit plot size was 2m x

1.5m. The bulbs were transplanted at the spacing of 30cm x 10cm. The soil of experimental plot was treated by Furadan @ 1 kg/bigha before transplanting the bulbs. Rovral (@ 2 g/L water) and Bavistin (1 g/L water) were used simultaneously at 8-10 days intervals during vegetative stage. The plot was irrigated 7 times at 7-10 days intervals before seed maturity stage. Other operations viz. mulching, weeding etc. were done in order to support normal plant growth. The crop was harvested at maturity on 4 April 2008. Observations were made on yield components from 10 randomly selected plants per plot. Yield data was taken as plot wise and thereafter converted into kg/ha. The data were analyzed statistically and the mean differences were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Effect of planting date

Significant variation was observed in seed yield and yield attributes of onion between two planting date except 1000 seed weight and umbel diameter (Table 1). The taller plant (85.72 cm) was obtained when seed bulb planted on 6 Nov. The maximum number of seeded fruits/umbel (190.49) and higher seed weight/umbel (1.78 g) were obtained when the seed bulb was planted on 21 Nov. and these attributes resulted in higher seed yield (881.56 kg/ha). On the other hand, the lower seed yield (782.22 kg/ha) was recorded when seed bulb was planted on 6 Nov. Maximum percentage of germination (73.11%) and minimum percentage of germination (63.89%) were found when bulb was planted on 6 Nov. and 21 Nov. respectively.

Effect of bulb size

Effect of bulb size on the seed yield and yield attributes of onion were significantly different among the bulb size except plant height and 1000 seed weight (Table 2). Large bulb was produced the highest number seeded fruits/umbel (208.50) followed by medium bulb (175.77) and the lowest number of seeded fruits/umbel (133.40) obtained by using small bulb. Similar trend was found in case of seed weight/umbel and significantly the highest (1.99g) and lowest (1.18g) seed weight/umbel were obtained by planting large and small bulb respectively. Large bulb size significantly produced large size umbel (6.42cm) followed by medium bulb (5.72cm) and small bulb (5.41cm). The highest seed yield (930.83 kg/ha) was produced by using large bulb that was identical to medium bulb but the lowest seed yield (720.5 kg/ha) was obtained from small bulb. Highest percentage of seed germination (75.17%) was recorded in when used large onion bulb followed by medium bulb size (67.83%) and the lowest percentage of germination (62.50%) were obtained from small size bulb.

Interaction effect of planting date and bulb size

The interaction effect of planting date and bulb size were significantly affected by the treatments except 1000-seed weight and plant height (Table 3). The maximum seed yield (995.33 kg/ha) was obtained by using large bulb (15±2g) planted on 21 November followed by medium bulb size (10±29) and large size of 6 November planting. The lowest seed yield was found from small bulb (5±2g) planted on 6 November followed by 21 November of same bulb size. Percentage germination significantly varied by the interaction effect of planting date and bulb size (Table 3). Higher percentage of germination (76.67%) was achieved from large bulb (15±2g) planted on 6 Nov. and the lowest percentage of germination (57.33%) was produced by small bulb (5±2g) when planted on 21 Nov.

Farmers' reaction

- Farmers are pleased to have higher seed yield
- Optimum time of bulb sowing is 20-25 November for seed production
- Farmers have got seed 525- 600 kg/ha.

Conclusion

Large bulb (15±2g) planting on 21st November produced the highest seed yield (995.33 t/ha). On the other hand the highest percentage of seed germination (76.67%) was recorded from large bulb (15±2g) when planted on 6 Nov. This was first year result so the trial should be continued for final recommendation in the next year.

References

Abedin, M.J., M.A. Rahim, K.S. Islam and M.A. Haider. 1999. Effect of planting date and bulb size on the yield and quality of onion seed. Bangladesh J. Seed Sci. Tec. 3 (1&2): 25-28.

Brewster,J.L. 1994. Onions and other vegetable Alliums. CAB International, UK. 236p.

Gomez K A. & A A Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd edn. John Wiley and Sons. New York. : 680.

HRDP.1995. Training Manual, Winter Vegetable and spices Production, Horticulture Research and Development Project (FAO/UNDP/ASDP Project: BGD/87/2005) and BADC, Dhaka. 285p

Perrin, R.K., D.L. Winkelman, E.R. Moseardi and J.R. Anderson. 1979. Farm agronomic data to farmer's recommendations. Information Bulletin 27, CIMMYT, MEXICO.

Rahim,M.A., M.M.U.Amin and M.A.Haider.1993. Onion seed production tecnology in Bangladesh. Allium Improvement Newsletter, 3:33.

Krisi Dairy. 2007. Krisi Dairy. Agriculture Information Service. Ministry of Agriculture, Govt. of the Peoples Republic of Bangladesh. Dhaka.

Table 1 Onion seed yield and yield attributes as affected by planting date at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Sowing date	Plant height (cm)	Seeded fruits/ umbel (No)	Seed wt/ umbel (g)	1000 seed wt (g)	Umbel. dia (cm)	Seed yield (kg/ha)	Seed Germination (%)
6th Nov.	80.07b	154.62b	1.38b	3.06	5.41	782b	73.11a
21st Nov.	85.72a	190.49a	1.78a	3.10	5.93	881a	63.89b
CV (%)	3.40	14.17	11.37	6.27	4.67	8.63	4.15

Table 2 Onion seed yield and yield attributes as affected by different bulb size at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Bulb size (g)	Plant height (cm)	Seeded fruits/ umbel (No)	Seed wt/ umbel (g)	1000 seed wt (g)	Umbel. dia (cm)	Seed yield (kg/ha)	Seed Germination (%
Small (5±2)	82.48	133.40c	1.18c	2.94	5.41b	721b	62.50c
Medium (10±2)	82.70	175.77b	1.56b	3.06	5.72b	844a	67.83b
Large (15±2)	83.50	208.50a	1.99a	3.24	6.42a	931a	75.17a
CV (%)	3.40	14.17	11.37	6.27	4.67	8.63	4.15

Table 3. Onion seed yield and yield attributes as affected by different bulb size and sowing date at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Bulb size x Sowing date		Plant height (cm)	No. of fruits/umbel	Seed wt/ umbel (g)	1000 seed wt (g)	Umbel dia (cm)	Seed yield (kg/ha)	Seed Germination (%)
6th Nov.	5±2	79.67	103.87c	0.97d	2.90	5.29b	668c	67.67bc
	10±2	78.87	164.33b	1.37c	3.03	5.68b	812b	75.00ab
	15±2	81.67	195.67ab	1.81b	3.24	6.36a	866ab	76.67a
21st Nov.	5±2	85.30	162.93b	1.39c	2.98	5.52b	773bc	57.33d
	10±2	86.53	187.20ab	1.78b	3.09	5.76b	876ab	60.67cd
	15±2	85.33	221.33b	2.17a	3.23	6.49a	995a	73.67ab
CV (%)		3.40	14.17	11.37	8.63	6.27	4.67	4.15

Yield Potential and Economic Return of Different Hybrid Maize Varieties under Potato-Maize Cropping Pattern

Abstract

A field experiment was conducted in the farmer's field of FSRD site, Kadamshahar, Rajshahi during 2007-08 to find out the suitable maize variety (s) that will be fitted well in Potato-Maize cropping pattern for higher grain yield and economic return. Six hybrid maize varieties viz. Pacific-60, Pacific-11, Pacific-984, NK-40, BARI Hybrid Maize-5 and BARI Hybrid maize-3 were tested in the farmer's field of HBT. Among the tested varieties, higher grain yield (6.56 t/ha) was produced by BARI hybrid maize-5 followed by NK-40 (5.95 t/ha) and Pacific-984 (5.93 t/ha) while the lowest grain yield was found in Pacific-60 (4.93 t/ha).

Introduction

In the recent years, both the area and production of maize are in increasing trend all over Bangladesh including High Barind Tract. In Barind area, it is generally cultivated followed by potato. But the farmers of this area do not know which variety (s) of maize will perform better under Potato-Maize cropping pattern. Injudicious selection of maize variety, the cultivated crop does not provide desirable yield. Cultivation of suitable maize variety with proper management practices may contribute higher yield that will be benefited for the farmers. Hence, the present study has been undertaken to find out the suitable variety of maize for obtaining higher yield and economic return to cultivate after potato crop in High Barind Tract.

Materials and Methods

The experiment was conducted at the FSRD site, Kadamshahar, Rajshahi during rabi 2007-08 in the farmers' field of High Barind Tract. The experiment was laid out in RCBD design with 3 dispersed replications. The experiment was conducted after harvesting of potato. The potato variety Cardinal was cultivated as per BARI recommended practice. The crop was sown on 5 December 2006 and harvested on 5 March 2007. After harvest of potato the plot was divided into six sub plots (3 m x 3 m) maintain 1 m distance between two sub plots. The unit plots were fertilized with 108-35-60-15-1 kg/ha N-P-K-S-Zn, respectively. Six maize varieties viz., Pacific-60, Pacific-11, Pacific-984, NK-40, BARI Hybrid Maize-5 and BARI Hybrid maize-3 were sown on 6 March 2007. The spacing was 75 cm distance between rows and 25 cm between two plants. The crops were harvested on 14 June 2007. The data on different yield and yield contributing characters of maize were collected from randomly selected 10 plants from each plot and yields were recorded plot wise. The data were analyzed statistically and the mean differences were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984). The economic analysis was done for gross return, gross margin and marginal benefit cost ratio for different treatments following the method suggested by Perrin *et al*. (1979).

Result and Discussion

Among the maize varieties significant variation was observed on the yield and yield contributing characters except cob length and straw yield (Table 1). BARI hybrid maize-3 produced the highest height (223.27 cm) that is identical to Pacific-984 (219.53 cm) and Nk-40 (219.20 cm) and the lowest plant height (206.33 cm) was observed in Pacific-11. The highest number of grains/cob (547) was recorded in BARI hybrid maize-5 followed by Pacific-984 (482.75) and the lowest number of seeds/cob was found in NK-40 (403.06). The highest grain weight/cob (201.53 g) was obtained from BARI hybrid maize-5. Similar trend was followed in case of 100-grain weight. The highest grain yield (6.56 t/ha) was recorded in BARI hybrid maize-5 followed by NK-40 (5.95 t/ha) and Pacific-984 (5.93 t/ha) and the lowest grain yield (4.93 t/ha) was found in Pacific-60. Higher yield was recorded from BARI hybrid maize 5 due to higher yield attributes than other varieties. The highest gross return (Tk.72690/ha) as well as gross margin (Tk.49140/ha) were recorded from BHM-5.

Farmers' reaction

- Farmers were very much happy to get higher yield from maize variety (BHM-5, NK-40 and Pacific-984) in kharif I season
- Farmers got large size cob as well as higher number of seeds/cob from their desired varieties

Conclusion

Among the tested varieties of hybrid maize, three promising varieties (BHM-5, NK-40 and Pacific-984) were found suitable for kharif I season. The trail should be needed for further study in the next year for final recommendation.

References

Gomez K A. & A A Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd edn. John Wiley and Sons. New York. : 680.

Perrin, R.K., D.L. Winkelman, E.R. Moseardi and J.R. Anderson. 1979. Farm agronomic data to farmer's recommendations. Information Bulletin 27, CIMMYT, MEXICO.

Table 1. Performance of different maize varieties in Potato–Maize cropping pattern at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Variety	Plant height (cm)	Cob length (cm)	No. of grains/cob	Grain wt /cob (g)	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
BHM-3	223.27a	17.30	420.66b	147.80b	29.80c	5.49bc	6.61
BHM-5	214.60bc	19.37	547.00a	201.53a	39.03a	6.56a	7.09
NK-40	219.20ab	17.13	403.06b	155.20b	33.60bc	5.95ab	6.44
Pacific-984	219.53ab	18.66	482.75ab	158.06b	33.80b	5.93ab	6.44
Pacific-60	208.60cd	17.86	459.33b	125.66b	31.53bc	4.93c	6.80
Pacific-11	206.33d	17.93	465.00b	132.86b	30.10bc	5.50bc	6.58
CV (%)	3.63	6.97	9.63	14.07	8.21	7.65	7.98

Table 2. Cost and return analysis of different maize varieties in Potato-Maize cropping pattern at the FSRD site, Kadamshahar, Rajshahi during 2007-08

Variety	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)
BHM-3	61510	23550	37960
BHM-5	72690	23550	49140
NK-40	65940	25700	40240
Pacific-984	65940	24150	41790
Pacific-60	56100	24150	31950
Pacific-11	61580	24150	37430

Evaluation of Different Tomato Varieties/Lines for Yield Potentiality and Adaptability under High Barind Environment

Abstract

Fifteen tomato varieties/lines were evaluated at the FSRD site Kadamshahar, Rajshahi during rabi 2007-2008 to find out the yield potentiality and adaptability of the varieties/lines in High Barind environments. The tomato varieties/lines were namely BARI Hybrid Tomato-3, BARI Hybrid Tomato-4, BARI Tomato-3 BARI Tomato-4, BARI Tomato-5, Abinash-3, Sathi, Safal, Hitom, T-1458, T-1387, T-848, T-2024, Minto and Surrokha. Among the fifteen variety/lines the highest yield (36.56 t/ha) was found in Surokkha followed by Abinash-3 (36.07 t/ha) and Sathi (35.46 t/ha). The varieties BARI Hybrid Tomato-3 and BARI Hybrid Tomato-4 produced 28.11 and 25.75 t/ha yield, respectively. On the other hand, BARI Tomato-3, BARI Tomato-4 and BARI Tomato-5 gave 21.82, 26.28 and 23.99 t/ha yield, respectively. The lowest yield (20.83 t/ha) was recorded from tomato line T-2024. The maximum gross return (200050 Tk./ha), net return (111550 Tk./ha) and BCR(2.26) were obtained from Surokkha. The lowest gross return (110050 Tk./ha), net return (30750Tk./ha) and BCR (1.38) were found in T-2024.

Introduction

Tomato is a popular vegetable in Bangladesh especially in the urban areas. The total tomato production in the country is about 1.03 lakh metric ton (BBS, 2004). Presently, the farmers of high Barind Tract extensively cultivate various local and exotic hybrid tomato varieties at early rabi season (September) after the harvest of T. aus rice (cv. *Parija*). Though a large number of tomato varieties, both local and exotic, are available in the country for cultivation but most of them are not well known as high yielding varieties to the tomato growers. Moreover, some exotic tomato varieties enter into vegetable seed market every year by the seed importers without any performance test in different agro climatic zones of Bangladesh (Islam, 1999). As a result, tomato growers are deceived because most of the exotic varieties may not be suitable in this environment. In these circumstances, the present study was undertaken to evaluate the productivity and profitability of fifteen tomato varieties/lines under High Barind environment.

Materials and Methods

The field trial was carried out at the FSRD site, Kadamshahar, Rajshahi during rabi 2007-2008 in the farmers' field of High Barind Tract. The experiment was laid out in a randomized complete block design with three replications. Fifteen tomato varieties/ lines used as a treatment in this experiment. The unit plot size was 3 m x 3 m. Seeds were sown in seedbed on 27 August 2007. The 29 days old seedlings were transplanted in the main plots on 26 September 2007 with spacing 60 cm row to row distance and 40 cm plant to plant distance. The experimental plot was fertilized with 250-90-125-30-1 kg/ha N-P-K-S-B, respectively in the form of urea, TSP, MP, gypsum and boric acid, respectively and 10 ton cowdung/ha (FRG, 2005). The TSP, boric acid and cowdung were applied during final land preparation as basal. The next MP and urea fertilizers were used in two installment after 25 and 40 days after planting, respectively. The tomato varieties and their sources of collection were presented in Table1. Irrigation was applied three times during the crop-growing period. Insecticide (Admire @ 0.5 ml/L water) and fungicide (Ridomil Gold @ 2g/L water) were sprayed four times for controlling insect and diseases of tomato plant. Weeding and other intercultural operations were done as per need for better growth and development of the crop plant. The tomato was harvested ranging from 28 November 2007 to 25 December 2007. The data on yield components of tomato were collected from five randomly selected plants of each plot and yield was recorded plot wise and then converted into ton per hectare. Data were analyzed statistically and means were separated by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Table 1. Tomato varieties and their source of collection tested in HBT

Sl. no.	Tomato variety/ line	Source of collection
1.	BARI Hybrid Tomato-3	HRC, BARI
2.	BARI Hybrid Tomato-4	HRC, BARI
3.	BARI Tomato-3	HRC, BARI
4.	BARI Tomato-4	HRC, BARI
5.	BARI Tomato-5	HRC, BARI
6.	Abinash-3	Syngenta, Bangladesh
7.	Sathi	Syngenta, Bangladesh
8.	Safal	Syngenta, Bangladesh
9.	Hitom	Syngenta, Bangladesh
10.	T-1458	East West Seed Co.Ltd.
11.	T-1387	East West Seed Co.Ltd.
12.	T-848	East West Seed Co.Ltd.
13.	T-2028	East West Seed Co.Ltd.
14.	Minto	East West Seed Co.Ltd.
15.	Surrokha	Namdhari Malik Seeds

Results and Discussion

Yield and yield contributing characters of tomato varied significantly among the different variety/lines (Table 2). Among the fifteen variety/lines higher yield (36.56 t/ha) was found in Surokkha which was identical to Abinash-3 (36.07 t/ha) and Sathi (35.46 t/ha). The highest single fruit weight (50.23 g) was found in surokkha which resulted in the highest fruit yield. BARI developed hybrids tomato varieties BARI Hybrid Tomato-3 and BARI Hybrid Tomato-4 produced 28.11 and 25.75 t/ha yield, respectively. On the other hand, open pollinated BARI developed tomato varieties BARI Tomato-3, BARI Tomato-4 and BARI Tomato-5 gave 21.82, 26.28 and 23.99 t/ha yield, respectively. The lowest yield (20.83 t/ha) was recorded from the line T-2024. The maximum gross return (Tk.200050/ha), net return (Tk.111550/ha) and BCR (2.26) were obtained from Surokkha. The lowest gross return (Tk. 110050/ha), net return (Tk. 30750/ha) and BCR (1.38) were found in T-2024. (Table 3).

Farmers' reaction

- Farmers are pleased to get high yield from hybrid variety Surokkha with large fruit size

Conclusion

From the first year evaluation, it should be suggested that the tomato hybrid variety Surokkha will become profitable but the experiment should be continued for next year for further conformation.

References

BBS (Bangladesh Bureau of Statistics). 2004. Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the People's Republic of Bangladesh. p. 144.

FRG (Fertilizer Recommendation Guide). 2005. Fertilizer Recommendation Guide. Bangladesh Agricultural Research Council, Farmgate, New Airport Road, Dhaka-1215. pp. 211-213.

Gomez, K.A. and A.A. Gomez. 1984. Statistical procedures for agricultural research (2nd Edition). An International Rice Research Institute Book. John Wiley and Sons, New York, USA.680 p.

Islam, M.M., M.D. Hossain, A. Rashid, M. A. Rahman and M.S. Islam. 1999. Performance of some local and exotic tomato varieties at the southern region of Bangladesh. Bangladesh Journal of Science and Technology 1 (1): 9-15.

Table 2 Yield and yield contributing characters of different tomato varieties/ lines at HBT during 2007-2008

Tomato variety/ lines	Days to flowering	Plant height (cm)	No. of fruits /plant	Vertical diameter/ fruit	Horizontal diameter/ fruit	Single fruit weight (g)	Fruit yield (t/ha)
BARI Hybrid Tomato-3	64	81.00cde	33.10f	5.33ab	4.59 a	35.74 i	28.11 d
BARI Hybrid Tomato-4	63	83.00bc	41.90a	4.36f	3.96 d	42.20 ef	25.75 e
BARI Tomato-3	66	79.50de	29.80gh	4.29f	4.32abc	40.00 g	21.82 g
BARI Tomato-4	67	76.40f	29.20hi	4.30f	3.92 d	37.73 h	26.28 e
BARI Tomato-5	56	82.0bcd	40.21b	4.55ef	4.15 cd	32.00 j	23.99 f
Abinash-3	65	79.00e	34.23f	5.20abc	4.49 ab	43.82 de	36.07 a
Sathi	64	83.50abc	37.50de	4.75cdef	4.24 bcd	45.32 cd	35.46 a
Safal	66	81.50cde	36.78de	4.62def	3.94 d	44.80 cd	30.49 c
Hitom	56	81.50cde	28.18i	4.98bcde	4.54 ab	47.63 d	33.43 b
T-1458	67	83.50abc	36.35e	5.12bcd	4.52 ab	51.52 a	28.65 d
T-1387	64	84.50ab	33.80f	5.31ab	4.30 abc	48.00 b	23.72 f
T-848	65	86.00a	39.55bc	5.40ab	4.36 abc	46.20 bc	31.21 c
T-2024	63	82.00bcd	30.80g	4.33f	3.60 e	48.00 b	20.83 g
Minto	65	86.00a	36.05e	4.67def	4.16 cd	41.23 fg	30.86 c
Surrokha	65	80.00de	38.18cd	5.66a	4.40 abc	50.23 a	36.56 a
CV (%)	-	3.40	3.80	6.34	5.01	5.89	6.67

Table 3 Net return achieved from different tomato variety/lines tested in HBT during 2007-2008

Tomato variety/lines	First harvest (64 DAT)		Second harvest (75 DAT)		Third harvest (185 DAT)		Fourth harvest (91 DAT)		Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
	t/ha	Tk./ha	t/ha	Tk./ha	t/ha	Tk./ha	t/ha	Tk./ha				
BARI hybrid tomato-3	10.20	102000	5.80	29000	6.50	22750	5.61	14025	167775	85210	82565	1.98
BARI hybrid tomato-4	8.50	85000	5.32	26600	5.00	17500	6.93	17325	146425	83200	63225	1.75
BARI tomato-3	5.23	52300	6.59	32950	5.00	17500	5.0	12500	115250	80115	35135	1.43
BARI tomato-4	8.60	86000	6.96	34800	5.20	18200	5.52	13800	152800	83710	69090	1.82
BARI tomato-5	6.23	62300	8.50	42500	4.60	16100	4.60	11500	132400	82225	50175	1.61
Abinash-3	8.60	86000	10.23	51150	7.40	25900	9.84	24600	191650	87610	104040	2.18
Sathi	9.30	93000	11.45	57250	6.20	21700	8.51	21275	193225	87915	105310	2.19
Safal	7.50	75000	10.23	51150	6.30	22050	6.46	16150	164350	85100	79250	1.93
Hitom	9.80	98000	7.50	37500	8.00	28000	8.13	20325	183825	87320	96505	2.10
T-1458	8.20	82000	6.50	32500	6.25	21875	7.70	19250	158625	84300	74325	1.88
T-1387	5.23	52300	4.89	24450	5.62	19670	7.98	19950	116370	81210	35160	1.43
T-848	6.56	65600	7.23	36150	9.45	33075	7.97	19925	154750	83915	70835	1.84
T-2024	5.42	54200	4.85	24250	5.20	18200	5.36	13400	110050	79300	30750	1.38
Minto	9.50	95000	8.20	41000	6.90	24150	6.26	15650	175800	86110	89690	2.04
Surrokha	9.80	98000	10.20	51000	9.20	32200	7.36	18400	200050	88500	111550	2.26

N.B. Local market price of tomato was 10.0 Tk./kg at first harvest, 5.0 Tk./kg at second harvest, 3.50 Tk./kg at third harvest and 2.50 Tk./kg at fourth harvest.

C. COASTAL/SALINE AREA

Intercropping Soybean with Kaon in Varying Plant Population

Abstract

A field experiments was conducted at the MLT site of Laxmipur in the growing season of 2007-08 to verify the performance of kaon as intercrop with soybean. Intercrop of Soybean with kaon (50%) produced the highest gross return (Tk.116200/ha) as well as gross margin (Tk.93748/ha). All the intercropped system produced the highest return and LER than sole crop (soybean).

Introduction

Soybean is one the major cash crop in the coastal areas of Bangladesh. It is cultivated widely as a sole crop in the district of Noakhali and Laxmipur, which covers about 41000 ha of land in rabi season (DAE, Noakhali & Laxmipur, 2006). Kaon is one of the most important drought tolerant millet for char area, which can be cultivated in unfertile land even without any chemical fertilizers. It is called the cereal of the poor in crises moment. It is observed that, the farmers of these areas cultivate kaon as a mixed crop with soybean without determining benefit, cost and return and land use efficiency. Soybean is one of the major cash crops in these districts which will provide the monetary benefit while Kaon may supplement the cereal needs for the resource poor farmers of these areas and thus total benefit, land and resource use efficiency will be maximized. The present study is therefore, undertaken to investigate the impact of intercropping on yield, monetary advantages and use efficiency against sole cropping in the rainfed condition and also to find out the agronomic and economic performance of intercropping soybean and kaon.

Materials and Method

The experiments were conducted at the MLT site of Laxmipur in the growing season of 2007-08. The soil of the experimental area belongs to Young Meghna Estuarine Floodplain (AEZ 18f) and Meghna Estuarine Floodplain (AEZ 18) respectively. The soils of the experimental plot were sandy loam in texture. The experiments were laid out in randomized complete block design with three replications. It was consisted of 5 treatments as follows: T_1: Sole soybean (100%), T_2: Sole kaon (100%), T_3: soybean (100%) + kaon (25%), T_4: soybean (100 %) + kaon (50%), T_5: soybean (100%) + kaon (75%). One row of kaon was planted between the two rows of soybean. The seeds were sown on the third week of January and first week of February, 2008. The unit plot size was 6 m x 4 m. Spacing of soybean was maintained at 30cm x 10 cm. The spacing of kaon verified according to treatment. Row to row distance was 30 cm and plant to plant distance was maintained as 5 cm, 20 cm, 10 cm and 7 cm as according to the treatment T_2: Sole kaon (100%), T_3: 100% soybean + 25% kaon, T_4: 100% soybean + 50% kaon and T_5: 100% soybean + 75% kaon, respectively. The land was fertilized with 100- 60-30 kg/ha N-P-K. The whole amount of P, K and $^1/_3$rd of N were applied at the time of final land preparation and remaining N was applied in two installments at 25 and 50 DAS. Data on yield and yield contributing characters were recorded and statistically analyzed. The salinity range was 2.20 to 8.13 dS/m during the study period.

Results and Discussion

The result indicated that most of the yield attributes of soybean were influenced due to intercropping system (Table1). However, plant height, seed per pod and 1000-seed weight was found insignificant. The highest number of pod/plant (38.93) was found from sole soybean which was statistically identical with T_3 (100% soybean + 25% kaon) and the lowest number of pod/plant (23.87) was recorded in T_5 (100% soybean + 75% kaon). The highest yield (2.68 t/ha) was achieved from sole soybean whereas the lowest yield (1.857 t/ha) was found in treatment T_5 (100 % soybean + 75% kaon) when kaon was grown as intercropped in between two rows of soybean. There was significant reduction in kaon yield in intercropped situation but 75% of kaon with 100% soybean showed more yield because of its more plant population than one 50% and 25% of kaon with 100 % soybean. The highest yield of kaon (1.978 t/ha) was found from the treatment T_2 (Sole kaon) whereas the lowest yield (0.503 t/ha) was found in treatment T_3 (100 % soybean + 25% kaon) as intercropped (Table 2).Though the treatment T_4 (100 % soybean + 50% kaon) gave the lower yield of soybean but it was gave the highest gross return (Tk. 116200/ha) and highest gross margin (Tk. 93748/ha).On the other hand lowest gross return (Tk.79100/ha) and lowest gross margin (Tk.61408/ha) were recorded from T_2 (Sole kaon). The highest LER (1.30) was found in treatment T_4 (100% soybean + 50% kaon) and the lowest LER (1.00) in T_1 and T_2 (sole soybean and kaon) (Table 2).

Farmers' reaction

As the farmers got the yield of kaon as additional crop. So, they are interested to grow kaon as intercrop with soybean. But line sowing of kaon in soybean is preferred.

Conclusion

Considering the yield and benefit it can be concluded that 50% of kaon in between 100% of soybean intercropping system is the most profitable than the other treatments. From the results of this experimentation it is evident that, intercropping is more profitable than the sole cropping and risk of cultivation of one crop can be reduced by intercropping. For more conformation the experiment should be repeated in the next year.

Table 1. Yield and yield components of sole and intercropped soybean at the MLT site Laxmipur during Rabi 2007-08

Variety/ Lines	Plant height (cm)	No. of pods/plant	No. of seeds/pod	1000-seed weight (gm)	Seed yield (t/ha)
T_1 (Sole soybean)	53.18	38.93	2.477	123.3	2.68
T_3 (100 % soybean + 25% kaon)	50.70	35.73	2.347	120.0	2.55
T_4 (100 % soybean + 50% kaon)	48.47	32.57	2.190	119.3	2.32
T_5 (100 % soybean + 75% kaon)	44.27	29.87	2.030	116.7	1.85
LSD (0.05)	NS	4.074	NS	NS	0.29
CV (%)	12.75	6.20	17.24	7.27	6.18

Table 2. Yield of soybean and kaon with economic study and LER in different intercropping system at the MLT site, Laxmipur during Rabi 2007-08

Combination	Yield/ha		Soybean equivalent yield (T/ha)	Gross return (Tk/ha)	*TVC (Tk/ha)	Gross margin (Tk/ha)	LER
	Soybean	Kaon					
T_1 (Sole soybean)	2.68	-	2.68	93800	20740	73060	1.00
T_2 (Sole kaon)	-	1.97	2.26	79100	17692	61408	1.00
T_3 (100 % soybean + 25% kaon)	2.55	0.50	3.13	109550	21746	87840	1.20
T_4 (100 % soybean + 50% kaon)	2.30	0.89	3.32	116200	22452	93748	1.30
T_5 (100 % soybean + 75% kaon)	1.85	0.94	2.93	102550	23308	79242	1.17

* TVC = Total variable cost * Market price: Soybean = 35/- Tk/kg, kaon = 40/- Tk/kg

Effect of Herbicides and Hand Weeding for Soybean Cultivation

Abstract

The experiment was conducted at the FSRD site Noakhali during Rabi season of 2007-08 to find out the proper weed control method for soybean in char areas under AEZ 18 and 18f. From the first year result it was found that the highest yield (2.10 t/ha) of soybean was obtained from Ronstar (@ 2 L/ha spraying before sowing + one hand weeding at 45 DAS which was closely followed by two hand weeding at 25 and 45 DAS (2.08 t/ha). The lowest yield (1.66 t/ha) was found in farmers practice (One hand weeding at 25 DAS). The highest gross return (Tk. 73500/ha) as well as gross margin (Tk.52010/ha) was recorded from Ronstar (@ 2 L/ha spraying before sowing + one hand weeding at 45 DAS followed by two hand weeding at 25 and 45 DAS.

Introduction

Soybean is a popular oilseed crop in Noakhali district. It is exclusively grown in rabi season as a cash crop and covers about 41,000 ha area in greater Noakhali. However, the yield of soybean is low in comparison to that of the other countries of the world. Experimental result showed that Shohag produced 2.58 t/ha with proper management in farmers field while 1-1.5 t/ha was found in farmers' practice in greater Noakhali. This low production might be due to infestation of weed. Weeds compete with crops for light, moisture, space and plant nutrients and other environment requirements and consequently interfere with the normal growth of crops. Like other oilseeds, farmers usually (only one weeding) do not do weeding in soybean. Due to high cost of labour, farmers are not interested more than one weeding. If herbicides are applied, it may reduce the production cost. Competition due to weed infestation results in the yield losses of 30%-50% depending on the extent and nature of weeds (Saxena, 1980*)*. *Chenopodium album* L. is the most important among the different types of weeds in soybean field. Therefore, present study was undertaken to evaluate the effectiveness of different pre-emergence herbicide and manual control of weeds at different stages of growth.

Materials and Methods

The experiment was conducted at the FSRD site Noakhali during 2007-08. The variety Shohag was used in this experiment. The experiment was laid out in randomized complete block design (RCBD) with six replications. There were five treatments namely, Farmers practice (One hand weeding at 25 DAS), Roundup (@ 2 L/ha spraying before 10 days of sowing), Ronstar (@ 2L/ha spraying before sowing), Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS and two hand weeding at 25 and 45 DAS. The unit plot size was 4m x 4m. Herbicidal treatments were done with hand sprayer. Samples of individual weed species were collected at 25 and 45 days after sowing. Data on weed counts and weed biomass were recorded. Yield and yield contributing data were taken at harvest.

Results and Discussion

Numbers of weeds per square meter were influenced by different treatments in soybean (Table 1). The maximum number of weeds were found from farmers practice at 25 (52) and 45 (86) DAS and the minimum number of weeds were found in Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS (11, 24 respectively) which was related to two hand weeding at 25 (14) and 45 (26) DAS, Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding controlled (>80%) *Chenopodium album* L., >70% *Cynodon dactylon,* about 70% *Echinocloa colonum* and >50% of *Digtaria sanguinalis.* Gupta (1984) reported that the soil active herbicides (pre-emergence) control weeds even before they germinate, thus eliminating early period of weed competition and they maintain weed control for considerable period after application. The weed biomass was affected by various herbicides in soybean (Table 2). Maximum weed biomass was found in farmers practice at 25 DAS (38.26 $g^{-2)}$ and 45 DAS (63.52 g^{-2}) and the minimum (10.60 g^{-2}) was observed in Ronstar (@ 2

L/ha spraying before sowing) + one hand weeding at 45. Different treatments had significant effect on plant height and seed yield except number of branch per plant, pods per plant and 100 seed weight (Table 3). The highest plant height (50.70 cm) was observed in Ronstar + one hand weeding at 45 DAS which was statistically similar with two hand weeding at 25 and 45 DAS (50.40 cm), Ronstar (@ 2 L/ha spraying before sowing) (48.57 cm) and Roundup (@ 2 L/ha spraying 10 days before sowing) (45.83 cm). The lowest plant height (44.30 cm) was observed in farmers practice. The highest number of branch per plant (2.77) was observed in Roundup (@ 2 L/ha spraying 10 days before sowing) and the lowest (2.07) in Ronstar application (@ 2L/ha spraying before sowing). Maximum pods/plant (34.60) was observed in two hands weeding at 25 and 45 DAS. But maximum 100-seed weight (12.70 g) was found in Ronstar (@ 2 L/ha sparing before sowing) + one hand weeding at 45 DAS. Higher seed yield (2.10 t/ha) was recorded in Ronstar (@ 2 L/ha sparing before sowing) + one hand weeding at 45 DAS which was statistically similar two hand weeding at 25 and 45 DAS (2.08 t/ha). The lowest seed yield (1.66 t/ha) was found in farmers practice.

Cost and Return analysis

The highest gross margin (Tk. 5201/ha) was found in treatment Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS and the lowest (Tk.38569/ha) in farmers practice (Table 4). This variation occurred due to the variation of yield of soybean and labour cost. Two hand weeding at 25 and 45 DAS also showed reasonable good yield as well as benefit.

Farmers' reaction

Farmers are well known about weed problem in their soybean field. They are not interested to control weed because of high labour cost involvement. In addition, they are not aware about the herbicide. They are now very much interested about Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS.

Conclusion

Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS effectively controlled (>80 % reduction number and biomass) *Chenopodium album* L. which is the major weed of soybean field in Noakhali and this method may be recommended. If weedicide is not available in the market then two times weeding 25 and 45 DAS could be effectively controlled weed in soybean field. However, the experiment should be repeated for 2nd year.

References

Gupta, O. P. and P. S. Lamba. 1984. Modern weed science in the tropics and sub-tropics. Pub. by Today and Tomorrow's Printers, New Delhi, India pp.103.

Saxena, M. C. 1980. Recent advance in chickpea agronomy. Proceedings of International Workshop on chickpea improvement, 28 February-2 March 1979, ICRISAT, Hyderabad, India.

Table 1. Number of weeds as affected by different treatments in soybean at the FSRD site Noakhali during 2007-08

Treatments	Weeds/m^2								Total no of weed per m^2	
	Chenopodium album L.		*Cynodon dactylon*		*Echinocloa colonum*		*Digtaria sanguinalis*			
	25DAS	45DAS	25DAS	45DAS	25DAS	45DAS	25DAS	45DAS	25DAS	45DAS
T_1: Farmers practice (One hand weeding at 25DAS)	20	25	15	28	8	19	9	14	52	86
T_2: Roundup (@ 2 L/ha spraying before10 days of sowing)	12 (40)	16 (36)	11 (27)	22 (32)	5 (38)	12 (37)	6 (34)	10 (29)	44 (18)	60 (30)
T_3: Ronstar (@ 2L/ha spraying before sowing)	3 (85)	7 (72)	8 (47)	14 (50)	4 (80)	9 (53)	5 (45)	6 (57)	20 (62)	36 (59)
T_4: Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS	2 (90)	4 (80)	3 (80)	8 (71)	2 (75)	6 (69)	4 (56)	6 (57)	11 (79)	24 (72)
T_5: Two hand weeding at 25 and 45 DAS	2 (90)	5 (84)	6 (60)	11 (61)	3 (63)	5 (74)	3 (67)	5 (64)	14 (73)	26 (69)

DAS: Days after sowing; (Figure in parenthesis is the percent weed reduction value)

Table 2. Weed biomass (g m^{-2}) as affected by different treatments at the FSRD site Noakhali during 2007-08

Treatments	Dry weight of weeds (g/m^2)								Total dry weight of weed (g/m^2)	
	Chenopodium album L.		*Cynodon dactylon*		*Echinocloa colonum*		*Digtaria sanguinalis*			
	25DAS	45DAS	25DAS	45DAS	25DAS	45DAS	25DAS	45DAS	25DAS	45DAS
T_1: Farmers practice (One hand weeding at 25DAS)	10.42	12.57	10.20	20.94	6.21	13.11	11.43	16.90	38.26	63.52
T_2: Roundup (@ 2 L/ha spraying before10 days of sowing)	6.22 (40)	8.02 (36)	8.21 (20)	15.28 (27)	3.64 (41)	9.10 (31)	7.20 (37)	13.10 (23)	25.27 (34)	45.5 (28)
T_3: Ronstar (@ 2L/ha spraying before sowing)	1.54 (85)	3.44 (73)	5.32 (48)	10.23 (51)	2.94 (53)	6.84 (48)	6.42 (44)	6.92 (59)	16.22 (58)	2743 (57)
T_4: Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS	1.52 (85)	2.12 (83)	2.19 (79)	6.17 (71)	1.60 (74)	4.29 (67)	5.29 (54)	7.22 (57)	10.60 (72)	19.80 (69)
T_5: Two hand weeding at 25 and 45 DAS	1.60 (85)	2.71 (79)	4.25 (58)	8.64 (59)	2.41 (61)	3.94 (70)	3.63 (68)	5.97 (55)	11.89 (69)	21.26 (67)

DAS: Days after sowing; (Figure in parenthesis is the percent weed biomass reduction value)

Table 3. The yield and yield contributing characters of soybean as affected by different at the FSRD site Noakhali during 2007-08

Treatments	Plant height (cm)	No of branch per plant (no.)	Pods per plant (no.)	Seeds per pod (no.)	1000 Seed weight (g)	Seed yield (t/ha)
T_1: Farmers practice (One hand weeding at 25DAS)	44.30	2.47	30.15	1.83	11.30	1.66
T_2: Roundup (@ 2 L/ha spraying before10 days of sowing)	45.83	2.77	32.92	1.97	11.20	1.82
T_3: Ronstar (@ 2L/ha spraying before sowing)	48.57	2.07	32.52	1.95	12.00	1.85
T_4: Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS	50.70	2.20	33.90	2.03	12.70	2.10
T_5: Two hand weeding at 25 and 45 DAS	50.40	2.13	34.60	2.02	12.00	2.08
LSD(0.05)	5.49	NS	NS	NS	NS	0.24
CV (%)	6.79	17.60	8.61	3.74	6.82	6.67

DAS: Days after Sowing

Table 4. Cost and Return analysis for weed control in soybean production at the FSRD site Noakhali during 2007-08

Treatments	Total variable cost (Tk./ha)	Gross return (Tk./ha)	Gross margin (Tk./ha)
T_1: Farmers practice (One hand weeding at 25DAS)	19531	58100	38569
T_2: Roundup (@ 2 L/ha spraying before10 days of sowing)	19800	63700	43900
T_3: Ronstar (@ 2 L/ha spraying before sowing)	20140	64750	44610
T_4: Ronstar (@ 2 L/ha spraying before sowing) + one hand weeding at 45 DAS	21490	73500	52010
T_5: Two hand weeding at 25 and 45 DAS	21940	72800	50860

DAS: Days after Sowing, Total variable cost included labour and fertilizer

Screening of Rabi Crops against Salinity

Abstract

The experiment was conducted at the FSRD site Noakhali and MLT site, Kuakata, Patuakhali during 2007-08 to select and evaluate the yield potentiality of different crops against salinity and adaptability in saline area. Yield of different rabi crops varied significantly due to various level of salinity (2-12 dS/m) and mortality (%) of plants. In the FSRD Site Noakhali barley, foxtail millet and chilli have given a good yield (1.83, 1.71 and 1.25 t/ha respectively). Cowpea has given satisfactory yield (0.76 t/ha), whereas mungbean (0.98 t/ha) and soybean (1.52 t/ha) have given moderate yield. Grass pea and field pea should be cultivated as relay crop with T.aman rice. In Patuakhali, among three farmers only one farmer was able to harvest chickpea, mungbean, cowpea and sweet potato crops at full maturity and yield were recorded. Yield of chickpea, mungbean, cowpea and sweet potato were 0.560, 0.680, 0.590 and 12.54 t/ha, respectively.

Introduction

In Bangladesh, more then 30% of the cultivable land is in the coastal area. Out of 2.83 million hectares in the 13 districts of coastal area in Bangladesh, about 0.84 million hectares are affected by varying degrees of soil salinity (Karim & Iqbal, 2001). It is a production constraint common to all rainfed coastal agriculture. According to the SRDI soil testing report it was observed that salinity level vary 0 to above 20 dS/m. During the rabi season salinity level is highly increased. Farmers of the saline area grow mainly soybean, groundnut, chilli, cowpea, sweet potato chili and grass pea in the rabi season. But it is observed that, the yield of these crops is not in satisfactory level. This lower yield might be the result of varying salinity level in this area. Different rabi crops response to salinity are variable. The germination percentages, shoot length, root length, number of functioning leaves per seedling and yield was affected significantly by different levels of salinity (Maurya *et al*., 1984). The reduction in germination and early vigor of crops due to salinity is attributed to the osmotic concentration of the media (Kaliappan *et al*., 1970; Kurian and Iyanger, 1967 and Daito, 1967). But a few systematic works has been done so far to study the effect of salinity levels on the various growth stages and yield of rabi crops in the saline area. The present study is undertaken to screen out different rabi crops for saline area.

.

Materials and Methods

The experiment was conducted at the FSRD site Noakhali and MLT site Kuakata, Patuakhali under rainfed condition during the rabi season of 2007-08 in the farmer's field. The experiment was laid out in RCB design with four replications for each crop. The plot size was 4m x 3m. There were ten crops in Nohakhali (Grasspea, Cowpea, Field pea, Barley, Foxtailmillet, Mungbean, Soybean, Chilli, Sweet potato and Groundnut) and thirteen crops in potuakhali (Cabbage, Nolkhol, Tomato, Brinjal, Okra, Mungbean, Cowpea, Sunflower, Chili, Chickpea, Cowpea, Sweet potato and Potato) to test in different salinity level. The crops were sown/planted in the field in between the month of December 2007 and January 2008. Each crop was harvested at its full maturity stage. All other intercultural operations were done as and when necessary. To set the experiment, the saline prone field was selected by testing salinity samples field in several spots prior to sowing. During the study period, the salinity data were recorded at different date and physiological stage of the crop. The data recorded whole the crop growth period related plant characters, salinity and rainfall were compiled sequentially and cautiously.

Table 1 Degree of salinity level (dS/m) in different crop growth stages at the FSRD site Noakhali during 2007-2008

Crop	Before sowing	At 20 DAE	At 40 DAE	At Harvest
Grass pea	3.89	5.14	12.01	3.46
Cowpea	4.25	5.49	11.23	5.60
Field pea	3.52	6.45	4.35	5.55
Barley	3.42	6.79	9.76	5.90
Foxtail millet	2.75	6.68	8.85	8.50
Mungbean	4.20	4.93	6.03	7.70
Soybean	5.37	5.88	8.87	9.05
Chilli	3.20	7.10	8.00	8.25-3.25
Sweet potato	3.70	7.60	8.57	4.29
Groundnut	3.47	5.95	7.75	2.01

Table 2. Salinity levels in the experimental plots at the MLT site, Kuakata, Patuakhali during 2007-2008

Date	Salinity level (dS/m)		
	Farmer 1	Farmer 2	Farmer 3
27.12.2007	1.8	3.7	3.1
07.01.2008	2.1	4.6	3.8
17.01.2008	2.8	5.4	4.7
27.01.2008	3.6	6.1	5.6
07.02.2008	4.5	7.8	6.3
17.02.2008	5.3	8.6	7.2
27.02.2008	5.9	9.4	8.0
07.03.2008	6.4	10.5	9.4
17.03.2008	7.2	11.2	10.8

Table 3. Date wise rainfall pattern during the crop growth period at the FSRD Site Noakhali during 2007-2008

Date	Rainfall (mm)	Date	Rainfall (mm)	Date	Rainfall (mm)
25.01.08	20	23.03.08	4.0	16.05.08	35.0
27.01.08	17	01.04.08	2.5	18.05.08	110.0
31.01.08	1.5	02.04.08	12.5	19.05.08	12.5
10.02.08	9.5	03.04.08	1.5	24.05.08	5.0
20.02.08	2.0	04.04.08	1.7	25.05.08	7.0
21.02.08	3.0	02.05.08	2.5	26.05.08	9.5
05.03.08	10.5	05.05.08	22.5	28.05.08	60.0
20.03.08	3.5	14.05.08	20.2		

Results and Discussion

FSRD site, Noakhali

The data recorded in the experiment period about sowing and harvesting date, germination (%), plant population (%) at different stages and plant survivability (%) have been given in Table 4. The salinity related data of different crop growth stages and rainfall date have been shown in the Table 1, 2 and 3 respectively.

Grass pea: The germination percentage of grass pea was 81% whereas 67% plant survived at harvesting time. The mortality rate was 33%, where 29% plants have died in the vegetative stage because of high salinity range (3.89-12.01 dS/m) during this time. Because of high mortality and retarded plant growth, the yield (0.50 t/ha) of grass pea was not satisfactory. But it was observed that, farmers of this region easily cultivate grass pea as a relay crop with T.aman.

Cowpea: The germination (%), survivability (%) and mortality (%) of cowpea were 83, 73 and 27 respectively. During the crop growth period it has suffered from the salinity range of 4.25-11.23 dS/m, but it has given comparatively satisfactory yield (0.76 t/ha).

Field pea: Field pea could not show satisfactory level of yield (0.52 t/ha) in the salinity range between 3.52-6.45 dS/m as because of its high mortality rate (41%).

Barley: Barley is the most tolerant crop against salinity beyond the salinity range above 7-8 dS/m. It showed higher plant survivability (82%) and gave satisfactory yield (1.83 t/ha).

Foxtail millet: Foxtail millet showed as good yield (1.71 t/ha) as barley with the mortality rate of 23%. It also showed tolerance against the salinity of 8.85 dS/m.

Mungbean: Mungbean has given moderate yield (0.98 t/ha) against the salinity level between 4 and 6.5 dS/m.

Soybean: Soybean has given moderate yield (1.52 t/ha) in the salinity range of 5.37-8.87 dS/m, but suffered a lot in the vegetative stage with the mortality rate of 29%.

Chilli: Mortality rate of chilli was very low (14%) has shown in entire growth period. But during the flowering stage it might be hampered above the salinity of 8 dS/m. However, chilli has given reasonably good yield (1.25 t/ha in dry basis). The salinity reduced to 3.25 dS/m at the harvesting period because of rainfall occurred in the month of May, 2008 (Table 3).

Sweet potato: Sweet potato is also known as a salt tolerant crop in the saline areas. It could be a valuable crop in between salinity range 3.70 and 8.57. But it has also suffered in the vegetative stage beyond the salinity of 5.5 to 6.5 dS/m. It has given a moderate yield (15.6 t/ha).

Groundnut: In the vegetative stage, groundnut has suffered highly in the salinity range of 3.47 to 7.75 dS/m with the mortality rate of 31%. About 1.90 t/ha yield was found from groundnut which is moderately good performance. If the salinity remained below 5.00 dS/m it could perform much better. The salinity reduced to 2.01 dS/m in the month of May 2008, because of rainfall at 1st and 3rd week (Table 3).

MLT site, Kuakata, Patuakhali

Among three farmers only one farmer was able to harvest chickpea, mungbean, cowpea and sweet potato crops to full maturity and yield were recorded. Sunflower was damaged by bird. The yield of chickpea, mungbean, cowpea and sweet potato were recorded 0.560, 0.680, 0.590 and 12.54 t/ha, respectively.

Farmers' reaction

- Cultivation of these crops is increasing in the fallow lands day by day.
- Lack of quality seed in the local market.
- Need salt tolerant varieties

Conclusion

From the above results and discussion it can be concluded that, cowpea, barley, foxtail millet, mungbean, soybean, chilli, sweet potato and groundnut are tolerant to some extent to the salinity level below 8 ds/m. Grass pea and field pea should be cultivated as relay crop with T.aman rice. This experiment was conducted in this area for the first time. Therefore, the experiment is needs to be conducted at least further two year in Nohakhali. In case of Patuakhali it was the first year result and the trial should be continued with change of location where salinity level is not high and land becomes free comparatively earlier.

Table 4 Date of sowing, harvesting, yield, soil salinity levels and plant survivability (%) of different crops at the FSRD site Noakhali during 2007-2008

Crops	Date of sowing	Date of harvesting	Germination (%)	Plant population/m^2		Mortality (%)	Yield (t/ha)
				20 DAE	Harvest		
Grass pea	17/12/07	08/04/08	81	71	67	33	0.50
Cowpea	17/12/07	08/04/08-25/04/08	83	79	73	27	0.76
Field pea	17/12/07	18/03/08	70	62	59	41	0.52
Barley	17/12/07	29/03/08	89	84	82	18	1.83
Foxtail millet	17/12/07	22/04/08	90	85	77	23	1.71
Mungbean	17/01/08	15/03/08-30/03/08	85	75	70	30	0.98
Soybean	17/01/08	28/04/08	80	71	71	29	1.52
Chilli	18/12/08	28/04/08-20/05/08	99	89	86	14	1.25
Sweet potato	18/12/08	01/05/08	Cuttings were planted	75	75	25	15.6
Groundnut	12/01/08	19/05/08	75	70	69	31	1.90

Screening of Chickpea Varieties in Southern Region of Bangladesh

Abstract

The experiment was conducted at the FSRD site, Razakhali and the MLT site, Kuakata, Patuakhali during Rabi 2007-2008 under rainfed condition to observe the performance of BARI released chickpea varieties at Patuakhali region. BARI chola-4 and 5 performed better at both the sites. The yield of BARI chola-5 was more than BARI chola-4 at both the locations. BARI cholla-5 produced 1068 kg/ha at Razakhali and 890 kg/ha at Kuakata. On the other hand BARI chola-4 gave 980 kg/ha at Razalhali and 778 kg ha at Kuakata.

Introduction

Chickpea is one of the most important pulse crops in Bangladesh. It is rich in protein (23-24 %) could help to overcome malnutrition problem. Among the pulses grown in Bangladesh, chickpea ranked third in terms of area and production but second in consumption. About 35-40% area of chickpea, are sown in late December after T.aman harvest. Similarly, a vast costal area in Patuakhali region remains fallow after T.aman harvest. So, there is a good possibility to cultivate chickpea in coastal area. But suitable varieties for coastal area yet to identified. Therefore, the present experiment was undertaken to observe the performance of different chickpea varieties in the southern part of the country.

Materials and Methods

The experiment was conducted at the FSRD site, Razakhali and the MLT site, Kuakata, Patuakhali during Rabi 2007-2008 under rainfed condition. The experiment was laid out in randomized complete block design with three replications in each site. Three chickpea varieties viz. BARI chola-4, BARI chola-5 and local (check) were tested. The plot size was 4m x 5m. Fertilizer was applied at the rate of 25-16-15 kg/ha NPKS. The seeds were sown on 15.12.2007 at Razakhali and on 29.12.2007 at Kuakata at a spacing of 40 cm x 10 cm. Weeding and other intercultural operations were done as and when necessary. At pod formation stage pod borer infestation was occurred and insecticide Karate was applied 2 ml/l water at 10 days interval and pod borer was controlled. The crop was harvested on 27.03.2008 at Razakhali and on 09.04.2008 at Kuakata. Data were collected on yield and yield attributes and analyzed statistically.

Results and Discussion

The highest seed yield was obtained from BARI chola-5 at Razakhali (1068 kg/ha) and Kuakata (890 kg/ha) which was followed by BARI chola-4 at Razakhali (980 kg/ha) and Kuakata (778 kg/ha) and the lowest yield 730 and 610 kg/ha were obtained from local variety in both the locations Razakhali and Kuakata, respectively.

Farmers' reaction

- Chick pea is a promising crop in this area.
- Pod borer is a problem but using Karate and Ripcord successfully controlled it.
- Seed was not available in the local market.

Conclusion

The trial should be continued for the next year for observation over the years.

Table 1. Yield of three chickpea varieties at the FSRD site Razakhali and the MLT site Kuakata, Patuakhali during 2007-08

Variety	Average yield (kg/ha)	
	Razakhali	Kuakata
BARI Chola-4	980 b	778 b
BARI Chola-5	1068 a	890 a
Local	730 c	610 c
CV (%)	8.64	10.83

Effect of Sowing Date and Different Container on Seed Germination of Soybean

Abstract

The experiment was conducted at the MLT site, Laxmipur, during 2007-08 to identify the better storing techniques and sowing date for seed germination and other attributes of soybean. It was observed that, the seeds of soybean stored in controlled moisture and temperature of BADC cold storage performed comparatively better in every sowing date. The germination of seeds observed higher (91%, 90%, 85% and 84%) in this treatment with respective sowing dates. It was also observed that, sowing dates after opening the seeds from container had a minimum effect whereas, different containers affected significantly on seed germination (%), plant population (%) at 20 DAE, plant population (%) at harvesting and insect infested seeds (%).

Introduction

Soybean is the major rabi crop in Laxmipur district. For cultivating soybean the farmers usually use their own preserved seed. But in some cases they purchase the seeds from seed market and BADC. A lot of seeds are damaged or lose their germination percentage and viability because of poor storage capacity. Miah (1985) reported that there are four levels of storage systems in Bangladesh i.e. farm level, commercial level, institutional level and government level. Usually the qualities of well dried and cleaned seeds are not deteriorated in the store. The farmers use traditional storage structures like earthen container, woven bamboo container, metal container gunny bags etc. for storing seeds. On the other hand in the government and institutional level it is assumed that they preserved seeds in controlled environment i.e. controlled moisture percentage and temperature. However, the farmers of the district Laxmipur opined that the seed of soybean supplied by government organizations like BADC, BARI were substandard in quality (e.g. germination percentage) than that of their own preserved seeds in the rabi season of 2006-07. The reason behind this may be due to the processing and time consumed in distributing the seeds from warehouse to farmers as well as to sowing time. Therefore, with this view in mind, the present study is undertaken to evaluate either the farmers or the organizational seed preserving methods are better by seeding within 10 to 15 days after getting open from storage condition.

Materials and Method

The experiment was conducted in the farmer’s field of MLT site, Laxmipur during 2007-08 to identify the better storing techniques and sowing date for seed germination and other attributes of soybean. This site is located within Young Meghna Estuarine Floodplain of agro ecological zone 18 of Bangladesh where soybean was grown well previously. Soybean seeds were kept in storage using five storage containers such as earthen container, plastic container and polythene bag covered by gunny bag, metal container and BADC cold storage. The seeds of soybean variety Shohag from each container were sown in 4 different sowing dates such as 22 and 27 of January; 01 and 06 of February 2008. The seeds were opened on 20 January 2008 and kept in normal polythene packet fastened the inlet of packet with rope made of jute to the last date of sowing. The two factor experiment was conducted in completely randomized design with three replications. Clean and well-dried good seeds of soybean were stored in each container up to 09 months. Data were recorded on germination (%), Plant population (%) at 20 DAE and harvesting. Data regarding insect infested seeds (%) were recorded before sowing the seeds of each container. All the data were statistically analyzed.

Fabrication of containers

C_1 (Earthen containers): Earthen containers (locally called kolshi) like BARI developed earthen containers were collected from local market smearing externally with bitumen.

C_2 (Plastic containers): Thick plastic container with a small inlet to the top of the container.

C_3 (Polythene bag)**:** Seeds sealed in polythene bag (0.05 mm) were kept inside gunny bag and then the inlet of bag was fastened with rope made of jute.

C_4 (Metal container): Rectangular metal container with a circular metal-lid was made from M.S. sheet following BARI developed metal container. Seeds were preserved directly in this container.

C_5 (BADC cold storage): Cold storage of BADC, Feni.

Results and Discussion

Effect of sowing date

Effect of different sowing date on germination and other attributes of soybean was presented in Table 1. The effect of sowing date on germination (%), plant population (%) at 20 DAE, plant population (%) at harvesting and insect infested seeds (%) were non-significant.

Effect of container

Types of containers significantly affected germination (%), plant population (%) at 20 DAE and insect infested seeds (%) except plant population (%) at harvesting (Table 2). Maximum germinated seeds (88%) were recorded from C_5 (BADC cold storage) whereas minimum level of germination (77%) was found in C_1 (earthen container). Similarly higher plant population (83%) at 20 DAE and plant population (77%) at harvesting were recorded in C_5. Insect infestation was higher (5.1%) in C_1 (earthen container) followed by C_3 (Polythene bag) (4.8%).

Combined effect:

Sowing date in combination with different container significantly affected germination (%), plant population (%) at 20 DAE, plant population (%) at harvesting and insect infested seeds (%) (Table 3). The higher germination (91%) was found in the treatment combination of sowing date S_1 with C_5. All the C_5 treatment with various sowing date have given higher percentage of germination (91, 90, 85, and 84). Plant population at 20 DAE (87%, 81%, 85% and 79%) was found higher in treatment combination of C_5 irrespective of sowing dates. It was observed that the magnitude of plant population at 20 DAE deteriorated with the delay of time from opening of seeds from the container. Incase of plant population (%) at harvesting time showed similar trend as plant population (%) at 20 DAE. Higher number of insect infested seeds was found in the seeds stored in earthen containers (5.3%, 5.4%, 5.2% and 4.9%) on respective sowing dates of S_1, S_2, S_3 and S_4. On the other hand, lower insect infestation (2.9%, 2.4%, 3.4% and 3.1%) was found in C_5 on respective sowing dates of S_1, S_2, S_3 and S_4. The other treatment combination effect was statistically similar with among others.

Farmers' reaction

- Farmers usually use traditional earthen pots for storing soybean seeds
- They are starting to use plastic containers for storing soybean seeds
- They did not go for BADC cold storage, because they individually store small quantity of seeds.

Conclusion

From the results it can be concluded that sowing date from 22 January to 6 February, 2008 had a minimum effect on seed germination (%), plant population (%) at 20 DAE, plant population (%) at harvesting and insect infested seeds (%). On the other hand, different containers affected on seed germination (%), plant population (%) at 20 DAE, plant population (%) at harvesting and insect infested seeds (%). However, for making a concrete recommendation at least further two years conduction of the present experiment is necessary.

Table 1 Effect of sowing date on seed germination and other attributes of soybean

Treatment	Germination (%)	Plant pop^n (%) at 20 DAE	Plant pop^n (%) at harvesting	Insect infested seeds (%)
S_1	83	80	75	4.0
S_2	83	79	75	4.2
S_3	79	77	74	4.4
S_4	81	76	72	4.5
LSD (0.05)	NS	NS	NS	NS

S_1= sowing on 22-01-08, S_2 = sowing on 27-01-08, S_3= sowing on 01-02-08, S_4= sowing on 06-02-08

Table 2 Effect of container on seed germination and other attributes of soybean

Treatment	Germination (%)	Plant pop^n (%) at 20 DAE	Plant pop^n (%) at harvesting	Insect infested seeds (%)
C_1	77	74	71	5.1
C_2	80	77	75	4.6
C_3	78	79	73	4.8
C_4	85	77	74	3.9
C_5	88	81	77	2.9
LSD (0.05)	7.42	6.97	NS	0.54

C_1= Earthen container, C_2= Plastic container, C_3= Polythene bag, C_4= Metal container, C_5= BADC cold storage
DAE= Days After Emergence

Table 3. Combined effect of sowing date and container on seed germination and other attributes of soybean

Treatment combination		Germination (%)	Plant pop^n (%) at 20 DAE	Plant pop^n (%) at harvesting	Insect infested seeds (%)
S_1	C_1	71	69	65	5.3
	C_2	83	81	80	4.9
	C_3	80	78	72	5.1
	C_4	88	85	80	4.0
	C_5	91	87	80	2.9
S_2	C_1	73	73	70	5.4
	C_2	81	78	73	4.3
	C_3	86	83	80	4.9
	C_4	83	81	77	3.9
	C_5	90	81	78	2.4
S_3	C_1	73	70	71	5.2
	C_2	78	75	72	4.1
	C_3	84	81	80	4.7
	C_4	78	85	70	5.1
	C_5	85	85	81	3.4
S_4	C_1	81	76	71	4.9
	C_2	80	77	76	4.2
	C_3	76	72	70	4.0
	C_4	83	79	71	3.8
	C_5	84	79	72	3.1
LSD (0.05)		6.55	5.49	3.99	0.78

Intercropping Groundnut with Mungbean in Varying Plant Population

Abstract

An experiment was carried out at the MLT site, Laxmipur during the rabi season of 2007-08 to verify the performance of mungbean as intercrop with groundnut. Groundnut (100%) with mungbean (40%) produced the highest groundnut equivalent yield (2383 kg/ha) along with the highest LER (1.13). All the intercropped treatments except groundnut (100%) with mungbean (60 %) showed the highest gross return compared to sole crop of groundnut.

Introduction

In Bangladesh continued population expansion has been forcing the farm households to utilize the available crop land more intensively to produce more food. Because significant expansion of cultivated area in Bangladesh is not economically or environmentally sound option like most countries of the world. Intercropping or mixed cropping is a way for increasing crop production per unit land area. This has been reported from many countries viz, Bangladesh, India, China, Taiwan, Srilanka Vietnam Africa and Latin America (BEETs, 1977). Intercropping is widely practiced by the farmers in Bangladesh because of increased productivity and reliability in production. Moreover, intercropping gives a greater stability of yield over monoculture (Willey and Reddy, 1981). Besides mixed or intercropping is widely practiced by the farmers because it often gives higher cash return and total production per hectare than growing one crop alone (Grims *et al*., 1983, Kurata, 1986, Evans, 1960) and ensure greater resource use efficiency (Herrara and Harwood 1974, Pathick and Malla 1979). Groundnut is a long duration crop that requires about 130-140 days to mature if sown in December 15 to January. Groundnut is an important legumes crop in Bangladesh and can be grown as an intercrop with maize and sugarcane successfully. Mungbean is an important short duration legumes crop and can profitably be grown with groundnut to avoid competition for lands with other crops. Therefore, there is a need for developing technology suitable for mungbean/ groundunt intercropping. It is reported that the use of variety, row arrangement, spacing and plant population are some of the strategies that may prompt the yield of the intercrop (Herrara and Harwood 1974).Therefore the present study was undertaken to evaluate the performance of mungbean grown as intercrop with groundnut.

Materials and Methods

The experiment was conducted at the MLT site, Laxmipur during the rabi season of 2007-08. The soil of the experiment area belongs to Young Meghna Estuarine Floodplain (AEZ 18f) and Meghna Estuarine Floodplain (AEZ 18) respectively. The soils of the experimental plot were sandy loam in texture. The experiment was laid out in a randomized complete block design with three replications in each location. The treatments are as follows: T_1: Sole groundnut, T_2: Sole mungbean, T_3: Groundnut (100%) + mungbean (20%), T_4: Groundnut (100%) + mungbean (40%), and T_5: Groundnut (100%) + mungbean (60%). The unit plot size was 6mx 4m. The variety of groundnut and mungbean used were Dhaka-1 and BARI Mung-5, respectively. The crops were sown on third week of January in 2008. Spacing of groundnut was maintained at 40cm x 10 cm. The spacing of mungbean was varied according to treatment-to-treatment. Row to row distance was 40 cm and plant to plant was maintained as 5cm, 50 cm, 25 cm and 12 cm as according to the treatment T_2: Sole groundnut 100%, T_3: 100% groundnut+ 20 % mungbean, T_4: 100% groundnut+ 40 % mungbean and T_5: 100% groundnut+ 60 % mungbean, respectively. The land was fertilized with 20-30-25-7 kg/ha (N-P-K-S), the whole amount of P, K, S and half of N were applied at the time of final land preparation and remaining was applied at 30 DAS. Harvesting data varied from treatment to treatment and crop to crop. Groundnut equivalent yield, land equivalent ratio (LER) and economic analysis were done for each treatment on a hectare basis considering the market rate of crop. Groundnut Equivalent Yield (GEY) was calculated by converting the yield of mungbean to the yield of Groundnut as follows:

$$GEY = \frac{\text{Mungbean yield (kg /ha) X Mungbean price (Tk /ha)}}{\text{Groundnut price (Tk/ha)}}$$

Data on yield and yield contributing characters were recorded and analyzed.

Results and Discussion

The result indicated that most of the yield attributed of groundnut was influenced due to intercropping system (Table 1). But plant height and branch per plant was found insignificant. The highest pods per plant (17.23) were found in sole groundnut which was statistically similar with 100% Groundnut+ 20% Mungbean (15.71) and 100% Groundnut + 40% Mungbean (14.86) and lowest (11.91) was found in 100% groundnut + 60% mungbean. The maximum seeds per pod (1.79) were found in 100% Groundnut+ 40% Mungbean. The highest 100 kernel weight (32.96g) was found in 100% Groundnut+ 40% Mungbean. The highest groundnut yield (2.11 t/ha) was obtained from sole crop which was statistically identical with 100% groundnut+ 20% mungbean (1.95 t/ha) and 100% groundnut + 40% mungbean (1.93 t/ha). The lowest yield (1.58) was found in 100% Groundnut+ 60% Mungbean. All the intercropped system showed higher groundnut equivalent yield than sole groundnut except (100% groundnut + 20% mungbean). The highest groundnut equivalent yield was recorded from groundnut (100%) + mungbean (40%) and lowest in groundnut (100%) + mungbean (60%). The highest gross return (Tk. 71490) and gross margin (Tk.38012) were obtained from 100% groundnut + 40 % mungbean though cost of cultivation was higher than sole groundnut. The highest LER (1.13) was found in 100 %groundnut + 40% mungbean and lowest (0.97) was found in 100% groundnut + 60% mungbean.

Farmers' reaction

Farmers already cultivated the mungbean as broader crops. Farmers opined that groundnut (100%) + mungbean (40%) was more suitable combination due to satisfactory yield of groundnut with additional yield of mungbean.

Conclusion

It can be concluded that groundnut (100%) + mungbean (40%) intercropping system is one of the feasible and profitable combination of intercrop than other treatments.

References

Beets. W. C. 1977. Multiple cropping of maize and soybean under a high level of crop management. *Netherland J. Agric. Sci*. 25(2): 95-102

Evan, A. C. 1960. Studies of intercropping maize or sorghum with groundnut. East Africa Agriculture Journal 26 (1): 1-10

Grimes,A.,A. Quasem, M. Sabajal Uddin, M Jahiruddin and R.N. Mallik.1983. the performance of different cropping patterns in 1992-93 at the cropping system research site, Hathazari, ChittagongRARS, Publication No-1

Herrara,W. A. T. and R.R. Harwood.1974. The effect of plant density and row arrangement on productivity of corn rice intercrop. Paper presented at the 5 th Annual Convention of the Crop science Society of Philippines. Nagar City, May, 16-18.1974

Kurata, T.1986. A Study on the farming system in USA. *Quarterly J. of Agro. Eco.* 26 (3):179-205

Pathik, D. C. and M.L.Malla. 1979. Study on the performance of crop legumes under monoculture and intercrop combination, Sixth Annual Maize Development Workshop, Napal, 1979

Willey, R.W. and M. S. Reddy.1981. A field technique for separating above and below ground interaction for intercropping or expt. With pearlmillet/groundnut. Expt. Agric. 17:257-264

Table 1 Yield and yield contributing characters of groundnut as affected by varying plant population in groundnut-mungbean intercropping.

Treatments	Plant height (cm)	No. of branches/ plant	No. of pods/plant	No. of seeds/pod	100-kernal weight (g)	Nut yield (t/ha)
Sole groundnut	36.52	6.75	17.23	1.70	32.19	2.11
Groundnut (100%) + mungbean (20%)	35.87	6.17	15.71	1.73	32.59	1.95
Groundnut (100%) + mungbean (40%)	34.87	6.12	14.86	1.79	32.96	1.93
Groundnut (100%) + mungbean (60%)	33.42	6.02	11.91	1.69	31.54	1.58
LSD (0.05)	NS	NS	3.203	0.063	3.75	0.43
CV (%)	12.02	6.31	10.92	1.89	5.82	10.96

Table 2 Groundnut equivalent yield, LER and economic analysis of groundnut and mungbean intercropping

Treatment	Yield		Groundnut equivalent yield (kg/ha)	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)	LER
	Groundnut (t/ha)	Mungbean (kg/ha)					
Sole groundnut	2.11	_	2110	63,300	30,550	32750	1.00
Sole Mungbean	_	1031	1546	41240	14821	26418	1.00
Groundnut (100%) + mungbean (20%)	1.95	196	2244	67,320	32,514	34806	1.06
Groundnut (100%) + mungbean (40%)	1.93	302	2383	71,490	33,478	38,012	1.13
Groundnut (100%) + mungbean (60%)	1.58	315	2052	61575	35,442	26133	0.97

Market price of groundnut =30 Tk/kg, Mungbean = 45 Tk/kg

Effect of Date of Sowing on Growth, Yield and Yield Components of Mungbean in the Saline Area

Abstract

A field experiment was conducted at the MLT site Kuakata, Patuakhali during rabi, 2008 to find out the optimum sowing time of mungbean. Three sowing times viz. 01 January, 10 January, and 21 January 2008 and three variety (BARI mung-2, BARI mung-5 and BM 01) were included in the experiment. The yield was higher in 2nd and 3rd sowing than 1st sowing. On the other hand BM 01 gave comparatively higher seed yield due to salt tolerance ability more than others. The highest yield (0.956 t/ha) was obtained when BM-10 sown on 10 January.

Introduction

Mungbean (*Vigna radiata*) is the fifth important pulse crop of Bangladesh and contributes about 1.53% of total production. Its area and production are decreasing day by day. About 65% of mungbean is grown in the southern region. In the coastal area of Patuakhali where soil salinity is minimum, farmers are growing local mungbean cultivars with poor yield potential. In the farmers' field of Kuakata MLT site it was observed that BARI mung-2 perform better than local varieties. Farmers are growing local variety in the middle of January. During the reproductive phase of the crop soil moisture dries up and the crops suffer from drought. Early sowing in December could save the crop from drought. Moreover with the increasing of soil dryness soil salinity also increased. Therefore, the experiment was conducted to find out the optimum date of sowing for maximum growth and yield of mungbean.

Materials and Method

The experiment was laid out in RCB design having three replications with three varieties/lines sown in three sowing time. Unit plot size was 5 m x 2 m. Seeds were sown in a continuous row keeping line to line 30 cm apart. Mungbean variety BARI mung-2, BARI mung-5, and BM 01 were used. Seeds were sown in three different sowing dates as 01 January, 10 January and 21 January, 2008. The land was fertilized with 50-85-35 kg/ha Urea, TSP and MP as basal dose. Harvesting was done on 22 March, 25 March and 29 March, 2008, respectively. Yield and yield attributes were recorded and analyzed statistically.

Results and Discussion

Yield and yield contributing characters were presented in Table 1. Significant difference was found in plant height and seed yield in respect of sowing time. Maximum plant height was found in 10 January sowing which was statistically identical to 21 January. Both 2nd and 3rd sowing date gave higher and identical seed yield/ha. The lowest yield was recorded in 01 January sowing.

Performance of mungbean varieties were presented in Table 2. Plant height, number of seeds /pod and seed yield ha^{-1} differed significantly. The highest plant height was found in BM 01 and the lowest in BARI mung-5. But number of seeds/pod was the highest in BARI mung-5. The highest seed yield ha^{-1} was found in BM 01which was significantly different from other two variety. It might be due to more salt tolerance ability of BM 01 than others.

Combined effect of sowing time and variety was significant in case of plant height, number of seeds /pod and seed yield ha^{-1} (Table 3). The highest and statistically identical plant height was observed in $D_1 \times V_1$ and $D_2 \times V_1$ and it was lowest in $D_3 \times V_3$ treatment. Number of seeds /pod was highest where BARI mung-5 was used which might be due to characteristics of the variety. The highest and identical seed yield was observed in $D_2 \times V_1$, $D_2 \times V_2$ and $D_3 \times V_1$ treatments. It might be due to more salt tolerance ability of BM-01 and prolong cold weather in 01 January sowing. The lowest seed yield was observed in $D_1 \times V_2$, $D_1 \times V_3$ and $D_3 \times V_3$ treatments. It is revealed from the experiment that comparatively lower temperature increases the life span of mungbean and in the coastal belt mungbean should be sown at the time of Joe condition just after harvest of T.aman rice. Salinity of the experimental plots was ranged from 1.70-4.20 dS/m during period of mungbean of production (Table 4).

Farmers' reaction

- Farmers are satisfied to get higher yield of mungbean.

Conclusion

It is the result of 2nd year the trial and should be continued to the next year for final recommendation. In the coastal area where slightly salinity was prevailed mungbean should be sown on mid January.

Table 1. Effect of sowing time on the yield and yield contributing characters of mungbean at the MLT site Kuakata, Patuakhali during 2007-08

Sowing time	Plant population m^{-2}	Plant height (cm)	No. of pods /plant	No. of seeds /pod	Seed yield (kg/ha)
D_1	39	28.01 a	8	9	724 b
D_2	40	29.42 a	9	10	877 a
D_3	37	26.04 b	8	10	809 a
CV (%)	10.26	8.03	7.05	4.50	12.04

Table 2. Performance of mungbean varieties at the MLT site Kuakata, Patuakhali during 2007-08

Variety	Plant population m^{-2}	Plant height (cm)	No. of pods /plant	No. of seeds /pod	Seed yield (kg/ha)
V_1	36	30.50 a	9	9 b	880 a
V_2	39	28.02 b	8	8 b	786 b
V_3	41	26.30 c	8	12 a	710 b
CV (%)	10.26	8.03	7.05	4.50	12.04

Table 3. Combined effect of time of sowing and variety on the yield and yield contributing characters of mungbean at the MLT site Kuakata, Patuakhali during 2007-08

Sowing time x variety	Plant population m^{-2}	Plant height (cm)	No. of pods /plant	No. of seeds /pod	Seed yield (kg/ha)
$D_1 \times V_1$	38	31.56 a	9	9 bc	794 b
$D_1 \times V_2$	36	28.05 b	9	8 c	685 c
$D_1 \times V_3$	41	27.62 b	8	11 a	642 c
$D_2 \times V_1$	37	32.02 a	8	10 b	956 a
$D_2 \times V_2$	40	28.83 b	9	8 c	882 a
$D_2 \times V_3$	39	27.00 bc	8	12 a	792 b
$D_3 \times V_1$	41	28.04 b	10	8 c	891 a
$D_3 \times V_2$	38	27.15 c	8	8 c	790 b
$D_3 \times V_3$	37	25.72 d	8	12 a	695 c
CV (%)	10.26	8.03	7.05	4.50	12.04

D_1: 1st Jan, 2008, D_2: 10 Jan, 2008, D_3: 21 Jan. 2008 , V_1: BM-01, V_2: BARI mung-2, V_3: BARI mung-5

Table 4, Salinity levels of experimental plots in 2007-2008

Date	Salinity level (dS/m)
01.01.2008	1.70
10.01.2008	2.20
20.01.2008	2.61
30.01.2008	2.85
10.02.2007	2.90
20.02.2007	3.07
01.03.2008	3.38
10.03.2008	3.85
20.03.2008	4.20

Performance of Salt Tolerance Barley Genotypes in the Coastal Region of Bangladesh

Abstract

The experiment were conducted at the FSRD site Noakhali, MLT site Kuakata, and Satkhira during Rabi 2007-2008 under rainfed condition to find out suitable salt tolerant barley genotypes in this locality. Four genotypes of barley BHL-13, BHL-15, BHL-18 and BHL-19 were compared with variety BARI barley-4 under rainfed condition. Significant differences were found in grains/spike, 1000 grain wt. and yield among the genotypes. Among the genotypes, the highest grain yield 1550 kg/ha and 2327 kg/ha were recorded from BHL-15 at Kuakata, Patuakhali and Noakhali, respectively. But in Satkhira, BARI barley-4 was produced the highest grain yield (2150 kg/ha). The salinity levels during crop production period were 2.85-6.80, 1.52-7.0 and 2-10 dS/m in Kuakata, Satkhira and Noakhali, respectively.

Introduction

Barley (*Hordium vulgare* L.) is the world's 4th most important cereal crops and it has the potential to become one of the important crops in Bangladesh. Barley though a minor crop of the country can play an important role in enhancing the food security of the country and in reducing the drainage of foreign currency. It is nutritionally comparable to wheat and rice being a traditional of this subcontinent. Barley is popular for home consumption of rural people. This has several industrial uses also for which import is unavoidable. Further of all cereals barley is well known for its high resistance to salinity and thus has a great potentiality for expansion in the coastal saline area which remains mostly fallow in the rabi season. Therefore, development of high yielding superior quality barley varieties is very much necessary for reducing the drainage of foreign currency and for enhancing the over all food security of the country. (Chowdhury, 1962). BARI has recently developed some high yielding variety and is developing some new genotypes, which would be released as varieties after testing their performance at field level in the saline areas. The performance of these variety or genotypes needs to be evaluated in saline area at farmer's field. Keeping this in mind the trial was undertaken.

Materials and Methods

The experiment were conducted at the FSRD site Noakhali, MLT site Kuakata, and Satkhira during Rabi 2007-2008 under rainfed condition to determine salt tolerant barley genotypes in this locality. Four genotypes of barley BHL-13, BHL-15, BHL-18 and BHL-19 were compared with variety BARI barley -4. The experiment was laid out in RCB design with three replications. The unit plot size was 20 sqm. The seeds were sown in line with row to row distance 25 cm with seed rate 100 kg ha^{-1}. Fertilizers @ 100-60-40 kg ha^{-1} of N-P-K were applied as basal during the final land preparation. The seeds were sown on 06 December at Satkhira, 17 December at Noakhali and 26 December 2007 at Kuakata MLT site. All the intercultural operations were done as and when necessary. Data on yield and yield attributes were collected and analyzed statistically.

Result and Discussion

MLT site Kuakata, Patuakhali

Yield and yield contributing characters were presented in Table 1. Significant differences were found in grains/spike, 1000-grain weight and grain yield. The highest number of grains/spike was observed in BHL-15 which was statistically identical to BHL-19. Grain weight was the highest in BHL-15. The highest grain yield (1550 kg/ha) was obtained from BHL-15 due to higher yield attributes. The lowest yield was obtained from BHL-18 (1170 kg/ha). The salinity level during crop production period was 2.85-6.80 dS/m.

MLT site Satkhira, Satkhira

The performances of barley lines/variety have been presented in Table 2. The results revealed that higher grain yield (2.15 t/ha) was obtained from BB-4 which was closely followed by BHL-18 and BHL-19 and the lowest yield (1.24 t/ha) was recorded from BHL-13. The highest yield produced by BB-4 might be due to higher grain weight and spike/m^2. The salinity level during crop production period was 1.52- 7.0 dS/m.

FSRD Site Noakhali

Yield and yield attributes of four barley genotypes are presented in Table 3. The tallest plant (72.93 cm) was found in BHL-15, which was followed by BHL-13 (68.97 cm) and the lowest (59.33 cm) was found in BB-4. Number of effective tillers per m^2 did not differ significantly. However, the highest effective tillers per m^2 (149.3) was observed in BHL-15. The longest spike (9.9 cm) was found in BHL-15, which was significantly at par with BHL-19 (9.20 cm) and BHL-18 (9.4). The shortest spike (7.6 cm) was observed in BB-4. The genotype BHL-15 showed the highest number of grains/spike (38.7) but statistically identical with the others. In respect of 1000-grain weight, genotype BHL-15 (39.67 g), BHL-19 (38.33 g), BHL-18 (37.67 g) and BHL-13(37.33 g) were found identical and the lowest 1000 seed weight was found in BB-4 (35.00 g). The highest grain yield (2327 kg/ha) was obtained from the genotype BHL-15 followed by BHL-13 and BHL-18 and the lowest yield (1410 kg/ha) was found in BB-4.

Salinity tolerance level of Barley was recorded at various physiological stage of the crop period (Table 4). It was observed that the crop could tolerate a wide range of salinity (2-10 dS/m) in various growth stages. It was also found that, the crop was severely affected in vegetative stage. Above the salinity level 10 dS/m, it is economically not feasible to cultivate barley because of high mortality percentage. But in the heading to maturity stage it is observed that, in salinity range above 8 dS/m, yield reduced 30 to 40%. At the maturity stage salinity could not affect the plant adversely (0% mortality rate).

Farmers' reaction

- Farmer's are interested to grow barley in small scale for medicinal purpose
- Post harvest processing like winnowing and threshing is very trouble & tedious
- No demand in local market
- Lack of harvest facilities
- The grain yield would be satisfactory if it is sown within 15 November

Conclusion

From the study it was observed that the BARI barley-4 performed well in saline area in Satkhira. So, this variety can be grown in Fallow-T.aman -Fallow cropping pattern. In Noakhali it was observed that, BHL-15, BHL-18 and BHL-19 performed better than the other genotypes in the saline area which can be grown in the salinity level from 03 to 10 dS/m.

Table 1 Grain yield and yield contributing characters of barley genotypes during rabi 2007-08 at the MLT site Kuakata, Patuakhali

Variety	Plant height (cm)	Spike length (cm)	Effective tillers/hill	No. of Grains /spike	1000 grain wt. (g)	Grain yield (kg/ha)
BHL-15	67	6.15	3.0	44 a	29.75 a	1550 a
BHL-18	60	6.0	2.5	39 b	27.33 b	1170 c
BHL-19	64	6.0	2.5	42 a	27.66 b	1340 b
CV (%)	7.52	4.35	5.04	6.98	3.43	9.62

Table 2 Grain yield and yield contributing characters of barley genotypes during rabi 2007-08 at the MLT site Satkhira

.Variety/ line	Days to maturity	Plant height (cm)	Spike/m^2	Spike length (cm)	Grains/spike (No.)	1000-grain weight (g)	Grain yield (t/ha)
BB-4	106	85.93	162	8.40 a	43.67	33.67 a	2.15 a
BHL-13	112	78.73	123	6.70 b	39.00	28.33 b	1.24 b
BHL-18	108	86.00	141	9.26 a	45.67	32.33 ab	2.00 a
BHL-19	109	77.47	138	8.80 a	42.00	31.00 ab	1.99 a
CV(%)	--	5.07	13.31	5.77	8.83	7.12	5.18

Table 3 Grain yield and yield contributing characters of barley genotypes during rabi 2007-08 at the FSRD site Noakhali

Variety	Plant height (cm)	No. of effective tiller/m^2	Spike length (cm)	Grains/spike (no)	1000-grain weight (g)	Grain yield (kg/ha)
BHL-19	62.43	147.7	9.2	38.1	38.33	2144
BHL-18	65.17	145.3	9.4	36.5	37.67	1992
BHL-15	72.93	149.3	9.9	38.7	39.67	2327
BHL-13	68.97	140.0	7.7	32.8	37.33	1737
BB-4	59.33	129.0	7.6	27.5	35.00	1410
LSD (0.05)	11.02	NS	1.168	NS	3.73	832.6
CV (%)	8.90	14.10	7.06	16.29	5.27	13.00

Table 4 Relation between salinity and plant mortality of barley at different Physiological stage at the FSRD site Noakhali during 2007-08

Salinity range (dS/m)	Plant Mortality (%)			
	Vegetative stage	Heading stage	Grain filling stage	Maturity stage
0-2	0	0	0	0
2-4	15	5	0	0
4-8	30	18	5	0
8-12	50	23	15	0
12->19	>60	>30	>20	0

Performance of Mustard Varieties Relaying With T.aman in Coastal Region of Bangladesh

Abstract

The trial was carried out at the MLT site Satkhira during the rabi season 2007-08. Five mustard varieties were tested to evaluate their performance under relayed condition in T.Aman rice. The highest yield (1.57 t/ha) was obtained from BARI sarishaa-11 which was followed by BARI sarisha-9 (1.20 t/ha). The short duration variety BARI Sarisha-9 gave reasonable seed yield 1.20 t/ha.

Introduction

Bangladesh has an acute shortage of oil seeds in respect of its demand. The farmers of Satkhira area generally grow local mustard variety after harvest of T.aman rice. The productivity of this mustard variety is very low that cannot full fill the demand of oil of a farm family. In most cases, farmers sow the mustard seed after harvest of long duration local T.aman rice variety that drastically reduced the mustard yield due to its late planting and high soil salinity. Therefore, the farmers seek a new mustard variety, which can perform well without disturbing the existing cropping pattern. Oil Seed Research Centre of BARI has developed some varieties of mustard which posses the high yield potential and less disease susceptible. Mustard can be relayed with T.aman to ensure the optimum sowing time. Keeping this in mind the experiment was undertaken.

Materials and Methods

The experiment was conducted at the MLT site Satkhira during the rabi season of 2007-08 to evaluate performance of mustard varieties. The experiment was laid out in RCB design with 3 replications. The mustered varieties BARI Sarisha-9, BARI Sarisha-11, BARI Sarisha-15, Tori-7 and BINA Sarisha-5 were considered as treatment in this study. The mustard seed was broadcast in T.aman rice field 15days before T.aman (Var. BINA Dhan-4) harvest. The seed rate of mustard was 10kg/ha and were sown on 2 November 2007. Initially the experimental plots were fertilized with 250-170-85-150-15-15kg/ha Urea, TSP, MP, Gypsum, Zinc sulphate and Borax, respectively. All the fertilizers were applied as basal except urea. Urea was applied as top dressed on 20 and 35 days after sowing. The crop was harvested according to their maturity. Intercultural operation and plant protection measures were taken as and when necessary. The data on yield contributing characters were collected from 10 plants selected at random in each plot and yield recorded plot wise. All necessary data were collected and analyzed statistically. During the growing period of the crop salinity was rage from 3.72 to 5.05 dS/m in the soil.

Results and Discussion

The performance of different mustard varieties have been presented in Table 1. The variety Tori-7 and BARI saisha-9 took the shortest time for maturity (85 days) while BARI sarisha-11 took maximum time to get maturity (100 days). BARI sarisha-11 gave higher yield (1.57 t/ha) and its yield contributing characters i.e. plant height (124.1cm) and pod/plant (71.60) were also higher than any other variety whereas BARI sarisha-9 produced 1.20 t/ha yield which was followed by Tori-7 (1.00 t/ha). Seeds per pod were found the highest in BARI sarisha-9 (26.43) which was statistically similar with Tori-7. Maximum plant population (128.3) was found in BARI sarisha-15 which was statistically similar with Tori-7 and BARI sarisha-9.

Farmers' reaction

- Farmers of this locality have liked the variety BARI sarisha-9 and Tori-7 because of short duration to maturity.
- They are interested to relaying mustard with T.aman for sowing of mustered in optimum time which helped in seedling survivability due to low salinity in presence of adequate soil moisture.
- Tori-7 and BARI Sharisha-9 can be grown in T.aman- Boro cropping pattern.

Conclusion

Considering the yield and days to maturity BARI sarisha-9 and Tori-7 can be suggested for rowing with T.aman and Boro rice.

Table 1 Yield and yield attributing characters of mustard relaying with T.aman at the MLT site Satkhira during 2007-08

Variety	Days to maturity	Plant pop^n/m^2	Plant height (cm)	Pod/plant (No.)	Seed/pod (No.)	1000 seed weight (gm)	Seed yield (t/ha)	Straw yield (t/ha)
BINA sharisha-5	94	98.67b	74.60c	37.50c	22.87ab	4.70a	0.75d	3.53a
Tori-7	85	114.7ab	78.30c	38.70bc	25.20a	3.70c	1.00c	2.47b
BARI sarisha-9	85	113.7ab	86.07b	48.93b	26.43a	3.87bc	1.20b	2.60b
BARI sarisha-11	100	93.33b	124.1a	71.60a	17.80c	4.07b	1.57a	3.53a
BARI sarisha-15	92	128.3a	87.83b	41.97bc	19.90bc	3.10d	1.06c	3.63a
LSD (0.05)	NS	20.89	6.26	9.65	3.67	0.24	0.13	0.74
CV (%)	-	10.11	3.69	10.96	8.69	3.25	6.17	12.41

Performance of Different Crops and Crop Cultivars in the Coastal Saline Area

Abstract

The experiment was conducted at Laudove, Dacope, Khulna during Kharif 2007-08 with different crop and crops cultivars viz mungbean, soybean and sesame. Among the crops sesame performed better and rest of the crops were damaged by salinity. Out of four sesame varieties Atshira gave the highest yield (970kg/ha) while the lowest yield (805 kg/ha) was recorded in local variety.

Introduction

There are 49 upazilas of 13 districts under the coastal zone of Bangladesh. Among them Khulna, Satkhira, Bagerhat are included. Southern part of Bangladesh is mainly rice based. The major cropping pattern in this area is Fallow-Fallow-T.aman. After harvesting T.aman vast land area remains fallow due to lack of adequate knowledge about salinity management and suitable crops or crop cultivars for the saline areas. Even though some farmers have grown some crops in this area with own innovative practices. So, there have a great scope of growing BARI released varieties in that area using farmers innovative practice. With this view the present study was conducted to verify the performance of BARI released varieties of different crops as well as to select the suitable salt tolerant crop varieties against salinity stage.

Materials and Methods

The experiments were conducted at Laudove, Dacope, Khulna during 2007-08. Three different crops-mungbean, soybean and sesame were sown on 25, February 2008. The experiment was laid in RCB design with three replications. Five mungbean varieties/lines (BARI mung-2 and BARI mung-6, BM-01, BM-08 and Local), three soybean varieties (Shohag, Bangladesh soybean-4 and BARI soybean-5) and four sesame varieties (BARI Til-2, BARI Til-3, Atshira and Local) were included in the study as treatments. The plot size was 3×4m. In case of sesame, soybean and mungbean plots were fertilized with 100-130-40-100-5-8kg/ha, 50-150-100-80kg/ha and 40-80-30kg/ha of urea, TSP, MP, Gypsum, Zinc sulphate and Boric acid respectively. Slandered cultivation methods were followed for these crops. Weeding and intercultural operation was done as and when necessary. All the crop varieties except sesame were damaged due to higher degree of soil salinity. Mungbean and soybean varieties/cultivars were damaged on 20 March 08 and 30 March 08, respectively. For sesame seeds were sown continuously in line keeping distance 30cm. The crop was harvested on 25, May 2008. During the crop growing period the soil salinity level in sesame plot was (4.32 to 6.50dS/m), mungbean (5.15 to 7.50dS/m) and soybean (5.02 to 7.15dS/m). The yield and yield contributing character were collected and analyzed statistically.

Result and Discussion

Yield and yield contributing characters of sesame are presented in Table 1. Among four varieties Atshira produced the higher yield (970kg/ha). It might be due to higher pods/plant, seeds/pod and 1000-seed weight which favored the increased yield of Atshira. The lowest yield (805kg/ha) was found in local variety however it was identical with BARI Til-2 and BARI Til-3.

Farmers' reaction: Farmers like Atshira due to it high yield.

Conclusion: This is the first year result. So, this experiment should be continued for final conclusion.

Table 1 Yield and yield related characters of sesame at Laudove, Dacope, Khulna during 2007-08

Variety	Plant population (No.)	Plant height (cm)	Branch/ plant (No.)	Pod/plant (No.)	Pod/ length (cm)	Seed/pod (No.)	1000 seed wt.(g)	Seed yield (t/ha)	Stover yield (t/ha)
BARI Til-2	61.46a	55.66c	1.70b	30.00ab	1.71b	45.06c	2.15a	822b	2038c
BARI Til-3	61.00ab	66.06a	2.17a	28.00bc	1.83a	53.66b	2.08ab	829b	2437ab
Atshira	59.00ab	61.66b	2.03a	32.33a	1.74b	64.66a	2.21a	970a	2555a
Local	57.00b	49.76d	1.18c	25.38c	1.62c	45.11c	1.94b	805b	2303b
LSD(0.05)	3.99	3.85	0.16	3.32	0.06	4.75	0.18	80.59	208.9
CV (%)	3.35	3.31	4.77	5.76	2.11	4.57	4.63	4.71	4.48

Effect of Nitrogen Fertilizer on Seed Yield of Soybean Varieties/Line

Abstract

The field experiment was conducted at the MLT site, Luxmipur during the rabi season of 2007-08 to study the effect of varieties/line and nitrogen levels on the seed yield of soybean. Two varieties and one line (Shohag, BARI Soybean-5 and line Amber) and four nitrogen levels (0, 20, 30 and 40 kg N/ha) were used as treatments. The result showed that 30 kg N/ha in combination with the line Amber gave the highest yield (3.54 t/ha) which was identical with 20 kg N/ha in combination with the line Amber (3.53 t/ha). The increase of nitrogen rates caused the yield reduction incase of varieties Shohag and BARI Soybean-5. The yield reduction in line Amber was not so remarkable in comparison to other two varieties. Farmers of Kamolnagar could use 20 kg N/ha for their optimum yield (3.53 t/ha) in case of line Amber.

Introduction

Soybean (*Glycine max* L.) originated in Eastern Asia, probably in north and central China. Nitrogen is essential for building up of protoplasm and protein which induce cell division initiate meristematic activity when applied in optimum quantity. Variety selection and nitrogenous fertilizer has a great influence on yield, oil and protein content in soybean. Considering the factors the present study has been undertaken to observe the response of different soybean varieties/line to nitrogen fertilizer on seed yield.

Materials and Methods

The experiment was conducted at the MLT site Kamolnagar, Laxmipur during the Rabi season of 2007-08. The soil of the experiment area belongs to Young Meghna Estuarine Floodplain (AEZ 18). The experiment was laid out in a split plot design with three replications. Unit plot size was 4mx3m.There were three varieties/line viz. Shohag, BARI soybean-5, Amber and four levels of nitrogen (N_0, N_{20}, $N3_0$, N_{40}) as treatment. The crop was fertilized with P-K-S @ 17-16-5 kg/ha, respectively. Half of nitrogen and all other fertilizers were applied as basal. Rest half of N was applied at 30 days of sowing after first weeding. Seeds were sown in lines maintaining 30cm x 10 cm spacing sown on 3 rd week of January 2008 and harvesting was done on 2nd week of May, 2008. Data on yield and yield contributing characters were recorded and statistically analyzed.

Result and Discussion

Data on yield contributing characteristics and yield of soybean varieties/ line influenced by nitrogen level have been presented in Table 1. It was observed that incase of every varieties/line with no use of nitrogen fertilizer gave the minimum time for flowering (51-55 days) and maturity (100-105 days). But after applied 20 kg N/ha flowering time ranged 55-59 days and maturity time ranged 105-108 days. Similarly, when increased dose (30 kg N/ha and 40 kg N/ha) were applied flowering occurs according to variety/line ranges from 56-61days and maturity time took110-112 days.

Effect of varieties/Line

Incase of varieties and line there was no significant difference in plant height, branch per plant, and seed per pod but pods/plant and 100-seed weight were found significant. The highest pod per plant (31.42) was found in line Amber. The lowest pod per plant was found in Shohag (24.86) which was statistically similar with BARI Soybean-5 (26.80). The maximum 100-seed weight (11.54g) was obtained from Amber which was similar with Shohag (11.21g) and lowest in BARI Soybean-5 (10.46). The highest seed yield (2.83 t/ha) was obtained from line Amber. The lowest yield was found in variety Shohag (1.89 t/ha) which was statistically similar with BARI Soybean-5 (2.04 t/ha) (Table 2).

Effect of N dose

There was no significant difference between branches per plant. The highest plant height (71.61 cm) obtained from 40 kg N/ha which was statistically similar with 30 kg N/ha (66.62 cm) and the lowest was found in without N (43.81 cm). There was a trend to increase plant height with the increase of N level. The maximum pod per plant (32.28) was found in 20 kg N/ha which was statistically similar with 30 kg N/ha (31.91) and minimum was found in without application of N (18.09). Similar trend was followed in case of seeds/pod and 100-seed weight. The highest yield (3.05 t/ha) was obtained from 20 kg N/ha which was statistically similar with 30 kg N/ha (2.67 t/ha). The lowest yield (0.99 t/ha) was obtained from without application of N. There was trend to decrease seed yield after application of 20 Kg N/ha (Table 3).

Combine effect of variety/line and nitrogen dose

Data on yield components and yield of soybean varieties and line as affected by various nitrogen levels have been presented in Table 4.

Plant height

Among the treatment combinations 40 kg N/ha with Amber produced maximum plant height (71.97 cm) which was statistically similar to 40 kg N/ha with BARI Soybean-5 (71.50cm) and Shohag (71.37 cm), respectively. The shortest plant height (41.77cm) was found in Shohag, BARI Soybean-5 (43.58 cm) and Amber (46.09cm) without N. The result is in conformity with Kuksal *et al*. (1997) reported that nitrogen application at higher rates increased plant height.

Branch per plant

There was no significant difference of branch per plant among the treatment combinations. But maximum branch per plant were found from treatment combinations 20 kg N/ha in Amber (2.00) and 40 kg N/ha in BARI Soybean -5 (2.00) and the lowest branch per plant found in without application of N in Amber (1.33), Shohag (1.33) and 20 to 30 kg N/ha with Shohag.

Pods per plant

Pod per plant was significantly influenced by various nitrogen levels in varieties (Table 4). The highest pods per plant was obtained in 30 kg N/ha with Amber (37.36) which was statistically similar with 20 kg N/ha (35.85) and 40 kg N/ha (34.72) of same variety. Number of pods per plant was found lowest (17.74) in without N in Amber, Shohag (17.90) and BARI Soybean-5(18.62) and followed by Shohag (25.49) and BARI Soybean-5(25.26) with 40 kg N/ha respectively. Increased vegetative growth at higher N dose might have suppressed pod formation and no nitrogen also caused lower pod formation.

Seed per pod

Significant differences were not observed 20 to 40 kg N/ha with Amber (2.45). The lowest seed per pod (1.85) was found in without nitrogen of all the variety.

100-seed weight

The highest 100-seed weight (13.17 g) was found in 20 kg N/ha with Shohag which was statistically similar with Amber (12.67 g) of same dose of nitrogen. The lowest (8.67 g) was observed in without application of N with Shohag, BARI Soybean-5(9.33) and Amber (9.33) respectively.

Seed yield

The highest seed yield (3.54 t/ha) was found in 30 kg N/ha with Amber which was statistically identical with 20 kg N/ha (3.53 t/ha) and 40 kg N/ha (3.25 t/ha) of same variety and 20 kg N/ha with BARI Soybean-5(3.03). Increasing N dose from 20 kg N/ha to 40 kg N/ha did not give any yield advantage. This is because soybean being an atmospheric N- fixing crop needs only a little amount of N fertilizer for its optimum production. This result is in agreement with those of Graham *et al.* (1984) and Chamberland (1982) who reported that higher dose of nitrogen fertilizer reduced nodulation and grain production. The higher seed yield was found in 20 kg N/ha irrespective of all varieties and line. When nitrogen level increased from 30-40 kg N/ha yield was drastically reduced. This might be due to higher vegetative tendency in all varieties particularly for Shohag and BARI Soybean-5. Also higher dose of nitrogen application caused maximum insect infestation.

Farmers' reaction

Farmers are very much interested about the line Amber and its fertilizer response in relation to yield. They also realized that high dose of nitrogen caused highest plant height and lower pod formation but yield did not increased substantially.

Conclusion

The highest yield (3.54 t/ha) was found in 30 kg N/ha in combination with the line Amber which was at par with same variety with 20 kg N/ha and BARI Soybean-5 (3.02 t/ha) with 20 kg N/ha. Further increase of nitrogen rates decrease yield in all the varieties/lines. Therefore, for achieving higher yield 20 kg N/ha could be used for the two varieties and one line. This was first year experiment. The experiment needs further trail for two years for confirmation.

References

Chamberland, E.1982. Predicting the N, P and k requirements of legumes grown in a mineral soil, Peas and Beans. Canadian J. of Soil Science 62 (4):663-672

Graham, R.A. and T.W. Scott. 1984. Response of cowpea to nitrogen and inoculation in Trinidad. Trop. Agric. 61 (1):56-58

Kuksal R.P., R. D. Singh and N. Yadar. 1997. Effect of different levels of nitrogen and phosphorus on fruit and seed yield of tomato. Prog. Hort. 9 (2):3-20.

Table 1. Plant characteristics influenced by combination of soybean varieties/ line and different nitrogen levels during 2007-08

Treatment combinations	Days to flowering (>50%)	Days to maturity
N_0 X Amber	52	100
N_{20} X Amber	55	105
N_{30} X Amber	58	111
N_{40} X Amber	60	112
N_0 X Shohag	51	105
N_{20} X Shohag	56	108
N_{30} X Shohag	56	110
N_{40} X Shohag	60	112
N_0 X BARI Soybean-5	55	102
N_{20} X BARI Soybean-5	59	106
N_{30} X BARI Soybean-5	59	108
N_{40} X BARI Soybean-5	61	110

Table 2. Effect of varieties/line on the yield and yield contributing characters of soybean at the MLT site Laxmipur during 2007-08

Varieties/Line	Plant height (cm)	Pods per plant (no.)	Seed per pod (no.)	100 seed weight (g)	Seed yield (t/ha)
Amber	60.55	31.42	2.31	11.54	2.83
Shohag	60.00	24.86	2.05	11.21	1.89
BARI Soybean-5	60.10	26.80	2.17	10.46	2.04
CV (%)	9.38	6.04	6.46	4.19	12.71
$LSD_{0.05}$	NS	2.83	NS	0.79	0.48

Table 3. Effect of nitrogen levels on the yield and yield contributing characters of soybean at the MLT site Laxmipur during 2007-08

Nitrogen level (kg/ha)	Plant height (cm)	No. of pods/plant	No. of seeds/pod	100-seed weight (g)	Seed yield (t/ha)
0	43.81	18.09	1.90	9.11	0.99
20	58.80	32.28	2.37	12.50	3.05
30	66.62	31.91	2.24	11.56	2.67
40	71.61	28.49	2.21	11.11	2.30
CV (%)	9.38	6.04	6.46	4.19	12.71
LSD(0.05)	5.18	2.83	0.23	0.78	0.48

Table 4. Seed yield and yield components of soybean as influenced nitrogen levels and variety/line at the MLT site, Laxmipur during 2007-08

Treatments	Plant height (cm)	No. of branches/ plant	No. of pods/plant	No. of seeds/pod	100-seed weight (g)	Seed yield (t/ha)
N_0 × Amber	46.09	1.33	17.74	1.90	9.33	1.00
N_{20}× Amber	58.16	2.00	35.85	2.45	12.67	3.53
N_{30} × Amber	65.98	1.67	37.36	2.47	12.00	3.54
N_{40} × Amber	71.97	1.67	34.72	2.40	12.17	3.24
N_0 × Shohag	41.77	1.33	17.90	1.85	9.33	.98
N_{20} × Shohag	58.96	1.33	28.47	2.16	13.17	2.59
N_{30} × Shohag	67.85	1.33	27.57	2.08	11.83	2.16
N_{40} × Shohag	71.37	1.67	25.49	2.12	10.50	1.81
N_0 × BARI Soybean-5	43.58	1.67	18.62	1.92	8.67	.99
N_{20} × BARI Soybean-5	59.30	1.67	32.51	2.50	11.67	3.02
N_{30} × BARI Soybean-5	66.03	1.67	30.79	2.17	10.83	2.29
N_{40} × BARI Soybean-5	71.50	2.00	25.26	2.11	10.67	1.84
LSD (0.05)	5.19	NS	2.83	0.24	0.79	0.48
CV (%)	5.09	42.42	6.04	6.46	4.19	12.71

Performance of Salt Tolerant Mungbean Varieties/Lines in the Coastal Area

Abstract

The experiment was conducted at the FSRD site, Hazirhat, Noakhali under rain fed condition during 2007-08 with the mungbean lines BM-01, BM-08, BU-02, BU-04 and varieties of BARI mung-5 and 6 to find out salt tolerant mungbean variety. BM-08 gave the highest yield (1.44 t/ha) but it was at par with BARI mung 6 (1.26 t/ha) and BM-01. The lowest yield (0.49 t/ha) was recorded from BU-02. Lower plant mortality was observed in BM-08.

Introduction

Mungbean is one of the major pulse crop in Bangladesh. It has high protein, good flavor and is easy to digest. It may play a vital role to supplement protein in the cereal based low-protein diet people of Bangladesh. In our country per capita consumption of pulse is only 12 g/day (BBS, 1998) while the world health organization (WHO) 45 g/day/capita (PRC, 1998) for a balance diet. Though, mungbean is an important pulse crop and can be grown both in rabi and kharif season. The growing behaviour of mungbean has made a great opportunity to fit well it in the fallow period of saline area. A vast coastal area in the southern part of Bangladesh are exhibit soil salinity of various magnitude due to on rush of salt water from the bay. During the dry season (November- March) surface layer of the soil dries up due to evaporation and the saline water from the underground moves up due to capillary forces. Thus a considerable amount of salt crust occurs. So, cultivation of winter crops is very limited due to absence of irrigation water and salinity. As a result, a vast area remains fallow during the dry months. To increase pulse area and production especially mungbean needs to be grown in the southern saline part of Bangladdesh. Therefore, the experiment was carried out to select salt tolerant mungbean varieties/lines under farmer's field condition in coastal area.

Materials and Methods

The experiment was conducted at the FSRD site Hazirhat, Noakhali under rainfed condition during 2007-08 with two varieties (BARI mung-5, BARI mung-6) and four advanced lines viz. BM-01, BM-O8, BU-02 and BU-04. The experiment was laid out in RCB design with three replications. The unit plot size was 6 m^2. Seeds were sown second week of February, 2008 with 30cm X 10cm spacing. Recommended dose of fertilizers (33-90-20-17 kg/ha Urea, TSP, MP and Gypsum respectively) were applied as basal during the final land preparation. The first picking was started at 20.4.08 and final picking was continued upto 12.05.08. The plots were weeded in two times. Data on yield and yield contributing characters were recorded and analyzed statistically. During the period of experiment the salinity range was 1.6 to 5.9 ds/m (Table 3).

Results and Discussion

Yield and yield contributing characters of different mungbean varieties and lines were presented in table 1. Among the varieties/lines significant difference were found in respect of plant height, pod/plant, 1000-seed weight and seed yield. Branches/plant, pod length and seeds/pod were insignificant. BM-08 gave the tallest plant (53.34 cm) and the shortest plant (32.36 cm) was recorded in BU-04. The maximum branch/plant (4.12) was observed in BM-08 which was statistically insignificant. The highest number of pod/plant (16.43) was observed from BM-08 and the lowest number of pod/plant (10.10) was found in BU-02. The highest pod length (9.58 cm) was observed from BARI mung-6 and BU-04 gave the lowest pod length. BARI mung-6 produced the maximum number of seed/pod (11.57) but at par to other variety. The highest 1000seed weight (38.59 g) was recorded from BARI mung-6 and the lowest 1000 seed weight (25.46 g) was recorded from BM-01. BM-08 gave the highest grain yield (1.44 t/ha) due to its lowest mortality (6.89 %) and the highest plant population at harvesting stage (Table 2) but grain yield of BM-08 was statistically similar with

BARI mung-6 (1.26 t/ha) and BM-01(1.06 t/ha).The lowest grain yield (0.49 t/ha) was found in BU-04.

Farmers' reaction

Farmers are interested to cultivate BM-08/ BARI mung-06 because of higher seed yield. Farmers were especially interested to cultivate BM-08 because of its higher yield, less mortality and salt tolerant ability in saline area.

Conclusion

BM-08 gave the highest grain yield which was identical to BARI mung-6. The experiment should be repeated for the next year.

References

BBS. 1998. Banglad3esh bureau of statistics. Year Book of Agricultural Statistics of Bangladesh. Ministry of Planning, Government of the People's Republic of Bangladesh , Dhaka.

Pulse Research Centre (PRC). 1998. Annual Report of Pulse Research Centre for the Year 1998 BARI, Joydebpur.

Table 1 Seed yield and yield attributes of mungbean as influenced by different varieties at the FSRD site Hazirhat, Noakhali during 2007-08

Varieties/lines	Plant height (cm)	Branch / plant	Pod/plant	Pod length (cm)	Seeds/pod	1000 seed wt. (g)	Seed yield (t/ha)
BM-01	40.32	3.37	14.36	6.81	10.17	25.46	1.061
BM-08	53.34	4.12	16.43	7.84	10.57	30.10	1.442
BARI mung-5	34.70	3.42	12.53	8.71	10.03	35.52	0.984
BARI mung-6	40.26	3.62	13.10	9.58	11.57	38.59	1.258
BU-02	33.13	3.07	10.10	6.92	8.27	29.87	0.521
BU-04	32.36	3.22	11.23	6.41	9.93	30.03	0.492
CV (%)	6.10	19.09	15.94	4.04	13.79	11.87	26.67
LSD (0.05)	4.33	NS	2.53	NS	NS	6.82	0.467

Table 2 Plant population per m^2 at different stage and mortality % of different mungbean varieties at the FSRD site Hazirhat, Noakhali during 2007-08

Varieties/lines	At 10 DAS	At Harvest	Mortality (%)
BM-01	24	22	8.33
BM-08	29	27	6.89
BARI mung-5	23	20	13.04
BARI mung-6	26	23	11.53
BU-02	23	16	30.43
BU-04	23	14	39.13

Table 3 Salinity levels at different crop growth period at the FSRD site Hazirhat, Noakhali during 2007-08

Varieties/lines	Salinity at different date					
	28/02/08	10/03/08	19/03/08	30/03/08	09/04/08	22/04/08
BM-01	1.89	3.20	3.69	4.50	4.60	4.60
BM-08	1.85	2.90	4.85	4.10	5.15	5.35
BARI mung-5	1.65	2.87	3.14	4.90	3.20	3.90
BARI mung-6	1.85	3.32	4.82	5.50	5.20	4.50
BU-02	2.35	4.92	4.69	4.60	5.90	4.30
BU-04	2.55	3.95	4.13	5.20	5.20	5.20

D. HILLY AREA

Development of Alternate Cropping Pattern against Existing One at Hilly Areas in Bandarban

Abstract

A field experiment was conducted at Chemi dalo para, Bandarban during 2007- 2008 to study the suitability of proposed cropping patterns, increase the total productivity and cropping intensity. The patterns were (i) Maize (BARI hybrid-3) - T.aman (ii) Mustard (BARI sarisha-11) - T.aman, (iii) Chickpea (BARI chola-5) - T.aman, (iv) Cucumber - T.aman and (v) Fallow - T.aman. It was observed that chickpea produced the highest BCR followed by Maize and Mustard.

Introduction

In Bandarban sadar major cropping pattern is Fallow-Fallow-T.aman which covered the area of 1149 hectare and it was 16% of the total area of existing 11 cropping pattern. The second important cropping pattern is Boro-fallow-T.aman, 930 ha (13%) followed by winter vegetable-fallow-T.aman, 200 ha (3%). Maize is an important crop in hilly areas which could be cultivated in rabi and kharif season. The local maize variety gave lower yield 1.5 t/ha while BARI hybrid maize and Pacific-11 gave higher yield 8-10 t/ha. The area coverage of maize is increasing day by day due to high local demand of maize. Mustard is the dominant oil crop in Bandarban and area covered by 1605 ha and production 880 m t (BBS, 2004). In that case area and production could be increased by introducing BARI sarisha-11 in existing cropping pattern and farmers' will get higher benefit from this crop. Chickpea is one of the new pulse crops in Bandarban. Introducing chickpea in existing cropping pattern can play a vital role to meet up the pulse deficit in hilly areas. Cucumber is one of the most important crop in Bandarban which grown widely in hilly area. Therefore, inclusion of maize, mustard, chickpea and cucumber in the fallow period of the existing cropping pattern to increase the productivity and profitability of the farmers' and increase cropping intensity.

Materials and method

The experiment was conducted at Chemi dalo para, Bandarban during 2007- 2008 to study the suitability of proposed cropping pattern, increase the total productivity and cropping intensity. The pattern were (i) Maize (BARI hybrid -3) - T.aman (ii) Mustard (BARI sarisha-11) - T.aman, (iii) Chickpea (BARI chola -5) - T. aman, (iv) Cucumber-T.aman and (v) Fallow-T.aman. The alternate cropping patterns were tested with three dispersed replications across the farmer's field under same land type. The unit plot size was 40 m^2. BARI hybrid maize-3 was sown at 3^{rd} week of December with maintaining the spacing 75cm x 25cm. Fertilizers was applied @ 250-55-144-34-13-1 kg N- P- K-S-Zn-B/ha, respectively. One third of N and all other fertilizer were applied as basal and rest $2/3^{rd}$ N; $1/3^{rd}$ N were applied at 8-10 leaves stage and rest $1/3^{rd}$ N at tasseling stage. The maize was harvested on 22-24 April 2008. BARI sarisha 11 was sown at 2^{nd} week of November with maintaining the 30cm line spacing. Fertilizers were applied @ 138-36-50-32 kg N- P- K-S-Zn/ha, respectively. One third N and all other fertilizer were applied as basal. Rest of N was applied in equal splits at 25 and 45 DAS. Mustard was harvested on 28 February 2008. BARI chola-5 was sown at 3^{rd} week of December with maintaining the spacing 40cm apart line. Fertilizers were applied @ 23-18-20 kg N- P-K/ha, respectively. All fertilizers were applied at final land preparation. The chickpea was harvested on 07-08 April 2008. Yield of the first crops were recorded from each cropping pattern. Cucumber was sown in late kharif-1 season and harvesting is going on.

Results and discussion

Yield and economic analysis of first crops of different alternate cropping patterns of the experiment are presented in Table 1. The results showed that maize produced the highest gross margin (Tk.53750/ha) but the highest BCR (3.22) was recorded from chickpea. So, there is a great scope to earn extra income in same piece of land through introducing new crop in the cropping pattern.

Conclusion

Maize, chickpea, mustard and other suitable crop can be introduce in existing cropping pattern and increase socio-economic condition of farmers of Bandarban district. It was first year experiment. It should be continued for next year.

Table 1. Performance of different crops in the alternate cropping pattern at hilly areas in Bandarban district during 2007-08

Crop	Yield (t/ha)	Gross return (Tk/ha)	Total cultivation cost (Tk/ha)	Gross margin (Tk/ha)	BCR
Maize	9.5	114000	60250	53750	1.89
Chickpea	1.5	63000	19550	43450	3.22
Mustard	1.4	49000	27640	21360	1.77
Cucumber	-	-	-	-	-

On-Farm Verification Trial of Hybrid Maize

Abstract

The trial was carried out in the farmer's field at Gobindaganj-Gaibandha, Kaligonj-Jhenidah, Bandarban, Pushpapara-Pabna and Gangni-Meherpur during 2007-08 to compare the performance of BARI developed hybrid maize advance line/varieties and commercial varieties. At Gobinagaj BTC-04-05 gave the highest grain yield, however it was at par with BHM-5, P2XP4 and P6XP7. While at Jhenaidah BHM-3 gave the highest yield whereas at Bandarban and Meherpur line P6XP7 produced the highest yield. However, at Pabna highest yield was obtained from commercial cultivar, NK-40 and it was at par with 900M-Gold.Averaged over locations cultivar P6XP7 gave apparently the highest yield (9.08 t/ha).

Introduction

Maize is a very common, popular and diversified used cereal crop at present situation. Every year a huge amount of maize grain is required as feed and fodder for livestock sector and major portion of them are fulfilled by importing from other countries. Farmers are growing mainly imported hybrid varieties for their exceptionally high yields. Plant Breeding Division of BARI has developed some varieties/lines of maize with almost similar yield potentials to that of the imported varieties. It is therefore important to evaluate the performance of this varieties/line in farmer's field condition and popularize them for general use by the farmers. Keeping this view, the trial was conducted with the following objectives

Objectives

i) To compare the performance of BARI hybrid maize and commercial variety in the farmer's field
ii) To monitor the farmer reaction about the cultivars/varieties

Materials and Methods

The trial was carried out in the farmer's field at Gobindaganj-Gaibandha, Kaligonj-Jhenidah, Bandarban, Pushpapara- Pabna and Gangni-Meherpur, during 2007-08 to compare the performance of BARI developed hybrid maize cultivars/varieties and commercial variety. The test cultivars/varieties were, BARI hybrid maize (BHM)-3, BHM-5, BHM-7, lines, P2XP4, P6XP7, BTC 04-05, commercial hybrid NK-40, 900M, 900M-Gold and Pacific 984. The experiment was laid out in randomized complete block design with three dispersed replications. The unit plot size was 5m x 4.5m. Seeds of different varieties/line were sown on 3 December 2007 at Gaibandha, 1 December 2007 at Jhenaidah, 25-28 November 2007 at Bandarban and 10-13 December 2007 at Pabna and 30 November 2007 at Meherpur with a spacing of 75 cm x 25 cm. The crop was fertilized with 250-55-144-34-13-1 kg N-P-K- S- Zn-B/ha. One third urea and the full amount of other fertilizers were applied as basal. The rest urea was applied in two equal splits at 8-10 leaves stage and tasseling stage. Earthing up was done after 2nd top dress of urea. At the early stage the crop received one rainfall. One irrigation was applied at late vegetative stage (95days after sowing). Weeding was done at 28 days after sowing. At the initial vegetative stage, recommended pesticide was used to save crop from cutworm infestation. Other intercultural operations and plant protection measure were taken when required. The crop was harvested on 5 May /08 at Gaibandha, 28 April/08 at Jhenaidah, 19-24 March/08 at Bandarban , 20-22 May/ 2008 at Pabna and 20-25 April/08 at Meherpur. Data on different plant characters and yield were collected and analyzed statistically.

Results and Discussion

Gaibandha

The germination percentage/performance of all the maize varieties was good. The highest yield (8.98 t/ha) was found in BTC04-05 treatment and it also identical with BHM-5, P_6 x P_7 & NK-40. The highest yield was found in BTC04-05 due to the highest cob length, seeds per cob and also highest 100 seed weight (Table-1). The lowest yield (7.40 t/ha) was obtained from P_2 x P_4 cultivar.

Jhenaidah

The variety BHM-3 produced the highest grain yield (8.05 t/ha) in Kaligonj MLT site, Jhenaidah. The lowest yield was obtained from the line P_6 x P_7 (7.56 t/ha) which was statistically similar to the line P_2 x P_4 (7.61 t/ha).

Bandarban

Plant height, number of plant /m^2, number of cobs/m^2, 1000-grain wt. and yield are presented in Table 3. It is seen from the table that no. of plants and no. of cobs were highest in P6XP7 resulting in the highest yield and which was statistically identical to the line P_2 X P_4. The lowest grain yield (7.83 t/ha) was recorded from BHM-7.

Pabna

Plant population per unit area was similar except BHM-3. The maximum plant height was in BHM-3 which was similar to commercial variety 900M-Gold. The maximum number of grains cob^{-1} was recorded in 900M-Gold and it was identical with other varieties/line except NK-40. The highest weight of 100 grain was obtained from NK-40 which significantly differed from other varieties/line. The lowest 100 grain weight was recorded in BHM-5. The highest grain yield was obtained from NK-40 which was similar to 900M-Gold. The lowest grain yield was obtained from BHM-3 and BHM-5. The cumulative effect of maximum plant population per unit area and higher 100 grain weight might be contributed to the highest yield in NK-40. The lowest plant stand per unit area might have contribution to the lowest yield. Though the grains cob^{-1} of BARI developed varieties was similar to commercial varieties, the lower grain weight might be the major factor for lower yield. In addition to that, BHM-3 and BHM-5 were lodged at the grain filling stage due to strong storm which might resulted the lowest yield.

Meherpur

The plant height, no. of plants /15 m^2, no. of seeds/cob and 1000-seed weight were highest in line P_6 $\times P_7$. The highest yield was also recorded from $P_6 \times P_7$ (9.44 t/ha) and lowest from variety Pacific-984 (6.88 t/ha). Days to tasseling and days to silking were almost same.

Farmer's reaction

From the farmers own set of selection criteria, shinny grain color and low seed price of BARI developed varieties/line initially attracted the farmers. But regarding yield, BARI developed line P6XP7 apparently did not satisfy the farmers need because their major selection criteria was higher yield.

Conclusion

On the average line P6XP7 gave the highest yield. But the grain yields of commercial hybrid maize NK-40 and 900M-Gold were higher over BARI developed varieties/lines in some locations. However. some BARI developed varieties and lines gave comparable and even higher yield over commercial cultivars in Gaibandha, Meherpur and Bandarban. The trial should be repeated across locations with more number of BARI developed promising hybrid maize lines. It may me mentioned that in general yield was lower (about 1-2 t/ha) than previous years probably due to timely non-availability and high price of fertilizer along with delayed plantation of rabi maize.

Table1: Performance of different maize variety at MLT site, Gobindoganj during 2007- 2008.

Treatments	Days to maturity	Plant height (cm)	Cob length (cm)	Seeds/cob	100-seeds wt (gm)	Yield (t/ha)
BHM-3	144	228.90a	20.60b	515.40b	34.40bc	7.92b
BHM-5	144	228.56a	19.83bcd	466.90b	39.31bc	8.76a
BHM-7	145	214.63abc	18.75d	482.8b	39.14c	7.98b
P_2XP_4	147	191.46c	18.93cd	515.60b	39.61bc	7.40c
P_6XP_7	140	223.9ab	20.56b	481.40b	39.71ab	8.87a
BTC 04-05	140	229.2a	22.76a	653.00a	40.23a	8.98a
NK-40	149	219.66abc	20.15bc	488.20b	39.51bc	7.94b
900M	149	198.43bc	22.45a	626.20a	39.25bc	8.68a
CV (%)		7.67	5.65.	7.36	4.84	5.26

Table 2: Yield and yield contributing characters of maize at MLT site, Kaligonj, Jhenaidah during rabi 2007-08

Variety/ lines	Plant height (cm)	Cob length (cm)	Cob diameter (cm)	No. of grains/cob	100 grain wt. (g)	Yield (t/ha)	Straw yield (t/ha)
P_2 x P_4	172.67d	16.33c	16.20	502.67d	38.10b	7.61c	7.47bc
BHM-7	179.13c	19.13b	17.40	554.00b	39.83a	7.84b	8.07ab
P_6 x P_7	190.33a	19.60ab	16.20	568.00a	37.80b	7.56c	7.37bc
BHM-3	184.80b	20.40a	16.80	534.67c	40.13a	8.05a	8.61a
BTC-04-07	181.20c	17.17c	15.93	500.67d	36.80c	7.82b	6.80c
CV (%)	7.61	3.05	5.91	6.89	2.82	5.10	6.00
F-test	**	**	NS	*	**	**	*

Table 3. Yield and yield contributing characters of hybrid maize at hill valleys in Bandarban, 2007-08

Variety/Line	Days to maturity	Plant height (cm)	No. of plant /m^2	No. of cobs/ m^2	Ear height (cm)	1000-grain wt.(g)	Grain yield (t/ha)
BHM – 3	145-150	271	4.25	7.82	96	315	7.94 b
BHM – 7	144-148	273	4.51	7.17	97	310	7.83 b
BTC 04-05	140-145	257	4.87	8.65	102	305	8.06 b
P_2 5 P_4	144-147	260	4.95	8.77	101	320	8.96 ab
P_6 5 P_7	145-150	264	5.13	9.69	102	330	10.46 a
LSD (.005)	-	-	-	-	-	-	2.21
CV (%)	-	9.87	5.41	6.32	4.87	5.21	9.51

Table 4: Yield and yield contributing characters of different hybrid maize variety at FSRD site, Pushpapara, Pabna during the *rabi* season of 2007-08.

Maize variety	Days to tasseling	Days to silking	Days to maturity	Plant popn/m^2	Plant height (cm)	Ear height (cm)	Grains/ cob (no.)	100-grain weight (g)	Grain yield (t/ha)
BTX-04-05	96	101	156	5.33	186.7	89.5	533.47	33.6	7.51
BHM-3	99	104	155	4.84	206.2	101.6	532.53	32.9	7.02
BHM-5	99	104	155	5.15	182.9	94.5	563.06	27.6	7.44
NK-40	96	101	151	5.51	169.8	86.1	469.87	39.2	9.01
900M-Gold	96	101	154	5.24	191.7	99.2	588.00	34.8	8.89
LSD (0.05)	1.03	0.60	3.581	0.66	18.96	NS	59.52	3.44	1.39
CV (%)	2.56	3.31	2.23	6.71	5.37	10.56	5.88	5.42	9.23

Table 5. Effect of different varieties on yield and yield components of Maize at Kushtia during 2007-08

Treatments	plant height (cm)	Plant population /15m^2	No. of Seed /Cob	Seed wt /cob (g)	1000 seeds wt. (g)	Seeds wt /15m^2(kg)	Yield (t/ha)
T_1: BHM-3	208.33	77.33	513.33	166.66	340.00	12.00	7.99
T_2: BHM-7	199.00	71.33	578.33	181.66	381.66	12.66	8.44
T_3: $P_2 \times P_4$	202.10	78.33	498.66	168.33	365.00	12.33	8.15
T_4: $P_6 \times P_7$	209.00	81.00	655.00	191.66	383.33	14.16	9.44
T_5: BTC-0405	182.66	76.66	568.00	170.00	383.33	12.36	8.24
T_6: 900M	204.50	79.33	539.00	160.00	380.00	12.53	8.35
T_7: Pacific-984	176.66	75.33	549.00	138.33	341.66	10.33	6.88
CV (%)	1.71	3.13	4.29	6.90	2.08	4.00	4.78
LSD (0.05)	6.03	1.54	42.61	4.78	13.61	3.90	0.70

Table 6. Mean Grain yield (t/ha) of different maize varieties/lines at four locations, Rabi, 2007-08

Line/Variety	Location					Mean yield (t/ha)
	Gaibandha	Jhenaidah	Bandarban	Pabna	Meherpur	
BHM-3	7.92	8.05	7.94	7.02	7.99	7.78
BHM-5	8.76	-	-	7.44	-	8.1
BHM-7	7.98	7.84	7.83	-	8.44	8.02
P2XP4	7.40	7.61	8.96	-	8.15	8.03
P6XP7	8.87	7.56	10.46	-	9.44	9.08
BTC 04-05	8.98	7.82	8.06	7.51	8.24	8.02
NK-40	7.94	-	-	9.01	-	8.47
900M	8.68	-	-	-	8.35	8.51
900M-Gold	-	-	-	8.89	-	-
Pacific-984		-	-	-	6.88	-

Performance of Different Maize Varieties in the Coastal Regions of Bangladesh

Abstract

The experiment was conducted at Banerpota Farm, Satkhira and in the farmer's field of Kuakata, Patuakhali during the rabi season of 2007-08 to evaluate the performance of hybrid maize varieties in the coastal area. Seven hybrid varieties/lines were tested in both locations, but in Satkhira additionally two open pollinated varieties were also included in the trail. At Satkhira, Pacific 11 gave highest yield (7.91 t/ha) while exceptionally the lowest yield was found in BHM-5(4.61 t/ha), on the other hand Mohor a open pollinated variety produced good yield (6.0 t/ha). Whereas at Patuakhali, highest grain yield was obtained from BHM-3 (9.08 t/ha) followed by BHM-5 (8.26 t/ha). Averaged over locations BHM-3 produced the highest yield, all other hybrid maize varieties also gave comparable yields except the BHM-5 at Satkhira.

Introduction

Maize is a very common, popular and diversified used cereal crop at present situation. Every year a huge amount of maize grain is required as feed and fodder for livestock sector and major portion of them are fulfilled by importing from other countries. Farmers are growing mainly imported hybrid varieties for their exceptionally high yields. Plant Breeding Division of BARI recently developed some lines of maize with high yield potential. These varieties/lines need to be tried under different agro ecological zones, particularly for its adaptation to coastal regions. Therefore, the trial was conducted with an objective to compare the performance of BARI developed varieties/lines of maize with the commercial hybrid cultivars.

Materials and Methods

The experiment was conducted at Banerpota Farm, Satkhira and Kuakata, Patuakhali during the rabi season 2007-08 with five BARI developed varieties viz. BARI hybrid maize-2, BARI hybrid maize-3, BARI hybrid maize-5, BARI bhutta-5 (OP) and Mohar (OP) and four commercial hybrid varieties, namely, Pacific-11, Pacific-60, Pacific-983 and Pacific-984, but at Patuakhali BARI bhutta-5 and Mohor were not included.. The experiment was laid out in RCB design with three replications. Seeds of different varieties/line were sown on 28 December/07 at Satkhira and 10-11 January/08 at Patuakhali with spacing of 75 × 25 cm. The crop was fertilized with 253-52-110-46-5 -1.2kg/ha+6 t/ha of N-P-K-S-Zn-B+CD respectively. All fertilizers along with 1/3 urea were applied as basal during final land preparation. The rest of urea was applied in two equal split at 35 and 65 DAS. Two irrigation were given after last three top dressed. Earthing up was done after 2nd top dress of urea. There times weeding and necessary plant protection measures were taken. The crop was harvested during 10 May, 2008 at Satkhira and 02 May, 2008 at Patuakhali. During the crop growth period the salinity levels at Satkhira were 2.5, 2.75, 2.38, 2.04, 2.28, 9.50, 5.15, 4.60, 7.08 and 8.24 dS/m on 28 Dec.'07, 12 Jan.'08, 27 Jan'08, 12 Feb.'08, 27 Feb.'08, 12 Mar'08, 27 Mar.'08, 12 Apr.'08, 27 Apr.'08 12 May'08 respectively. While at Kuakata, Patuakhali salinity level was below 4dS/m. Data on different plant characters and yield were record and analyzed statistically.

Result and Discussion

Satkhira

There were significant differences among all the tested maize varieties in respect of all the characters studied. Among nine varieties/lines Pacific 11 gave the highest yield (7.91 t/ha), which was followed by BHM-3 (6.89 t/ha). The lowest yield was found in BHM-5 (4.61 t/ha), probably due to its lowest 1000 grain weight and shorter cob diameter. The reason behind it might be high soil salinity (around 7dS/m) of the location at later stage of the crop. However, it needs to verify before making any conclusion. The second highest yield was found from BARI hybrid maize-3 which was statistically identical with the BARI hybrid maize-2, Pacific-60, Pacific-984.

Patuakhali

Significant difference was found only in grain yield. The highest grain yield was observed in BARI hybrid maize-3 (9.08 t/ha) followed by BARI hybrid maize-5 (8.26 t/ha) and BARI hybrid maize-2 (8.12 t/ha). The lowest grain yield was obtained Pacific-983 (7.59 t/ha) which was identical to other Pacific series varieties.

Farmers' reaction

Farmers of Patuakhali preferred BHM-5 for its good taste and reasonably higher yield.

Conclusion

This is the first year experiment. It needs to be studied over the years to make a conclusion.

Table 1. Yield and yield attributing characters of maize at Banerpota Farm, Satkhira, 2007-08

Variety/line	Plant popn/3m^2	Plant height (cm)	Cob/plant (No.)	Cob length (cm)	Cob diameter (cm)	Grain/cob (No.)	1000 Grain wt.(g)	Grain yield (t/ha)
BARI HM-2	16	171.33	1	19.33ab	2.19 abcd	451.66 ab	296.66a	6.67b
BARI HM-3	16	178.33	1	18.66abc	2.25abc	484.33a	255.00cd	6.89b
BARI HM-5	16	180.00	1	17.33c	2.11cde	491.66a	215.00e	4.61e
Pacific -11	16	177.66	1	18.33abc	2.36a	425.66b	276.66b	7.91a
Pacific -60	16	173.00	1	18.00abc	2.36a	491.33a	270.00bc	6.63b
Pacific -983	16	174.00	1	17.66bc	2.33ab	492.00a	250.00 d	5.64cd
Pacific -984	16	175.33	1	19.66a	2.16bcde	489.33a	253.33cd	6.77b
BARI bhutta-5	16	181.33	1	17.66bc	2.00e	461.00ab	245.00d	4.91de
Mohor	16	179.33	1	17.66bc	2.05de	464.33ab	236.66d	6.00 bc
LSD (0.05)		23.23		1.65	0.16	45.90	17.36	0.82
CV(%)		7.60		5.23	4.32	5.61	3.93	7.60

Table 2. Yield and yield contributing characters of hybrid maize in rabi, 2007-08 at Kuakata, Patuakhali

Variety	PP/ 10 m^2	Plant height (cm)	No of cobs/plant	No. of grains/cob	100- grain wt. (gm)	Grain yield (t/ha)
BHM-2	53	186	1	585	27.2	8.12 b
BHM-3	57	185	1	612	28.6	9.08 a
BHM-5	58	197	1	583	27.3	8.26 b
Pacific-11	55	186	1	602	27.6	7.69 c
Pacific-984	58	188	1	580	27.0	7.64 c
Pacific-60	56	181	1	579	27.0	7.62 c
Pacific-983	56	178	1	578	26.9	7.59 c
CV (%)	5.61	10.35	-	6.32	3.12	9.68

Table 3. Grain yield (t/ha) of maize in two locations of coastal regions, rabi, 2007-08.

Varieties/Lines	Location		Mean yield
	Satkhira	Patuakhali	
BHM-2	6.67	8.12	7.39
BHM-3	6.89	9.08	7.98
BHM-5	4.61	8.26	6.43
Pacific -11	7.91	7.69	7.8
Pacific -60	6.63	7.62	7.12
Pacific -983	5.64	7.59	7.20
Pacific -984	6.77	7.64	7.20
BARI bhutta-5	4.91	-	-
Mohor	6.00	-	-

On-Farm Adaptive Trial of Advance Lines of Rapeseed and Mustard

Abstract

The experiment was conducted at eight locations viz. Jhikargacha-Jessore, Gangni-Meherpur, Atghoria,-Pabna, Hatgobindopur-Faridpur, Kadamsahar-Barind (Rajshahi), Melandah-Jamalpur, Manikganj and Razakhali, Patuakhali during the rabi season of 2007-08. Two advance lines BJDH-11, BJDH-18 and two mustard varieties Daulat and BARI Sarisha-11 (as check) were included in the study. On the average the highest seed yield (1.6 t/ha) was recorded from line BJDH-18 and BARI saris 11, but BJDH-18 took about 5-7 days more for maturity than the check variety BARI sarisha 11. Except Jamalpur, farmers of all the locations preferred BARI sarisha 11 over two advance lines due to its higher yield and shorter growth duration.

Introduction

Rape seed is one of the most important oil seed crop in Bangladesh. It is deficit in edible oil, which cost valuable foreign currency for importing seeds and oils every year. In Bangladesh, yield of this crop is lower compared to other mustard growing countries. The reason behind this lower yield is attributed to the genetically low yield potential of local varieties and poor management practices. Thus, there was need for varieties with high yield potential of oil seed crop. To meet up the need Oil seed Research Centre BARI, has developed some lines and varieties, which needed adoption studies across locations in the country. Therefore, the study was undertaken with the following objective.

Objective

- To evaluate the performance of advance lines of rapeseed and mustard in the farmer's field across locations.

Materials and Methods

The experiment was conducted at MLT site, Jhinkorgacha-Jessore, Gangni-Meherpur, Atghoria,-Pabna, Hatgobindopur-Faridpur, Kadamsahar-Barind (Rajshahi), Melandah-Jamalpur, Manikganj and Razakhali-Patuakhali during the rabi season of 2007-08. Two advance lines BJDH 11, BJDH 18 and two mustard varieties Daulat and BARI Sarisha-11 (as check) were used in the study. The experiment was laid out in randomized complete block design with four dispersed replications. The unit plot size was 5 m x 3 m. The crop was fertilized at the rate of 120, 36, 50, 33, 1.6 and 1 kg ha^{-1} of N, P, K, S, Zn and B respectively. Half of N and all other fertilizers were applied during final land preparation. Rest half of N was used as top dress at 30 days after sowing. The seeds were sown on November 14-29/07 at Jessore, October 27/07 at Meherpur, November 08-09/07 at Pabna, October 30/07 at Faridpur, November 3/07 at Barind (Rajshahi), October 30/07 at Jamalpur, November 8/07 at Manikganj and December 9/07 at Razakhali, Patuakhali with 30 cm x 5 cm spacing. One irrigation was applied at 20-25 DAS. The crops received two times rainfall at 7 and 88 days after sowing. One weeding and thinning was done at 13 days after sowing. The crop was harvested on Feb. 22-28/08 at Jessore, Feb. 17-22/08 at Meherpur, Feb. 18-25/08 at Pabna, Feb. 4-7/08 at Faridpur, Feb. 10-14/08 at Barind, Feb. 9-14/08 at Jamalpur, Feb 24-1 March/08 at Manikganj and March 6/08 at Patuakhali. Plant protection measures were taken as and when required.

Results and Discussion

Jessore

The highest seed yield (2.25 t/ha) was recorded in BJDH-18 and the lowest was in Daulat (1.11 t/ha). Thousand grain weight was also found highest in BJDH-18 (3.25 g) and the lowest was in Daulat variety (1.93 g). There is no significant difference among the yield of BJDH-11, Daulat and BARI Sarisha-11 (Table 1).

Meherpur

Results revealed that the highest seed yield was obtained from BARI Sharisha-11 (1.97 t/ha) and it was statistically at par with treatment BJDH-18 (1.90 t/ha). Among the yield contributing characters, highest no. of siliqua/plant was obtained from BARI Sharisha-11 (167) while Daulat gave the highest no. of seeds/siliqua (Table 2).

Pabna

Line BJDH-18 took the maximum days to flowering followed by BJDH-11 (Table 3).The lowest days to flowering was observed in BARI sarisha-11. The highest plant height was observed in two new lines while the lowest was recorded in the variety Daulat. Plant population per unit area was similar in the tested varieties and line except BJDH 11. The highest number of siliqua plant^{-1} was recorded from BARI sarisha-11 and the lowest was in BJDH 11. Highest number of seeds siliqua^{-1} was observed in BARI sarisha-11 which was followed by BJDH 18. The line BJDH 11 attributed to minimum number of seeds siliqua^{-1}. The maximum weight of 1000 seeds was recorded in BJDH 11 which was statically identical to BARI sarisha-11 and BJDH 18. The highest seed yield was obtained from BARI sarisha-11and it was significantly differed from other variety/lines. Probably the cumulative effect of maximum plant stand, maximum number of siliqua plant^{-1} and seeds siliqua^{-1} resulted in the highest seed yield of BARI sarisha-11. The lowest seed yield was obtained from the line BJDH 18. The highest stover yield was obtained from the two new lines while the two varieties contributed to the lower stover yields.

Faridpur

Plant height, number of siliqua per plant, number of seeds per siliqua, 1000 seed weight and seed yield are significantly influenced by variety or lines (Table 4). The variety BARI sarisha 11 gave the highest yield (1884 kg/ha) followed by BJDH 18 (1569 kg/ha). Significantly the highest number of siliqua per plant was found in BARI sarisha 11. TSW was the highest in BJDH 11 (2.85 g).

Barind

All the plant characters significantly influenced by lines of rapeseed and mustard except plant population/m^2 and siliqua/plant (Table 5). Among the plant characters studied plant height, number of branch/plant, number of seed/siliqua, Siliqua length and thousand seed weight were statistically significant. The tallest plant (168.75 cm) was found in the line BJDH-18 that was followed by line BJDH-11 (139.75 cm), Daulat (139.50 cm) and variety BARI sarisha-11 (123.30 cm). Highest no. of branch/plant (7.25) was also found from BJDH-18. The highest number of seeds/siliqua (15.75) and thousand seed weight (4.00 g) were observed in the line BJDH-11 which was statistically similar BJDH-18 and BARI sarisha-11.Daulat had lowest seed/siliqua (11.50) and thousand seed weight (2.50 g). Seed yield and stover yield were also differed from lines and varieties. Among the advance rapeseed lines BJDH-11 produced significantly the highest seed yield (1.85 t/ha) followed by BJDH-18(1.64 t/ha) and BARI Sarisha-11 (1.50 t/ha). It might be due to higher seed/siliqua and thousand seed weight. The lowest seed yield obtained from Daulat (1.23 t/ha). Stover yield was found highest (4.13 t/ha) from BJDH-18 and that was identical to BJDH-11 (4.09) and Daulat (4.02 t/ha) but lowest in BARI Sarisha-11 (3.88 t/ha). Plant height and number of branch/plant were highest in BJDH-18 resulted to highest stover yield.

Jamalpur

The longest plant was recorded from BJDH 11 which was statistically different from other three varieties (Table 6). BJDH 18 and Daulat produced identical plant height while BARI sarisha 11 produced the shortest plant. The number of plants/m^2 was found insignificant due to varieties variation. The highest number of siliqua/plant was obtained from BJDH 11 and was differed from other three varieties. These three varieties produced identical siliqua/plant. But the highest number of seeds/siliqua was found in BJDH 18 and which was statistically different from other three varieties. The similar pattern of behaviour was also recorded in case of 1000 seed weight. However, the highest seed yield was recorded from BJDH 18 (1847 kg/ha). The lowest yield was recorded from Daulat (1592 kg/ha). BJDH 11 and BJDH 18 matured about 10 days later than Daulat and BARI sarisha 11.

Manikganj

Plant height, Plants/m^2, yield attributes and yields were significantly influenced by variety/lines (Table 7). The highest plant height was obtained from line BJDH-18 followed by BJDH-11 and other varieties were at par. Plants/m^2 varied significantly where higher population from BARI Sarisha-11 followed by Daulat and the lowest from BJDH-11. The highest pod/plant and seed/pod were recorded from BARI Sarisha-11. The bold size seed might have contribution to maximum weight of 1000-seed in BJDH-11. Higher seed yield was obtained from BARI Sarisha-11 followed by Daulat but Daulat was 5 days earlier than other variety/lines

Patuakhali

The highest yield was obtained from BARI sarisha- 11 (1373 kg/ha) followed by Daulat (1323 kg/ha). Comparatively lowest yield was observed from BJDH-18 (1221 kg/ha). The trial should be continued for the nest year for more confirmation. Block demonstration should also be done. The upper phase of the medium high land may be suitable for mustard cultivation in this region if the farmers cultivate early variety of T. aman rice in this land.

Farmer's reaction

Farmers preferred BARI sarisha 11 in comparison to BJDH-11 and BJDH-18 for its good yield and comparatively shorter growth duration.

Conclusion

The trial should be repeated across more locations for making a conclusion. However, for acceptance among the farmers cultivars with shorter or similar growth duration along with higher/similar yield like BARI sarisha 11 would be needed.

Table 1: Yield and yield attributes of mustard at MLT site, Jhikargacha, Jessore during rabi 2007-08

Line/varieties	Plant Pop./m^2 (no.)	Plant height (cm)	Pods/ plant (no)	Seeds/ pod (no)	1000- gr. wt. (g)	Seed yield (t/ha)	Straw yield (t/ha)
BJDH-11	65.91	183.35a	64.8b	10.05c	3.00b	1.23b	3.10a
BJDH-18	64.92	169.50ab	86.9a	12.75a	3.25a	2.25a	3.36a
Daulat	64.58	145.40c	89.1a	11.75ab	1.93c	1.11b	2.32b
BARI sarisha-11	64.83	158.90bc	83.0a	11.05bc	3.08ab	1.44b	2.81b
CV (%)	14.31	7.39	10.24	8.59	12.13	15.34	13.96
F-test	NS	**	**	*	**	**	*

Table 2: Effect of different varieties on yield and yield components of Mustard at Gangni MLT site, Meherpur during, rabi, 2007-08

Line/variety	Field duration (days)	Plants/m^2	Plant height (cm)	Siliqua /plant (No).	Seeds / siliqua (No)	1000 seed wt. (gm).	Grain yield (t/ha)	Straw yield (t/ha)
BJDH-11	117	48	199.33	111	5.00	3.43	1.80	5.80
BJDH-18	117	47	197.66	118	9.00	3.53	1.90	5.70
Daulat	112	48	135.00	132	12.50	2.36	1.49	4.60
BARI Sharisha-11	112	47	167.66	167	11.83	3.50	1.97	5.30
LSD (0.05)		5.84	54.38	6.50	2.69	0.25	13.97	34.44
CV (%)		6.18	14.28	8.00	3.00	3.78	3.91	3.20

Table 3. Yield and yield contributing characters of different advance lines /variety of rapeseed (*B. juncea*) and mustard during the rabi season of 2007-08 at MLT site, Atghoria, Pabna

Line/variety	Days to flower (50%)	Days to maturity (no.)	Plant height (cm)	Plants/m^2 (no.)	Siliqua/ plant (no.)	Seeds/ siliqua (no.)	1000-seed wt. (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
BJDH-11	48.00ab	105	166.6a	64.00b	81.83c	12.50c	4.07a	1522bc	1737a
BJDH-18	49.17a	105	165.6a	65.67ab	86.43c	12.97ab	3.70a	1489c	1764a
Daulat	47.67b	98	108.9c	65.17ab	96.17b	12.67bc	3.13b	1578b	1504b
BARI sarisha-11	44.67c	98	122.5b	66.33a	108.2a	13.00a	3.80a	1878a	1459b
LSD (0.05)	1.42	-	4.93	2.07	5.49	0.30	0.40	81.58	45.81
CV (%)	7.44	-	6.85	6.59	4.80	7.93	8.92	4.10	8.30

Table 4. Yield and yield attributes of different advance lines and varieties of mustard in FSRD site, Hatgobindopur, Faridpur

Lines/varieties	Pl.pop/ m^2	Plant height (cm)	Siliqua/plant (No)	Seed/siliqua (No)	TSW (g)	Seed yield (kg/ha)
BJDH-11	43.9	191.9	180.7	12.32	2.85	1403
BJDH -18	38.0	198.9	178.4	13.10	2.68	1569
Daulat	45.3	157.1	167.2	14.32	1.78	1548
BARI Sarisha 11	40.7	156.1	213.0	12.20	2.82	1884
LSD (0.05)	NS	8.5	30.8	1.25	0.16	182
CV (%)	13.3	4.8	10.4	6.04	4.67	7.17

Table 5. Yield components of mustard as influenced by different varieties/lines at High Barind Tract, FSRD Site Kadamshahar, Rajshahi during rabi 2007-08.

Line/Variety	Days to maturity	Plant pop./m^2	Plant height (cm)	Branch /plant	Siliqua/ plant	Siliqua length (cm)	Seeds/ Sliqua	TSW (g)	Seed yield (t/ha)
BJDH 11	99	64.00	139.75 b	7.00 b	125.55	4.41 a	15.75 a	4.00 a	1.85 a
BJDH 18	99	60.00	168.75 a	7.25 a	118.85	4.38 ab	15.00 a	3.82 a	1.64 a
BARI sarisha 11	94	66.75	123.30 b	6.50 c	104.05	4.24 c	14.75 a	3.70 a	1.50 ab
Daulat	95	67.50	139.50 b	5.00 d	112.20	4.19 c	11.50 b	2.50 b	1.23 b
CV (%)	-	12.52	6.47	13.26	18.87	2.07	12.81	11.72	9.90

Table 6. Yield and yield contributing characters of different turnip rape mustard at Jamalpur, rabi, 2007-08

Line/variety	Plant ht (cm)	Plants/m^2 (no.)	Siliqua/ plant (no.)	Seeds/siliqua (no.)	1000 seed wt (g)	Seed yield (kg/ha)	Maturity (days)
BJDH-11	192.0 a	61.85	136.3 a	11.52 b	3.12 b	1675 b	105 a
BJDH-18	182.6 b	60.27	119.7 b	13.80 a	3.71 a	1847 a	104 a
Daulat	175.3 bc	59.87	117.2 b	11.40 b	3.24 b	1592 b	96 b
BARI sharisa11	167.4 c	6157.	116.4 b	11.55 b	3.09 b	1612 b	96 b
F	**	NS	**	**	*	**	**
CV (%)	8.15	10.95	7.74	5.74	4.41	8.79	3.85

Table 7. Yield contributing characters and yield of rape seed and mustard (*Brassica juncea*) at MLT site, Manikganj during the rabi season, 2007-08.

Line/variety	Days to maturity	No. of plants/m^2	Plant height (cm)	No. of pods/plant	No. of seed/pod	1000-seed weight (g)	Seed yield (t/ha)
BJDH-11	110	52.50b	182.85a	83.05c	8.70b	3.86a	1.287bc
BJDH-18	110	57.25b	194.88a	132.60b	8.65b	3.36b	1.123c
BARI sarisha-11	110	88.75a	141.43b	141.08a	9.65a	3.66ab	1.677a
Daulat	105	63.50b	132.65 b	124.73b	10.30a	1.94c	1.398b
CV (%)		13.56	7.29	10.42	7.48	8.33	5.83

Table 8. Yield and yield contributing characters of four mustard and rapeseed varieties at FSRD site, Patuakhali 2007-08.

Variety	Plant height(cm)	Siliqua/plant (no.)	Seeds/siliqua (no.)	1000-seed wt (g)	Seed yield (kg/ha)
BJDH-11	169.8	136.4	10.6	2.18	1136
BJDH-18	165.8	143.8	10.4	2.32	1221
Daulat	125.0	166.6	11.2	1.96	1323
BARI sarisha 11	134.0	177.0	10.6	2.0	1373

Table 9. Mean seed yield (t/ha) of mustard at eight locations, rabi, 2007-08.

Variety/Line	Location								Mean yield
	Jessore	Meherpur	Pabna	Faridpur	Barind	Jamalpur	Manikganj	Patuakhali	
BJDH-11	1.23	1.80	1.52	1.40	1.85	1.67	1.28	1.14	1.5±0.26
BJDH-18	2.25	1.90	1.49	1.57	1.64	1.84	1.12	1.22	1.6±0.36
Daulat	1.11	1.49	1.57	1.55	1.23	1.59	1.67	1.32	1.4±0.19
BARI sarisha 11	1.44	1.97	1.87	1.88	1.50	1.61	1.39	1.37	1.6±0.24

On-Farm Adaptive Trial of Commercial Mustard Cultivars across Locations

Abstract

The trail was conducted at Domar, Nilphamari (AEZ 3), Gangni, Meherpur (AEZ 11) and Puthia, Rajshahi (AEZ 11) in the farmers' field during rabi season of 2007-08. Two commercial mustard cultivars viz. Pioneer 44S01 and Pioneer 45S02 were tested against the check variety BARI sarisha 11. Results (Table 1) revealed that Pioneer 45S02 gave numerically the highest seed yield at Gangni and Domar but statistically there was no difference among the cultivars. However, at Puthia highest seed yield was obtained from BARI Sarisha 11. But, on the average Pioneer 44S01 gave the highest seed yield (1.76 t/ha) followed by Pioneer 45S02 (1.67 t/ha) and the lowest by BARI Sarisha 11 (1.53 t/ha). Both Pioneer cultivars were 4-7 days longer than BARI Sarisha 11. Farmers of Gangni preferred both the varieties of Pioneer Company for its yield and biomass, but farmers of Domar preferred Pioneer 44S01 for high yield and less disease infection. However, the farmers of Puthia liked BARI Sarisha 11 for higher seed yield and shorter growth duration. The study should be repeated across locations before recommendation.

Introduction

Mustard is one of the most important oil seed crop in Bangladesh giving 65% production among all oil crops (Sufian, 2004). Bangladesh is deficit in edible oil, which cost valuable foreign currency for importing seeds & oils every year. The average yield of mustard is only about 740 kg/ha (Mondol & Wahab, 2001). The reason behind low yield is generally low yield potential of local varieties. Thus the imported commercial cultivars are need Multi location adaptability trial to fit them in a specific situation of farming systems before recommendation for mass cultivation. Therefore, the study was undertaken to evaluate the performance of commercial mustard cultivars in comparison to local check BARI sarisha 11.

Materials and Methods

The study was carried out at, Gangni-Meherpur, Domar-Nilphamari and Puthia-Rajshahi during the rabi season of 2007-08. Two cultivars viz., Pioneer 44SO1 and Pioneer 45SO2 and one local check BARI sarisha 11 were tested. The experiment was carried out with RCB design with 5 replications. Unit plot size was 5 decimal Seed were sown in broadcast method with a seed rate of 7-8 kg/ha. Sees were sown on 31 Oct to 7 Nov/07 at Gangni, 17-22 Nov/07 at Domar and 4 Nov/07 at Puthia. Fertilizer dose were 80-25-61-20-2-1 kg NPKSZnB /ha. Intercultural operation was done as and when necessary. The crop was harvested during 19-28 Feb/08 at Gangni, 17-27 Feb/08 at Domar and 14-18 Feb/08 at Puthia. Yield and yield attributes data were collected and analyzed statistically.

Results and Discussion

Gangni

The results revealed that highest seed yield was obtained from Pioneer 45S02 (2.07 t/ha) followed by Pioneer 44S01 and the lowest yield was given by BARI sarisha 11(Table 1). Highest gross return (Tk. 100950/ ha) and gross margin (Tk. 74925/ha) and BCR (3.87) were found in Pioneer 45S02.

Domar

Varieties differed significantly in plant height, pod/plant and grains/pod but non significant on yield. The height grain yield was obtained from Pioneer 44SO1 (1.51 t/ha) whereas lowest yield was recorded from BARI Mustard 11.

Puthia

Yield and yield attributes were significantly influenced by different lines/variety (Table 3). No significant variation was observed in plant population/m^2, branches/plant, seeds/pod and 1000-grain weight but higher plant population per meter square and branches per plant was observed in BARI Sarisha-11. Though there was no significant different in 1000-grain weight but BARI sarisha-11 has lower 1000-grain weight. BARI Sarisha-11 produced significantly the highest grain yield (1.99 t/ha) followed by Pioneer 44S01 (1.54 t/ha). Plant height and stover yield were significantly different among the genotypes. The highest plant height (204, 78 cm) was found in Pioneer 45S02 and the lowest (179.02 cm) was observed in BARI Sarisha-11. Highest stover yield (6.43 t/ha) was found in BARI Sarisha-11 followed by Pioneer 44S01 (5.43 t/ha). It revealed that though the plant height of Pioneer genotypes was much higher than BARI Sarisha-11, but they (Pioneer genotypes) were more succulent than BARI Sarisha-11. Pioneer genotypes had the higher growth duration (106 days) than Sarisha-11 (102 days).

Economic analysis showed that the highest gross margin of 76249 Tk/ha and BCR (6.73) was obtained from BARI Sarisha –11.

Farmer's reaction at Gangni

Farmers reacted very positively with new high yielding commercial mustard varieties. Farmers expressed their satisfaction regarding high yield and bold size seed of Pioneer mustard varieties.

Farmer's reaction at Domar

Farmers were expecting more yields from all the varieties. They want cultivars with more yields.

Farmer's reaction at Puthia

Farmers showed better interest to the variety BARI Sarisha-11 for its higher yield.

Conclusion

The experiment should be repeated for the second year for making any conclusion. Oilseed Research Centre of BARI may include these cultivars (Pioneer 44S01 and Pioneer 45S02) in their gene pool to widen genetic base of *Brassica juncea*.

Table 1. Yield and yield components of newly imported Mustard cultivars at Gangni MLT site Meherpur during 2007-08

Variety	Plants/m^2	Plant height (cm)	Pods/Plant	Seeds/Pod	1000 seed wt. (g)	Seed yield (t/ha)	Biomass yield(t/ha)
Pioneer 44S01	47	203.00	130.40	11.20	3.60	1.98	5.93
Pioneer 45S02	46	206.80	131.60	11.40	3.72	2.07	5.97
BARI Sharisha-11	48	164.00	156.00	11.30	3.40	1.89	5.42
LSD(0.05)	2.43	6.08	9.64	0.77	-	0.11	0.26
CV (%)	3.53	2.18	4.75	4.68	-	3.89	3.09

Table 2. Yield and yield attributing characters of mustard cultivars at Domar, Nilphamari during 2007-08

Cultivars	Days of maturity	Plant height (cm)	Plant/m^2	Pod/plant	Grains/pod	Seed yield (t/ha)
BARI Mustard11	96.8c	139.4 c	64.6a	173.4 b	12.b a	1.43
Pioneer 44S01	99.8b	161.4 b	60.2c	185.a	11.2 b	1.51
Pioneer 45S02	103.2	174.2 a	61.8b	182.2 a	10.80 b	1.44
CV (%)	4.1	3.2	4.5	2.6	6.9	3.4
F-Test	**	**	**	*	**	ns

Table 3. Response of different lines/variety on yield and yield attributes of mustard during 2007-08 at MLT site Shibpur, Puthia-Rajshahi

Variety/ line	Plants/ m^2	Branch /Plant	Pod/ Plant	Seed/ Pod	1000-grain wt (g)	Yield (t/ha)	Stover yield (t/ha)	Plant height (cm)	Oil (%)	Crop duration (days)
Pioneer 44S01	63.8	2.72	137.14	12.04	4.76	1.54	5.43	198.20	26.87	102
Pioneer 45S02	63.2	2.36	142.06	10.58	4.92	1.00	5.39	204.78	26.25	106
BARI Sarisha-11	76.6	3.12	109.48	12.76	4.48	1.99	6.43	179.02	25.00	106
LSD (0.05)	NS	NS	14.67	NS	NS	0.342	0.48	11.53	-	-
CV (%)	14.30	16.20	6.18	16.98	6.63	15.57	5.75	4.08	-	-

Table 4. Mean seed yield of different mustard cultivars/variety at three locations during rabi season of 2007-08

Cultivar/variety	Location			
	Gangni	Domar	Puthia	All locations
	Seed yield (t/ha)	Seed yield (t/ha)	Seed yield (t/ha)	Mean grain yield (t/ha)
Pionner 44S01	1.98a	1.43a	1.89b	1.76
Pioneer 45S02	2.07a	1.51a	1.44c	1.67
BARI Sarisha 11	1.89ab	1.00a	1.99a	1.53
CV (%)	3.89	3.4	15.57	-

Table 5. Field duration of different mustard cultivars/variety at three locations during rabi 2007-08

Cultivar/variety	Location			
	Gangni	Domar	Puthia	All locations
	Duration (days)	Duration (days)	Duration (days)	Mean duration (days)
Pionner 44S01	116	100	110	108.6
Pioneer 45S02	116	103	110	109.6
BARI Sarisha 11	109	97	106	104

Oil % : Pioneer 44S01-40.40 , Pioneer 45S02-40.81, BARI sarisha 11-40.38

Table 6. Economic performance commercial mustard varieties at Gangni-Meherpur, rabi 2007-08

Variety	Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	BCR
Pioneer 44S01	97000	26025	70975	3.72
Pioneer 45S02	100950	26025	74925	3.87
BARI Sharisha-11	92282	26025	66257	3.54

Price: Mustard : 43 Tk/kg

Table 7. Cost and return analysis of different lines/ variety in mustard at Shibpur, MLT site, Puthia-Rajshahi during 2007-08

Variety/ line	Grain yield (t/ha)	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross Margin (Tk/ha)	BCR
Pioneer 44S01	1.54	69,300	13,401	55,899	5.17
Pioneer 45S02	1.00	45,000	13,401	31,599	3.36
BARI Sarisha-11	1.99	89,550	13,301	76,249	6.73

Price : Mustard @ 45 Tk/kg, Mustard Seed @ 100 Tk/kg.

Urea @ 6 Tk/Kg, TSP @ 35 Tk/Kg, MP @ 33 Tk/Kg, Gypsum @ 6 Tk/Kg, Boric Acid @ 120 Tk/Kg, Zinc Sulphate @ 100 Tk/Kg

On-Farm Trial of Mustard and Rapeseed Varieties at Sylhet

Abstract

The trial was carried out to compare and determine the best rapeseed / mustard varieties at the FSRD site, Jalalpur, Sylhet during 2007-08. Four rapeseed / mustard varieties namely BARI sarisha 8, BARI sarisha 9, BARI sarisha 11 and BARI sarisha 13 were evaluated for their yield and yield contributing characters. The highest yield was obtained from BARI sarisha 11 (1550 kg/ha) followed by BARI sarisha 13 (1505 kg/ha). The comparatively earlier variety, BARI sarisha 13 gave reasonable seed yield. BARI sarisha 13 and BARI sarisha 11 could be promising mustard varieties in this region.

Introduction

Oilseed crops can utilize limited soil moisture and use nutrients more efficiently than cereals and mainly for this reason these crops are grown in areas after satisfying the demand for cereals. In the Sylhet region, a vast area of land remains fallow for a long time (December-May) after the harvest of aman rice due to moisture stress. Mustard is a short duration low water requiring and deep rooted crop which can play a major role in acquisition of both water and nutrient from below the soil surface. In order to increase oil production, suitable rapeseed/mustard variety may be introduced in the existing fallow period. Therefore, the present experiment was undertaken to find out the yield and suitability of rapeseed/mustard variety(s) after harvest of T.aman rice in the Sylhet region.

Objectives

1. To evaluate the performance of the varieties under farmer's conditions
2. To popularize and disseminate the BARI released high yielding rapeseed/mustard variety (s).

Materials and Methods

The trial was carried out at the FSRD site, Jalalpur, Sylhet during November 2007 to March, 2008. Four rapeseed/mustard varieties viz. BARI Sarisha 8, BARI Sarisha 9, BARI Sarisha 11 and BARI Sarisha 13 were used in the trial. The plot size was 10m $\times$3m. Fertilizer was applied at the rate of 250-170-85-150-10 kg/ha of Urea, TSP, MP, gypsum and Borax, respectively. The seeds were sown on 14 November 2007 and spacing was maintained at 30cm$\times$10cm. The crop was harvested during 1st week of March to 3rd week of March, 2008. Data were collected on yield and yield attributes.

Result and Discussion

The highest yield was obtained from BARI Sarisha 11 (1550.00 kg/ha) followed by BARI Sarisha 13 (1505.00 kg/ha). The earliest variety BARI Sarisha 9 gave the lowest seed yield (1111.67 kg/ha). All the yield contributing characters were significantly superior in BARI Sarisha 11 than the other varieties except seeds/siliqua (Table 1).

Farmers' reaction

- Farmers of this locality have preferred BARI sarisha 11 and BARI sarisha 13.
- As a short duration variety farmers liked variety BARI Sarisha 13.

Conclusion

Due to higher yield performance, BARI Sarisha 11 (1550 kg/ha) may become the profitable variety for this area along with BARI Sarisha 13.

Table 1. Agronomic characteristics of four mustard and rapeseed varieties at FSRD site, Jalalpur, Sylhet during 2007-08

Treatment	Plant height (cm)	Days to 50% flowering	Days to maturity	Siliqua/ plant (No.)	Seeds/ Siliqua (No.)	1000-seeds wt. (g)	Yield (kg/ha)
BARI Sarisha 8	103.21	44.13	92.46	103.58	19.77	3.13	1463.33
BARI Sarisha 9	87.22	36.48	82.84	91.66	14.60	2.57	1111.67
BARI Sarisha 11	109.24	50.47	100.44	111.88	15.64	3.80	1550.00
BARI Sarisha 13	91.23	41.79	86.08	73.16	24.82	3.50	1505.00
LSD (0.05)	6.773	2.602	4.235	0.935	1.479	0.1094	26.85
CV (%)	8.47	5.01	4.34	5.49	7.96	5.6	9.92

On-Farm Adaptive Trial of Advance Lines of Soybean

Abstract

The experiment was conducted at Laxmipur, Patuakhali, Mymensingh and, Kishoreganj during the *rabi* season of 2007-08 to evaluate the performance of advance lines/varieties of soybean. From the tested lines and varieties similar seed yields were obtained from Amber, Shohag and BARI Soybean 5. On the average over locations Amber gave the highest seed yield (2.43 t/ha) which was closely followed by BARI Soybean 5 (2.40 t/ha) and Shohag (2.13 t/ha). Amber gave apparently higher yield at Laxmipur (3.48 t/ha) while in other three locations BARI Soybean 5 produced higher yields. For dissemination of soybean cultivation in the new area like, Patuakhali, Mymensingh and Kishoreganj timely availability of seed and creation of marketing facility are important.

Introduction

Soybean (*Glycine max* L.) is an important oil seed crop in the world although it is considered as minor oil crop in Bangladesh. However, in the recent years, it is gaining popularity in Bangladesh as a crop for poultry feed ingredient. We use soybean oil for cooking. Extraction of soybean oil from seed is not practiced in the country due to its small scale production and non-availability of extraction machine. Its seed contain 42-45 % protein and 20-22 % edible oil. Soybean produced in the country is used in poultry industry and for making nutritious food items like soyadal, soyakhechuri, soyamisty, soyapolao, soyamilk, soyacake, soyabiscuits, soyabread etc. Oil Seed Research Centre, BARI has developed some varieties/lines of soybean which needs to be tested in the farmers' field. So, the experiment was designed to evaluate the performance of advance lines/varieties of soybean.

Materials and Methods

The study was conducted in the farmers' field of Laxmipur, Kuakata-Patuakhali, Trishal-Mymensingh and Hossainpur MLT site, Kishoreganj during *rabi* 2007-08 to evaluate the performance of advance lines/variety of soybean under farmer's condition. The experiment was laid out in RCB design with four replications. The unit plot was 3 m × 5 m. The seeds were sown at a spacing 30 cm apart row with continuous seeding maintaining a distance of about 5-10 cm seed to seed at the rate of 60 kg/ha. The crop was sown on 16 January/08 at Laxmipur, 28 December/07 at Patuakhali, 19 December/07 at Mymensingh and 21 December/07 at Kishoreganj. The crop was fertilized with NPKS @ 25-33-55-18 kg/ha, respectively. Half of N and all other fertilizers were applied as basal. Rest half of N was applied at 30 days after sowing after first weeding. Second weeding was done at 50 days of sowing. Before sowing, the seeds were treated with bavistin @ 3 g/kg seed. Weeding was done within 15-20 days after sowing. Excess seedlings were thinned out keeping 50-60 plants/m^2 in *rabi* season for better yield. Marshal 20 EC was used at the rate of 2 ml per litre of water to control the infestation of hairy caterpillar. The crop was harvested at maturity on 5-7 May/08 at Laxmipur, 13 April/08 at Patuakhali, 17 April/08 at Mymensingh and 9-14 April/08 at Kishoreganj. Data on yield and yield contributing characters were recorded and analyzed statistically.

Results and Discussion

Noakhali

The highest plant height was found in Shohag (58.07cm), Amber (56.30) and BARI Soybean-5 (50.77 cm) respectively which was not statistically significant.(Table 1). The maximum no. of pods per plant (48.84) was recorded in Amber and the minimum no. of pods per plant was found in Shohag (35.50) and BARI soybean-5 (37.37) respectively. The highest seed per pod (2.26) was recorded in Amber which was statistically identical with others varieties. And the lowest seed per pod (2.20) was recorded in Shohag. The highest 1000 seeds weight (134.70 gm) was recorded in Amber and the lowest 1000 seeds weight (126.70 gm) was recorded in BARI Soybean-5. The highest yield (3.48 t/ha) was obtained in Amber which was identical with BARI soybean-5 while the lowest yield (2.97 t/ha) was found in Shohag.

Mymensingh

The plant characters like population/m^2 and number of branches/plant were not statistically significant (Table 3). But grain and stover yield, plant height, number of pods/plant, number of seeds/plant, 1000 seed weight were statistically significant. Plant population varied from 34.2-37.6 plants/m^2 where the maximum (37.6) was in BARI Soy-5 and in local and minimum (34.2) was in the variety Amber. Significantly higher plant height (38.2 cm) and number of branches/plant (1.96) were observed in the variety BARI Soy-5 . However, plant height of Amber and local were identical. Number of pods/plant varied from 21.6-27.8, number seeds/pod varied from 1.8-2.0 and 1000 seed weight varied from 128-143 g. BARI Soy-5 gave significantly the highest seed yield of 1.87 t/ha. But it was identical to Amber. Higher seed yield in BARI Soy-5 was attributed due to higher number of pods/plant and higher population per unit area. The lowest seed yield (1.38 t/ha) was observed in the variety Shohag. Higher stover yield (2.90 t/ha) was also observed in BARI Soy-5 which was identically followed by Amber.

Kishoreganj

The plant characters viz. population/m^2, days to maturity and plant height were insignificant (Table 4). But branch /plant, number of pods/plant, number of seeds/pod and 1000 seed weight and grain yield were statistically significant. Higher number of branches/plant (1.78), was observed in the variety BARI soybean-5 followed by Amber. The BARI soybean-5 gave higher pods/plant, seeds/pod, 1000 seed weight and seed yield (2.17 t/ha) followed by advance line Amber. BARI soybean-5 gave 6.45 and 15 % higher seed yield over Amber and Shohag, respectively. It might be due to higher 1000 seed weight, higher number of seeds/pod, pods/plant and population per unit area. The variety Shohag gave the lowest seed yield (1.84 t/ha) and it was statistically different from BARI soybean-5 and Amber. The maturity dates were close to each other by variety/line. There was some incidence of insect in the new varieties/line.

Farmer's reaction at Laxmipur

Farmers are very much interested for the new lines (Amber) for its higher yield.

Farmers' reaction at Patuakhali, Mymensingh and Kishoreganj

- It is a new crop to the farmers
- Farmers are interested to cultivate soybean
- But seed availability and marketing of soybean is a problem.

Conclusion

It was observed that line Amber showed highest yield at Laxmipur, however, in other three new locations apparently BARI Soybean-5 gave higher yield. Further investigation in relation to screening and management practices should be done to evaluate the performance of the mentioned lines and varieties. Ensuring availability of seed at proper time and creating marketing facility are important for dissemination of soybean cultivation in new areas.

Table 1. Yield and yield contributing characteristics of adaptive trial of advance Lines/varieties of soybean at Laxmipur, rabi, 2007-08.

Variety/ Lines	Plant height (cm)	Pods/plant (no.)	Seeds/pod (no.)	1000-seed weight (gm)	Yield (t/ha)
Amber	56.30	48.84	2.26	134.70	3.483
Shohag	58.07	35.50	2.20	128.30	2.977
BARI Soybean-5	50.77	37.37	2.21	126.70	3.047
LSD (0.05)	NS	10.32	NS	NS	0.633
CV (%)	7.79	11.31	8.76	4.93	8.79

Table 2. Yield and yield contributing characters of three soybean varieties at MLT site Kuakata, Patuakhali 2007-08.

Variety	Plant height (cm)	No. Pods/plant	Seeds/pod	100-seed weight (g)	Seed yield (kg/ha)
BARI Soybean-5	37	26	2	9.16	1480
Shohag	37	25	2	9.17	1400
Amber	36	26	2	9.76	1450

Table 3. Yield and yield contributing characters of soybean at MLT site, Trishal, Mymensingh during rabi' 2007-08

Varieties/lines	Plant population / m^2	Plant height (cm)	No. of branches / plant	No. of pods/ plant	No. of seeds/ pod	1000-seed weight (g)	Seed yield (t/ ha)	Stover yield (t/ha)
BARI Soy-5	37.6	38.2	1.96	27.8	1.9	137	1.87	2.90
Amber	34.2	35.0	1.80	26.8	2.0	136	1.73	2.76
Shohag	34.4	33.9	1.64	21.6	1.8	143	1.38	2.32
Local	37.6	36.4	1.96	23.9	1.8	128	1.65	2.61
LSD (0.05)	NS	3.45	NS	4.47	1.17	7.91	4.32	5.32
CV (%)	7.41	7.26	13.57	13.48	7.05	4.39	11.95	9.18

Table 4. Yield and yield contributing characters of soybean varieties/line at Hossainpur MLT site, Kishoreganj during rabi, 2007-08

Variety/ Line	Plant /m^2 (no.)	Days to maturity (Days)	Plant height (cm)	Branches /plant (no.)	Pods/ plant (no.)	Seeds/pod (no.)	1000-seed wt.(g)	Yield (t/ha)
Shohag	57	108	65	1.39	25.92	2.04	98	1.84
BARI soybean-5	57	113	59	1.78	37.16	2.11	105	2.17
Amber	58	115	65	1.48	30.78	2.08	102	2.03
LSD (0.05)	NS	NS	NS	0.17	5.45	0.06	3.91	0.18
CV (%)	12.21	9.26	5.56	7.48	13.54	4.77	2.99	6.95

Table 5. Mean yield seed yield (t/ha) of different soybean cultivar/varieties across locations during rabi season of 2007-08

Line/Variety	Location				Mean yield
	Laxmipur	Patuakhali	Mymensingh	Kishoreganj	
Amber	3.48	1.45	2.76	2.03	2.43
Shohag	2.97	1.40	2.32	1.84	2.13
BARI Soybean 5	3.05	1.48	2.90	2.17	2.40

On-Farm Adaptive Trial of Advance Lines of Sesame

Abstract

The experiment was conducted in the farmers field of MLT site, Bharamara-Kushtia, FSED site Hatgobindopur-Faridpur during Kari-I season while at Razakhali-Patuakhali the trial was carried out during Rabi season of 2008 to find out the performance of sesame lines/varieties. Two advance lines (SES-0570, Atshira) and two varieties (BARI Til-2 and BARI Til-3) were tested . Results revealed that there was a variation in grain yield among the varieties. Among the four varieties/lines, Atshira gave the highest yield (1.42 t/ha) at Kushtia and Patuakhali whereas SES 0570 produced apparently higher yield at Faridpur. However, on the average Atshira gave a bit (1.28 t/ha) higher yield but not at significant level.

Introduction

Sesame is the main oil seed crop during kharif season. It is cultivated in almost every where of the country. In Bangladesh 96,000 ha of land is cultivated for sesame production and 25,000 metric tons is produced (BBS, 2002-07). Sesame contains 42-50% oil and 25% protein. We can get a very good quality edible oil from Til and it can be conserved for a long time. The Til oil-cake is good food for poultry, fish, cattle, goat, sheep. The yield of this crop in Bangladesh is found lower compared to that in other countries. The main reason behind this lower yield is lack of high yielding variety. Farmers are cultivating sesame with local varieties and do not follow the recommended management practices. High yielding varieties have bold size seed, high oil content and attractive colour, which may be sold in the market at a high price. BARI has developed high yielding variety BARI Til-3, which can be easily fit into the cropping pattern.

Objectives

i) To introduce improved variety of sesame replacing local variety.
ii) To see the farmer's reaction about the variety.

Materials and Methods

The trial was conducted at Bharamara MLT site, Kushtia and Hatgobindopur-Faridpur during kharif-I season of 2008 and during rabi season/2008 at Patuakhali. with two sesame advance lines and two varieties, namely SFS- 0570, Atshira, BARI Til-2 and BARI Til-3. The experiment was set up in RCBD design with 4 replications in the farmers' field. The unit plot size was 3m × 5m. The seeds were sown on 4 March/08 at Kushtia, 5 March/08 at Faridpur and 19 February/08 at Patuakhali with a spacing of 30 cm x 5cm. The crop was fertilized with 120-140-45-105-5 and 10 kg/ ha of Urea, TSP, MP, Gypsum, Zinc sulphate and Boric acid. 50% Urea and all other fertilizers were applied as basal during land preparation. The rest half of Urea was applied as top dress at 21-22- DAS. One irrigation was applied. Plant protection measures and other intercultural operations were done as and when required. The crops were harvested on 9 June/08 at Kushtia, 2-4 June/08 at Faridpur and 6 May/08 at Patuakhali. Yield and yield contributing data were collected and analyzed statistically.

Results and Discussion

Kushtia

Plant population/ m^2 were highest in sesame SFS-0570. Plant height (cm) was highest in BARI Til-2. Highest no. of pods/plant was found in SFS-0570. No. of seeds/pod (76.50) and yield (1.42 t/ha) was highest in Atshira (Table 1)

Faridpur

The seed yield and yield contributing characters like plant height, number of seeds/pod and 1000 seed weight differed significantly among the different varieties/ lines (Table 2). The plant population/m^2 and number of pods/plant showed insignificant response. The variety BARI til-2 gave higher yield (1.58 kg/ha) due to higher yield-contributing characters like number of pods/plant (43.6). BARI til-2 also gave highest pod/plant (37.85) in last year. The highest thousand seed weight (2.95g) was obtained from the Atshira like last year. The lowest seed yield (1.45 t/ha) was obtained from BARI Til-3.

Patuakhali

Atshira yielded the highest (0.95 kg/ha) followed by BARI Til-3 (0.83 kg/ha). SES-0570 produced the lowest yield (0.74 t/ha). This was first year result and the experiment should be repeated for next year.

Farmer's reaction

Kushtia: Among the cultivated varieties sesame SFS-0570 and Atshira was more demandable. Most of the farmers want enough seed availability of Atshira variety. Besides this, they demanded water logging tolerant variety.

Faridpur: Farmers were very encouraged to observe the performance of new lines/varieties of til.

Patuakhali: Farmers liked Atshira. They demand seeds of BARI variety.

Conclusion: The experiment should be repeated for the next year.

Table 1. Yield and Yield contribution character of BARI Til & Advance lines at Kushtia during Kharif-1 Sesame.

Line/variety	P.Population/ m^2	Plant height (cm)	Pods/Plant	Seeds/Pods	1000 seed wt. (g)	Seeds yield (t/ha)
SES-0570	44.75	86.07	46	72.50	3.0	1.17
Atshira	39.25	83.32	38	76.50	2.9	1.42
BARI Til-2	43.25	92.97	41	57.25	2.7	1.20
BARI Til-3	35.25	93.87	43	59.00	2.6	1.16

Table 2. Yield and yield attributes of sesame in FSRD site, Hatgobindopur, Faridpur

Line/variety	Pl.pop/ m^2	Plant height (cm)	Pods/ plant (no)	Seed/pod (no)	TSW (g)	Seed yield (kg/ha)	
						2007-08	2006-07
Atshira	33.5	104.8	36.9	93.2	2.95	1481	1791
SES 0570	36.0	98.8	37.3	91.8	2.8	1545	1842
BARI Til-2	32.8	111.4	43.6	85.5	2.78	1588	1837
BARI Til 3	37.0	105.1	39.0	67.0	2.9	1448	1680
LSD (0.05)	ns	10.95	ns	7.80	0.09	131	ns
CV (%)	8.35	6.58	17.13	6.14	3.41	5.42	11.44

Table 3. Yield and yield attributes of different sesame varieties at Razakhali in rabi, 2006-07

Variety/line	PP (m^{-2})	Plant height (cm)	# capsule/ plant	# seeds/ capsule	Seed yield (kg/ha)
BARI Til-2	37	83	41	50	792 b
BARI Til-3	35	80	42	52	830 b
Atshira	38	77	38	55	948 a
Ses-0570	35	72	38	48	742 c
CV(%)					8.75

Table 4. Mean seed yield (t/ha) of sesame across three locations during rabi 2008.

Line/variety	Location			Mean seed yield
	Kushtia	Faridpur	Patuakhali	
Atshira	1.42	1.48	0.95	1.28
SES-0570	1.17	1.54	0.74	1.15
BARI Til-2	1.20	1.59	0.79	1.19
BARI Til-3	1.16	1.45	0.83	1.15

On-Farm Adaptive Trial of Advance Lines/Varieties of Groundnut

Abstract

The experiment was conducted in the farmers' field of Kishoreganj and Sunamganj during rabi 2007-08 to evaluate the performance of groundnut advance line/varieties in char area. At Kishoreganj the highest seed yield (2.47 t/ha) was recorded from, BARI chinabadam-6 followed by ICGV-90265 (1.91) while the lowest seed yield was recorded from ICGV-96346 (1.16 t/ha) due to less germination of seed. While at Sunamganj ICGV-90227 out yielded all other cultivars followed by ICGV-90265. However, on the average BARI chinabadam 6 gave higher yield followed by ICGV-90265.

Introduction

Groundnut (*Arachis hypogaea*) is an important oilseed crop. In Bangladesh, it occupies third place in respect of area and production. At present, in rabi and kharif seasons a total of 36 thousand hectare of land is under groundnut cultivation. Groundnut seed contains 48-52% oil and 24-26% protein. Groundnut is mainly consumed as roasted nut and as a confectionery item. Most of the farmers' of Bangladesh cultivate local variety of groundnut with traditional management practices resulting in the very low yield compared to HYV. Oilseed Research Centre of BARI selected some advance lines of groundnut on the basis of their performance in the regional yield trials. The yield performance of the selected materials needs to be tested in the farmers' field before released as variety for cultivation. So, the present study was undertaken to evaluate the performance of some advance lines of groundnut under farmer's field conditions.

Materials and Methods

The study was conducted at Hossainpur MLT site, Kishoreganj and MLT site Sunamganj during the rabi season of 2007-08 to evaluate the performance of some advance lines of groundnut under farmer's condition. Six groundnut varieties/lines namely; ICGV-90265, ICGV-96346, ICGV-96342, PK-1 Dhaka-1 and BARI chinabadam-6 were included as a check in the experiment at Kishoreganj while at Sunamganj cultivars were PK-1, ICGV-90227, ICGV-90265, BARI chinabadam 6 and Dhaka-1. The experiment was laid out in RCB design with three replications. Unit plot size was 1.8 m × 4 m and 12-32-43-54-1 kg/ha of NPKS43654B were applied, respectively. All fertilizers were applied as basal dose during final land preparation. Seeds were sown in lines maintaining 30 cm × 10 cm spacing at the rate of 100 kg/ha, on 18 December/07 at Kishoreganj and 9 December/07 at Sunamganj. Intercultural operation such as irrigation, weeding and earthing up and plant protection measure were done properly. Thereafter slightly incidence of disease and insect attack was found in experimental plot. Harvesting was done variety wise from 13-25 May/08 at Kishoreganj and 8-11 May/08 at Sunamganj.. The data of yield components were collected from 10 plants selected at random in each plot and pod yield was recorded plot wise. The collected data were analyzed statistically.

Results and Discussion

Kishoreganj

Days to maturity, shelling percent and plant height was statistically insignificant. The result showed that pods/plant, kernels/pod, 100-kernel wt., and nut yield were significantly different in groundnut varieties/lines (Table1). The higher pods/plant and kernel/pod were recorded from BARI chinabadam-6 which was statistically identical to ICGV-96346, ICGV-96342 Dhaka-1. Highest 100-kernel weight was recorded from variety BARI Badam-6 which was statistically different to other varieties/lines of groundnut. The highest pod yield (2.47 t/ha) was obtained from BARI Badam-6 followed by ICGV-90265. BARI Badam-6 gave the highest nut yield due to higher number of pods/plant, kernel/pod and 100-kernel weight. The line ICGV-96346 gave the lowest nut yield due to less plant population per m^2 area.

Sunamganj

Yield and yield attributes of groundnut were significantly influenced by different lines/variety except number of pods per plant. Days to maturity, shelling %, 100 kernel weight were highest in ICGV-90227 that's why it produced the highest yield (2.28 t/ha) followed by ICGV-90265, PK-1, BARI chinabadam-6 and Dhaka-1. All the genotypes produced higher pod yield than the check variety Dhaka-1.

Farmer's reaction- Kishoreganj

Farmer's of MLT site, Hossainpur opined that there was incidence of insect and diseases in the new varieties. They also opined that the yield of BARI Badam-6 yielded higher than other variety/lines. They preferred BARI Badam-6 due to its higher yield, taste, pod size and color.

Farmers Reaction-Sunamganj

Farmers preferred advance line ICGV-90227 due to its superior yield.

Conclusions

The experiment should be conducted over the years across more number of locations to reach to conclusion.

Table 1. Performance of yield and yield contributing characters of groundnut varieties/lines at Hossainpur MLT site, Kishoreganj, 2007-2008

Line/Variety	Plants /m^2 (at harvest)	Days to maturity	Shelling %	Plant height (cm	Pods /plant (no.)	Kernel /pod (no.)	100-kernel wt.(g)	Nut yield (t/ha)
CGV-90265	24	155	73	54	13	1.40	36	1.91
ICGV-96346	8	150	70	48	25	1.60	36	1.16
ICGV-96342	12	145	69	51	20	1.50	40	1.48
PK-1	23	145	74	49	17	1.67	35	1.86
Dhaka-1	21	140	72	56	23	1.56	29	1.64
BARI Badam-6	21	156	69	59	25	1.68	54	2.47
LSD (0.05)	23.35	ns	ns	ns	5.96	0.12	2.87	0.54
CV (%)	10.05	7.55	7.32	7.42	16.24	4.36	4.11	17.27

Table 2. Yield and yield contributing character of groundnut variety, FSRD site Jalalpur, Sylhet, 2007-08

Line/Variety	Days to maturity	No. of pods/ plant	Shelling %	100 kernels wt. (g)	Nut yield (Kg/ha)
PK-1	152.33ab	15.00	72.66c	35.69d	2.03c
ICGV-90227	153.00a	15.00	74.67a	49.78a	2.28a
ICGV-90265	151.32b	13.92	73.66b	46.83b	2.16b
BARI badam-6	151.00b	15.33	71.67d	33.69c	1.91d
Dhaka-1	151.00b	13.35	72.32c	25.99e	1.51e
CV (%)	6.75	7.28	8.96	11.23	8.58
LSD (0.05)	1.575	1.975 (ns)	0.4874	1.151	54.02

Table 3. Mean nut yield (t/ha) of groundnut in two locations, rabi, 2007-08.

Line/Variety	Location		Mean nut yield(t/ha)
	Kishoreganj	Sunamganj	
ICGV-90265	1.91	2.16	2.03
ICGV-96346	1.16	-	-
ICGV-96342	1.48	-	-
ICGV-90227	-	2.28	-
PK-1	1.86	2.03	1.94
Dhaka-1	1.64	1.51	1.57
BARI chinabadam 6	2.47	1.91	2.19

Adaptive Trial of Bread Wheat Lines/Varieties across Environments

Abstract

The trial was conducted in the farmer's field of 14 locations viz. Kashinathpur-Pabna Sujanagar-Pabna, Paba-Rajshahi 2 sets, Ghatail-Tangail-2, Hatgobindopur-Faridpur-2sets, Kaliganj-Jhenaidah, Tularampur-Narail, Kusumhati-Sherpur, Melandah-Jamalpur, Ulipur-Kurigram and Domar-Nilphamari during the rabi season of 2007-2008. Four entries viz. Shatabdi, Kanchan, BAW-1059 and BAW-1064 were tested in the study but in Faridpur Pradip was used instead of Kanchan to test the yield performance of new wheat lines in comparison to standard variety and to determine yield potentiality in different regions. Averaged over locations the line BAW-1059 gave the highest yield and it was closely followed by Shatabdi and BAW-1064 while lower yields were obtained from Pradip and Kanchan. However, Kanchan had lower SD(±) value over all other cultivars, indicating its better yield stability across locations.

Introduction

Wheat is the second major cereal crop next to rice and cultivated during the rabi season in Bangladesh. It has to compete with other important winter crops like maize, pulses, oil seeds, vegetables and boro rice. It occupies 1.38 million acres of land with a total production of 0.98 million tons (BBS, 2005). A high yield potential variety with short duration and with a good fit into a cropping pattern is needed for wheat cultivation in greater area. Wheat Research Center of BARI recently developed some improved lines of wheat with high yield potential. These improved lines need to test under different agro-ecological zones before release as a new variety. Hence, a study was undertaken with the following objectives.

Objectives

i. To assess the yield performance of bread wheat lines in different agro-climatic zones and to determine their potentiality.

ii. To see the farmers reaction

Materials and Methods

The trial was conducted in the farmer's field of 14 locations namely, Kashinathpur-Pabna Sujanagar-Pabna, Paba-Rajshahi 2 sets, Ghatail-Tangail-2, Hatgobindopur-Faridpur-2sets, Kaliganj-Jhenaidah, Tularampur-Narail, Kusumhati-Sherpur, Melandah-Jamalpur, Ulipur-Kurigram and Domar-Nilphamari during the rabi season of 2007-2008. Four entries viz. Shatabdi, Kanchan, BAW-1059 and BAW-1064 were tested in the study but in Faridpur Pradip was used instead of Kanchan. The experiment was laid out in randomized complete block (RCB) design with three compact replications. The size of unit plot was 5m × 4m. Fertilizers were applied at the rate of 102, 36, 26, 22, 2 and 0.5 kg N, P, K, S, Zn and B ha^{-1} respectively. Two third of urea and entire amount of other fertilizers were applied as basal and the rest one-third urea was applied at crown root initiation (CRI) stage. Seeds were sown on 25-29 November/07 at both site of Pabna, 24-26 November/07 at both site of Rajshahi, 29 November/07 at Tangail(1st set) but 2nd set was sown on 17 Decembeer/07, 27-29 November/07 at Faridpur, 29 November/07 at Jhenaidah, 3 December/07 at Narail, 22 November/07 at Sherpur, 25 November/07 at Jamalpur, 30 November/07at Kurigram and 21 November/07 at Nilphamari . The seed rate was 120 kg per hectare. One irrigation was done at 20-23 days after sowing at both sites. Top dressing of urea was done immediately after first irrigation at both the locations. Weeding and other intercultural operations were done when required. The crop was harvested on March 20-27/ 08 at Pabna, 30 March/08 at Rajshahi, 17 March/08 (1st set), 30 March/08 (2nd set) at Tangail, 28-March/08 at Faridpur, 22 March/08 at Jhenaidah, 20 March/08 at Narail, 19 March/08 at Sherpur and 27 March/08 at Jamalpur, 20-26 March/08 at Kurigram and 15-20 March/08 at Niphamari . All necessary data were collected and analyzed statistically.

Results and Discussion

Pabna

Shatabdi took the highest days to heading (Table 1). The similar observation was recorded in case of days to maturity. The maximum plant height was in Shatabdi followed by Kanchan and the shortest in the lines BAW 1059 and BAW 1064. Plant population m^{-2} was similar in all varieties/lines except BAW 1059. The minimum population was in BAW 1059. There was similarity in all variety/lines in spike length and spike lets $spike^{-1}$. The highest grains $spike^{-1}$ was recorded in BAW-1059 which was identical with Shatabdi followed by the lines BAW-1064 and Kanchan. The maximum weight of 1000 grains was obtained in BAW-1064 which was significantly differed from other lines/varieties and the lowest was in Kanchan. The highest grain yield was obtained from Shatabdi which was identical to BAW 1064. The lowest grain yield was recorded in Kanchan. In Sujanagar (Table 2), similar observation was noted on days to heading and days to maturity of the tested lines/varieties as of Kashinathpur site. The plant population per unit area was identical in all the varieties/lines. The longest plant height was in Shatabdi followed by the line BAW-1059 and BAW 1064 and the shortest in Kanchan. The spike length was highest in Shatabdi and the lowest in Kanchan. The maximum number of grains $spike^{-1}$ was in Shatabdi and the lowest was observed in Kanchan. The maximum weight of 1000 grains was attained from Shatabdi followed by BAW 1059 and the lowest was recorded in Kanchan. The highest grain yield was obtained from Shatabdi. Probably the cumulative positive effect of yield contributing characters like plant population, grains $spike^{-1}$ and 1000 grain weight might be attributed to increased grain yield of Shatabdi. The lowest grain yield was recorded from Kanchan. Similar response was observed in straw yield. Grain yield was slightly lower in MLT site, Sujanagar than MLT site, Kashinathpur probably due to late sowing and comparatively lower plant stand.

Rajshahi

Significant difference was observed only in grain yield in set-I (Table 3) but all characters were insignificant. The line BAW-1064 produced height yield (3.94 t/ha) followed by Shatabdi (3.71 t/ha). Shatabdi also produced similar yield to Kanchan (3.67 t/ha). The line BAW-1059 produced the lowest yield (3.53 t/ha) which was similar to Kanchan.

In set-II (table 4) significant difference was observed only in plant height but all the characters failed to produce significant differences among them. Numerically the highest yield was found in Shatabdi (4.73 t/ha) followed by BAW-1064 (4.50 t/ha). Kanchan produced the lowest yield (3.93 t/ha).

From general observation, it was observed that candidate lines were not uniform due to some admixture of different varieties. For this reason, selection team of seed certification Agency (SCA) rejected the selection process for this year.

Tangail

Yield and yield attributes of different varieties/lines were significantly influenced by the treatments (Table 5). The highest plant height (93.73cm & 89.73cm) was recorded from the variety shatabdi in both the two sowing sets where as those of the lowest from BAW 1059 (88.20cm & 85.27cm). The result showed that Shatabdi took the highest time for the maturity in both the sowing times (110 days & 105 days). The line BAW 1064 and the variety Kanchan matured earlier in both the situation. Variation was also observed in spike length. In set-1 the highest number of grains per spike was obtained from BAW 1059 (44.5) which were statistically identical to Shatabdi (40.9) and that of the lowest from BAW 1064 (37.4). Almost similar result was also observed in set-2 for grains per spike. But here, the lowest grains per spike were obtained from Shatabdi (37.3). The highest 1000 grain weights were the highest in set-1 for all the varieties/lines over that of set-2. As such, the grain yields were higher in November 29 planting (set-1) over that of December 17 (set-2) planting. Variety Kanchan and Shatabdi produced 45% and 43% higher yields respectively in November 29 sowing over that of December 17 sowing. While BAW 1059 and BAW 1064 produced only 16% & 19% higher yields respectively over that of December 17 sowing.

Faridpur

In Farmer 1 yield and number of spikes/m^2 and 1000-grain weight were significantly influenced by different varieties/lines (Table 7). Plant height and number of grains/spike was insignificant among the varieties/lines. The highest number of spikes/m^2 was found in BAW 1059 followed by BAW 1064. Significantly highest 1000-grain weight was given by BAW 1064 (46.804 g). The highest grain yield was produced from the line BAW 1059 and the yield of all other lines/varieties are at par. Lowest grain yield was produced from Shatabdi.

In Farmer 2, yield and yield attributes were significantly influenced by different varieties/lines (Table 8). The number of spikes/m^2, 1000-grain weight and seed and straw yield differed significantly among the varieties/lines. The highest number of spikes/m^2 was obtained from Prodip and others are at par. Thousand grain weight was highest in BAW 1064 like Farmer 1. Here Prodip gave significantly highest grain yield, which are at par with BAW 1059.

Jessore

The variety Shatabdi produced the highest grain yield (4.73 t/ha) at the MLT site Kaligonj, Jhenaidah (Table 9). The second highest yield (4.28 t/ha) was obtained from the line BAW 1059 and the lowest was in Kanchan (2.48 t/ha). At MLT site Tularampur, Narail highest yield (4.72 t/ha) was obtained from Shatabdi (Table 10)which did not differ from BAW 1059 and BAW 1064 and the lowest yield (3.13 t/ha) was obtained from Kanchan variety.

Jamalpur

All most all the yield contributing characters were significantly differed due to variety variation. At FSRD site, Kushumhati, Sherpur the tallest plant was found from Shatabdi (Table 11) and was identical to all varieties except Kanchan. Kanchan produced the shortest plant. The number of plants/m^2 was found insignificant due to variety differentiation. The number of spikelets/spike was found highest in BAW 1059 was identical to BAW 1064 and Shatabdi. The lowest number was recorded from Kanchan. The number of grains/spike was insignificant. The weight of 1000 grain was found highest in BAW 1059 while Kanchan produced the lowest. However, the highest seed yield was obtained from BAW 1059 (4.73 t/ha) and was statistically identical to BAW 1064 (4.50 t/ha). Kanchan produced the lowest grain yield (3.91 t/ha). At MLT site, Malancha, Melandah, Jamalpur the plant height and number of plants/m^2 were found insignificant (Table 12). The number of spikelets/spike was noted highest from BAW 1064 was identical to BAW 1059. Shatabdi and Kanchan produced statistically lowest number of spikelet/spike. The highest number of grains/spike was found in BAW 1059 statistically different form other three varieties which were produced lowest number grains/spike. The weight of 1000 grain was found highest in BAW 1064 and the other three varieties produced the lowest 1000 grain weight. The highest seed yield obtained from BAW 1059 (4.25 t/ha) and was identical to BAW 1064 (4.15 t/ha). Shatabdi and Kanchan produced the lowest grain yield (3.81 t/ha and 3.70 t/ha, respectively). At both the locations BAW 1064 and BAW 1059 matured 4 days early than Shatabdi and Kanchan.

Rangpur

At Ulimur MLT site, Kurigram highest grain yield was obtained from Shatabdi, but it was identical with BAW-1059 and BAW-1064 while Kanchan gave the lowest yield (Table 13).Shatabdi gave apparently the highest yield due to cumulative effect of higher spike/m2 and 100-seed weight. At Domar MLT site, Nilphamari Shatabdi also gave the highest yield but it was at par with BAW-1064 and BAW-1059 (Table 14).

Farmers' reaction

Across all locations farmers were interested to grow Shatabdi, BAW-1059 and BAW-1064.

Conclusion

Shatabdi and two lines BAW 1059 and BAW 1064 performed well and could be recommended for mass cultivation. The two advance lines BAW-1059 and BAW-1064 should be quickly released as variety.

Table 1. Yield and yield contributing characters of Wheat varieties/lines at MLT site, Khaloibhara, Kashinathpur, Pabna during the rabi season of 2007-08.

Treatments	Days to heading	Days to maturity	Plant population m^{-2} (no.)	Plant height (cm)	Spike length (cm)	Spikelets $spike^{-1}$ (no.)	Grains $spike^{-1}$ (no.)	1000 Grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
Kanchan	73	111	283	93.40	10.10	15.87	36	43.96	3.65	2.53
Shatabdi	78	116	257	97.07	9.55	16.07	41	44.92	4.20	2.95
BAW-1059	74	109	203	87.63	9.78	16.13	39	45.31	3.78	2.61
BAW-1064	73	111	252	88.77	10.45	16.70	36	46.45	4.17	2.78
CV (%)	3.81	4.08	7.91	5.33	5.89	NS	6.66	5.87	8.35	NS
LSD (0.05)	1.20	2.42	39.31	2.43	1.17	0.84	2.78	0.784	0.11	0.52

Table 2. Yield and yield contributing characters of Wheat varieties/lines during the rabi season of 2007-08 at MLT site, Bhabanipur, Sujanagar, Pabna.

Treatments	Days to heading	Days to maturity	Plant population m^{-2} (no.)	Plant height (cm)	Spike length (cm)	Grains $spike^{-1}$ (no.)	1000 grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
Kanchan	71	113	248.00	83.40	9.13	37.33	39.97	3.45	2.30
Shatabdi	79	117	250.30	96.00	10.47	42.20	45.73	3.75	2.50
BAW-1059	75	111	244.00	90.33	9.77	39.40	45.50	3.60	2.40
BAW-1064	74	110	243.30	88.93	9.47	39.00	45.17	3.54	2.37
CV (%)	3.65	4.23	NS	4.95	5.81	7.57	4.43	5.08	6.16
LSD	1.52	2.78	7.92	1.71	0.35	1.24	0.38	0.06	0.06

Table 3. Effect of variety lines on yield and yield attributes under adaptive trial (set-I) of wheat at Paba MLT site, Rajshahi, in 2007-08

Varieties/ entries	Maturity days	Plant height (cm)	Spike/m^2	Grain/Spike	1000-grain weight (g)	Grain yield (kg/ha)
Kanchan	111	95.57	425.0	41.17	47.83	3.67
Shatabdi	119	95.20	451.3	44.0	43.50	3.71
BAW-1064	115	94.17	443.3	41.50	47.67	3.94
BAW-1059	117	91.47	408.3	45.67	44.17	3.53
LSD (0.05)	-	NS	NS	NS	NS	0.167
CV (%)	-	1.66	7.43	7.66	4.65	2.26

Table 4. Effect of varieties/lines on yield and yield attributes under adaptive trial (set-II) of wheat Paba MLT site, Rajshahi in 2007-2008.

Varieties/ entries	Maturity days	Plant height (cm)	Spike/m^2	Grain/Spike	1000-grain weight (g)	Grain yield (kg/ha)
Kanchan	109	90.73 b	435.0	45.97	47.83	3.93
Shatabdi	121	101.13 a	447.67	49.43	43.50	4.73
BAW-1064	114	90.07 b	378.67	57.67	47.83	4.50
BAW-1059	116	93.03 b	385.0	51.43	44.17	4.27
LSD (0.05)	-	5.41	NS	NS	NS	NS
CV (%)	-	2.89	10.16	11.68	4.57	10.12

Table 5. Yield and yield contributing parameters of wheat varieties/lines at MLT site, Ghatail (set-1 sown on 29 November, 2007)

Treatments	Plant population/m^2	Plant height (cm)	Days to maturity	Spike length (cm)	Spikelets/ spike	Grains /spike	1000 grain wt (g).	Grain yield (t/ha)
Kanchan	422	90.47	101	8.77	16.53	33.7	42.1	3.50
Shatabdi	464	93.73	110	9.33	17.67	40.9	42.5	3.37
BAW 1059	374	88.20	103	9.40	17.60	44.5	45.2	3.38
BAW 1064	417	89.93	101	9.47	18.13	37.5	47.2	3.70
LSD (0.05)	92.50	12.92	0.58	0.45	0.81	5.18	6.28	0.99
CV (%)	11.0	7.1	0.3	2.5	2.3	6.6	7.1	14.2

Table 6. Yield and yield contributing parameters of wheat varieties/lines at MLT site, Ghatail (set-2 sown on 17 December, 2007)

Treatments	Plant populatio n /m^2	Plant height (cm)	Days to maturity	Spike length (cm)	Spikelets / spike	Grains/ spike	1000 grain wt.	Grain yield (t/ha)
Kanchan	413	87.53	93	10.03	16.87	41.5	30.8	2.42
Shatabdi	398	89.73	105	9.60	16.67	37.3	32.7	2.35
BAW 1059	400	85.27	94	10.70	17.60	43.7	32.1	2.90
BAW 1064	443	86.93	92	10.47	18.60	43.9	32.4	3.10
LSD (0.05)	78.10	8.20	1.63	0.41	1.67	1.50	2.98	0.49
CV (%)	9.5	4.7	0.8	2.0	4.8	1.8	4.7	9.0

Table 7: Yield and yield contributing characters of wheat lines in Farmer 1 at FSRD site, Hatgobindopur, Faridpur

Variety/line	Days to maturity	No. of spikes/m2	No. of grains/spike	1000 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
Prodip	106	239.6b	29.26	44.03b	2.57	3.12
Shatabdi	113	237.6b	32.16	43.20d	2.48	3.21
BAW 1059	109	274.0a	32.00	43.60c	2.78	3.45
BAW 1064	109	265.0b	29.83	46.80a	2.50	3.15
CV (%)	-	7.98	9.21	1.2	7.35	8.42

Table 8: Yield and yield contributing characters of bread wheat lines in Farmer 2 at FSRD site, Hatgobindopur, Faridpur

Variety/line	Days to maturity	No. of spikes/m2	No. of grains/spike	1000 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
Prodip	104	335.3a	33.21	45.9b	3.43a	4.12a
Shatabdi	111	309.6ab	30.54	43.7c	3.18b	3.78b
BAW 1059	107	310.6ab	31.50	44.6c	3.42a	4.00a
BAW 1064	107	290.6b	30.60	48.2a	3.26b	3.95b
CV (%)	-	4.85	7.62	1.52	2.54	6.42

Table 9: Yield and yield contributing characters of wheat at MLT site, Kaligonj, Jhenaidah during rabi 2007-08

Variety/ lines	Popn/m^2	Plant height (cm)	Spike length (cm)	Grains/ spike (no)	1000-grain wt (g)	Grain yield (t/ha)	Straw yield (kg/ha)
BAW 1064	380.5	95.9b	9.5b	45.5b	44.00a	4.02c	4.05
BAW 1059	389.4	94.5c	8.7c	47.2b	46.30a	4.28b	4.11
Shatabdi	327.7	98.4a	10.3a	51.8a	43.43b	4.73a	4.16
Kanchan	324.2	94.3c	8.4c	46.0b	37.73c	2.48d	3.81
CV (%)	7.29	10.39	10.85	12.18	5.53	3.58	20.08
F-test	NS	**	*	**	**	**	NS

N. B.:NS:Non significant, * : Significant at 5% level, **: Significant at 1% level.

Table 10: Yield and yield contributing characters of wheat at MLT site, Tularampur, Narail during rabi 2007-08

Variety/ lines	Population/m^2	Plant height (cm)	Spike length (cm)	Grains /spike (no)	1000-grain wt (g)	Grain yield (t/ha)	Straw yield (t/ha)
BAW 1064	400.3	87.9	9.8	43.3	51.40a	4.57a	4.10
BAW 1059	394.3	86.3	10.6	44.7	48.10b	4.63a	4.22
Shatabdi	380.3	89.7	10.6	44.6	48.33b	4.72a	3.70
Kanchan	388.4	88.6	9.9	44.0	38.70c	3.13b	3.66
CV (%)	12.26	9.77	12.94	13.51	5.86	6.29	12.04
F-test	NS	NS	NS	NS	**	**	NS

N.B.: NS:Non significant, * : Significant at 5% level, **: Significant at 1% level.

Table 11. Yield and yield contributing characters of bread wheat line at MLT Site, FSRD site, Kushumhati, Sherpur during 2007-08

Treat	Plant ht. (cm)	Plant/ m^2 (no.)	Spikelets/ spike (no.)	Grains/ spike (no.)	1000-grain weight (g)	Grain yield (t/ha)	Duration (Days)
BAW-1064	96.6 a	404.3	16.6 ab	42.2	43.93 b	4.50 ab	107 c
Shatabdi	97.0 a	442.6	16.4 ab	42.6	40.66 c	4.26 b	112 a
BAW-1059	96.6 a	430.0	17.0 a	39.3	46.34 a	4.73 a	108 c
Kanchan	94.0 b	411.0	16.0 b		38.97 d	3.91 c	110 b
F	*	NS	*	NS	**	**	**
CV(%)	6.51	7.19	8.10	8.87	3.87	8.07	2.63

Table 12. Yield and yield contributing characters of bread wheat line at MLT Site, Malancha, Melandah during 2007-08

Treat	Plant ht. (cm)	Plant/ m^2 (no.)	Spikelets/ spike (no.)	Grains/ spike (no.)	1000-grain weight (g)	Grain yield (t/ha)	Duration (Days)
BAW-1064	83.6	390	17.5 a	33.4 b	45.66 a	4.15 a	108 c
Shatabdi	86.2	362	15.4 b	31.6 b	43.00 b	3.81 b	112 a
BAW-1059	82.8	403	16.1 ab	37.4 a	43.00 b	4.25 a	107 c
Kanchan	86.6	374	14.6 b	31.2 b	42.33 b	3.70 b	110 b
F	NS	NS	*	**	**	*	**
CV(%)	5.94	7.16	5.12	4.52	4.12	8.54	3.59

Table 13. Yield and yield attributes of different wheat varieties at MLT site, Ulipur, Kurigram during rabi 2007-08

Treatment	Days to maturity	Plant height (cm)	No. of spike/m^2	No. of grain/spike	1000-grain wt. (g)	Grain yield (t/ha)
BAW-1064	109b	98	284	44	44.1a	4.28a
BAW-1059	109b	97	279	45	43.4a	4.50a
Shatabdi	112a	99	294	45	43.3a	4.53a
Kanchan	110b	95	288	43	43.0b	3.47b
CV (%)	1.0	2.0	3.1	3.0	4.3	3.9

Table 14. Yield and yield attributes of different wheat varieties at MLT site, Domar, Nilphamari during rabi 2007-08

BAW-1064	-	86.7	-	53.3	51.6	5.13a
BAW-1059	-	84.3	-	51.7a	54.6	4.72a
Shatabdi	-	85.0	-	50.3a	49.6	5.14a
Kanchan	-	83.7	-	56.7a	53.3	3.65b
CV (%)	-	4.1	-	11.0	6.6	4.6

Table 15. Mean grain yield (t/ha) of bread wheat in 14 locations, rabi 2007-08.

Line/variety	Location														Mean yield
	P-1	P-2	R-1	R-2	T-1	T-2	F-1	F-2	J-1	J-2	Ja-1	Ja-2	Ra1	Ra-2	
Kanchan	3.65	3.45	3.67	3.93	3.50	2.42	-	-	2.48	3.13	3.91	3.70	3.47	3.65	3.41±0.49
Shatabdi	4.20	3.75	3.71	4.73	3.37	2.35	2.48	3.18	4.73	4.72	4.26	3.81	4.53	5.14	3.92±0.85
Pradip	-	-	-	-	-	-	2.57	3.43	-	-	-	-	-	-	3.0
BAW-1059	3.78	3.60	3.94	4.50	3.38	2.90	2.78	3.42	4.28	4.63	4.73	4.25	4.50	4.72	3.96±0.66
BAW-1064	4.17	3.54	3.53	4.27	3.70	3.10	2.50	3.26	4.02	4.57	4.50	4.15	4.53	5.13	3.92±0.69

P: Pabna, R: Rajshahi, T: Tangail, F: Faridpur; J: Jessore, Ja: Jamalpur, Ra- Rangpur

Performance of BARI Released Wheat Varieties in Coastal Area of Khulna

Abstract

The experiment was conducted in farmer's field to find out the suitable wheat variety(s) for coastal region. In this experiment four varieties was tested in two different locations namely MLT site, Satkhira and Laudove, Dacope during rabi season 2007-'08. Among the varieties it was found that Bijoy performed better in Satkhira MLT site, where as Sourav gave higher yield in Laudove, Dacope.

Introduction

Wheat is the most important staple food of the world. In Bangladesh it is one of the main food crops, next only to rice. It is grown on about 8.5 lakh hectares and the annual production is about 7.3 lakh metric tons. But yield of wheat is lower in our country than that of other wheat growing countries. It may be due to variety/environment or technological difference. In saline area soil salinity and irrigation crisis due to leak of sweet water are major problem to grow wheat. So, considering the above discussion the experiment was conducted in the farmers field during rabi 2007-'08 to verity the yield performance of the varieties.

Materials and Methods

The experiment was conducted in the farmer's field at MLT site, Satkhira and Laudove, Dacope, Khulna. The experiment had four dispersed replications with RCB design. The unit plot size was 5m×4m. A total of four verities were tested. The land was well prepared and seeds were sown during 07 Deember'07 and 30 November'07 at Satkhira and Laudove respectively. The fertilizer Urea-TSP-MP-Gypsum were applied at the rate of 180-180-50-90kg/ha. The field was irrigated twice at 20 and 45 DAS. The crop was harvested at 24 March, 2008 and 15 March,2008 at Satkhira and Laudove, Dacope respectively. During this period soil salinity was 2.50-7.70ds/m. Rat attack was managed by rodenticide (Lanirat). All the necessary data were collected and analyzed by MSTATC.

Result and Discussion

Yield and yield related data were presented in Table 1 and 2

MLT site, Satkhira

Among 4 wheat varieties Bijoy performed better and gave highest yield (3.73t/ha). It is due to all the yield contributing character e.g. Spike length, grains/spike and 100 grain weight were higher of the variety. The second highest yield was found in Shatabdi (3.37t/ha) which statistically identical with Sourav and Prodip.

Laudove, Dacope

The highest grain yield was found in Sourav (3.40t/ha) which statistically similar with that of Bijoy (3.23t/ha). All the yield contributing characters except spike/m^2 helped to Sourav give highest yield. Through its no of spike was low, grains/spike and 1000 grain weight compensate the yield. The lowest grain yield was found in Prodip. It is due to its lowest no. of grains/spike and 1000-grain weight.

Farmers' reaction

At MLT site Satkhira, wheat was grown with minimum tillage which was a new technology to the farmers. So, most of the farmers are interested to grow wheat in next year.

At Laudove, Dacope, farmers were not habituated to grow wheat at all. They did not do it due to high salinity and poor irrigation facility. But last rabi season, OFRD Khulna took initiative to grow wheat in muddy soil just after harvest of T.Aman rice. After observing this technology farmers are interested to grow wheat now.

Conclusion

All the varieties perform better more or less other than Prodip. This is the 1st year experiment. So, it needs to be studied over the year.

Table 1. Yield and yield attributing characters of wheat at Satkhira MLT site during 2007-08

Variety	Days to maturity	Spike/m^2	Plant height (cm)	Spike length (cm)	Grains/spike (No.)	1000 grain wt.(g)	Grain yield(t/ha)	Straw yield(t/ha)
Shatabdi	100	205	85.90	9.63	37.20	48.33	3.37	3.23
Bijoy	100	200	89.53	10.30	39.67	52.33	3.73	3.40
Sourav	103	210	79.80	8.90	33.97	45.00	3.01	3.10
prodip	104	180	51.40	9.13	36.73	48.67	2.90	2.90
LSD(0.05)	-	--	3.49	1.13	2.12	4.70	0.477	0.362
CV(%)	-	--	2.07	5.98	2.89	4.85	7.34	5.70

Table 2: Yield and yield attributing characters of wheat at testing area of Laudove, Dacope during rabi season, 2007-08.

Variety	Days to maturity	Spike/m^2	Plant height (cm)	Spike length (cm)	Grains/spike (No.)	1000 grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
Shatabdi	102	195	93.25	8.43	38.00	45.50	3.09	3.00
Bijoy	100	200	94.25	8.56	37.50	45.50	3.23	3.24
Sourav	80	185	90.00	8.05	40.00	49.50	3.40	3.45
Prodip	98	178	91.75	8.25	36.50	42.75	2.50	2.45
LSD(0.05)	-	12.17	3.72	0.60	3.07	3.02	024	0.20
CV(%)	-	2.10	2.52	4.52	5.08	4.12	4.85	6.20

Adaptive Trial of Recently Released Potato Varieties and Seedling Tuber Progenies

Abstract

An adaptability trial on newly released potato varieties/progenies, Raja, Felsina, Asterix , Granola , BARI TPS-1 and Diamant were conducted at five locations viz. MLT site Dhirashram, Gazipur, FSRD site Jalalpur, Sylhet, MLT site Manikganj, FSRD site Kadamsahar, High Barind Tract (HBT) Rajshahi, and Barura MLT site, Comilla during the rabi season of 2007-2008 to evaluate their performance under farmers condition across environments. Averaged over locations Diamant (26.57 t/ha) gave the highest yield followed by Granola (23.26 t/ha) while BARI TPS-1 produced the lowest (20.03 t/ha). Felsina (22.03 t/ha0 and Asterix (22.18 t/ha) also gave reasonable yields. Among the locations lower yield was recorded in Sylhet due to late planting.

Introduction

In Bangladesh potato is a major crop occupying third position after rice and wheat. But in Bangladesh per hectare production of potato is low (14.6-15 t/ha) (BBS 2004) as compared to other potato growing countries (Ahmed et. al. 1979). This low yield may be due to cultivation of low yielding local varieties, poor seed quality, lack of technical know how, etc. Potato can play a vital role as supplementary to cereals having balanced dietary value and also a carbohydrate containing crop that can reduce pressure on rice. Generally farmers grow local varieties and they are highly interested to cultivate potato. With this point of view Tuber Crop Research Centre (TCRC) of Bangladesh Agricultural Research Institute developed some potato varieties and genotypes. The varieties/progenies may help to increase farmers' income. As such, the present study aims to evaluate the performance of potato varieties/progenies under farmers' field condition and popularize them among the farmers.

Materials and methods

The experiment was conducted at MLT site Dhirashram, Gazipur, FSRD site Jalalpur, Sylhet, MLT site Manikganj, FSRD site Kadamsahar, High Barind Tract (HBT) Rajshahi, Barura MLT site, Comilla during the rabi season of 2007-2008. Six different varieties viz. Raza, Felsina, Asterix, Granola, BARI TPS-1 and Diamant were used as check variety, however at Barind instead of Diamant variety Cardinal was used.. Unit plot size was 5m ×4m with the spacing of 60 cm × 25 cm. At the time of final land preparation cowdung @ 10 t/ha was applied. The field was fertilized with @ 350 kg Urea, 220 kg TSP, 260 kg MP and 120 kg Gypsum per hectare. Half of Urea and full dose of TSP, MP and Gypsum were applied and incorporated immediately before planting in the seed furrows and mixed properly with the soil. The rest amount of urea was top dressed at 35 days after planting following by irrigation. The whole potato tubers were planted on 29 November/07 at Gazipur, 17 December/07 at Sylhet, 25 November/07 at Manikganj, 27 November/07 at Barind and 28 November/07 at Comilla. The crop was sprayed with Dithane M-45 @ 0.25 and Ridomil gold @ 2ml/L for preventing late blight disease. Other intercultural operations were done as and when necessary. Harvesting was done 29 February/08 at Gazipur, 3 March/08 at Sylhet, 14 February/08 at Manikganj, 1 March/08 at Barind and 24 February at Comilla. The yield contributing characters data were recorded from ten randomly selected plants.

Results and Discussion

Gazipur

Tallest plant height (94.3cm) was recorded from the variety BARI TPS-1(Table 1). Highest number of tuber/plant (6.3) was produced by Diamant variety which was followed by BARI TPS-1 (6.2). The variety Asterix, Raja, Felsina showed higher and identical number of tuber per plant whereas lowest number (4.8) was recorded from Granola. The individual weight of tuber (204.5g) was highest in Felsina which was followed by Granola (188.8 g), Asterix (175 g), Raja (166 g), Diamant (151g) and where as the lowest weight (81.5g) was found in BARI TPS-1. The highest tuber yield (27.3 t/ha) was obtained from Diamant variety which was statistically identical to variety Asterix (27.0 t/ha) due to higher no. of tuber/plant, length and breath of tuber which was followed by Granola (26.6 t/ha) due to tuber weight was higher (188.8g). Raja and BARI TPS-1 gave lower yield (21.7 and 20.3 t/ha) than that of other varieties due to lower number of tuber/plant and tuber weight respectively.

Cost and return analysis

Among the varieties highest gross return was obtained from Diamant (Tk. 218400/ha) which was identical to Asterix (Tk. 216000/ha). Same trend, were observed in gross margin and BCR. The lowest gross margin was obtained from BARI TPS-1 and Raja due to lower yield than that of others varieties (Table 1).

Sylhet

Six potato varieties were evaluated in the farmer's field. The varieties were Diamant, Asterix, BARI TPS-1, Granula, Felsina and Raja. Raja Gave the highest yield (21 ton/ha) and BARI TPS-1 gave the lowest yield (ton/ha).

Manikganj

The result showed that the variety Granola produced the highest tuber weight/plant (0.573 kg) which differs from other varieties. Diamant gave the second highest per plant yield which was followed by BARI TPS-1 and Asterix. Consequently the variety Granola gave the highest yield (22.72 t/ha) followed by Diamant (21.21 t/ha). The crop did not perform well because it was infested by late blight disease of potato (75 DAS).

Barind

Yield components of potato responded to different varieties (Table 1). Among six varieties, the highest plant height (48.40cm) was found in the variety BARI TPS-1 but lowest (37.50 cm) in Cardinal variety. Maximum number of stems/plant (6.10), tuber/plant (14.50) and foliage coverage (85.60 %) were found from the variety Cardinal followed by BARI TPS-1. The highest average tuber weight (70.20g) was produced by Cardinal which was followed by BARI TPS 1 (69.70g) but lowest (55.50g) in the variety Asterix. The maximum days (93) for maturity of potato were found in BARI TPS 1, which was at per with Felsina (91). Tuber yield were also differed from different varieties. Variety Cardinal was produced the highest tuber yield (22.29 t/ha) followed by BARI TPS-1 (20.44 t/ha) but lowest yield (16.76 t/ha) from the variety Felsina. The highest no. of tuber/plant and average tuber weight were observed in the variety Cardinal and those contributed to higher tuber yield.

Comilla

Yield and yield attributes of potatoes are presented in Table 1. Significant variation was observed in plant height, shoot/plant, tuber number/plant, tuber weight/plant, and tuber yield among the different varieties. Comparatively highest tuber yield (37.77 t/ha) was recorded in the variety Diamant which was statistically similar to the variety BARI TPS-1(37.31 t/ha) and Felsina (34.53 t/ha). The lowest tuber yield was found in Raja (28.43 t/ha). The highest yield was obtained from the variety Diamant and BARI TPS-1 because of the statistically similar tuber weight per plant in Diamant (723.33 gm) and BARI TPS-1 (716.67 gm). The maximum tuber number per plant was recorded from BARI TPS-1 (17.85) and that is statistically identical with Diamant (13.93). The lowest tuber number per plant (8.13) and tuber weight (380.00 gm) was recorded from Raja and for this reason Raja gave the lowest yield.

The highest number of shoot per plant (8.0) was recorded from check variety Diamant which was statistically differ from other variety. Plant height was highest in variety Felsina (66.3 cm) and lowest plant height was found in Granola (44.9 cm).

Farmers' reaction at Barind: The co-operator farmer and their neighbors were encouraged to observe the performance of Cardinal and BARI TPS-1 variety. They expressed their willingness to cultivate variety Cardinal and BARI TPS-1 in the next year on the availability of seed. Seeds of Cardinal variety were preserved by the co-operator farmers for the next year cultivation.

Farmers' reaction at Gazipur: Most of the potato varieties were new at Dhirashram MLT site. Farmers expressed their satisfaction due to higher yield and tested of the varieties. They preferred Diamant, Raja, Felsina, Asterix and Granola for cultivation.

Conclusion

The experiment should be repeated across more locations with promising lines those are higher yielder than Diamant/Cardinal.

Table 1. Yield attributes and yield and economic performance of different potato varieties at Dhirashram MLT site, Gazipur during the rabi season of 2007-08

Varieties	Plant height at harvest (cm)	No of tuber per plant	Tuber per wt. (g)	Length of tuber (cm)	Breath of tuber (cm)	Yield (t/ha)	Gross return (Tk/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Diamant	66.0	6.3	151.0	6.87	4.72	27.3	218400	119481	98919	1.83
Raja	77.2	5.2	166.0	7.19	4.64	21.7	173600	119481	54119	1.45
Felsina	66.1	5.2	204.5	7.29	5.36	25.2	201600	119481	82119	1.69
Asterix	68.7	5.7	175.0	7.11	5.26	27.0	216000	119481	96519	1.81
Granola	60.1	4.8	188.8	7.57	4.93	26.6	212800	119481	93319	1.78
BARI TPS-1	94.3	6.2	81.5	4.15	3.0	20.3	162400	119481	42919	1.36

Price : Tk 8/kg

Table 2. Varietal trial of different potato varieties at FSRD site, Jalalpur, Sylhet

Variety		Yield/ton
01	Diamant	20.13
02	Asterix	16.20
03	BARI TPS-1	12.43
04	Granola	17.07
05	Felsina	15.86
06	Raja	21.30

Table 3. Yield contributing characters and yield of potato varieties at MLT site Manikganj during rabi 2007-08

Variety	Plant/m2	Tuber/plant (no.)	Wt. of tuber/plant (kg)	Diameter/Tuber (cm)	Tuber yield (t/ha)
Raja	6.57	7	0.355	3.25	16.63
Asterix	6.82	6	0.358	3.51	17.68
BARI TPS-1	6.16	11	0.436	1.87	10.10
Diamant (Check)	6.16	10	0.527	3.25	21.21
Granola	6.57	10	0.573	3.25	22.72
Felsina	5.56	7	0.347	3.27	18.69

Table 4. Yield and yield components of potato varieties at Barind, Rajshahi, 2007-08

Varieties	Plant ht.(cm)	No. of Stems/plant	(%)Foliage coverage	No. of tuber/plant	Av. wt. of tuber (g)	Days to maturity	Tuber yield (t/ha)
Granola	40.00	5.80	78.00	13.50	60.20	89	17.85
Raja	39.75	3.10	79.00	10.80	60.25	90	18.18
Asterix	42.50	3.80	78.33	10.50	55.50	88	18.93
Felsina	41.90	3.60	76.00	11.00	62.25	91	16.76
BARI TPS-1	48.40	4.00	83.00	14.40	69.70	93	20.44
Cardinal	37.50	6.10	85.60	14.50	70.20	88	22.29

Table 5. Yield and yield contributing characters of different potato varieties

Variety	Plant height (cm)	Number of Shoot/plant	Number of Tuber/plant	Tuber wt/plant (gm)	Yield (t/ha)
BARI TPS-1	51.0	4.7	17.87	716.67	37.31
Raja	46.3	3.9	8.13	380.00	28.43
Felsina	66.3	5.5	10.07	543.33	34.53
Granola	44.9	5.5	11.27	471.00	32.13
Asterix	58.9	6.4	10.47	473.33	31.29
Diamant	57.4	8.0	13.93	723.33	37.77
CV (%)	8.25	7.09	20.21	30.62	8.09
LSD (5%)	8.128	0.73	4.395	307.1	4.94

Table 6. Mean tuber yield (t//ha) of potato across five locations during rabi 2007-08

Line/variety	Location					Mean tuber yield
	Gazipur	Sylhet	Manikganj	Barind-Rajshahi	Comilla	
Diamant	27.3	20	21.21	-	37.77	26.57
Raja	21.7	21	16.63	18.18	28.43	21.18
Felsina	25.2	15	18.69	16.76	34.53	22.03
Asterix	27.0	16	17.68	18.93	31.29	22.18
Granola	26.6	17	22.72	17.85	32.13	23.26
BARI TPS-1	20.3	12	10.10	20.44	37.31	20.03
Cardinal				22.29	-	-

Screening of Potato Varieties for Saline Area

Abstract

Performance of eight potato lines/varieties namely, Asterix, Alegra, Diamant, Felsina, Lady rosestta, Melody, Provento, Saikat were evaluated at MLT site, Satkhira, FSRD site, Hazirhat Noakhali and Kuakata, Patuakhali during the rabi season 2007-08. Averaged over locations Asterix gave highest yield (20.65 t/ha) followed by Provento (17.96 t/ha) and Diamant (17.95 t/ha). Higher yield at Satkhira was due to less salinity and proper management, whereas lower yield at Noakhali was because of higher salinity and moisture stress, while very low yield at Patuakhali was due to late planting.

Introduction

In Bangladesh, more than 30% of the cultivable area is in the coast. Out of it 2,88 million hectares are affected by varying degrees of soil salinity (Karim and Iqbal, 2001). After harvesting of T.Aman vast land remain fallow. During Rabi season, the soil salinity levels increase through capillary movement. It is a production constraint common to all rainfed salinity affected agriculture. In Bangladesh around 5 lakh ha land is under potato cultivation, which produces 78 lakh ton potatoes. But in coastal districts area of potato is negligible due to this production constraint. High soils salinity and lack of irrigation facilities are the major problems to cultivate potato in this area. BARI developed some potato varieties, some of which could be saline tolerant and which might influence the farmers to cultivate potato in this coastal area. The performances different advance lines/ varieties of potatoes need to be evaluated in saline
area.

Materials and Methods

The trial was conducted at MLT site Satkhira, FSRD site, Hazirhat, Noakhali and Kuakata, Patuakhali during rabi season, 2007-2008 with eight varieties namely Asterix, Alegra, Diamant, Felsina, Lady rosesta, Melody, Provento, Saikat, however, instead of Saikat, Local was included at Noakhali following RCB design with three replications. The unit plot size was 3m×1.5m. Seeds were sown on 06 December07 at Satkhira, 28 Noverber/07 at Noakhali and 25 December/07 at Patuakhali with 60cm×25cm spacing The experiment plots were fertilized with 250-150-250-120-10-10fg/ha of Urea, TSP, MP, Gypsum, Zinc sulphate and Borax respectively. Half of the total urea and rest of the fertilizers were applied as basal during final land preparation. Rest of the urea was applied after 20 and 45 DAS as top dressed. Three irrigations were given during the growth period at Satkhira, while at Noakhali one irrigation was applied and at Patuakhali two irrigation was provided. All the intercultural operations were done as and when necessary. The soil salinity level at the Satkhira site were 06 Dec'07, 22 Dec.'07, 06 Jan.'08, 21 Jan.'08, 05 Feb.'08, 21 Feb.'08 and 28 Feb.'08 were 4.43, 2.57, 6.28, 4.52, 4.25, 3.19 and 4.30ds/m respectively. At Noakhali salinity range during the experiment was 1.47 to 8.09 dS/m. At Patuakhali salinity levels were 2.53, 3.02, 3.94, 4.35, 5.01 and 5.68 dS/m on 24 December/07, 9 Janyary/08, 21 January/08, 12 February/08, 27 February/08 and 11 March/08 respectively. The crop was harvested on 27-28 February/08 at Satkhira, 19-25 February/08 at Noakhali and 11 March/08 at Patuakhali. Data on yield and yield attributes were collected and analyzed statistically.

Results and Discussions

Satkhira

The major yield contributing characters viz. no of hills/plant, tubers/plant and weight of tuber's were significantly influenced by varieties (Table 1). Asterix produced the significantly highest tuber yield (33.78t/ha). Saikat produced the lowest yield (20.78t/ha). The results revealed that the significantly highest tuber yield (33.78t/ha) was obtained from Asterix could be due to maximum number of hills/plant, no of tubers/plant and tuber weight. Similarly the results revealed that the lowest tuber yield (20.78t/ha) was obtained from Saikat significantly could be due to minimum weight of tuber/plant.

Noakhali

The highest plant height was recorded in Felsina (51.75 cm), which was followed, by Alegra (45.55 cm). The lower plant height was found in local (30.25 cm). The higher number of stem (3.70) was found in the variety Diamant. Higher number of tuber per plant (6.65) was in Asterix and L. Rosetta, which was followed by Diamant (6.55). The highest tuber yield was found in variety Diamant (18.97 t/ha), which was followed by L. Rost (18.30 t/ha) and Provento (17.89 t/ha). The lowest yield (Table 2)was found in Local (10.32 t/ha) followed by Alegra (13.03 t/ha).

Alegra, L. Rost and Melody needed the longer duration i. e, 14 days whereas Felsina and Diamant variety needed the shorter duration(12 days) for 80% emergence. Felsina, Asterix and L. Rost showed the maximum foliage coverage (77.50%) at 60 DAS and Local showed the lowest foliage coverage i.e., 67.50% at the same DAS. (Table 3)

Patuakhali

Lady Rosetta produced the highest tuber yield (12.22 t/ha) which was statistically identical to Asterix (11.39 t/ha) followed by Alegira (10.19 t/ha). Provento gave the lowest yield which was identical to Melody. This lower yield might be due to salinity effect.

Farmer's reaction-Satkhira

Farmer's choose Asterix and Diamant-

- High yield
- High return

Farmer's reaction at Noakhali

Farmer's were interested about cultivation of potato with mulch. Diamant is the most favorite variety among all other varieties to the farmers. They also liked Melody and Provento for their higher yield, size and color.

Farmers' reaction at Patuakhali

1. If potato could be planted early it would be a profitable crop.
2. Seed tuber availability is a problem in potato cultivation.

Conclusion

The experiment should be repeated over the years to select suitable variety(s) for specific saline areas.

Table 1: Yield and yield contributing character of different potato varieties tested at Satkhira MLT site during rabi season, 2007-08

Entry/variety	Days to maturity	Plant population/m^2	Hills/plant (No.)	Tubers/plant (No.)	Wt. of tubers/plant (g)	Tuber yield (t/ha)
Asterix	90	6.67	3.73	9.37	520	33.78
Alegra	90	6.44	3.47	8.07	399	25.00
Diamant	90	6.67	3.73	10.30	446	29.41
Felsina	90	6.67	3.63	9.57	431	27.78
l.rosesta	90	6.44	3.03	9.43	379	23.33
Melody	90	6.44	3.20	9.03	357	22.59
Provento	90	6.67	2.93	9.64	445	27.88
Saikat	90	6.56	3.63	8.30	320	20.78
LSD(0.05)	-	0.23	0.54	1.43	74.11	4.40
CV(%)	-	2.0	3.03	8.85	10.27	9.55

Table 2. Yield and yield contributing characters of different potato varieties at FSRD site, Hazirhat, Noakhali, 2007-08

Name of the variety/ line	Tuber plant $^{-1}$(no.)	Grades (mm)			Yield (t/ha)
		>55	28-55	<28	
Felsina	6.35	72	108	127	14.88
Provento	5.80	104	154	140	17.89
Asterix	6.65	87	114	169	16.77
Alegra	6.20	33	50	95	13.03
Diamant	6.55	143	124	155	18.97
L. Rost	6.65	111	138	173	18.30
Melody	6.35	57	133	141	14.57
Local	5.35	10	168	182	10.32
LSD (0.05)	0.088	-	-	-	0.426
CV (%)	8.44	-	-	-	23.36

Table 3. Growth characters of different potato varieties at FSRD site, Hazirhat, Noakhali, 2007-08

Varieties	Plant height (cm)	Days to 80% Emergence	Foliage coverage at 60 DAS (%)
Felsina	51.75	12	77.50
Provento	42.75	13	75.00
Asterix	41.65	13	77.50
Alegra	45.55	14	70.00
Diamant	36.20	12	75.00
L. Rost	34.35	14	77.50
Melody	30.80	14	70.00
Local	30.25	13	67.50
LSD(0.05)	0.0334	-	0.127
CV (%)	13.86	-	11.39

Table 4. Yield and yield attributes of potato varieties under salinity environment at Kuakata, Patuakhali, 2007-08

Variety	Plant height (cm)	No. of tubers Plant^{-1}	Tuber yield (t/ha)
Lady Rosetta	32	5.7	12.22 a
Alegria	26	5.5	10.19 b
Melody	30	5.0	8.20 c
Asterix	28	5.0	11.39 a
Diamant	29	5.0	7.59 d
Felsina	16	4.3	7.96 d
Provento	22	4.5	8.11 c
CV (%)	-	-	9.64

Table 5. Mean tuber yield (t/ha)of potato in three saline affected areas of Bangladesh, 2007-08

Line/variety	Location			Mean tuber yield
	Satkhira	Noakhali	Patuakhali	
Asterix	33.78	16.77	11.39	20.65
Alegra	25.00	13.03	10.19	16.07
Diamant	29.41	18.97	7.59	18.65
Felsina	27.78	14.88	7.96	16.75
l.rosesta	23.33	18.30	12.22	17.95
Melody	22.59	14.57	8.20	15.12
Provento	27.88	17.89	8.11	17.96
Saikat	20.78	-	-	-
Local	-	10.32	-	-

Screening of Germplasms/Varieties of Sweet Potato against Salinity

Abstract

The experiment on screening of the salt tolerant sweet potato cultivars was conducted in the farmer's field of FSRD site, Hazirhat, Noakhali, MLT site Satkhira and Kuakata-Patuakhali under rainfed conditions during the rabi season of 2007-08. Ten germplasms and two varieties of sweet potato were included in the study. At Noakhali the highest root yield (12.43 t/ha) was given by BARI SP- 6. The highest vine survival percent in a range of 75-85% was found in SP-498, BARI SP-6, BARI SP-7, SP-166. While at Satkhira SP-498 gave the highest root yield (41.44 t/ha) but farmers preferred Sp-264 for its red color as well as good yield (35.71 t/ha). Whereas at Patuakhali yield level was low though salinity level was low, could be due to acute soil moisture stress and the highest root yield was obtained from BARI SP-7 (16 t/ha). Averaged over locations highest root yield was from SP-498 (21.44 t/ha).

Introduction

Sweet potato is a carbohydrate rich root crop, which can be used as substitute of cereal crops in Bangladesh to meet the up food shortage. Generally, the poor people are the consumers to sweet potato. In Bangladesh, the average yield of sweet potato is less than 10 t ha^{-1} (Krishi Projukti Hatboi, BARI). It is the main source of carbohydrate and carotene for their survival. Sweet potato grows well in non-saline char area of Bangladesh. A vast area of char, which contains varying degrees of salinity (2->20 dS/m), remains fallow in the rabi season. Farmers can grow here only T. aman. Therefore, the cropping intensity of the saline char area is very low. If crops like sweet potato could be fitted in that fallow period, the cropping intensity would be increased. Bangladesh Agricultural Research Institute (BARI) has developed some new varieties. BARI is also working with a number of sweet potato germplasms that have high yielding ability and contain high amount of carotene. These varieties/ germplasms need to be screened in farmer's field under natural conditions to evaluate their performance and to identify the suitable variety/ germplasm for specific saline area and also to get the feed back from the farmers. Keeping these views in mind the experiment was undertaken to evaluate the performance of sweet potato germplasms against salinity.

Materials and Methods

The experiment was conducted at FSRD site, Noakhali, MLT site Satkhira and Kuakata, Patuakhali under rainfed condition during the rabi season of 2007-08 in the farmer's field. The experiment was laid out in RCB design with three replications. The plot size was 1.8m × 1.5m. Two weeding were done on 19 January and 09 February 2008 during the crop growth period. There were twelve germplasms of BARI developed sweet potato to conduct the experiment. Vines were planted in line with 60 cm × 30 cm spacing on 29 December/07 at Noakhali, 3 December/07 at Satkhira and 31 December/07 at Patuakhali. To set the experiment, the saline prone field was selected by testing salinity samples field in several spots. The crop was harvested on 15 April/08 at Noakhali, 4-8 May/08 at Satkhira and 5 May/08 at Patuakhali. At Noakhali the crop was harvested earlier than it's expected life duration because of the vine's drying up due to high salinity stress and lack of soil moisture. During the study period, the salinity data were recorded at different physiological stage of the crop. There was no remarkable disease and pest attack. The data on yield and yield attributes were analyzed statistically.

Results and Discussion

Noakhali

Yield contributing characteristics showed significant different among each other (Table 1). Highest number of root per plant (4.06) was found in SP-360 that was non-significant with the germplasms, SP 271(3.63), SP 560 (3.69). Significantly, lowest root per plant (2.3) was found in the germplasm SP 305. The range of the number of root per plant in all the germplasms was in between 2.46- 4.06. The highest individual root weight per plant was found in SP-368 (101.8 g) followed by SP-264(100.0 g) which were at par with some other germplasms. The highest root weight per plant was found in SP-360 (303.3 g) because of its higher number of root per plant, which was significantly higher than the germplasms SP 305 (177.0 g) and SP330 (176.3 g). The highest root weight per plot was found in BARI SP 6 (3350 g) which was significantly higher than germplasm SP 305 (1416 g) and SP 330 (1411 g). The highest yield (12.43 t ha^{-1}) was found in the BARI SP 6 which was at par with SP 264 (11.20 t ha^{-1}), SP 560 (10.82 t ha^{-1}), BARI SP 7 (10.53 t ha^{-1}), because of their comparatively higher number of root per plant and individual root weight than the other germplasm. Sweet potato is a familiar crop to the farmers of saline area. However, all the germplasms showed comparatively lower yields than that of expected yield because of the high salinity of the field, which was the main reason of plant mortality and to retard the crop growth. It was observed that dark colored roots mortality is lower and liked by the farmers as well as the buyers.

Data related to soil salinity and plant survivability at different plant growth stages have been presented in Table 2. It was observed that salinity and plant survivability were related reversely. At planting time of cuttings precautions were taken to set each and every variety in almost similar salinity level of the replications. But salinity varied in wide range because salinity of the soil in the field in a few centimeters might change and which could not be controlled. Therefore, several data related to salinity and plant survivability were recorded from each replication. It was observed that, the plant mortality percentage of cuttings was higher in the vegetative stage (10-45%). It was also observed that, that in vegetative stage plant could mostly survive (75-90%) with the salinity level of 1.5 to 6.5 dS/m. With the passing of time plant growth advance, canopy started to cover the soils and in some sporadic areas salinity reduced. In the canopy covered situation and maturity stage salinity could not adversely affect the crop and survivability percentage was more or less static after vegetative stage. At harvesting time it was found that, the highest number of (85%) vines survived in germplasms SP 498 followed by the germplasms, SP 166, BARI SP 6 and BARI SP 7 (70% survivability). The lowest survivability (50%) was found in the germplasm SP 305. All the germplasms and varieties gave very poor growth as well as yield because of high salinity and lack of moisture in the soil along with high plant mortality percentage.

Satkhira

The highest tuber yield was found in SP-498 (41.44 t/ha) (Table 3). It was due to higher number tuber, maximum tuber weight/plant as well as high plant population per square meter. The lowest yield was found in SP-305 (18.96t/ha) because of lower plant population and lower tuber weight. SP-213, gave the highest yield next to SP-498 which followed by SP-213 (37.48t/ha), SP-560 (36.59t/ha), SP-264 (35.71t/ha), SP-368 (34.39t/ha), SP-271 (34.30t/ha) and SP-360 (33.95t/ha). During the period the salinity range was 2.35 to 12.08dS/m.

Patuakhali

Root yield varied significantly due to genetic characteristics (Table 4). The highest root yield (16.0 t/ha) was obtained from BARI SP-7 followed by SP-330. All the varieties produced more or less closer root yield except SP-271, SP-360 and SP-368. However, as the trial is a part of salt tolerant variety development the trial should be continued for the next year in different farmers' field.

Farmer's Reaction-Noakhali

- Fond of dark colored and even sized sweet potato, which have high market value.
- Closer line spacing (50 cm line to line) could be helpful for canopy coverage as well as to reduce salinity.
- Want block production

Farmers Reaction-Satkhira

Among the lines, farmers liked SP-264 and SP-498 due to its higher production. Farmers also preferred red colored sweet potato for its sweetness and low dry matter.

Conclusion

This is the first year experiment, so it is very difficult to draw any rigid conclusion about performance of variety/germplasm against salinity. It should be repeated in the next year for further study.

Table 1. Yield & yield contributing characteristics with the root colour of Sweet Potato germplasms at Noakhali, rabi, 2007-08

Name of germplasm	No. of roots/plant	Individual root weight (g)	Root weight/ plant (g)	Root weight/plot (g)	Root yield (t/ha)	Root colour
SP 166	2.53	71.3	180.3	2164	8.02	Light orange
SP 213	2.46	92.0	220.0	2200	8.15	Brown to red
SP 264	2.97	100.0	302.3	3023	11.20	Red
SP 271	3.63	62.3	238.7	2625	9.72	Cream to red
SP 305	2.30	79.0	177.0	1416	5.24	Cream
SP 330	2.50	71.6	176.3	1411	5.22	White
SP 360	4.06	74.3	303.3	2730	10.11	Red
SP 368	2.53	101.7	253.0	2277	8.43	Cream
SP 498	2.93	70.7	211.7	2752	10.19	Red
SP 560	3.60	76.3	278.3	2923	10.82	Cream
BARI SP 6	3.50	81.7	279.7	3356	12.43	Light orange
BARI SP 7	3.14	76.0	237.0	2844	10.53	Red
CV (%)	12.96	18.20	16.85	18.69	18.60	
LSD (0.05)	1.11	24.59	108.30	1203	2.45	

Table 2. Plant survival characteristics against different salinity level at different stages of sweet potato, FSRD site, Hazirhat, Noakhali, rabi, 2007-08.

Name of germplasm	20 DAT		☆40 DAT		60 DAT		80 DAT		At Harvest	
	Salinity (dS/m)	Survived plant (%)	Salinity (dS/m)	Survived plant (%)	Salinity (dS/m)	Survived plant (%)	Salinity (dS/m)	Survived plant (%)	Salinity (dS/m)	Survived plant (%)
SP 166	1.5-5.5	85	1.4-3.2	85	2.6-6.4	80	1.7-3.7	80	3.6-7.5	70
SP 213	1.3-6.8	70	1.5-5.7	70	2.0-6.2	65	2.3-5.9	65	3.5-8.9	65
SP 264	1.2-6.2	70	1.2-1.6	70	1.7-2.3	70	2.1-8.5	65	4.1-8.75	65
SP 271	4.3-8.8	75	1.3-2.7	75	3.7-8.2	75	3.5-6.3	75	3.8-8.9	75
SP 305	1.4-13.4	55	1.3-3.8	55	2.7-9.2	50	2.5-12.7	50	3.4-10.2	50
SP 330	1.2->20	65	2.0-13.7	60	2.5-14.5	55	2.8-9.0	55	4.5->20	55
SP 360	1.2->20	65	1.4-5.7	65	3.2-14.0	60	3.2-14.7	60	4.2->20	60
SP 368	1.6-14.7	70	1.7-6.8	60	2.6-16.4	60	2.9-10.0	60	4.5-10.1	60
SP 498	1.7-9.3	90	1.7-4.7	90	3.5-15.6	85	2.8-12.7	85	4.5-10.3	85
SP 560	2.1-6.6	85	1.8-4.3	80	2.7-8.4	75	2.5-13.5	75	4.4-10.3	75
BARI SP 6	2.2-6.68	90	1.4-3.6	90	4.4-13.7	80	4.9-8.0	80	7.5->20	70
BARI SP 7	1.74-9.4	85	1.3-5.2	85	4.9-12.7	80	5.5-17.7	80	4.1-12.2	70

40 DAT : Salinity level was reduced because of sudden thundershower and rainfall

Table-3. Yield and yield influencing characters of sweet potato at MLT site, Satkhira, 2007-08.

Variety/line	Plant popn/m^2	Vine length (cm)	No. of roots/plants	Root wt./plant (g)	Root yield (t/ha)	Root colour
BARI SP-6	4.85 a	208.00 ab	5.20 ab	857.33 bcd	29.10 bcd	Cream
BARI SP-7	4.94 a	243.13 a	5.07 abc	88.67 bcd	28.66 bcd	Deep red
SP-166	4.40 a	203.26 ab	3.40 c	768.00 d	28.83 bcd	Pink
SP-213	4.58 a	176.00 ab	6.00 ab	1238.00 ab	37.48 ab	Brown
SP-264	4.32 a	214.67 ab	5.47 ab	1054.67 abcd	35.71 abc	Red
SP-271	4.53 ab	193.33 ab	5.13 ab	1148.00 abcd	34.30 abc	Cream
SP-305	2.38 b	175.61 ab	4.40 bc	813.33 cd	18.96 d	Cream
SP-330	3.41 ab	154.40 b	4.27 bc	1102.00 abcd	25.57 cd	White
SP-360	4.23 a	190.60 ab	5.40 ab	1243.33 ab	33.95 abc	Red
SP-368	3.79 ab	218.20 ab	5.67 ab	1160.00 abc	34.39 abc	Red
SP-498	4.76 a	257.26 a	6.46 a	1364.67 a	41.44 a	Brown
SP-560	4.58 a	250.33 a	5.80 ab	1013.33 abcd	36.59 abc	Red
LSD (0.05)	1.37	74.21	1.55	339.30	9.80	--
CV(%)	19.40	21.17	17.66	19.01	18.04	--

Salinity range: 2.35 to 12.08dS/m.

Table 4. Yield and yield attributes of sweet potato germplasm against salinity at Kuakata, Patuakhali, 2007-08.

Germplasm	No. of roots/plant	Average root wt. (g)	Root yield (t/ha)
SP-213	3	75	11.8 c
SP-271	2	90	9.9 d
SP-266	3	80	11.5 c
SP-305	3	73	11.0 cd
SP-360	3	67	8.6 e
BARI SP-7	3	117	16.0 a
SP-560	3	83	11.7 c
SP-498	3	90	12.7 bc
SP-330	3	102	14.1 b
SP-368	2	75	8.6 e
CV (%)	-	-	11.24

Table 5. Salinity levels of experimental plots at MLT site, Kuakata, Patuakhali in rabi, 2007-2008

Date	Salinity level (dS/m)	Date	Salinity level (dS/m)
31.12.2007	2.58	15.03.2008	5.02
15.01.2008	3.10	30.03.2008	5.54
02.02.2008	3.62	15.04.2008	5.93
15.02.2008	3.95	30.04.2008	6.30
01.03.2008	4.43		

Table 6. Mean root yield (t/ha) of sweet potato in three saline affected areas of Bangladesh, rabi, 2007-08

Line/variety	Location			Mean root yield
	Noakhali	Satkhira	Patuakhali	
SP 166	8.02	28.83	11.5	16.12
SP 213	8.15	37.48	11.80	19.14
SP 264	11.20	35.71	-	23.45
SP 271	9.72	34.30	9.90	17.97
SP 305	5.24	18.96	11.0	11.73
SP 330	5.22	25.57	14.1	14.96
SP 360	10.11	33.95	8.6	17.55
SP 368	8.43	34.39	8.6	17.14
SP 498	10.19	41.44	12.7	21.44
SP 560	10.82	36.59	11.7	19.70
BARI SP 6	12.43	29.10	-	20.76
BARI SP 7	10.53	28.66	16.0	18.39

On-Farm Adaptive Trial of Improved Varieties of Sweet Potato

Abstract

On farm performance of sweet potato varieties namely , BARI SP-4, BARI SP-5, BARI SP-6, BARI SP-7 were evaluated against the farmers' local variety at Hossainpur MLT site, Kishoreganj, Melandah-Jamalpur, Devidar-Comilla and Noakhali during *rabi* 2007-2008. Averaged over locations the highest root yield (27.27 t/ha) was produced by BARI SP-7. Local variety produced the lowest tuber yield (15.55 t/ha). The highest gross return and benefit cost ratio were also obtained from BARI SP-7 . However, the Local variety was better in respect of storability and taste.

Introduction

Sweet potato, a carbohydrate rich root crop can be used as a substitute of cereals in Bangladesh to meet up the food shortage. Generally, poor people are the consumers of sweet potato. It is the main source of carbohydrate and carotene for their survival. Generally, farmers cultivated local variety of sweet potato which are low yielder and contain less carotene. Bangladesh Agricultural Research Institute (BARI) has developed four sweet potato varieties viz. BARI sweet potato-4 , BARI sweet potato-5, BARI sweet potato-6, BARI sweet potato-7 which have high yield potentiality and also contain higher amount of carotene. These varieties need to be evaluated at farmers' level. Keeping the view, the experiment was undertaken to evaluate their performance of recently developed sweet potato varieties developed by BARI compared to local variety.

Materials and Methods

The experiment was conducted at Hossainpur MLT site, Kishoreganj, Malancha MLT site, Melandah-Jamalpur and Devidar MLT site, Comilla and Hazirhat, Noakhali during *rabi* 2007-2008. Four varieties viz. BARI SP-4, BARI SP-5, BARI SP-6 BARI SP-7 were evaluated against the farmers' local variety, however, Noakhali additional two lines (SP-271 and SP-560) were included It was laid out in randomized complete block design with four replications. The unit plot size was 6 m× 6 m. The vine was planted at the spacing 40 x 30 cm. The crop was fertilized with 70 – 25 - 88 kg/ha of NPK respectively. Half of urea and all others fertilizers were used at final land preparation. Remaining part of N fertilizer was applied at the side of the row in two equal splits at 30 & 60 DAT. The vines were planted on 19 November/ 07 at Kishoreganj, 15 November/07 at Jamalpur and 13 December/07 at Comilla . One weeding and earthing up was done after 30 DAT. There was no remarkable disease and pest attack. The crop was harvested variety wise on 7 April/ 08 at Kishoreganj, 30 April/08 at Jamalpur and 5 May/08 at Comilla.. Data of yield components were collected from 10 plants selected at random in each plot and tuber yield was recorded plot wise. The collected data were analyzed statistically.

Result and Discussion

Kishoreganj

The result showed that vine length/plant, weight of tuber/plant and tuber yields was significantly different in sweet potato varieties (Table1). The higher vine length/plant was recorded from variety BARI SP-6 which was statistically at par BARI SP-7. Local variety produced statistically shorter vine length (106 cm). All varieties produced identical tuber wt./plant except local variety. Highest tuber yield (31.08 t/ha) was obtained from BARI SP-7 followed by BARI SP-6. BARI SP-7 gave the higher tuber yield due to higher number of tubers/plant and tuber weight/plant. While the farmers' variety gave the lowest tuber yield (19.40 t/ha) due to lower number of tuber/plant and tuber weight/plant.

The highest gross return (TK.186480/ha) and benefit cost ratio (4.49) was calculated from BARI SP-7, which was close to BARI SP-6. The local variety gave the lowest gross return due to lower yield than BARI developed varieties.

Jamalpur

It was observed that all the yield contributing character viz. branches/plant, tuber/plant, tuber weight/plant, tuber length, tuber breadth and tuber yield were influenced due to variety (Table 3). The results showed that BARI varieties were better than local variety. The highest tuber yield was obtained from BARI SP 7 (33.16 t/ha) and it was statistically similar to BARI SP 4 (31.00 t/ha). BARI SP 5 gave the second highest tuber yield (26.66 t/ha). Among the all BARI varieties, BARI SP 6 gave the lower yield (20.33 t/ha). Local variety gave the lowest tuber yield. (14.16 t/ha). The highest gross margin (88,340.00 Tk/ha) as well as highest benefit cost ratio (2.99) was obtained from BARI SP 7.

Comilla

Significant variation was observed in respect to tuber weight/plant and root yield (Table 5). But there are no significant differences in number of tuber/plant. Highest root weight/plant (403.3 gm) was recorded from the variety BARI SP-7, which was statistically similar BARI SP-4 (373.3 gm) and BARI SP-5 (336.7 gm). Highest root yield (21.06 t/ha) was obtained from the variety BARI SP-7 which was statistically differ from the other variety. Highest yield was found from BARI SP-7 because it produced the highest root weight/plant. BARI SP-6 gave the lowest yield (14.24 t/ha) due to the lowest root weight (273.33 gm), and that was identical to local variety.

Noakhali

Yield and yield performance of sweet potato varieties are presented in Table 1. Higher number of root per plant (4.67) was found in BARI sweet potato-6 that was statistically identical with BARI sweet potato-7 (4.53). The lowest number of root per plant was recorded in local variety (2.67). The highest root weight per plant was found in BARI sweet potato-6 (428.7g) that was statistically different from all varieties of BARI, two lines and local variety. Higher root yield was showed by BARI sweet potato-6 (23.79 t/ha), which was statistically equal to all other BARI varieties except BARI sweet potato -2 . The lowest root yield was recorded in local variety (13.47 t/ha), which was statistically different from other variety.

Farmer’s reaction-Kishoreganj

BARI varieties are more profitable than local variety due to higher yield. But local variety had better keeping quality than BARI released varieties when preserved under normal condition. Farmers, showed interest to cultivate BARI sweet potato-7 due to its higher yield. Already 12 neighboring farmers’ collected vine/sweet potato of BARI SP-7 from our cooperator farmer to cultivate BARI SP-7 in the next season. Farmers’ also opined that there was no incidence of insect and diseases in the new varieties.

Farmers' reaction-Jamalpur

BARI SP 7 was accepted by the farmer because of white colour like the local, higher yielder and was not soft after boiling. The local variety had better storage quality. The BARI varieties may be harvested few days earlier than the local varieties. But it is very difficult to keep the crop in the field at the mature stage because of sweetness. It had lower market price than the local.

Farmer’s reaction-Comilla

The farmers opined that BARI released varieties are less superior to local variety in respect of market value and taste.

Farmer’s reaction-Noakhali

The yield of BARI varieties is higher than that of local variety. But these varieties are less tasty than the local variety. Their size and color are not so attractive. Nevertheless their storability and market prices are less than local variety.

Conclusion

For getting higher benefit BARI SP-6 and BARI SP-7 can be grown at farmers' field. But creating local demand and to popularize of BARI variety, motivation work would be fruitful for sustaining these variety at farmers field. Beside these, BARI, TCRC should give attention to develop variety (s) whose size would be reasonably small, the quality is better than local variety in respect of yield, sweetness, keeping and boiling quality.

Table 1: Yield and yield components of sweet potato varieties at Hossainpur MLT site, Kishoreganj during *rabi* 2007-08

Variety	Vine length/plant (cm)	Root/plant (no.)	Root wt./plant (g)	Root yield (t/ha)
BARI SP-4	126	5.96	403	24.86
BARI SP-5	163	6.34	397	25.47
BARI SP-6	202	6.62	486	29.41
BARI SP-7	182	6.81	511	31.08
Local (Check)	106	4.11	229	19.40
LSD (5%)	10.26	1.17	43.53	2.02
CV (%)	13.58	13.56	14.08	10.15

Table 2: Cost and return analysis of sweet potato varieties developed by BARI tested at Hossainpur MLT site, Kishoreganj during *rabi* 2007-08

Variety	Gross return (Tk/ha)	Cultivation cost (Tk/ha)	Gross margin (Tk/ha)	Benefit cost ratio (BCR)
BARI SP-4	149160	41505	107655	3.59
BARI SP-5	152820	41505	111315	3.68
BARI SP-6	176460	41505	134955	4.25
BARI SP-7	186480	41505	144985	4.49
Local	100800	41505	59295	2.43

Price BARI sweet potato Tk. 6/kg, Local Tk. 7/kg

Table 3. Effect of different varieties on yield and yield components of sweet potato at MLT site, Malancha, Melandah, Jamalpur during rabi 2007-08

Treat	Branches/ plant (no.)	Leaves/ plant (no.)	Root/ plant (no.)	Root wt /plant (kg)	Root length (cm)	Root breath (cm)	Root yield (t/ha)
BARI SP 4	26.46 b	217.93	8.16 a	604.16 ab	12.53 a	5.43 ab	31.00 a
BARI SP 5	23.73 bc	171.73	6.91 b	541.66 b	11.27 ab	5.25 b	26.66 b
BARI SP 6	17.46 c	148.73	3.33 c	380.00 c	10.36 bc	5.18 b	20.33 c
BARI SP 7	19.53 bc	159.33	6.00 b	628.33 a	12.46 a	6.17 a	33.16 a
Local	37.40 a	185.73	2.66 c	280.00 d	8.62 c	4.79 b	14.16 d
F	**	NS	**	**	*	*	**
CV (%)	12.50	11.59	8.06	7.87	8.72	7.50	9.45

Table 4. Economic performance of sweet potato varieties developed by BARI at MLT Site, Malancha, Melandah, Jamalpur during 2007-08

Variety	GR (Tk/ha)	TVC (Tk/ha)	GM (Tk/ha)	BCR
BARI Sweet Potato 4	1,24,000.00	44,300.00	79,700.00	2.79
BARI Sweet Potato 5	1,06,640.00	44,300.00	62,340.00	2.40
BARI Sweet Potato 6	81,320.00	44,300.00	37,020.00	1.83
BARI Sweet Potato 7	1,32,640.00	44,300.00	88,340.00	2.99
Local	70,800.00	44,300.00	26,500.00	1.59

Price of product: Tk.5.00/kg (local), Tk.4.00/kg (BARI varieties)

Table 5. Yield and yield attributing characters of sweet potato varieties at Devidar, Comilla, rabi, 2007-08

Variety	No. of Root/Plant	Root weight/Plant (gm)	Yield (t/ha)
BARI SP-4	4.1	373.33 a	18.52 b
BARI SP5	3.9	336.67 ab	17.13 bc
BARI SP-6	3.3	273.33 b	14.24 d
BARI SP-7	4.5	403.33 a	21.06 a
Local	3.9	283.33 b	15.16 cd
CV (%)	17.51	10.59	7.33
LSD (5%)	NS	66.61	2.377

Table 6. Root Yield and yield attributes of Sweet Potato as influenced by different varieties at FSRD site, Hazirhat, Noakhali during 2007-08

Variety	No. of root/plant	Root wt/plant (g)	Root yield (t/ha)
BARI sweet potato-2	3.03	337.7	18.61
BARI sweet potato-4	3.43	391.0	20.85
BARI sweet potato-5	4.20	411.7	22.98
BARI sweet potato-6	4.67	428.7	23.79
BARI sweet potato-7	4.53	424.7	23.51
SP 271	3.40	391.3	21.48
SP 560	2.87	379.7	20.50
Local variety	2.67	308.3	13.47
CV (%)	13.42	5.10	7.70
LSD (0.05)	0.845	34.33	2.784

Table 7. Mean root yield (t/ha) of sweet potato in four locations during rabi season of 2007-08

Variety/Line	Location				Mean root yield
	Kishoreganj	Jamalpur	Comilla	Noakhali	
BARI SP-4	24.86	31.00	18.52	18.61	23.25
BARI SP-5	25.47	26.66	17.13	20.85	22.53
BARI SP-6	29.41	20.33	14.24	22.98	21.74
BARI SP-7	31.08	33.16	21.06	23.79	27.27
Local	19.40	14.16	15.16	13.47	15.55
SP-271	-	-	-	21.48	-
SP-560	-	-	-	20.50	-

On-Farm Adaptive Trial of Improved Stolon Producing Panikachu Varieties/Lines

Abstract

The experiment was conducted at Kishoreganj, Noakhali, Narsingdi, Narail, Magura, Comilla and Sylhet during *kharif* 2007. The variety Latiraj and line PK-176 were studied to compare with the local variety. Averaged over locations Latiraj produced the highest stolon yield (24.96 t/ha) followed by Local variety (18.20 t/ha), while PK-176 gave the lowest stolon yield (16.64 t/ha). In case of rhizome production, PK-176 gave the highest average yield (24.23 t/ha) followed by Local variety.

Introduction

Panikachu is an important edible aroid in Bangladesh and it contributes to the total supply of bulky vegetables during the summer when the vegetable becomes scarce in the market. It also plays an important role in the daily diet in other countries of the world. It compares favorably in terms of nutritional value with other root crops, such as cassava, yam, sweet potato and other edible aroids. It has export market in many parts of the world. Such important vegetables need improvement in variety aspects. Monitoring of cultivation practices of Panikachu revealed that all the farmers got very poor yield by using local varieties. Recently, Bangladesh Agricultural Research Institute (BARI) has developed high yielding variety of panikachu, viz. Latiraj, and some promising lines were also found. All those lines along with Latiraj variety needs to be verified at farmers field for its yield potential and acceptability.

Materials and Methods

The study was conducted at Katiadi MLT site, Kishoreganj, Noakhali, Narsingdi, Narail, Magura, Comilla and Sylhet during February to September 2007. The experiment was laid out in RCB design with five dispersed replications. The unit plot was 10 m × 10 m. The seedling were planted 23 February/07 at Kishoreganj, 11-14 March/07 at Noakhali, 15-18 February/07 at Narsingdi, 7 February/07 at Narail and Magura, 18 December/06 at Comilla and 10 February/07 at Sylhet maintaining the spacing of 60 cm × 45 cm. Fertilizers were applied at the rate of 5 ton cowdung and 70-25-85 kg/ha of NPK, respectively. All fertilizers were applied during final land preparation and urea was applied in two equal splits at 45 and 90 DAT. Irrigation and weeding was done properly. Harvesting started from 1st week of May and continued up to September, 2007 with an interval of 7-10 days. Data on yield and yield contributing characters were recorded and analyzed statistically. Data related to cost and return and farmers' reaction were also recorded. Economic analysis was done on the basis of prevailing market price of input and out. (Reddy and Reddi, 1992).

Result and Discussion

Kishoreganj

All the yield and yield contributing characters of Panikachu varieties/line varied significantly (Table 1). Number of stolon/plant, length of stolon, weight of stolon/plant and stolon yield were significantly highest in Latiraj but weight of rhizome/plant, diameter of rhizome, length of rhizome and rhizome yield were highest in Pk-176. However, weight of rhizome/plant, length of rhizome and yield of Pk-176 and local were statistically identical. Stolon yield of local variety was the lowest (15.18 t/ha) but the rhizome yield was the lowest 18.55 (t/ha) in Latiraj. However, the variety Latiraj gave significantly the highest 22.36 (t/ha) stolon yield but Pk-176 produced the highest rhizome yield (29.45 t/ha), which was statistically identical to local variety. The result clearly indicated that Latiraj is better for stolon production followed by Pk-176 but both Pk-176 and local varieties are better for rhizome production.

The Panikachu line PK-176 gave the highest gross return (TK. 335550 /ha), gross margin (TK. 290989/ha) and benefit cost ratio (7.53) due to higher rhizome yield and good stolon yield. The gross return and gross margin of PK-176 was 11 and 16 % higher than Latiraj and local. Local variety gave the lowest gross return (Tk.279050/ha) gross margin (Tk. 235389/ha) and benefit cost ratio (6.26) due to low yield potential. Latiraj variety also gave higher benefit cost ratio (BCR) than local variety due to higher rhizome yield as well as reasonable stolon yield.

Noakhali

All the yield-contributing characters of Panikachu varieties varied significantly (table 3). The highest plant height was observed in PK-176 (148.0 cm). Number of stolon/plant (16.7), length of stolon (71.1 cm), weight of stolon/plant (648.0 g) and stolon yield (23.97 t ha^{-1}) were significantly highest in Latiraj variety but length of rhizome (27.0 cm) and rhizome yield (23.56 t ha^{-1}) was highest in local 1 (Hollakachu) variety. Stolon yield of local 1 (Hollakachu) variety was the lowest (12.97 t ha^{-1}) and the lowest rhizome yield (12.21 t ha^{-1}) was found in local 2 (Thollakachu). However, the Latiraj gave significantly the highest (23.97 t ha^{-1}) stolon yield but highest rhizome yield (23.56 t ha^{-1}) was obtained from local 1 (Hollakachu) variety. The result clearly indicated that Latiraj is better for stolon followed by PK176 but local variety is better for rhizome production.

From Table 4, it is evident that the Panikachu variety Latiraj gave the highest gross return (Tk.340400/ha), gross margin (Tk.285150/ha) and benefit cost ratio (6.16) due to higher stolon and rhizome yield. Local 2 (Thollakachu) gave the lowest gross return (218640 Tk/ha), gross margin (163390 Tk/ha) and benefit cost ratio (3.95).

Narsingdi

All the yield and yield contributing characters of Panikachu varieties varied significantly (Table 5). Number of stolen/plant , length of stolon, weight of stolen/ plant and stolon yield were significantly highest in Latiraj but plant height, length of rhizome, diameter of rhizome and rhizome yield were highest in local variety. The stolon yield of local variety was the lowest (14.71 t/ha). However, the Latiraj gave significantly the highest stolon yield (24.84 t/ ha) but highest rhizome yield (25.67 t/ha) was obtained from local variety. Among the three tested variety/lines, Latiraj gave the highest gross return (Tk.321966/ha), gross margin (Tk.278166/ha) and benefit cost ratio (7.35). The lowest benefit cost ratio (4.9) was found in local variety. The total variable cost was Tk. 43800/ha for all the varieties/lines.

Narail and Magura

Latiraj produced the highest yield at both MLT site (Table 7 and 8). PK-176 produced the lowest yield at MLT site, Tularampur-Narail whereas the local variety produced the lowest yield at MLT site, Shalikha-Magura. Higher yield from Latiraj was due to higher yield contributing characters.

Comilla

Stolon yield was highest in Latiraj (35.18 t/ha) because number of stolon/plant (28.07), length of stolon (80.20 cm) and weight of stolon (35.77 g) was higher in Latiraj (Table 9). The variety local produced the tallest plant (145.93 cm). After the completion of harvesting the plant was uprooted and cut into the upper portion of rhizome and lower portion of leaves and it was preserved for next year for using as seedling because that type of seedling produced comparatively earlier stolon than that of 40 day old sucker resulting in higher production.

Sylhet

The lowest yield (12.96 t/ha) was obtained from local cultivar (Table 10). All the yield contributing characters like plant height, no. of stolon/ plant, length of stolon, diameter of stolon and weight of stolon/plant were highest in Latiraj variety compared to local one. That’s why it gave higher stolon yield than the local Panikachu cultivar. For this reason this variety should be cultivated as commercial basis in Sylhet region.

Farmer's reaction at Kishoreganj

Farmers' are very much interested to grow the line PK-176 for its dual production of stolon and rhizome. Though Latiraj gave better stolon yield but its rhizome quality and yield was not satisfactory. The farmers preferred the rhizome quality of PK-176 and Kishoreganj local. Already 13 neighboring farmers' collected PK-176 rhizome from our cooperator farmers and they cultivate kharif, 2008. Farmers' also opined that there was no incidence of insect and diseases in the new varieties.

Farmers' reaction-Narsingdi

Farmers showed greater interest to grow Latiraj for higher yield.

Farmers' reaction-Jessore

Farmers are more satisfied with the yield of Latiraj comparing with others.

Farmers Reaction-Comilla: Farmers are highly interested to grow Latiraj due to its higher stolon yield and quality of stolon.

Farmers reaction-Sylhet

1. Farmers opined that Latiraj is a good variety in terms of production.
2. They expressed that they are willing to cultivate Latiraj as a commercial basis

Conclusion

For stolon production Latiraj performed well. but for getting higher benefit PK-176 (due to stolon as well as higher rhizome yield) can be grown at farmers' field. But creating local demand and to popularize of BARI variety, motivation work would be fruitful for sustaining these varieties at farmers field. Besides these, TCRC should give attention to develop another variety whose size and quality of rhizome would be better than local variety.

Reference

Reddy, T Y and G H S Reddi, 1992. Principles of Agronomy, Kalyani publishers. New Delhi-110002, India. p. 423.

Table 1. Yield and yield contributing characters of panikachu at Katiadi MLT site, Kishoreganj during kharif, 2007

Varieties	Stolon / plant (no.)	Stolon length (cm)	Stolon wt./plant (g)	Rhizome wt. /plant (g)	Rhizome diameter (cm)	Rhizome length (cm)	Stolon yield (t/ha)	Rhizome yield (t/ha)
Latiraj	29.52	67.12	690	365	23.14	37.22	22.36	18.55
PK-176	24.33	57.40	546	880	29.34	48.62	18.83	29.45
Local	23.81	50.64	495	850	26.75	46.12	15.18	26.43
LSD (0.05)	2.98	8.78	56.92	36.19	1.68	2.79	2.66	3.12
CV (%)	11.23	10.07	11.20	12.91	9.76	9.25	12.03	11.32

Table 2. Cost and benefit analysis of panikachu at Katiadi MLT site, Kishoreganj during kharif, 2007

Varieties	Gross return (Tk/ha)	Cultivation cost (Tk/ha)	Gross margin (Tk/ha)	Benefit cost ratio (BCR)
Latiraj	297800	44561	253239	6.68
PK-176	335550	44561	290989	7.53
Local	279050	44561	235389	6.26

Price: Stolon of all varieties Tk.10 / kg, Rhizome of Latiraj Tk 4/kg, Rhizome of Pk-176 & Local Tk 5/kg

Table 3. Yield and yield contributing characteristics of stolon producing Panikachu varieties during Kharif season of 2007 in Noakhali

Variety	Plant height (cm)	Stolon plant^{-1} (no.)	Length of stolon (cm)	Weight of stolon plant^{-1} (g)	Yield of stolon (t ha^{-1})	Length of rhizome (cm)	Weight of rhizome plant^{-1} (g)	Yield of rhizome (t ha^{-1})
Latiraj	134.6	16.7	71.1	648.0	23.97	19.9	502.3	18.58
Local 1 (Hollakachu)	142.7	11.5	45.8	350.8	12.97	27.0	799.1	23.56
PK-176	148.0	12.5	55.3	430.9	15.94	15.0	338.2	12.51
Local 2 (Thollakachu)	117.7	13.2	55.9	408.6	15.12	14.2	330.3	12.21
LSD (0.05)	15.00	1.103	8.376	87.22	3.230	6.203	152.9	5.655
CV (%)	5.53	4.11	7.35	9.50	9.51	16.31	15.54	15.54

Table 4. Cost benefit analysis of Panikachu varieties during Kharif season of 2007 at Noakhali

Varieties	Gross return (Tk/ha)	∗TVC (Tk/ha)	Gross margin (Tk/ha)	☆BCR
Latiraj	340400	55250	285150	6.16
Local 1 (Holla kachu)	292240	55250	236990	5.28
PK-176	227600	55250	172350	4.11
Local 2 (Tholla kachu)	218640	55250	163390	3.95

∗TVC : Total Variable Cost, ☆BCR: Benefit Cost Ratio, N.B. Market Price: Stolon : 8 Tk/kg, Rhizome : 4 Tk/kg

Table 5. Yield and yield contributing characters of stolon producing panikachu varieties at Shibpur, Narsingdi during kharif season of 2007

Variety	Plant height (cm)	Stolon/ plant (no.)	Length of stolon (cm)	Weight of stolon/ plant (g)	Yield of stolon (t/ha)	Length of rhizome (cm)	Diameter of rhizome (cm)	Yield of rhizome (t/ha)
Latiraj	79.07	30.93	75.33	706.83	24.84	30.07	16.60	14.71
PK-176	75.53	21.27	45.60	337.17	11.87	33.33	21.33	19.69
Local	103.07	16.93	38.93	245.80	08.64	37.47	21.67	25.67
LSD(0.05)	2.56	2.39	6.12	34.80	1.50	1.14	2.01	0.38
CV (%)	1.32	4.57	5.07	3.57	4.39	1.49	4.46	0.84

Table 6. Cost and return analysis of panikachu varieties during kharif season of 2007, at Shibpur, Narsingdi

Variety	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)	BCR
Latiraj	321966	43800	278166	7.35
PK-176	217105	43800	173360	4.96
Local	214780	43800	170980	4.90

Price (Tk./kg): Stolon: 10 & Rhizome : 5

Table 7: Performance of yield and yield contributing characters of panikachu at MLT site, Tularampur, Narail during 2006-07

Variety/ lines	Stolon/plant (no.)	Length of stolon (cm)	Weight of stolon/ plant (g)	Yield/ plot (kg)	Yield (t/ha)
Latiraj	26.20	67.00	730	292	27.03
PK-176	19.20	44.30	567	226.8	21.00
Local	28.60	55.10	718	287.2	26.59

Table 8: Performance of yield and yield contributing characters of panikachu at MLT site, Shalikha, Magura during 2006-07

Variety/ lines	Stolon/plant (no.)	Length of stolon (cm)	Weight of stolon/plant (g)	Yield/ plot (kg)	Yield (t/ha)
Latiraj	25.8	65.00	590	236	21.85
PK-176	23.4	52.00	500	200	18.51
Local	19.6	45.00	420	168	15.55

Table 9. Yield and yield contributing characters of panikachu varieties at Devidar, Comilla, 2007

Variety	Plant height (cm)	No. of Stolon/Plant	Length of stolon (cm)	Diameter of stolon (cm)	Weight of Stolon (g)	Yield (t/ha)
Latiraj	137.33	28.07	80.20	0.650	35.77	35.18
Local	145.93	27.27	79.93	0.641	33.82	32.58

Table 10. Performance of different Panikachu variety at FSRD site, Jalalpur, Sylhet, 2007-08

Variety	Plant height (cm)	No. of stolon/ plant	Length of stolon (cm)	Diameter of stolon (cm)	Wt of stolon/plant (gm)	Yield of stolon (ton/ha)	Gross Return Tk/ha
Latiraj	60.72	22.77	91.82	0.62	590	19.47	233640
Local	45.2	15.2	75.2	0.42	350	12.96	155520

Table 11. Mean stolon yield (t/ha) of Panikachu in seven locations, rabi, 2007-08

Line/variety	Location							Mean stolon yield
	Kishoreganj	Noakhali	Narsingdi	Narail	Magura	Comilla	Sylhet	
Latiraj	22.36	23.97	24.84	27.03	21.85	35.18	19.47	24.96
PK-176	18.83	12.97	11.87	21.00	18.51	-	-	16.64
Local	15.18	15.94	08.64	26.59	15.55	32.58	12.96	18.20
Local-2	-	15.12	-	-		-	-	-

Table 12. Mean Rhizome yield (t/ha) of Panikachu in seven locations, rabi, 2007-08

Line/variety	Location							Mean stolon yield
	Kishoreganj	Noakhali	Narsingdi	Narail	Magura	Comilla	Sylhet	
Latiraj	18.55	18.58	14.71	-	-	-	-	17.28
PK-176	29.45	23.56	19.69	-	-	-	-	24.23
Local	26.43	12.51	25.67	-	-	-	-	21.54
Local-2	-	12.21	-	-	-	-	-	-

On-Farm Adaptive Trial of Improved Varieties/Lines of Mukhikachu

Abstract

The experiment was conducted at Kendua MLT site, Netrakona, Bogra, Jhenaidah, Jessore, Bandarban and Sylhet during Kharif-1 2007 to compare the yield performance of improved varieties/lines with the local variety. Averaged over locations the advance line MK-140 produced the highest yield (27.34 t/ha) while local variety gave the lowest yield (17.88 t/ha). The line MK-140 was preferred by the farmers' due to its higher yield, good shape and better boiling quality than local variety.

Introduction

Mukhikachu (*Colocasia esculenta*) is an important edible aroid in Bangladesh and it contributes remarkable to the total supply of bulky vegetables during the summer when the vegetable becomes scarce in the market. It also plays an important role in the daily diet in other countries of the world. It compares favorably in terms of nutritional value with other root crops, such as cassava, yam, sweet potato and other edible aroids. Such important vegetables need improvement in variety aspects. Monitoring of cultivation practices of Mukhikachu revealed that all the farmers got very poor yield by using local varieties. Bangladesh Agricultural Research Institute (BARI) has already developed high yielding variety of Mukhikachu, viz. Bilashi, and some promising lines were also found. All those lines along with Bilashi variety needs to be verified at farmers field for to test its yield potential under farmer's condition.

Materials and Methods

The study was conducted at farmers' field of Batta village under Kendua MLT site, Netrakona , Shibganj-Bogra, Jhenaidah, Jessore , Bandarban and Sylhet during kharif 2007 to compare the improved variety/line of mukhikachu with local one. The experiment was laid out in RCB design with five dispersed replications. The unit plot was 10 m × 10 m. The corms were planted 28 February/07 at Kishoreganj, 8 March/07 at Bogra, 16 April/07 at Jhenaidah and Jessore, 25 March/07 at Bandarban and 15 February/07 at Sylhet maintaining the spacing of 60 cm × 45 cm. Fertilizers were applied at the rate of 5 ton cowdung and 60-25-85 kg/ha of NPK, respectively. All fertilizers were applied during final land preparation and urea was applied in two equal splits at 45 and 90 DAT. Other intercultural operation such as Irrigation, weeding and earthing up were done properly. Harvesting was done from 15-18 October/07 at Kishoreganj, 25 September/07 at Bogra, 29 October/07 at Jhenaidah and Jessore, 28 October/07 at Bandarban and 15 August/07 at Sylhet. Data on yield and yield contributing characters were recorded and analyzed statistically. Data related to cost and return and farmers' reaction were also recorded. Economic analysis was done on the basis of prevailing market price of input and out. (Reddy and Reddi, 1992).

Result and Discussion

Netrakona

The number of secondary corm and cormels/plant showed the highest from line MK-029 (Table 1). But weight of secondary corm/plant was highest in MK-140 (334.70g) and the lowest in local. The weight of secondary corm/plant was 20 and 26 % higher in MK-140 than Bilashi and local due to higher number of secondary corm. The weight of cormels/plant was recorded the highest in MK-140 (476.10g). The weight of edible part (secondary corm and cormels) followed the same trend of cormels. The line MK-140 produced the highest yield (29.66 t/ha) which was statistically different from MK-029 (26.96 t/ha) and the lowest yield was recorded in local variety (17.46 t/ha) The yield of Mukhikachu line MK-140 was about 18 and 41 % higher than Bilashi and local variety.

The line MK-140 gave the highest gross return (TK. 296600 /ha), gross margin (TK. 254035/ha) and benefit cost ratio (6.96) due to higher yield. The gross return of MK-140 was 18 and 41 % higher than

Bilashi and local variety. Local variety gave the lowest gross return (Tk.174600/ha) gross margin (Tk. 132035/ha) and benefit cost ratio (4.10) due to low yield potential.

Bogra

The plant height was height in treatment T_2 (80.3 cm) and the lowest plant height was obtained in treatment T_4 (52.3 cm).The highest number of corm and cornel/ plant was obtained 26.4 which was followed by treatment T_2 (MK- 140) and the lowest number was obtained 21.5 which was followed by treatment T_4 (Bordhaman –local). The maximum weight of secondary corm and cornel/ plant was (697 g) which was followed by treatment T_2 and lowest (524g) which was followed by treatment T_4. The height yield was obtained from MK-140 (22.33 t/ha) and the lowest yield obtained from Local (19.80 t/ha) (Table 3).

Jhenaidah and Jessore

The highest yield (30.46 t/ha) was obtained from MK-029 and the lowest (23.15 t/ha) from Local variety at Kuadabazar, Jessore. Similar trend was found at Kaligonj, Jhenaidah. So, farmers own variety has the lower yield potential (Table 4 and 5).

Bandarban

The result showed that the highest plant height (76.33cm) was produced by the variety Bilashi (Table 6) which was similar to the line MK-140 (73.33cm). The local variety produced lowest plant height (59.33 cm). The highest number of cormel/plant (52.00) and weight of cormel/plant (837.70 g) was produced by the line MK-140. Local variety produced lowest number corms/plant and weight of cormel/plant. The highest yield (24.84 t/ha) was obtained from MK-140 and the lowest yield (11.46 t/ha) was obtained from the local variety.

Sylhet

The highest weight of primary corm (118.23 g), number of secondary corms/plants (14.36) and number of cormels/plant (15.83) were found from MK-029 line (Table 7). The highest weight of secondary corm/plant (331g), weight of cormels/plant (477.04g), weight of edible portion/plant (807.98 g) were found from the line MK-140 followed by MK-029, Bilashi and local cultivars. The highest yield was obtained from MK-140 (27.23 t/ha) because of it's highest weight of secondary corms/plant; weight of cormels/plant and weight of edible portion/plant among all the varieties/lines. The lowest weight was obtained from the local cultivar (13.52 kg/ha)

Farmer's reaction at Netrakona

Farmers' are very much interested to grow MK-140 for its high yield potentiality. The farmers preferred its cormels due to its stickiness and softness than Kishoreganj local. Already 15 neighboring farmers' collected MK-140 cormels from our cooperator farmers and they cultivate kharif, 2008. Farmers' also opined that there was no incidence of insect and diseases in the new varieties/lines.

Farmer's reaction -Bogra

Farmer's preferred high yielding line MK-029 variety Bilashi / line for their smooth, round shape, big size. After boiling the above line/ variety were found soft and mucilaginous, palatable and tasty. The size of corm and skin color of the same was attractive. They will expand both (Mk-029/Bilashi cultivation in the next year.

Farmers Reaction-Sylhet

Mukhikachu production is satisfactory in Sylhet area in terms of yield and it can be a good crop to utilize the fallow land of this area. As advance lines (MK-140) showed highest production compare to others, it may introduce as variety in this region.

Conclusion

For getting higher benefit MK-140 can be grown at farmers' field. But creating local demand and to popularize of BARI variety, motivation work would be fruitful for sustaining these variety at farmers field. Beside these, attention should be given to ensure availability of seeds in proper time to the farmers'. The variety MK-140 and MK-029 should be released.

Reference

Reddy, T Y and G H S Reddi, 1992. Principles of Agronomy, Kalyani publishers. New Delhi-110002, India. p. 423.

Table 1. Yield and yield contributing characters of Mukhikachu varieties/line Kendua MLT site, Netrakona kharif, 2007

Varieties	Secondary corm/plant (no.)	Cormels /plant (no.)	Weight of primary corm/plant (g)	Weight of secondary. corm/plant (g)	Weight of cormels/ plant (g)	Wt. of edible part/plant (sec.corm + cormels) (g)	Yield (t/ha)
MK-029	13.13a	14.34a	120.23a	285.40b	413.65b	709.05b	26.96b
MK-140	10.56b	12.22b	111.99ab	334.70a	476.10a	820.80a	29.66a
Bilashi	9.47bc	9.32c	108.20b	266.50c	372.20c	648.70c	24.42c
Local	8.00c	6.72d	88.97c	248.10c	223.10d	481.20d	17.46d
CV (%)	10.89	12.13	11.75	12.24	9.85	8.78	10.12

Table 2. Cost and benefit analysis of Mukhikachu at Kendua MLT site, Netrakona during kharif, 2007

Varieties	Gross return (Tk/ha)	*Cultivation cost (Tk/ha)	Gross margin (Tk/ha)	Benefit cost ratio (BCR)
MK-029	269600	42565	227035	6.33
MK-140	296600	42565	254035	6.96
Bilashi	244200	42565	201635	5.73
Local	174600	42565	132035	4.10

Price: All varieties /lines cormels :Tk.10 / kg, *Cultivation cost includes cost of seedling, fertilizers, labour and draft power.

Table 3: Yield and yield contributing characters of Mukhikachu at Goneshpur, Shinbone, Bogra during 2007-08

Variety/lines	Plant height (cm)	No. of corm and cormel/ plant	Weight of secondary corm and cormel/plant (g)	Corm and cormel yield (t/ha)	Field duration (days)	Yield (t/ha) during (2006-07)
MK-029	77.8	28.5	683	27.04	190	21.00
MK-140	80.3	26.4	697	27.82	192	22.33
Bilashi	62.4	25.8	638	25.17	188	21.17
Bordhaman (local)	52.3	21.5	524	20.23	173	19.80
LSD (0.05)	2.11	1.81	60.53	2.24	0.88	
CV %	1.6	3.6	4.8	4.5	0.2	3.5

Table 4: Performance of yield and yield contributing characters of mukhikachu at MLT site, Kaliganj, Jhenaidah during 2006-07

Variety/ lines	Plant height (cm)	Cormel/plant (no)	Weight of cormel/plant (g)	Yield (t/ha)
MK-140	77.6	38.4	756.8	28.03
MK-029	72.2	40.8	767.34	28.42
Bilashi	69.2	29.0	600.6	22.21
Farmer's own	44.2	26.0	591.84	21.92

Table 5. Performance of yield and yield contributing characters of mukhikachu at MLT site, Kuadabazar, Monirampur, Jessore during 2006-07

Variety/ lines	Plant height (cm)	Cormel/plant (no)	Weight of cormel/ plant (g)	Yield (t/ha)
MK-140	96.8	36.00	822.50	30.46
MK-029	94.8	33.00	825.00	30.56
Belasis	91.6	35.00	687.50	25.47
Farmer's own	99.6	33.00	625.00	23.15

Table 6. Performance of yield and yield contributing characters of mukhikachu at Chemi Dalo para, Bandarban during 2007

Variety/lines	Plant height (cm)	Cormel/plant	Wt. of cormel/plant (g)	Yield (t/ha)
MK-029	65.00 b	45.00 b	693.00 b	21.54 b
MK-140	73.33 a	52.00 a	831.70 a	25.84 a
Bilashi	76.33 a	42.00 c	553.30 c	20.83 b
Local	59.33 c	30.00 d	409.30 d	11.46 c
CV (%)	10.67	9.98	11.23	12.11

Table 7. Yield and yield contributing characters of mukhikachu variety in Sylhet, 2008

Treatment	Wt. of primary corm/plant (g)	No. of secondary corm / plant	No of cormels/ plant	Wt of secondary corm / plant (g)	Wt. of cormels (g)	Wt. of edible corm (secondary corm & cormels) (g)	Yield (t/ha)
MK-029	118.23	14.36	15.83	279.37	427.70	707.04	23.50
MK-140	115.03	11.83	13.92	331.00	477.04	807.98	27.23
Bilashi	104.20	10.86	10.93	263.33	378.90	642.20	21.09
Local	89.37	9.740	8.06	202.33	226.45	428.76	13.52
CV (%)	4.56	6.78	8.96	7.63	5.56	7.99	11.12
LSD (0.05)	3.462	0.7764	0.477	22.11	13.92	27.82	1.539

Table 8 . Mean cormel yield (t/ha) of Mukhikachu in six locations, 2007

Line/variety	Location						Mean cormel yield
	Kishoreganj	Bogra	Jhenaidah	Jessore	Bandarban	Sylhet	
MK-029	26.96	21.00	28.03	30.46	21.54	23.50	25.25
MK-140	29.66	22.33	28.42	30.56	25.84	27.23	27.34
Bilashi	24.42	21.17	22.21	25.47	20.83	21.09	22.53
Local	17.46	19.80	21.92	23.15	11.46	13.53	17.88

Effect of Planting Method and Mulching on the Yield of Potato in Coastal Area of Satkhira

Abstract

The experiment was conducted at MLT site, Satkhira during rabi season 2007-08. The objective of the experiment was to find out the suitable planting method for higher yield of potato. Six planting methods was included in the study and found that raised bed with mulch gave the highest yield (41.78t/ha) whereas normal furrow and normal flat planting system produced the lowest yield (25.74 and 25.70 t/ha respectively).

Introduction

Southern region of Bangladesh is mainly rice based. Cultivation of vegetable is very low here. It is a vegetable deficit area. Potato is a promising crop for this area. Potato is not only a vegetable but also a carbohydrate-containing crop that can reduce less pressure on rice. Our country is now passing very crucial moment in food crisis. So, potato may be the supplementary food to minimize the existing problem. Though production is somewhat lower than North Bengal and Munshiganj area, price is higher than that of those areas. So, it has an scope to cultivate potato in this area. But, soil salinity is one of main constraint to grow potato with satisfactory yield. Poor drainage system of the heavy soil is also another constraint to grow the crop. Farmer's grow potato through normal furrow system. Modern planting method including mulching system may increase the yield. With this point of view the study was tested to find out the suitable planting technique of potato production in coastal area.

Materials and Methods

The experiment was conducted at the farmers field at MLT site, Satkhira during the rabi season of 2007-'08. Six planting methods viz. raised bed (15cm height), raised bed with mulch, normal flat, normal flat with mulch, furrow with mulch and furrow were taken as treatment in the experiment. The experiment was RCB design with 3 replications. Unit plot size was 3m×3m. Urea, TSP, MP, Gypsum, Zinc sulphate and Borax were applied at the rate of 250-150-250-120-10-10kg/ha respectively. All fertilizers were applied as basal during land preparation other than urea. Urea was applied at two times- 20 and 40 DAS. The whole potato Root was planted of 05 December'07 with 60×25cm and harvesting was done on 04 March'08. Potato variety Diamant was used as seed. Two irrigation were given. All the data were recorded at the time of harvest and statistically analyzed and the means were separated with DMRT test.

Results and Discussions

Out of the six treatments highest potato yield (41.78 t/ha) was found under the planting method of raised bed and mulching (Table 1). It is due to raised bed and at the same time mulching reduced soil salinity considerably. Many of yield attributing characters e.g. no. of Roots/plant and weight of Roots/plant both were high in this treatment that helped to increase the yield also. The second highest yield (35.37t/ha) was found in raised without mulch which was followed by normal flat with mulch and normal furrow with mulch. The yield of normal furrow with mulch (30.82t/ha.) and normal flat with mulch (30.93t/ha) were statistically identical. Yield contributing characters, no. of Roots and weight of Roots/plant were also identical. The lowest yield was seen in both normal flat (25.704t/ha) and in normal furrow (25.74t/ha). In both treatments soil salinity was high (6.26 and 6.56ds/m respectively) that affected the yield of potato.

Farmer's reaction

Farmer's choose the raised bed with mulch because-

- Higher potato yield
- No risk of rotting Roots by stagnant water

- Infestation of diseases was also minimized
- Conserve soil moisture and control weed infestation
- Minimized soil salinity.

Conclusion

This is the 1st year experiment. The experiment should be continued in next year for confirmation.

Table 1: Yield and yield contributing character of potato as affected by planting method and mulching at Satkhira MLT site during rabi season, 2007-08

Planting methods	Days to maturity	Plant popn/m^2	Plant height (cm)	Hills/plant (No.)	Roots/ plant (No.)	Wt. of Roots/ plant (g)	Root yield (t/ha)
Raised bed with mulching	91	6.67	41.77a	8.43b	13.37a	592a	41.78a
Raised bed	91	6.67	33.33b	7.57bcd	11.20b	520b	35.37b
Normal flat with mulch	91	6.67	40.97a	8.03bc	11.33b	481bc	30.93c
Normal flat	91	6.67	32.50b	6.77d	10.60b	437cd	25.70d
Normal furrow with mulch	91	6.67	39.50a	9.40	10.97b	478bc	30.82c
Normal furrow	91	6.47	32.60b	7.17cd	10.13b	404d	25.74d
LSD(0.05)	-	0.05	3.10	0.95	1.87	50.27	4.14
CV(%)	-	0.39	4.64	6.63	9.14	5.69	7.17

Table 2: Salinity level of the site during the crop growth period

Salinity (dS/m)					
Raised bed with mulch	Raised bed	Normal flat with mulch	Normal flat	Normal furrow with mulch	Normal furrow
2.25-4.34	2.54-6.32	2.54-4.67	3.10-6.26	2.16-5.05	2.57-6.56

On-farm Trial of BARI Tomato Varieties

Abstract

Performance of three BARI released tomato varieties namely BARI tomato-2, BARI tomato-3, BARI tomato-9 and one local variety (Ruma VF) were evaluated at FSRD site, Hazirhat, Noakhali, Razakhali-Patuakhali, Shibpur-Narsingdi, Melandah-Jamalpur and Bhuapur, Tangail. Averaged over locations BARI tomato-2 (75.76 t/ha) and BARI tomato-3 (75.75 t/ha) gave higher yield followed by other BARI varieties while the local variety produced the lowest yield (53.87 t/ha).

Introduction

Tomato is the most important and very widely popular vegetable in Bangladesh. It is moderately high in vitamin A and C. BARI has developed a good number of high yielding tomato varieties with several high quality parameters. These varieties have potential to help generate farmer's income within a very short period. The average yield of local variety is very low compared to release BARI varieties. However, potentiality and other qualities of those BARI released varieties should be verified under farmer's field condition across locations for mass adoption. Therefore, this experiment was undertaken to determine the adaptability and performance of BARI developed tomato varieties in the farmer's field.

Materials and Methods

The experiment was conducted at FSRD site, Hazirhat, Noakhali, Razakhali-Patuakhali, Shibpur-Narsingdi , Malancha-Melandah-Jamalpur and Bhuapur, Tangail during the Rabi season of 2007-08. Three BARI released tomato varieties viz. BARI tomato-2, BARI tomato-3, BARI tomato-9 and one local variety (Ruma VF) was tested in farmer's field, however, at Patuakhali instead of BARI tomato-9 BARI tomato-8 was included and in Tangail BARI tomato 6 and BARI tomato were included. The experiment was laid out in RCB design with three replications. The unit plot size was 16 m^2. Twenty five days old seedlings were transplanted on 29 November/07 at Noakhali, 15 December/07 at Patuakhali, 10 December/07 at Narsingdi, 20-22 November/07 at Jamalpur 16-9 December/07 at Tangail, with 50cm X 40cm spacing. Recommended dose of fertilizers (250-80-125 kg/ha NPK and 5 t/ha cowdung) were applied. Total amount of cowdung, TSP and 1/3 each of Urea and MP were applied at final land preparation. 2/3 of the rest portion of urea and MP were applied in 2 equal installments at 21 and 35 DAT. The crop was harvested during late February/08 to early April/08 across locations. The plots were weeded two times. Data on yield and yield contributing characters were recorded and analyzed statistically.

Results and Discussion

Noakhali

The varieties differed significantly in all characters (Table 1). Among the varieties BARI tomato-9 gave the tallest plant (100.40 cm) and the shortest plant (86.65 cm) was recorded in local variety. The highest number of fruits (21.29) per plant was observed in BARI tomato-3 which was statistically non-significant with others varieties. Highest individual fruit weight was found in BARI tomato-9 (79.67 g), BARI tomato-3 (76.67 g) and BARI tomato-2 (74.00 g) respectively, the lowest individual fruit weight was obtained from local variety (53.00 g). The highest fruit yield (61.56 t/ha) was recorded from BARI tomato-9 which was statistically similar with BARI tomato-2 (59.34 t/ha) and BARI tomato-3 (60.38 t/ha). The lowest yield was given by local variety (40.73 t/ha).

Patuakhali

All BARI varieties performed well (Table 2). BARI Tomato-8 produced the highest fruit yield (78.60 t/ha) followed by BARI Tomato-3 (71.30 t/ha), BARI Tomato-2 (69.20 t/ha) whereas Local variety produced lowest yield (48.60 t/ha). Pilot production program of these varieties should be undertaken in the next year to disseminate the varieties.

Narsingdi

The tallest plant was produced by the local variety (114.04 cm) but the shortest was from BARI tomato-9 (67.43 cm). The highest number of fruits per plant was found in BARI Tomato-9 (55.87) and the lowest in local variety (Table 3). The highest individual fruit weight was found in BARI Tomato-2 (83.10 g) followed by local (44.20 g). Individual fruit weight of these varieties varied from 44-83 g which was close to the findings of Anon, 2000. The highest fruit yield was obtained from BARI Tomato-3 (114.52 t/ha) and the lowest from local variety (51.90 t/ha). All the variety performed better with reasonable yield.

BARI Tomato-3 gave highest gross return (Tk. 1145200/ha), gross margin (Tk. 969840/ha) and benefit cost ratio (6.27). Other varieties also gave satisfactory benefit cost ratio (5.13-6.27). The lowest benefit cost ratio was found in local variety (2.96).

Jamalpur

The result indicated that the longest plant was recorded from BARI tomato 3 was statistically identical to BARI tomato 2 (Table 5). The second longest plant was recorded from BARI tomato 8 while the local produced the shortest plant. The number of branches/plant did not differ significantly due to variety differentiation. The highest number of fruits/plant was recorded from BARI tomato 8 and was identical to other BARI varieties but significantly differed form local. The individual fruit length was recorded longest form BARI tomato 8. BARI tomato 2 and 3produced identically the second longest length while the local produced the shortest fruit length. The highest fruit diameter was noted from BARI tomato 3 while the lowest diameter was found in the local. BARI tomato 2 and 8 produced the second highest fruit diameter. The similar pattern of behaviour was also noted in case of fruit wt/plant. However, the highest fruit yield was recorded from BARI tomato 8 (67.30 t/ha). The other BARI varieties produced identical yield. The lowest yield was recorded from local (34.27 t/ha).

Out of the tested tomato varieties the highest gross return was obtained from BARI tomato 8 which also showed higher gross margin. Higher BCR was recorded from BARI tomato 8 due to higher yield and benefit. But other varieties also showed reasonable yield and benefit.

Tangail

BARI Tomato-3 gave the highest plant height (107.0 cm) and the lowest height was obtained from BARI Tomato-6 (98.4 cm). Number of branches per plant, number of clusters per plant and number of fruits per cluster significantly varied due to variety (Table 7). BARI Tomato-7 produced the highest number of fruit per plant (41) and the lowest. Number (35) was obtained from BARI Tomato-3. Individual fruit weight was also the highest in BARI Tomato-7 (101.9 g). The highest fruit yield (85.17 t/ha) was recorded in BARI Tomato-7, while BARI Tomato-3 produced the lowest fruit yield (72.92 t/ha). As the fruit cluster per plant, fruit per cluster and individual fruit weight were higher in BARI Tomato-7 the higher yield obtained from the variety is justified.

Farmer's reaction-Noakhali

Farmers are interested to grow hard skin tomato varieties for easy carrying and storage.

Farmers' Reaction -Patuakhali

Farmers are satisfied to get this yield.

1. Seeds are not available at local level
2. To make these technologies sustainable quality seed production should be ensured.

Farmers' reaction-Narsingdi

Farmers showed greater interest to grow BARI Tomato-3 for higher yield and economic return.

Farmers' reaction-Jamalpur

BARI tomato 8 was more preferred by the farmers because of their shorter plant size and for its attractive fruit shape.

Farmers' reaction-Tangail

Farmers were interested to grow this crop because, earlier it was never cultivated here. It is palatable and its market price was higher.

Conclusion

The experiment should be continued with more varieties/lines and hybrid varieties which are available in the market.

Reference

Anonymous, 2000. Sabjir Unnatajat O Uttpadan Paddati (In Bengali). Published by Olericulture Division, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur 1701.

Hossain, S. M., M. Matiur Rahman, M. H. Rashid, A. T. M. Farid, M. A. Quayyum, Mostaque Ahmed, M. S. Alam and K. M. Salauddin, 2007. Krishi Projukti Hath Boi (In Bangla). 4th edition Bangladesh Agricultural Research Institute, Joydebpur, Gazipur 1701.

Table 1. Yield and yield attributes of tomato varieties at FSRD site, Noakhali during rabi 2007-08

Variety	Plant height (cm)	Fruits plant^{-1} (no)	Individual fruit weight (gm)	Yield (t ha^{-1})
BARI-2	88.95	21.10	74.00	59.34
BARI-3	99.65	21.29	76.67	60.38
BARI-9	100.40	19.63	79.67	61.56
Local	86.65	20.39	53.00	40.73
LSD (0.05)	11.36	NS	6.003	14.20
CV (%)	6.06	10.51	4.24	11.41

Table 2. Yield of Tomato varieties at Razakhali, Patuakhali in rabi, 2007-2008.

Varieties	No. of branch/plant	No. of fruits cluster/plant	Average Yield (t/ha)
BARI Tomato-2	6.5	3.47	69.20 b
BARI Tomato-3	6.3	3.66	71.30 b
BARI Tomato-8	6.8	3.81	78.60 a
Local	4.4	3.15	48.60 c
CV (%)			10.35

Table 3. Yield and yield contributing characters of BARI Tomato varieties at Shibpur, Narsingdi during 2007-08

Variety	Plant height (cm)	Branches/ plant (no.)	No. of fruits/ plant	Weight of individual fruit (g)	Weight of fruit/plant (kg)	Yield (t/ha)
BARI tomato-2	112.60	2.73	49.27	83.10	3.76	109.93
BARI tomato-3	104.20	2.80	48.20	79.10	3.82	114.52
BARI tomato-9	67.43	2.73	55.87	51.93	2.90	90.00
Local	114.80	3.00	38.33	44.20	1.69	51.91
LSD(0.05)	21.03	0.24	6.01	11.38	0.63	19.38
CV (%)	10.55	4.27	6.27	8.82	10.31	10.59

Table 4. Cost and return analysis of BARI Tomato varieties at Shibpur, Narsingdi during 2007-08

Variety	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)	BCR
BARI tomato-2	1099270	175360	923910	6.27
BARI tomato-3	1145200	175360	969840	6.53
BARI tomato-9	900030	175360	724670	5.13
Local	519070	175360	343710	2.96

Price (Tk./kg): Tomato : 10.1

Table 5. Agronomic performance of different BARI tomato varieties at MLT site, Malancha, Melandah, Jamalpur during rabi, 2007-08

Treatment	Plant ht(cm)	Branch/ plant (no.)	Fruit/ plant (no.)	Fruit length (cm)	Fruit diameter (cm)	Fruit wt/ plant (kg)	Yield (t/ha)
BARI Tomato-2	82.7 a	6.0	43.3 a	4.93 b	5.50 a	1.34 a	64.60 a
BARI Tomato-3	84.9 a	5.4	43.4 a	4.73 b	5.66 a	1.41 a	60.65 a
BARI Tomato-8	73.3 b	5.9	49.3 a	5.70 a	5.40 a	1.30 a	67.30 a
Local	67.7 c	6.2	30.5 b	3.10 c	3.46 b	0.80 b	34.27 b
F	**	NS	**	**	*	**	**
CV%	8.55	8.28	8.58	5.82	13.57	11.10	11.50

Table 6. Cost and return analysis of BARI tomato varieties, Malancha, Melandah, Jamalpur, 2007-08

Treatment	GR (Tk/ha)	TVC(Tk/ha)	GM (Tk/ha)	BCR (TVC basis)
BARI Tomato-2	4,52,200.00	91,735.00	3,60,435.00	4.92
BARI Tomato-3	4,24,550.00	91,735.00	3,32,815.00	4.62
BARI Tomato-8	4,71,100.00	91,735.00	3,79,365.00	5.13
Local	2,39,890.00	91,735.00	1,48,155.00	2.61

Table 7. Yield and other yield contributing parameter of tomato varieties at MLT site, Bhuapur, Tangail during rabi 2007-08.

Treatments	Days to flowering	Days to harvest	Plant height (cm)	Branches/ plant (no)	Clusters/ plant (no)	Fruits/ cluster (no)	Fruits/ plant (no)	Individual fruit wt. (g)	Fruit yield/ plant (kg)	Yield (t/ha)
BARI Tomato 3	54	101	107.0	5	10	4	35	84.7	2.50	72.92
BARI Tomato 6	54	98	98.4	5	10	5	38	85.4	2.62	76.42
BARI Tomato 7	54	98	145.1	6	11	5	41	101.9	2.92	85.17
BARI Tomato 9	52	92	101.4	6	10	4	36	85.7	2.51	73.21
LSD (0.05)	2.43	0.00	3.60	0.64	0.99	0.32	2.47	3.14	0.29	8.30
CV (%)	3.3	0.0	2.3	8.3	7.0	5.3	4.8	2.5	7.8	7.8

Table 8. Mean fruit yield (t/ha) of tomato in five locations, rabi, 2007-08

Variety	Location					Mean fruit yield
	Noakhali	Patuakhali	Narsingdi	Jamalpur	Tangail	
BARI tomato-2	59.34	69.20	109.93	64.60	-	75.76
BARI tomato-3	60.38	71.30	113.52	60.65	72.92	75.75
BARI tomato-8	-	78.60	-	-	-	-
BARI tomato-9	61.56	-	90.00	67.30	73.21	73.02
Local	40.73	48.60	91.91	34.27	-	53.87
BARI tomato-6	-	-	-	-	76.42	-
BARI tomato-7	-	-	-	-	85.17	-

On-Farm Trial of BARI Summer Hybrid Varieties of Tomato

Abstract

Performances of two hybrid summer tomato varieties were evaluated at Sabjipara, Shambhuganj of Mymensingh Sadar Upazila and FSRD site Kusumhati, Sherpur during Kharif 2007. Averaged over locations BARI hybrid tomato-4 gave the highest fruit yield (24.15 t/ha). At Mymensingh the lowest yield was obtained from BARI hybrid tomato-3 (7.28 t/ha) but at Sherpur Line C44 gave reasonable yield (24.15 t/ha). Higher gross return (Tk.1422000/ha), gross margin (Tk. 1197600/ha) and benefit cost ratio (6.34) was also obtained from BARI hybrid tomato-4. Farmers preferred BARI hybrid tomato-4 for its reasonable higher yield, economic return and higher demand in the market.

Introduction

Tomato is an important vegetable crop in Bangladesh. Generally it is grown in the winter season. But Bangladesh Agricultural Research Institute (BARI) has developed some summer hybrid tomato varieties which need to be popularized among the farmers. As there is no production of tomato in the summer season, its demand and price in the market at that time will be higher than the winter season. So, the farmers might be benefited by the production of summer tomato. On-farm trials with these varieties might be helpful to popularize summer tomato production to the farmers. So, the experiment was conducted with the following objectives:

1. To evaluate the performance of new summer tomato hybrid varieties in farmers field a
2. To popularize the BARI summer tomato hybrid lines.

Materials and Methods

The experiment was conducted at Sabjipara village, Shambhuganj under Mymensingh sadar Upazila, FSRD site Kusumhati, Sherpur during Kharif 2007 to evaluate the performance of two hybrid summer tomato varieties. The design of the experiment was randomized complete block with six replications. The treatments of the experiment were two summer hybrid tomato varieties BARI hybrid tomato-3 and BARI hybrid tomato-4 but for Sherpur line C-44 was used instead of BARI tomato-3 Unit plot size was 4.0 m x 1.0 m. A polythene tunnel was made to protect the tomato plants from rain water. The size of the tunnel was 8.5 m x 2.3 m to accommodate 4 beds of size 4.0 m x 1.0 m. Bed to bed distance was 30 cm. The height of the tunnel was 180 cm in the middle and 135 cm in the two edges. Fertilizers were applied @ 450-250-150 kg/ha of urea, TSP and MP, respectively along with 10 t/ha of cowdung. Half of cowdung and MP and full amount of TSP were applied during final land preparation. The remaining cowdung was applied during pit preparation. The entire amount of urea and remaining MP were applied in three equal installments at 10, 25 and 40 days after transplanting. Tomato seedlings of 30 days were transplanted as first planting on 3 June 2007 and second planting on 4 July 2007 at Mymensingh, while at Sherpur seedlings were planted during 5-7 July/07. The spacing used was 60 cm x 40 cm. Intercultural operations like weeding, watering and pest control were done as and when necessary. The "Tomatotone" hormone was applied 2-3 times on the blooming flowers for better setting of fruits. The second planting was severely attacked by virus from seedling stage to growing stage and only in a few plants fruiting was observed which was not acceptable. So, data were not collected from second planting. In the first planting, harvesting of fruits started from 24 August, 2007 and continued up to 9 September, 2007 at Mymensingh, whereas at Sherpur harvesting was done during 29 July/07 to 25 August/07.. At maturity data on yield and yield contributing characters were recorded.

Results and discussion

Mymensingh

Plant height, number of branches/plant, number of fruits /plant, weight of fruits and yield of BARI hybrid tomato-4 were higher compared to BARI hybrid tomato-3 (Table 1). The yield of BARI tomato-4 (23.7 t/ha) was 3 times higher than the yield of BARI tomato-3 (7.28 t/ha). However, the yield of BARI tomato -3 was affected by virus. Within the two tested varieties, BARI tomato-4 gave higher gross return (Tk. 1422000/ha), gross margin (Tk. 1197600/ha) and benefit cost ratio (6.34) compared to BARI tomato-3 with gross return, gross margin and benefit cost ratio of 436800/ha, 212400/ha and 1.95, respectively (Table 2).

Sherpur

Data on different yield and yield contributing characters are presented in table 1. The result obtained from the study indicated that BARI Hybrid tomato 4 produced higher yield (26.25 t/ha) than C 44 (24.15 t/ha).

Farmer's reaction at Mymensingh

Farmers opined that there is a great demand of summer tomato and they faced no problem of selling it, rather they obtained a reasonable higher average price of Tk. 60.00/kg. Besides, farmers are interested to adopt the technology but they are afraid of its high production cost and disease infestation. Farmers liked BARI hybrid tomato-4 due to its higher yield, economic return and higher demand in the market.

Farmers' reaction-Sherpur

The farmers were impressed with the off-season fruit yield. They opined that if they were ensured of enough seedlings they would go for field cultivation.

Conclusion: The experiment should be repeated with more number of cultivars across more locations.

Table 1. Agronomic performance of hybrid summer tomato varieties at Mymensingh Sadar during Kharif, 2007

varieties	Plant height (cm)	No. of branches/plant	No. of fruits/plant	Wt. of fruits/plant (g)	Fruit yield (t/ha)
BARI Tomato-4	124.00	4.37	20.44	1147.91	23.7
BARI Tomato-3	121.93	3.07	10.91	384.58	7.28

Table 2. Cost benefit analysis of two hybrid summer tomato varieties at Mymensingh Sadar during Kharif, 2007

Varieties	Gross return (Tk./ha)	*TVC (Tk./ha)	Gross margin (Tk./ha)	B/C ratio
BARI Tomato-4	1422000	224400	1197600	6.34
BARI Tomato-3	436800	224400	212400	1.95

*TVC includes cost of seedling, fertilizer, cowdung, insecticide/fungicide, hormone, man and animal labour cost along with cost of polytunnel.

Price of tomato: Tk. 60.00/kg.

Table 3. Yield and yield contributing character of summer hybrid tomato varieties, Sherpur, 2007

Treatment	Plant ht.(cm)	Fruit/plant (no.)	Fruit wt. (g)	Fruit diameter (cm)	Fruit length (cm)	Yield (t/ha)
BARI H.Tomato 4	126.4	28.50	39.00	5.15	6.15	26.25
C 44	109.3	26.20	33.25	4.75	5.25	24.15

Table 4. Cost and return analysis of summer hybrid tomato, Sherpur, 2007

Treat	GR (Tk/ha)	TVC (Tk/ha)	GM (Tk/ha)	BCR
BARI hybrid T. 4	10,50,000.00	4,76,000.00	5,74,000.00	2.20
C 44	9,66,000.00	4,76,000.00	4,90,000.00	2.02

Price: Tk.40.00/kg

Table 5. Mean fruit yield of hybrid summer tomato, kharif, 2007

Variety/Line	Location		Mean fruit yield
	Mymensingh	Sherpur	
BARI hybrid tomato-3	7.28	-	-
BARI hybrid tomato-4	23.7	26.25	24.15
C 44	-	24.15	-

On-Farm Trial of BARI Motorshuti Varieties

Abstract

The experiment was conducted at Multilocation Testing site, Trishal, Mymensingh, Gazipur and Jamalpur during rabi 2007-08 to evaluate different Motorshuti varieties, viz., BARI Motorshuti 1 and BARI Motorshuti 3 and IPSA Motorshuti-1. BARI Motorshuti 3 was a short duration variety maturing within 75 days whereas BARI Motorshuti-1 matured by 100 days. Averaged over locations BARI Motorshuti 1 gave the highest green pod yield (7.01 t/ha). However, at Mymensingh BARI Motorshuti 3 had higher yield (8.01 t/ha) than BARI Motorshuti 1 (6.60 t/ha).

Introduction

Motorshuti (Garden pea) is a very short duration high value winter crop suitable for generating farmers' income in a short time. It is liked by the people both in rural and urban areas. Considering its economic importance BARI made efforts to develop high yielding varieties of the crop and recommended some varieties. The present study aims at evaluating the performance of BARI developed two Motorshuti varieties in farmer's field and to promote their adoption by the farmers.

Materials and Methods

The experiment was conducted at Multilocation Testing site, Trishal, Mymensingh Dhirashram-Gazipur and Malancha, Melandah, Jamalpur during rabi 2007-08. The test varieties were BARI motoshuti-1, BARI motorshuti-3 and IPSA motorsuti-1.The design of the experiment was randomized complete block with five dispersed replications. The seeds were sown on 28 November 2007 at Mymensingh, 12 November/07 at Gazipur and 30 November/07 at Jamalpur with 20 cm x 15 cm. spacing. The crop was fertilized with STB fertilizer dose for high yield goal following FRG' 05. The STB fertilizer dose was 44-20-19-8000 kg/ha of N, P, K and cowdung. Half of the N and all other fertilizers including cowdung were applied as basal. Rest of N was applied on 20 DAS. BARI Motorshuti 3 was harvested on 17th February 2008 at Mymensingh, 23 December/07 at Gazipur 6 February/08 at Jamalpur. BARI Motorshuti 1 was harvested on 8 March 2008 at Mymensingh, 25 January/08 at Gazipur and 5 March/08 at Jamalpur. Green pods were harvested and sold in the market. Data on yield and yield contributing characters were recorded. Economic analysis was done on the basis of prevailing market price of input and output.

Results and Discussion

Mymensingh

Days to maturity of BARI Motorshuti 3 variety was 75 days whereas in BARI Motorshuti 1 was 100 days (Table 1). BARI Motorshuti 3 gave higher average number of pods/plant (13), weight of pods/plant (30.72g), and 100- green pod weight (419 g) than BARI Motorshuti 1 which was 11, 28.7g and 373g, respectively. Green pod yield was higher in BARI Motorshuti 3 (8.01t/ha) compared to BARI Motorshuti 1 (6.60 t/ha). Gross return and benefit cost ratio was also highest in BARI Motorshuti 3 9Tabel 2). Gross return and benefit cost ratio of BARI Motorshuti 3 was Tk.200250/ha and 7.83, respectively. However, gross return and benefit cost ratio of BARI Motorshuti 1 was also reasonable which was Tk.165000 /ha and 6.45, respectively.

Gazipur

Motorshuti varieties had significant effects on yield and yield contributing characters except seeds/pod (Table 3) during 2007-08. Days to maturity of BARI Motorshuti-3 and IPSA Motorshuti-1 were 57 and 53 days whereas BARI Motorshuti-1 required maximum 83 days. Among the varieties, tallest pea plant (68 cm) was obtained from BARI Motorshuti-1 and the shortest (32.2 cm) was obtained from IPSA Motorshuti-1. The highest branch per plant was given by BARI Motorshuti-l which was identical to other varieties. The number of pods/plants was found higher in BARI Motorshuti-l (35.3) and followed by other two varieties. The highest pod length was recoded from

BARI Motorshuti-1 (7.7 cm) which was followed by other two varieties. The maximum seeds per pod were in BARI Motorshuti-l (6) that was identical to BARI Motorshuti-3 (5.5). The highest 100 seeds weight was obtained from BARI Motorshuti-l (62.3 g) while the lowest from BARI Motorshuti- 3 (53 g) and which was identical to IPSA Motorshuti-l (56.0 g) variety. During 2007-08 highest green pod yield (8.1 t/ha) was obtained from BARI Motorshuti-l due to higher pods/plant, seeds/pod, pod length, 100-seed weight than other varieties. The lowest pod yield (4.7 t/ha) was recorded from IPSA Motorshuti-l. From two years average data, same trend was observed in green pod yield of all varieties. The highest mean yield was record from BARI Motorshuti-l (7.2 t/ha) which was followed by BARIMotorshuti-3 (5.7 t/ha) and the lowest (4.4 t/ha) one was found in IPSA variety due to lowest yield contributing characters (Table 4).

Jamalpur

Highest yield and economic return were obtained from BARI Motorshuti-1.

Farmer's reaction-Mymensingh

Farmers preferred both the BARI Motorshuti varieties for their higher yield and economic return. They are interested to grow both BARI Motorshuti 1 and BARI Motorshuti 3 varieties in the next year if seeds are available.

Farmers' reaction-Jamalpur: Farmers' were pleased with production of BARI Motorshuti varieties.

Table 1. Yield and yield contributing characters of BARI Motorshuti varieties Trishal, Mymensingh, rabi, 2007-08

Variety	Days to maturity	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	Wt. of green pods/plant (g)	Wt. of 100 green pod (g)	No. of seed/pod	Green pod yield (t/ha)
BARI Motorshuti 1	100	64.08	4	11	28.7	373	4	6.60
BARI Motorshuti 3	75	55.88	3	13	30.72	419	5	8.01

Table 2. Economic analysis of BARI Motorshuti varieties, Mymensingh, 2007-08

Variety	Gross return (Tk./ha)	*TVC (Tk./ha)	Gross margin (Tk./ha)	Benefit cost ratio
BARI Motorshuti 1	165000	25575	139425	6.45
BARI Motorshuti 3	200250	25575	174675	7.83

*TVC includes cost of seed, fertilizer, man and animal labour cost

Price: Seed: Tk.50.00, Urea: Tk. 6.5/kg, TSP: Tk.18.00/kg, MP: Tk. 15.00/kg, and Cowdung: Tk. 1.00/kg. Market price of motorshuti: Tk. 25.00/kg

Table 3. Yield and yield contributing characters of different Motorshuti varieties at Dhirashram MLT site Gazipur Sadar (AEZ 28), during 2007-08

Varieties	Days to maturity	Plant height (cm)	No of branches/ plant	Pod length (cm)	No. of pods/ plant	No. of seeds/ pod	100-seed wt. (g)
BARI Motorshuti-l	82.7a	68a	10.8a	7.7a	35.3a	6.0a	62.0a
BARI Motorshuti-3	56.7b	5l.7b	9.1b	6.9b	32.3b	5.5a	53.0b
IPSA Motorshuti-l	53.3b	32.2c	8.2c	5.9c	27.7c	3.7b	56.0b
CV (%)	2.75	4.54	2.04	3.58	2.49	12.14	3.62

Table 4. Yield, cost and return analysis of different Motorshuti varieties at Dhirashram, ML T site Gazipur (AEZ 28) during 2006-07 and 2007-08.

Varieties	Yield (t/ha)			Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)	BCR (average)
	2006-07	2007-08	Mean				
BARI Motorshuti-1	6.3a	8.1a	7.2	128250	32809	95441	3.91
BARI Motorshuti-3	5.0ab	6.3b	5.7	100500	32809	67691	3.06
IPSA Motorshuti-1	4.0b	4.7c	4.4	77000	31809	45191	2.42

Price: Motorshuti (all varieties) : Tk. 15/kg (2006-07) and 20 Tk./kg(2007-08)

Table 5. Performance of BARI Motorshuti at MLT site, Malancha, Jamalpur during 2007-08

Treatment	Plants/ m^2 (no.)	Pods/ plant (no.)	Seeds/ pod (no.)	Pod wt/plant (g)	Green pod yield (t/ha)
BARI Motorshuti 1	28	21	6.3	148	7.65
BARI Motorshuti 3	30	19	6.1	142	6.95

Table 6. Cost and return analysis of BARI Motorshuti 3 at Malancha, Melandah, 2007-08

Treatment	GR (Tk/ha)	TVC (Tk/ha)	GM (Tk/ha)	BCR
BARI Motorshuti 1	1,53,000.00	45,500.00	1,07,500.00	3.36
BARI Motorshuti 3	1,39,000.00	45,500.00	93,500.00	3.08

Price of green pod :Tk.20.00/kg

Table 7. Mean green pod yield (t/ha) of Motorshuti in three locations, rabi, 2007-08

Variety	Location			Mean pod yield
	Mymensingh	Gazipur	Jamalpur	
BARI Motorshuti-1	6.60	7.2	7.65	7.15
BARI Motorshuti-3	8.01	5.7	6.95	6.88
IPSA Motorshuti-1	-	4.4	-	-

On-Farm Trial of BARI Stem Amaranth Variety

Abstract

An experiment was conducted at Sabjipara, Shambhuganj under Mymensingh Sadar Upazila, Gazipur and Sherpur during Kharif season of 2008 to see the performance of BARI developed stem amaranth variety, against the local variety. Better yield and economic return was obtained from BARI Data 1 (Laboni). It gave the highest mean yield (43.16 t/ha) across locations against 33.8 t/ha in the local variety. The variety Laboni was preferred by the farmers for its higher yield, better taste and higher demand in the market.

Introduction

Stem amaranth is a very popular summer vegetable grown throughout the country. In recent years, BARI has developed a high yielding good quality variety Laboni and released for farmers' use. The present study aims at evaluating the performance of BARI developed variety Laboni in farmers' field condition and to promote its adoption by the farmers.

Materials and Methods

The experiment was conducted at Sabjipara, Shambhuganj, Mymensingh, Dhirashram, Gazipur and Kusumhati, Sherpur during Kharif-1 season, 2008. The design of the experiment was randomized complete block with six dispersed replications. The BARI developed stem amaranth variety Laboni was tested with the local check. The unit plot size was 5.0 m x 4.0 m. The seeds were sown as broadcast @ 3.0 kg/ha during 5-6 March/08 at Mymensingh, 25 February/08 at Gazipur and 21 April/08 at Sherpur. The crop was fertilized with STB fertilizer dose for high yield goal following FRG' 05. The STB fertilizer dose was 113-33-40-6000 kg/ha of N, P, K and cow dung. Full cow dung, TSP and half urea and MP were applied during final land preparation. The rest urea and MP was applied as top dressing after 20 days of sowing. Other intercultural operations like weeding and irrigation was done as and when necessary. The crop was harvested during 13-17 April/08 at Mymensingh, 8-13 April/08 at Gazipur and 07 May to 07 June/08 at Sherpur . Data on yield and yield contributing characters were recorded. Data related to cost and return and farmers' reaction were also recorded.

Results and discussion

Mymensingh

From Table 1 it is evident that the BARI developed stem amaranth variety BARI data 1(Laboni) was agronomically and economically viable. Plant population/m^2, plant height, diameter of stem, weight of plant and also the yield was higher in BARI Data 1 compared to the local check. BARI Data 1 gave higher yield of 43.70 t/ha compared to 36.20 t/ha in local. Higher gross return (Tk. 218500/ha), higher gross margin (Tk. 195900/ha) and higher benefit cost ratio (9.67) were obtained from BARI Data 1 against gross return (Tk. 181000/ha), gross margin (Tk. 158400/ha) and benefit cost ratio (8.01) in the local.

Gazipur

The agroeconomic performance of the three stems amaranth varieties have been presented in Table 1. Results showed that BARI developed stem amaranth variety Laboni gave better performance than local check variety. Plant height, plant weight and diameter were higher in the variety Laboni. The highest yield (38.14 t/ha) was recorded from BARI developed variety Laboni and the local varieties Bhutan and Aman gave lower yields (28 and 25.7 t/ha respectively). Higher gross return (Tk. 228840/ha), and higher BCR (10.7) were also obtained from Laboni whereas Aman data gave the lowest gross margin (Tk. 123809 /ha) and BCR (7.2).

Sherpur

The agro-economic performance of two stems amaranth varieties have been shown in Tale 1 and Table 2. From the result it was evident that the BARI developed stem amaranth variety, Laboni was better both agonomically and economically. Total plant weight, stem weight and stem diameter and also the yield was higher in Laboni compared to the local check. The Laboni variety gave higher yield of 47.71 t/ha compared to 39.33 t/ha in local. Higher gross return (Tk. 238550/ha), the higher gross margin (Tk.204328/ha) and higher benefit cost ration (6.97) was obtained form Laboni against the gross return (Tk.196650/ha), gross margin (Tk. 162428/ha) and benefit cost ratio (5.74) in the local.

Farmer's reaction at Mymensingh

Farmers are very much interested to grow the BARI Data 1. The colour, taste and market demand of Laboni is better than that of the local. The farmers also opined that the Laboni variety is soft and palatable to eat.

Farmers Reaction-Gazipur

Farmers are very much interested to grow the BARI developed high yielding variety Laboni. The color, taste and market demand of Laboni is better than that of the local.

Farmers' reaction-Sherpur

Farmers are interested to grow BARI developed high yielding variety Laboni. The colour, taste and market demand of Laboni is better than the local. They opined that Laboni is soft, palatable and can be eaten even up to flowering because of no fibre production in the stem.

Conclusion- Mymensingh

BARI Data 1 is agro-economically suitable for mass cultivation but its seed should be made available to the farmers for its extensive cultivation.

Table 1. Agro-economic performance of stem amaranth varieties at MLT Site, Mymensingh Sadar during Kharif-1, 2008

Variety	Plants /m^2	Plant height (cm)	Pericycle /plant (cm)	Wt./ plant (g)	Yield (t/ha)	Gross return (Tk/ha)	*TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Laboni	37.0	70.5	5.01	119	43.7	218500	22600	195900	9.67
Local	36.8	68.5	4.58	100	36.2	181000	22600	158400	8.01

*TVC includes cost of seed, fertilizer, man and animal labour cost

Price : seed : Tk. 5.00/kg , Urea : Tk. 6.00/kg, TSP : Tk.30.00/kg, MP : Tk. 30.00/kg, Cowdung : Tk. 1.00/kg.

Table 2: Agro-economic performance of stem amaranth varieties at MLT site Dhirashram, Gazipur Sadar during Kharif-1, 2008

Variety	Plant height (cm)	Plant weight with leaf (g)	Plant weight without leaf (g)	Plant diameter (cm)	Yield (t/ha)	Gross return (Tk/ha)	TVC (Tk./ha)	Gross margin (Tk/ha)	BCR
BARI Data 1	81.42 a	209.86 a	149.68 a	2.30 a	38.14 a	228840	21391	207449	10.7
Bhutan Data	75.40 b	140.18 b	110.024 b	1.98 b	28.02 b	168120	21391	146429	7.9
Aman Data	73.64 b	139.60 b	107.220 b	1.65 c	25.7 b	154200	21391	132809	7.2
CV (%)	2.73	11.78	8.66	5.66	7.49	-	-	-	-

Table 3. Yield of stem amaranth varieties at FSRD site, Sherpur during Kharif 1, 2007

Treatment	Plant height (cm)	Total plant wt. (g)	Stem wt. (g)	Stem diameter (cm)	Yield (t/ha)
Laboni	80.7	267	207	1.65	47.71
Local	85.7	238	185	1.51	39.33

Table 4. Cost and return analysis of stem amaranth varieties, Sherpur, 2007-08

Treatment	GR (Tk./ha)	TVC (Tk./ha)	GM (Tk./ha)	BCR
Laboni	2,38,550.00	34.222.00	2,04,328.00	6.97
Local	1,96,650.00	34,222.00	1,62,428.00	5.74

Table 5. Mean yield (t/ha) of stem amaranth in three locations, kharif, 2008

Variety	Location			Mean yield
	Mymensingh	Gazipur	Sherpur	
BARI Data-1	43.7	38.1	47.7	43.16
Local	36.2	25.7	39.5	33.8
Bhutan Data	-	28.0	-	-

On-Farm Trial of BARI Bitter Gourd Variety

Abstract

A field trial was conducted at Sabjipara, Shambhuganj under Mymensingh Sadar Upazila and Kusumhati, Sherpur during Kharif-1 season of 2007 to evaluate the performance of BARI developed bitter gourd variety- BARI Karola-1 against local variety. Averaged over locations BARI Korola-1 gave higher yield (17.76 t/ha) in comparison to local variety (16.49 t/ha). In both locations BARI Korola-1 fetched higher yield and economic return over the local variety.

Introduction

Bitter gourd is one of the popular cucurbitaceous vegetable cultivated throughout the country. Among the cucurbits, bitter gourd is considered as a nutritious vegetable containing 83-92% water, 4.0-10.5% carbohydrate, 1.5-2.0% protein, 0.2-1.0% oil, 0.8-1.7% fiber, 20-23 mg Ca, 1.8-2.0 mg Fe and 88-96 mg vitamin C. In recent years, BARI has developed a bitter gourd variety namely BARI karola-1 and released for farmer's use. The present study aims at evaluating the performance of BARI developed variety, BARI Karola-1 under farmers' field condition and to popularize and disseminate it.

Materials and Methods

The experiment was conducted at Sabjipara, Shambhuganj under MLT site, Mymensingh sadar, FSRD site Kusumhati, Sherpur during Kharif season, 2007. The design of the experiment was Randomized Complete Block with six dispersed replications. The BARI developed bitter gourd variety, BARI Karola-1 was tested with the local check. Seeds were sown on 3 March/07 at Mymensingh and 15 March/07 at Sherpur, maintaining 1.0 m x 1.0 m spacing and unit plot size was 8.0 m x 1.0 m. The crop was fertilized with STB fertilizer dose for high yield goal following FRG 2005. The STB fertilizer dose was 276-100-250- 54-6000 kg/ha of N, P, K, S and cowdung. Half of cowdung, P and all of S, Zn and B acid were applied during final land preparation. Rest of cowdung and P and 1/3 N and 1/3 K were applied as basal in pit. 1/3 N and 1/3 K were applied after 20 days of transplanting. After that, rest of N and K in 3 and 2 equal installments, respectively were applied at 20 days interval. Different intercultural operations, irrigation, and plant protection measures were done as and when necessary. The crop was harvested during 13 May-12 August 2007 at Mymensingh and 19 May to 22 June/07 at Sherpur. Data on yield and yield contributing characters were recorded and mean data are presented in table. Data related to cost and return and farmers' reaction were also recorded.

Results and Discussion

Mymensingh

From the Tables (1 and 2) it is evident that the BARI developed bitter gourd variety BARI Karola-1 was agronomically and economically viable. Fruit length, fruit diameter, fruit weight and yield of BARI Karola-1 were higher compared to the local check. The variety BARI Karola-1 gave higher yield (13.50 t/ha) than the local one (12.74 t/ha). Higher gross return (Tk. 270000/ha), gross margin (Tk. 212100/ha) and higher benefit cost ratio (4.66) were also obtained from BARI Karola-1 compared to local with gross return, gross margin and benefit cost ratio of Tk. 254800/ha, Tk.196900/ha and 4.40, respectively.

Sherpur

The agro-economic performance of two bitter gourd varieties has been summarized in Tale 1 and Table 2. From the result it was evident that the BARI Karola 1 was agonomically and economically viable. The number of fruits/plant, individual fruit weight, even fruit length and fruit diameter was higher in BARI Karola 1 than the local hybrid. However, the yield of BARI Karola 1 was 22.08 t/ha) while the local one gave 20.25. The higher gross return (Tk.231810/ha), the higher gross margin (Tk.130980/ha) and higher benefit cost ration (2.29) was obtained form BARI Karola 1. On the other hand, the gross return, gross margin and benefit cost ratio for the local were Tk.212625/ha, Tk.100830/ha and 2.10, respectively.

Farmer's reaction-Mymensingh

Farmers are very much interested to grow the BARI developed high yielding variety of bitter gourd due to its higher yield and economic return. According to them, the size, weight and market demand of BARI Karola-1 is better than that of the local. The farmers also opined that the variety BARI Karola-1 is palatable as smash rather than fry.

Farmers' reaction-Sherpur

Farmers' were interested to grow BARI Karola 1 due to its good shape, size, taste and high market value. The hybrid one was less tasty, do not boil uniformly, a little bit bitter and lower market demand.

Table 1. Yield and yield contributing characters of bitter gourd varieties during Kharif-1, 2007 at MLT Site Mymensingh

Varieties	No. of fruits/plant	Fruit size (cm)		Fruit wt.(g)	Yield (t/ha)
		Length	Diameter		
BARI Karola-1	18	15.09	4.89	68.83	13.50
Local	18	13.46	4.78	63.08	12.74

Table2. Economics of bitter gourd production during Kharif-1, 2007 at MLT site, Mymensingh

Varieties	Gross return (Tk./ha)	*TVC (Tk./ha)	Gross margin (Tk./ha)	B/C ratio
BARI Karola-1	270000	57900	212100	4.66
Local	254800	57900	196900	4.40

*TVC includes cost of seed, fertilizer, pesticide, man and animal labour cost
Price: Urea: Tk. 6.0/kg, TSP: Tk.18.00/kg, MP: Tk. 18.00/kg, Gypsum: 6.00 Tk./kg, and Cowdung: Tk. 1.00/kg.
Market price of bitter gourd: Tk. 20.00/kg

Table 3. Yield of bitter gourd at FSRD site, Sherpur during Kharif 1, 2007

Treatment	Fruits/plant (no)	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Yield (t/ha)
BARI Karola 1	25	256	24.5	4.24	22.08
Local (Shaktiman)	22	236	22.0	4.13	20.25

Table 4. Cost and return analysis of bitter gourd varieties

Treatment	GR (Tk./ha)	TVC (Tk./ha)	GM (Tk./ha)	BCR
BARI Karola 1	2,31,810.00	1,00.830.00	1,30,980.00	2.29
Local (Shaktiman)	2,12,625.00	1,00,830.00	1,11,795.00	2.10

Price of bitter gourd: Tk. 10.50/kg
TVC includes cost of land preparation, seed, fertilizer, insecticide/fungicide, man, animal, labour etc.

Table 5. Mean yield (t/ha) of bitter gourd in two locations, kharif, 2007

Variety	Location		Mean yield
	Mymensingh	Sherpur	
BARI Korola1	13.05	22.08	17.65
Local	12.74	20.25	16.49

On-Farm Adaptive Trial of Hyacinth Bean Varieties at Sylhet

Abstract

The experiment was conducted at the FSRD site Jalalpur during 2007-08. BARI shim-1 is a good variety in terms of yield and market price. But local Goalgadda is more productive and its market price is also higher in Sylhet region than that of BARI shim-1 due to excellent size, shape, colour and taste. Gelada may be introduced as a variety.

Introduction

BARI developed two high yielding hyacinth bean varieties with high yield potential and good quality. The varieties have been popularized in some areas of the country and farmers are adapting the varieties rapidly. Performance evaluation of the varieties at FSRD site Jalalpur, Sylhet will help demonstrate the performance of the variety as well quick dissemination of the varieties in this area.

Objectives

i) To evaluate the performance of the variety under farmers field.
ii) To popularize and disseminate the BARI high yielding hyacinth bean variety.

Materials and Methods

The experiment was conducted at the FSRD site Jalalpur, Sylhet during Rabi season 2007-2008 with 4 hyacinth bean varieties as BARI shim-1, IPSA shim-1, IPSA shim-2 and Goalgadda (local) The experiment was established in RCBD with 3 replications. Recommended fertilizer doses were applied as per BARC Fertilizer Recommendation Guide 2005.

Result and Discussions

From the Table 1, it was found that the highest yield was obtained from local cultivar Goalgadda (20.23 t/ha) followed by BARI shim-1 (17.92 t/ha). The lowest yield was obtained from IPSA shim-1(14.54 t/ha). BARI shim-1 is a good variety in terms of yield and market price and it is an early variety and farmers can sale it with a high price in the earlier season.. But local Goalgadda is more productive and it's market price is also higher than that of BARI shim-1 due to excellent size, shape, colour and taste and this cultivar grows well in slightly acidic soil of the highland of Sylhet area. Goalgadda should be adapted and improved for releasing as a variety.

Farmers reaction

But they express their opinion for Goalgadda as a high productive and profitable variety. Farmers opined that BARI shim-1 is also a good variety in terms of production and earliness

Conclusion

BARI shim-1 is a good variety in terms of moderate yield, earliness and market price. But local Goalgadda is more productive and its market price is also higher than that of BARIshim-1 due to excellent size, shape, colour and taste and this cultivar grows well in slightly acidic soil of the highland of Sylhet area. Goalgadda should be adapted and improved for releasing as a variety.

Table 1**.** Performance of different Hyacinth bean at FSRD site, Jalalpur, Sylhet, 2007-08

Treatment	Days to 1st flowering	Days to 1st harvesting	No. of pods/plant	Pod yield (t/ha)
BARI shim-1	57.25b	82.43b	343.47b	17.92b
IPSA shim-1	59.17b	84.46b	316.45c	14.54d
IPSA shim-2	64.82 a	89.02a	326.83c	16.24c
Goalgadda (local)	63.76a	91.80a	420.33a	20.23a
CV (%)	7.5	7.83	9.79	8.10
LSD (0.05)	4.279	3.172	12.59	1.413

On-Farm Trial of Carrot Lines at Farmers' Field

Abstract

An experiment was conducted on three carrot varieties viz. Kuroda, C. Kuroda Sakata and Carrot T. summer in the farmers' field at Multilocation Test Site, Jhenaigati, Sherpur while at Bhuapur, Tangail the cultivars tested were New kuroda, Shin Kuroda and SB kuroda during the rabi season 2007-08 to find out the performance of the imported Japanese carrot varieties for particular AEZ regions of Bangladesh. At Mymensingh, Kuroda and C. Kuroda Sakata was agro-economically better than the other two varieties Carrot T. Summer. These two varieties gave statistically identical yield but C. Kuroda Sakata gave a little bit higher yield than the other two varieties. It gave 26.35 t/ha root yield with gross return Tk. 131750/ha, gross margin Tk.76511/ha and benefit cost ratio 2.38. The other varieties were also performed well. While at Tangail Shin kuroda gave the highest root yield (21.02 t/ha) followed by New kuroda. Averaged over locations Shin kuroda produced the highest root yield 23.59 t/ha).

Introduction

Carrot is one of the most important winter vegetable in Bangladesh. The vast floodplain and the char area of Jamuna and Brahmaputra river is specially suitable for the crop. In the recent years, carrot cultivation is becoming popular in this area. Though there is no variety recommended by BARI, some imported varieties are performing well in Bangladesh condition. The present study aims at evaluating the performance of available imported varieties at farmers' field to popularize them among the farmers to promote their adoption.

Materials and Methods

The experiment was conducted at the farmers' field at Multilocation Test Site, Jhenaigati, Sherpur and Bhuapur, Tangail during the rabi season 2007-08 to find out the performance of the imported carrot varieties. The design of the experiment was randomized complete block design three replications. The treatment of the experiment was Japanese carrot varieties viz. i) Kuroda ii) C. Kuroda Sakata and iii) Carrot T Summer. The unit plot size was 3m x 4m. Seeds were sown on November 22, 2007 at spacing 25cm x15 cm following the seed rate of 5 kg/ha across the locations. Fertilizer were applied at the rate of 173-30-125 kg/ha of NPK and 10 t/ha of cowdung. The entire quantity of cowdung, P and half of N and K were applied at the time of final land preparation. The rest N and K were applied in two equal installments at 3 and 5 weeks after sowing. Intercultural operations were done properly when necessary. The crop was harvested on February 03, 2008. Data on yield and yield contributing characters were recorded and analyzed statistically and means were separated as per DMRT.

Results and Discussion

Jamalpur

The result showed that all the varieties produced identical plant height (Table 1). The height ranged from 43.53 cm to 46.87 cm. The number of plants/m^2.were also found identical. But the longest root length was found in C. Kuroda Sakata was identical to Kuroda. The shortest root length was noted from Carrot T. Summer. The diameter of the varieties was found insignificant. The individual root weight was found highest in Kuroda was statistically similar to C Kuroda Sakata. However, the highest root yield was obtained from C. Koruda Sakata (26.35 t/ha) was statistically identical to Koruda (26.17 t/ha). Carrot T Summer produced lowest root yield (24.95 t/ha). The highest gross return Tk. 131750/ha, gross margin Tk. 76511/ha and benefit cost ratio 2.38 was found in C Kuroda Sakata. The other varieties were also performed well.

Tangail

Table 3 reveals that most of the plant characters varied significantly except plant population per square meter and root yield per square meter. Shin Kuroda gave significantly the highest root yield (21.02 t/ha) which was at par with new kuroda (20.22 t/ha). The variety S.B kuroda provided the lowest root yield (19.86 t/ha).

Farmers' reaction-Jamalpur

Farmers were satisfied with the yield of carrot because of better market price in both the locations. The farmers faced the problem of uprooting of carrot by the children when it was not fully matured. They opined that if large scale cultivation was initiated than the problem can be overcome. However, the farmers were interested to grow the carrot as it has good price and demand in the market.

Farmers' reaction-Tangail

Farmers are interested to grow this crop because its market price is high. They opined that it may be one of the cash crops during winter season. They want to have the availability of quality seeds during the growing season.

Conclusion-Tangail

Results of two consecutive years reveal that may be imported varieties may be cultivated under char land situation of Bhuapur. The varieties may be extended for large scale production in other similar agro-ecological situation.

References

Peirce, L. C. 1987. Vegetables, characteristics, production and marketing. John Wiley and sons. Inc, New York, pp. 251-252.

Shinohara, S. 1984. Vegetable seed production Technology of Japan. Vol. 1. shinohara Authorized Agricultural Consulting Engineer officer, 4-7-7N. Nishiori, Shingapore-ku, Tokyo. Pp 123-142.

Rashid, M. M. 1993. Shabjibignan, 1ST Edn. Golam Moyenuddin Director, Text Book Division, Bangla Academy, Dhaka. Pp. 502-507.

Rashid, M. M. and Shakur 1987. Effect of date of planting and duration of growing period on the yield of carrot. Bangladesh Hort, 14 (2): 28-42.

Table 1: Yield and yield contributing character of carrot varieties at Jamalpur Sadar, 2007-08

Treat	Plant ht. (cm)	Plants/m^2 (no.)	Root length (cm)	Diameter. (cm)	Root wt/m^2 (g)	Yield (t/ha)
Konoshinkuroda	43.53	34.55	9.34 a	2.97	66.40 a	26.17 a
Takills	45.75	34.61	9.24 a	3.31	64.75 a	26.35 a
Newkuroda	46.87	34.50	8.52 b	3.00	61.35 b	24.95 b
F	ns	ns	*	ns	*	**
CV (%)	8.97	7.21	5.99	9.39	8.38	8.85

Table 2. Cost and return analysis of different carrot varieties at Jamalpur, 2007-08

Treat	GR (Tk/ha)	TVC (Tk/ha)	GM (Tk/ha)	BCR
Kuroda	1,30,850.00	55,239.00	75,611.00	2.36
C Kuroda Sakata	1,31,750.00	55,239.00	76,511.00	2.38
Carrot T Summer	1,24,750.00	55,239.00	69,511.00	2.25

Price: Tk.5.00/kg

Table 3. Yield and yield contributing parameters of carrot varieties at MLT site, Bhuapur, Tangail, 2007-08

Cultivar	Plant population/ m^2	Leaves/plant (no)	Plant height (cm)	Root length (cm)	Individual root wt (g)	Root wt/m^2 (kg)	Root yield (t/ha)	
							07-08	06-07
New kuroda	32	12	78.17	12.22	82.97	2.38	20.22	11.42
Shin kuroda	31	12	69.38	13.08	86.20	2.47	21.02	12.52
SB kuroda	30	11	73.98	13.00	79.70	2.34	19.86	11.00
LSD (1.05)	4.01	0.81	3.452	0.555	2.694	0.706	0.600	9.95
CV (%)	10.1	5.3	3.6	3.4	2.5	6.7	7.3	10.18

Table 4. Mean root yield (t/ha) of carrot at two locations, 2007-08

Cultivar	Location		Mean root yield
	Jamalpur	Tangail	
New kuroda	24.95	20.22	22.58
Shin kuroda	26.17	21.02	23.59
SB kuroda	-	19.86	-
Takills	26.35	-	-

On-Farm Trial of Ash Gourd Variety

Abstract

The experiment was conducted in farmers' field at the Farming Systems Research and Development site, Kushumhati, Sherpur and Tularampur, Narail during the Kharif season of 2007 to evaluate the performance BARI developed ash gourd variety, BARI Chalkumra 1 with the local variety. BARI Chalkumra 1was better yield in comparison to local variety at Sherpur but at Narail local variety gave higher yield. BARI Chalkumra 1 is little bit longer in size than the local. It is tasty and easily boiled and it has good market value. Averaged over locations BARI chalkumra-1 produced the highest yield (17.83 t/ha).

Introduction

Ash gourd is one of the popular cucurbitaceous vegetable cultivated throughout the country. Ash gourd is considered as a nutritious vegetable. In recent years, BARI has developed ash gourd variety viz. BARI Chalkumra 1 and released it for farmers' use. The present study aims at evaluating the performance of BARI Chalkumra 1 in farmers' field and to popularize and disseminate it. Keeping the views in mind, the experiment was under taken at farmers' field of Sherpur and Narail.

Materials and Methods

The experiment was conducted in farmers' field of Farming Systems Research and Development site, Kushumhati, Sherpur and MLT site Tularampur, Narail during the Kharif 1 season, 2007. The design of the experiment was RCBD with six dispersed replications. The BARI developed ash gourd variety viz. BARI Chalkumra 1 was tested with the local variety. Seeds were sown on March 23-29, 2007 at Sherpur and 25-28 March/07 at Narail, . maintaining the spacing of 2.0 m x 2.0 m The unit plot size was 4.0 m x 4.0 m. The crop was fertilized with 80-35-75-18 kg/ha of NPKS. Cowdung were used at the rate of 10 t/ha. Half of cowdung and all of S and $^1/_3$ P were applied during the final land preparation. Rest cowdung, P and $^1/_3$ N and $^1/_3$ K were applied as basal in the pit. The $^1/_3$ N and $^1/_3$ K were applied after 20 days of transplanting. The rest $^1/_3$ N and $^1/_3$ K in 3 and 2 equal installment, respectively were applied at 20 days interval. Different intercultural operations, irrigation were taken as per crop requirement. The crop was harvested from May 27-June 6, 2007 and continued up to July 25, 2007 at Sherpur and ----- at Narail. Data on yield and yield contributing characters were recorded.

Result and Discussion

Sherpur

From the results it was evident that the BARI Chalkumra 1 was agronomically and economically viable (Table 1 and Table 2). The individual fruit weight, fruit length, fruit diameter and fruit/plant was higher in BARI Chalkumra 1 than the local variety. However, the yield of BARI Chalkumra 1 was 25.06 t/ha) while the local variety gave 18.72. The higher gross return (Tk. 1,03,000.00/ha), the higher gross margin (Tk. 51,525.00/ha) and higher benefit cost ration (2.00) was obtained form BARI Chalkumra 1. On the other hand, the gross return, gross margin and benefit cost ratio for the local were Tk. 93,600.00/ha, Tk. 42,175.00/ha and 1.82, respectively.

Narail

The yield of local ash gourd variety was higher than BARI Chalkumra-1 variety. The individual fruit weight was also higher in local variety but number of fruit was higher in BARI Chalkumra-1 (Table 3).

Farmers' reaction-Sherpur

BARI Chalkumra 1is little bit longer in size than the local, It is tasty and easily boiled. It has good market value.

Farmers' reaction-Narail

The performance of local ash gourd variety was better than BARI-released Chalkumra variety (BARI Chalkumra-1). So the farmers did not interest to grow BARI Chalkumra-1 in future**.**

Table 1. Yield of ash gourd at FSRD site, Sherpur during Kharif 1, 2007

Treatment	Fruits/plant (no)	Fruit wt. (kg)	Fruit length (cm)	Fruit diameter (cm)	Fruit yield/ plant (kg)	Yield (t/ha)
BARI Chalkumra 1	6.3	2.00	20.8	14.3	12.60	25.06
Local	6.6	1.60	18.5	12.5	10.56	18.72

Table 2. Cost and return analysis of ash gourd varieties, Sherpur, 2007

Treatment	GR (Tk./ha)	TVC (Tk./ha)	GM (Tk./ha)	BCR
BARI Chalkumra 1	1,03,000.00	51.425.00	51,525.00	2.00
Local	93,600.00	51,425.00	42,175.00	1.82

Price of bitter gourd: Tk. 5.00/kg

Table 3. Yield and yield contributing characters of ash gourd variety in Tularampur, Narail during rabi 2007-08

Variety/ lines	No. of fruit/plant (no.)	Fruit wt. (g)	Yield (t/ha)
BARI Chalkumra-1	2.33	1898	10.60
Local	2.00	1913	14.37
CV (%)	28.30	6.71	18.29
F- test	NS	NS	NS

Table 4. Mean yield (t/ha) of ash gourd in two locations, 2007-08

Variety	Location		Mean yield
	Sherpur	Narail	
BARI Chalkumra-1	25.06	10.60	17.83
Local	18.72	14.37	16.54

Adaptive Trial of Improved Varieties of Turmeric

Abstract

A field trial was conducted at Agricultural Research Station, BARI, Comilla, Mymensingh and Sherpur to evaluate the performance of a promising turmeric line T-107 and three varieties during 2007-08. At Comilla the line T-107 (46.8 t/ha yield) showed better performance compared to BARI Halud-3(35.8 t/ha yield) in all respect. While at Mymensingh BARI Halud 3 gave the highest yield but at Sherpur BARI Halud 1 and BARI Halud 2 produced higher and identical yield. Averaged over locations highest yield was obtained from BARI Halud 3 (27.41).

Introduction

Turmeric (*Curcuma longa*) is one of the most ancient spices of Indian Sub-continent. It is used in the preparation of tasty curries for its lucrative color and flavors. Turmeric is cultivated widely in the different parts of Bangladesh. But its yield is low in comparison with other turmeric producing country. This is may be due to lack of high yielding turmeric variety. So the study was undertaken to study the performance of BARI developed turmeric varieties/ line.

Materials and Methods

The trial was carried out at agricultural research station, BARI, Comilla, Mymensingh Sadar and Jhenaigati, Sherpur during kharif 2007. The seed material of turmeric (wt. 50 to 50 g plus) was planted on 3 May/2007 at Comilla, 13 April/07 at Mymensingh and 12-14 March/07 at Sherpur, maintaining the spacing 60cm x 30cm, The land was fertilized with cowdung, N, P and K at the rate of 5 ton, 100, 35 and 85 kg/ha respectively. The crop was harvested on 10-February/2008 at Comilla, 30 January-4 February/08 at Mymensingh and 29-31 December/07 at Sherpur. Data on yield and yield contributing components of turmeric was recorded and analyzed statistically.

Results and Discussion

Comilla

The mean data of different yield and yield components of turmeric line T -107 and check variety BARI Halud-3 are presented in Table-1. The turmeric line T-107 showed superiority for all the studied yield components than those of BARI Halud-3. Turmeric line-T-107 gave the longest plant height (95.06cm) highest number of leaf and tillers (28.90 and 4.8 respectively), highest yield per plant (850 g), and highest finger yield (46.8 t/ha).

Mymensingh

The characters like length and diameter of mother plant were not statistically significant (Table 2). But plant height, finger number, length, diameter, weight of ginger and mother plant (corm) were statistically significant. Plant height varied from 81.2-123.5 cm. The highest finger number/plant, finger diameter, finger weight was observed in BARI Turmaric-3. The yield contributing characters of local variety were lower. Corm weight of BARI Turmaric-2 and BARI Turmaric-3 were identical. BARI Turmaric-3 gave significantly the highest fresh yield of 22.84 t/ha which was followed by BARI Turmaric-2. Higher fresh yield in BARI Turmaric-3 was attributed due to higher finger number, finger weight and corm weight. The lowest fresh yield (14.25 t/ha) was observed in the local variety. Out of the three tested varieties, BARI Turmaric-3 gave higher gross return (Tk. 228400/ha), gross margin (Tk. 190440/ha) and benefit cost ratio (6.02) compared to other varieties. Local gave the lowest gross return (Tk.142500/ha), gross margin (Tk.104540/ha) and benefit cost ratio 3.75.

Sherpur

The result obtained from the study indicated that the longest plant was recorded from BARI Halud 3 and was statistically similar to BARI Halud 1 and 2 (Table 4). The local produced the shortest plant. The number of fingers/plant was found highest in BARI Halud 2 and was similar to that of BARI Halud 1 and 3. The local variety produced statistically the lowest number of fingers/plant. The number of corms/plant was found highest in BARI Halud 2 and statistically different from BARI Halud 1 and 3. The local variety was produced the lowest number of corms/plant. The highest number of fingers/plant was recorded from BARI Halud 2 and was statistically identical to BARI Halud 1 and 3. The local produced the lowest number of fingers/plant. However, the highest turmeric yield was obtained from BARI Halud 2 (24.93 t/ha.) and identical to BARI Halud 1. BARI Halud 3 produced a little bit lower yield than the other BARI varieties. The local variety produced significantly lowest yield (10.41 t/ha). The highest gross return (Tk. 2,49,300.00), gross margin (Tk. 1,68,010.00) and BCR (3.07) was found in BARI Halud 1 against gross return (Tk. 1,04,100.00), gross margin (Tk. 22,810.00) and BCR (1.28) in local (Table 5).

Farmer's reaction-Mymensingh

Farmers preferred the variety BARI Turmaric-3 for its higher yield and local variety for its colour. They are interested to grow BARI Turmaric-3 in the next year if seeds are available.

Farmers' reaction-Sherpur: Farmers preferred BARI Halud 2 for its disease resistance ability, attractive colour and higher yield than the local variety.

Conclusion

This was the 1st year study. So, further trial will be needed for the confirmation of the findings.

Table 1. Yield and yield component of turmeric as influenced by Turmeric line T-107 and variety BARI Halud-3, Comilla, 2007-08

Treatment	Plant height (cm)	Number of leaf/plant	Number of tillers	Yield/plant (g)	Yield/m^2 (kg)	Yield/ha (t)
Turmeric line T-107	93.06	28.90	4.8	850	4.68	46.8
BARI Halud -3	89.01	18.12	3.05	650	3.58	35.80

Table 2. Yield and yield parameters of Turmeric varieties at Mymensingh Sadar(2007-08)

Varieties	Plant height (cm)	Finger				Mother plant (corm)			Fresh yield (t/ha)
		No./ plant	Length (cm)	Diameter (cm)	Wt (g)	Length (cm)	Diameter (cm)	Wt (g)	
BARI Turmaric-2	98.9 b	21ab	8.12a	6.30a	174.4a	8.38	9.18	74.80a	18.53ab
BARI Turmaric-3	123.5a	22a	6.80b	6.62a	199.2a	8.42	9.40	77.00a	22.84a
local	81.2c	18b	5.76c	5.49b	123.2b	8.48	8.60	42.4b	14.25b
LSD (0.05)	10.28	3.38	0.67	0.17	48.68	NS	NS	15.47	4.45
CV (%)	7.49	7.41	7.16	6.47	10.67	8.94	7.59	9.62	9.73

Table 3. Cost benefit analysis of Turmeric varieties at Mymensingh Sadar(2007-08)

Variety	Gross return (Tk./ha)	*TVC (Tk./ha)	Gross margin (Tk./ha)	Benefit cost ratio
BARI Turmaric-2	185300	37960	147340	4.88
BARI Turmaric-3	228400	37960	190440	6.02
Local	142500	37960	104540	3.75

*TVC includes cost of Rhizome (seed), fertilizer, cowdung, man and animal labour cost.
Price of to turmeric: Tk. 10.00/kg.

Table 4. Yield and yield contributing characters of turmeric varieties at Sherpur, 2007-08

Treatment	Plant height (cm)	Fingers/plant (no.)	Corms/plant (no.)	Fingers/plant (no.)	Yield (t/ha)
BARI Halud 1	129.4 a	8.86 a	2.06 b	292.0 a	24.08 ab
BARI Halud 2	131..3 a	9.40 a	2.26 a	307.6 a	24.93 a
BARI Halud 3	133.7 a	9.00a	2.00 b	295.0 a	23.59 b
Local	95.6 b	6.53 b	1.33 c	172.3 b	10.41 c
CV (%)	**	**	**	**	**
F	6.52	8.08	10.59	9.07	10.81

Table 5. Cost and return analysis of turmeric, Jhenaigati, Sherpur, 2007-08

Treat	GR (Tk/ha)	TVC (Tk/ha)	GM (Tk/ha)	BCR
BARI Halud 1	2,40,800.00	81,290.00	1,59,510.00	2.96
BARI Halud 2	2,49,300.00	81,290.00	1,68,010.00	3.07
BARI Halud 3	2,35,900.00	81,290.00	1,54,610.00	2.90
Local	1,04,100.00	81,290.00	22,810.00	1.28

Price: Tk.40.00/kg

Table 6. Mean fresh yield (t/ha) of turmeric varieties/line in three locations, 2007-08

Line/variety	Location			Mean fresh yield
	Comilla	Mymensingh	Sherpur	
BARI Halud 1	-	-	24.08	-
BARI Halud 2	-	18.53	24.93	21.73
BARI Halud 3	35.80	22.84	23.59	27.41
T-107	46.8	-	-	-
Local	-	-	10.41	-

Performance of Different Chickpea Varieties in Sylhet Region

Abstract

An experiment was carried out at FSRD site Jalalpur, Sylhet to find out the yield and suitability of chickpea variety(s) after harvest of T. aman rice in the Sylhet region. Three BARI developed chickpea varieties (BARI Chola 3, 5, & 8) were evaluated during 2007-08 at FSRD site, Sylhet BARI Chola 8 gave the highest yield (1191.67 kg/ha) followed by BARI Chola 3 (1069.33 kg/ha) while BARI Chola 5 gave the lowest yield (813.32 kg/ha).

Introduction

Pulses as a group can utilize limited soil moisture and nutrients more efficiently than cereal and mainly for this reason these crops are grown in areas after satisfying the demand for cereals. In the Sylhet region, a vast area of land remains fallow for a long time (December-May) after the harvest of aman rice due to moisture stress. Chickpea is a drought tolerant and deep rooted crop which can play a major role in acquisition of both water and nutrient from below the soil surface. In order to increase pulse production, chickpea may be introduced in the existing fallow period. Therefore, the present experiment was undertaken to find out the yield and suitability of chickpea variety(s) after harvest of T.aman rice in the Sylhet region.

Materials and Methods

The experiment was conducted at the FSRD site, Jalalpur, Sylhet during rabi season of 2007-08. Three BARI developed chickpea varieties viz. BARI Chola 3, BARI Chola 5 and BARI Chola 8 were tested during 2007-08 at FSRD site, Jalalpur, Sylhet. Treatments were arranged in the RCB design with three replications. The plot size was 4m$\times$3m. Fertilizers were applied at the rate 20-18-17 kg/ha of N, P and K, respectively. The seeds were sown on 20 November, 2007 at FSRD site. Spacing was 40cm$\times$10cm. The crop was harvested on 9-14 March/08. Yield and yield attributes data were collected and analyzed statistically.

Results and Discussions

There were significant differences in all the characters studied (Table 1). The days to maturity ranged from 109 to 115. The earliest variety was BARI Chola 5. BARI Chola 3 produced the highest number of pods/plant (30.67) followed by BARI Chola 5 (28.07) and 8 (24.66). The highest 100 seed weight was recorded from BARI Chola 8 (28.00 g). BARI Chola 3 produced the second highest seed weight (22.50 g) but BARI Chola 5 showed minimum 100 seed weight (16.51 g). The highest yield (1191.67 kg/ha) was obtained from BARI Chola 8 probably due to the biggest seed size which was closely followed by BARI Chola 3 (1069.33 kg/ ha).

Farmers' reactions

1. Farmers opined that BARI Chola 8 is a good variety in terms of yield.
2. Pod borer is a major problem for cultivation of chickpea in Sylhet region.

Conclusion: The experiment should be repeated with more number of varieties.

Table 1. Yield and yield contributing characters of chickpea varieties at FSRD site, Jalalpur, Sylhet during Rabi 2007-08.

Variety	Maturity (Days)	plant height (cm)	pods/plant (no.)	100 seed wt. (g)	Seed yield (kg/ha)
BARI Chola-3	112.33 b	43.32b	30.67a	22.50b	1069.33b
BARI Chola-5	109.00c	37.33c	28.67b	16.51c	813.32c
BARI Chola-8	114.67a	47.66a	24.66c	28.00a	1191.67a
CV (%)	5.53	4.56	7.06	5.24	4.16
LSD (0.05)	1.308	1.511	1.308	1.133	73.42

Farmers' Participatory Varietal Selection of Chickpea in the High Barind Tract

Abstract

A field experiment was conducted in the farmer's field of FSRD site, Kadamshahar, Rajshahi during r*abi* 2007-08 to evaluate variety through farmers' selection under Barind (HBT) environments. Fourteen advance lines of chickpea viz. BCX-91010-1, ICCV-93158, ICCV-97004, BCX-910109-3, ICCV-96020, ICCX-960254-9, ICCX-960265-6, ICCX-960265-10, ICCV-97030, ICCV-03103, ICCV-03111, ICCV-03203, ICCV-03207 and one check variety BARI chola-5 were tested in the farmer's field of HBT. Among the tested entries BCX-91010-1gave the higher seed yield (1.82 t/ha) which was closely followed by ICCV-96020 (1.81 t/ha), ICCX-960265-6(1.81 t/ha), ICCV-93158 (1.80 t/ha) ICCX-960265-10 (1.79 t/ha) and BCX-910109-3 (1.78 t/ha). The lowest yield (1.46 t/ha) was obtained from ICCV-03111 and the check variety BARI Chola-5 gave 1.56 t/ha seed yield.

Introduction

Chickpea (*Cicer arietinum* L) is an important pulse crop in Barind area. Traditionally the farmers of Barind area cultivate chickpea after harvest of T.aman rice in residual soil moisture condition. The long duration T.aman rice affect the proper sowing time of chickpea that causes lower seed yield. Therefore, development of suitable chickpea variety is necessary for improving chickpea productivity in Barind area. In relation to the above situation the present trial was undertaken with a view to develop variety(s) through farmer's selection under Barind environments.

Materials and Methods

The field trial was conducted at FRSD site, Kadamshahar, Rajshahi during *rabi* 2007-08. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 2m x 4 m. The seeds were sown in 40 cm X 10 cm . Fourteen advance lines of chickpea viz. BCX-91010-1, ICCV-93158, ICCV-97004, BCX-910109-3, ICCV-96020, ICCX-960254-9, ICCX-960265-6, ICCX-960265-10, ICCV-97030, ICCV-03103, ICCV-03111, ICCV-03203, ICCV-03207 and one check variety BARI chola-5 were tested in the trial. Seeds were sown on 01 November 2007. The seed rate was used 50 kg/ha. The land was fertilized with 12-19-17-10-1 N-P-K-S-B kg/ha (FRG, 2005) in the form of urea, triple super phosphate, muriate of potash, gypsum and boric acid, respectively. All fertilizers were applied as basal after final land preparation. The crop was harvested on 17 March 2008. The seed yield and yield components of chickpea were recorded and analyzed statistically.

Results and Discussion

No significant variation was observed among the genotypes on the yield and yield parameters of chickpea except plant height and 100 seed weight (Table-1). The maximum seed yield was obtained from BCX-91010-1(1.82 t/ha) that was followed by ICCV-96020 (1.81 t/ha), ICCX-960265-6(1.81 t/ha), ICCV-93158 (1.80 t/ha) ICCX-960265-10 (1.79 t/ha) and BCX-910109-3 (1.78 t/ha). The lowest seed yield was recorded in ICCV-03111 (1.46 t/ha) and the check variety BARI Chola-5 gave 1.56 t/ha seed yield.

Farmers' reaction

Farmer own set of selection criteria (Before implementation)	**Farmer achievement** (Post implementation)
i) Promising cultivar for Barind condition	Farmers obtained some promising cultivar for Barind condition e.g. BCX-91010-1, ICCV-93158, ICCV-96020, ICCX-960265-6 and ICCX-960265-10
ii) Should be higher yield	Farmers are happy to have higher yield from selected varieties
iii) Should be disease resistant	Pest attack was minimum in selected varieties

Conclusion

Farmer selected five promising lines on the basis of performance. So it should be studied further for making any conclusion.

Table 1: Yield and yield attributes of Chickpea under farmer's participator selection at FSRD site, Kadamshahar, Rajshahi during 2007-08

Treat	Plant height (cm)	Plant population/m^2 (No)	Pods/ plant (No)	100 seed wt (g)	Seed yield (t/ha)	Straw yield (t/ha)
BCX-91010-1	56.20be	20.50	83.13	21.30bc	1.82	2.35
ICCV-93158	53.86ce	20.15	87.46	20.50bc	1.80	1.85
ICCV-97004	58.40ad	18.44	59.80	21.50bc	1.56	2.11
BCX-910109-3	54.26ce	19.02	73.00	24.50a	1.78	1.85
ICCV-96020	51.73de	20.41	68.53	20.63bc	1.81	1.98
ICCX-960254-9	62.73ac	19.87	67.66	26.13a	1.56	1.86
ICCX-960265-6	64.53ab	19.46	81.80	21.20bc	1.81	1.82
ICCX-960265-10	66.26a	19.00	67.60	21.93bc	1.79	2.15
ICCV-97030	53.26ce	20.20	80.23	20.23c	1.71	1.77
ICCV-03103	52.80ce	19.20	70.76	21.66bc	1.67	1.65
ICCV-03111	51.86de	19.04	79.53	24.73a	1.46	1.95
ICCV-03203	59.53ad	20.83	74.13	22.20b	1.75	1.88
ICCV-03207	52.93ce	21.73	61.06	17.56d	1.63	1.91
BARI chola-5	47.66e	19.78	58.66	13.06c	1.56	1.82
LSD (0.05)	8.66	NS	NS	1.64	NS	NS
CV (%)	9.18	5.89	16.97	4.61	13.39	18.67

Performance of BARI Released Pulse Varieties in Coastal Area of Satkhira

Abstract

The experiment was conducted at MLT site, Satkhira during rabi season of 2007-'08. The objective of the experiment was to find out the suitable pulse varieties for higher yield in coastal regions. Four lentil varieties and 2 chickpea variety/line were evaluated. It was found that BARI masur-3 gave highest yield (0.76t/ha) while Chickpea line ICCV-95138 yielded 0.875t/ha.

Introduction

During lost few decades, there has been a continuous decreasing trend in area, production and productivity of pulse crops in Bangladesh. The decrease was mainly due to competition of pulse crops with wheat and Boro rice. Southern region of Bangladesh is mainly rice based. Cultivation pulse is very low here. It is a protein deficit area. Lentil and chickpea are the second and third most important pulse crop in Bangladesh. As a legume crop, chickpea helps build up soil fertility in the traditional rice monoculture of Bangladesh through symbiotic nitrogen fixation. Considering the soil health as well as essentiality of protein the experiment was undertaken.

Materials and Methods

The experiment was conducted at the farmers field at MLT site, Satkhira during the rabi season of 2007-'08. Four lentil varieties viz. BARI masur-3, BARI masur-4, BARI masur-5, BARI masur-6 and 2 chickpea variety/line viz. BARI chickpea-5 and ICCV-95138 were tested. The experiment was RCB design with 3 replications. Unit plot size was 4m×5m. Fertilizer doses were 50-90-40 kg/ha of Urea, TSP and MP for both lentil and chickpea and in addition with 12 kg/ha of borax for chickpea. All fertilizers were applied as basal during final land preparation. Continuous line sowing was done keeping with row to row 40cm spacing. Date of sowing and harvesting was 4 Dec.'07 and 03Mar'08 for both pulse crops respectively. All the data were collected at the time of harvest. During this period soil salinity was 3.38 to 5.67ds/m.

Result and Discussion

Among four lentil varieties BARI masur -3 performed better than any other and yield was 0.71 t/ha which was followed by BARI masur-6 (Table 1). All the major yield contributing characters were high in BARI masur-3. BARI masur-4 gave the lowest yield (0.46 t/ha), though it took the shortest days to maturity. In case of chickpea, line ICCV-95138 gave the highest yield and it was 0.875 t/ha. It was due to its more no. of pod/plant and 1000-grain weight. BARI chola-5 gave lower yield (0.80 t/ha) (Table-2).

Farmer's reaction

Pulse crops are very sensitive to salinity as well as excessive water. So, farmers are not so interested to cultivate the crop.

Conclusion

This was the first year experiment. It can be continued by making raised bed to minimize soil salinity.

Table 1: Yield and yield attributing characters of lentil at Satkhira MLT site during rabi season, 2007-08

Variety	Days to maturity	Plant population/ m^2	Plant height (cm)	Pod/plant (No.)	1000 grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
BARI masur-3	102	187 a	33.70 ab	42.53 a	17 .00 a	0.71 a	1.67 a
BARI masur-4	100	141 b	30.13 b	29.50 b	15.67b	0.46 b	1.20 b
BARI masur-5	104	188 a	31.57 b	37.83 a	15.67 b	0.60 ab	1.36 ab
BARI masur-6	99	199 a	35.30 a	37.53 a	16.00 ab	0.64 a	1.53 ab
LSD (0.05)	--	44.50	3.58	6.362	1.20	0.15	0.35
CV (%)	--	12.43	5.49	8.36	3.74	13.33	12.45

Table 2: Yield and yield attributing characters of chickpea at Satkhira MLT site during rabi season, 2007-08

Variety/line	Days to maturity	Plant population/m^2	Plant height (cm)	Pod/plant (No.)	1000 grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
BARI chola-5	120	56.50	42.05	27.15	82.50	0.800	2.20
ICCV-95138	115	68.00	49.40	30.60	95.00	0.875	2.60

Performance of Salt Tolerant Mungbean Line in the Coastal Area of Satkhira

Abstract

The experiment was conducted at Banerpota Farm, Satkhira during 2007-08 to select the salt tolerant variety of mungbean. Mungbean line BM-01 performed better at Banerpota Farm, Satkhira. Further investigation in relation to screening and management practices need to be done.

Introduction

In Bangladesh, more than 30% of the cultivable area is in the coast. Coastal areas are seriously affected by various degrees of salinity. After harvesting of T.Aman vast land remain fallow. During rabi season, the soil salinity levels increase through capillary movement. For higher salinity most of the rabi crops do not survive in the area. BARI recently developed many high yielding varieties/line of mungbean. The performance of the varieties of mungbean need to be evaluated in saline area. The present study was therefore, undertaken to find out the suitable variety of mungbean in saline area.

Materials and Methods

The trial was conducted at Banerpota Farm, Satkhira during 2007-2008. Mungbean was sown on 15 February 2008 at Banerpota Farm, Satkhira. Six varieties/lines of mungbean (BM-01, BM-08, BARI Mung-2, BARI Mung-5, BARI Mung-6 and local) were included in the study. The unit plot size was 2m×1.5m. Seeds were sown following RCB design with three replications. The seeds were sown as line sowing. Line to line spacing was 30cm. 20-16-15-10kg/ha of N-P-K-S was applied as basal. Two irrigations were applied at initial stage. Intercultural operations were followed as and when necessary. During the period soil salinity was 4.45-6.97ds/m. Data on yield and yield attributes were collected and analyzed statistically.

Results and Discussion

Performance of mungbean varieties/lines has been presented in table-1. Plant population, plant height, 1000 seed weight, seed yield and stover yield differed significantly by variety/line. The result revealed that the highest seed yield (712.33kg/ha) was obtained from BM-01. The highest seed yield produced by BM-01 could be due to maximum plant/m^2. The lowest seed yield produced by BM-08 could be due to lightest seed weight. No viral disease infestation was observed in any variety except local one. Aphid infestation was observed in the field.

Farmers' reaction

Farmers preferred BM-01 for excellent growth. But dislike its pod harvesting system.

Conclusion

It was observed that mungbean variety BM-01 showed better adaptability at Banerpota Farm, Satkhira. Further investigation in relation to screening and management practices could be done to evaluate the performance of above mentioned crop.

Table 1: Yield and yield attributes of mungbean as affected by varieties/lines tested at Banerpota Farm, Satkhira during rabi season, 2007-'08.

Variety/line	Day's to maturity	Plants/m^2	Plant height (cm.)	Pod/plant (No.)	Seeds/pod (No.)	1000 seed weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
BM-01	68	55.33 a	60.33 ab	7.33	8.33	41.66 b	712.33 a	8.33 b
BM-08	75	49.00 ab	57.33 b	6.66	8.33	34.00 e	573.66 f	4.40 b
BARI Mung-2	64	38.66 d	53.66 b	7.00	8.66	37.66 d	615.66 d	8.10 b
BARI Mung-5	60	42.00 cd	53.66 b	6.66	8.66	39.66 c	650.00 c	8.26 b
BARI Mung-6	59	51.33 ab	53.00 b	8.00	8.33	48.33 a	594.33 e	9.16 a
Local	65	45.66 b	68.00 a	6.33	8.66	39.00 c	672.00 b	9.06 a
LSD (0.05)	--	6.39	9.511	1.69	1.37	1.135	5.38	0.52
CV (%)	--	7.48	9.07	13.30	8.86	1.56	0.47	3.34

On-Farm Trial of Barley Lines under Rainfed Condition in the High Barind Tract

Abstract

The trial was conducted in the farmer's field of FSRD site, Kadamshahar, Rajshahi during *rabi* 2007-08 with a view to select early and high yielding barley lines/ variety for drought prone High Barind Tract (HBT) areas. The trial consists of five barley genotypes viz., BHL-10, BHL-11, BHL-19, and BARI Barley-3 (check variety). Out of the five barley genotypes BHL-10 gave the highest seed yield (1.85 t/ha) followed by BARI barley-3 (1.75 t/ha) and BHL-11 (1.69 t/ha).The lowest seed yield was produced by BHL-19 (1.62 t/ha).

Introduction

Barley is the most adaptive cereal crop in different environment. It is used for making various delicious foods like baby food, horlicks, ovaltin etc. It contents about 12-14% protein. In respect of nutrient quality barley is better than wheat. In Bangladesh, the total area under barley cultivation is about 4000 hectare of land and the production is about 3000 metric ton (BBS, 2004). It has potentiality to grow under water stress condition. Therefore drought tolerant barley variety can be considered as beneficial crop in the drought prone areas such as High Barind Tract. In water-stressed environment it can be grown successfully after harvesting of short duration T. aman rice. Therefore, the field trial was under taken to select early and high yielding lines to release as a variety for droughty areas.

Materials and Methods

The field trial was conducted at FSRD site, Kadamshahar, Rajshahi during rabi season of 2007-08. The trial consists of five barley genotypes viz. BHL -10, BHL-11, BHL-19, and BARI Barley-3 (used as check variety). The trial was non-replicated. The unit plot size was 7m x 4m. Fertilizers were applied at the rate of 100-60-40-1 kg N, P_2O_5, K_2O and B/ha in the form of urea, triple super phosphate, muriate of potash and boric acid, respectively. All the fertilizers were incorporated with soil during final land preparation. The crop was sown on 5 December 2006. The spacing was line-to-line distance 25 cm with continuous sowing and seed rate was maintained 120 kg/ha. The crop was harvested on 13 March 2006. Weeding and plant protection measures were done as and when required. Data were collected on different yield and yield components.

Results and Discussion

The results of trial revealed that BHL-10 was given the higher seed yield (1.85 t/ha) due to the highest number of effective tillers/m^2 (259), longest panicle (8.75 cm) highest number of grains/spike (47.4) and heaviest seed (40.4 g) and it was followed by the genotypes BARI barley-3 (1.75 t/ha) and BHL-11 (1.69 t/ha). The genotype BHL-19 contributed lowest seed yield (1.62 t/ha)). All the genotypes required 59-61 days for 50% heading and 87-90 days for 50% maturity under rainfed condition in the high Barind Tract. Among the genotypes BHL-11 was taken comparatively shorter time (59 days) for heading and shorter 4ime (87 days) for maturity.

Farmer's reaction

Farmer own set of selection criteria (Before implementation)	**Farmer achievement** (Post implementation)
i) Promising cultivar for Barind condition	Farmers obtained some promising cultivar for Barind condition e.g. BHL-11
ii) Should be higher yield	Farmers are happy to have higher yield from selected varieties
iii) Should be disease resistant	Pest attack was minimum in selected varieties

Conclusion

Among the tested cultivars BHL-10 produced better yield under rainfed condition for last three years; so it may be released as a variety.

Table 1. Performance of different barley genotypes under rainfed condition at HBT

Genotypes	Plant height (cm)	Effective tillers/m^2	Spike length (cm)	Grains/ Spike	TSW (g)	Seed yield (t/ha)	50% Heading (days)	50% Maturity (days)
BHL-10	59.3	259	8.75	47.4	40.4	1.85	60	89
BHL-11	62.3	240	8.15	47.3	40.5	1.69	59	87
BHL-19	58.7	232	8.45	36.9	39.5	1.62	60	87
BB-3 (Check)	64.3	223	8.20	36.4	39.0	1.75	61	90

Adaptive Trial of BARI Developed Ginger Variety

Abstract

An experiment was conducted at Multilocation Testing site, Trishal, Mymensingh and Comilla during 2007 to evaluate the performance of BARI developed ginger variety, BARI ada-1 along with the local one. At Mymensingh, better yield and economic return was obtained from BARI ada-1. It gave the highest yield of 12.30 t/ha against the local variety (8.26 t/ha). The higher gross return (Tk.430500/ha), gross margin (Tk. 324775 /ha) and benefit cost ratio (4.07) were also obtained from BARI ada-1. The variety BARI ada-1 was preferred by the farmers for its higher yield and higher demand in the market. While at Comilla the experiment was carried out to study the performance of two ginger lines during 2007-2008. The line GOO-21 performed well in respect of morphological and yield contributing characteristics. The highest yield (48.43 t/ha) was recorded from line ginger line GOO-21.

Introduction

Ginger is an aromatic perennial herb of the family Zingiberaceae, and a native of Southeast Asia. It is used more as a condiment than as a spice. Bangladesh produces about 49,405 metric tons of ginger from about 7715 hectares of land in 2006 (FAO, 2008). Ginger is cultivated as a rain-fed annual crop in upland and hill slopes But the farmers of this area are growing low yielding local varieties. Spices Research Center of BARI has already released a high yielding good quality variety of ginger and also possesses some advance lines having high yield potential. The present study aims to evaluate the performance of BARI developed variety, BARI ada-1 in farmer's field condition and to promote its adoption among the farmers.

Materials and Methods

The experiment was conducted at Multilocation Testing site, Trishal, Mymensingh and Comilla during 2007. The BARI developed ginger variety BARI ada-1 was tested with the local check. Rhizomes were sown on 15 May 2007 maintaining a spacing of 50cm x 20 cm. The unit plot size was 5.0 m x 4.0 m whereas farmers maintained a spacing 75 cm x 20 cm. Before sowing, the rhizomes were treated with fungicide Cormil MZ-72 @ 2g/litre of water. The experiment was laid out in a Randomized Complete Block Design with 3 replications. The crop was fertilized with STB fertilizer dose for high yield goal following FRG 2005. The STB fertilizer dose was 120-45-80-10-3-5000 kg/ha of N, P, K, S, Zn and cow dung. The entire quantity of cow dung, P, K, S, Zn and half of the N were applied during final land preparation. Remaining half of the N was applied as top dressing after six weeks of planting. Before planting time the soil was treated with Curaterr -5 G at the rate of 10 kg/ha to control the insects. All intercultural operations were done as and when necessary. The crop was harvested during 10-14 February 2008. Data on yield and yield contributing characters were recorded. Data related to cost and return and farmer's reaction were also recorded.

Results and Discussion

From the results it is evident that the BARI developed ginger variety BARI ada-1 was agronomically and economically better in respect of number of tillers/plant, diameter of rhizome, weight of rhizome and yield compared to the local check (Table 1). The variety BARI ada-1 gave higher yield of 12.30 t/ha against the local (8.26 t/ha). Higher gross return (Tk. 430500/ha), gross margin (Tk.324775/ha) and benefit cost ratio (4.07) were also obtained from BARI ada-1 against gross return (Tk. 426300/ha), gross margin (Tk. 206800/ha) and benefit cost ratio (1.94) of the local (Table 2).

Comilla

The yield and yield attributes of two lines contributed more or less same trend of ginger production (Table 2). The highest plant height (73.97 cm), maximum number of leaves and tillers (199.67 and 18.44, respectively), yield per m^2 (4.84 kg)' yield per plant (880.55 g) and yield 48.43 t per hectare were obtained from the line GOO-21.

Farmer's reaction-at Mymensingh

Farmers are very much interested to grow BARI ada-1 variety of ginger due to its high yield potential. It is also observed that the market demand of BARI ada-1 is better than that of the local.

Conclusion-Comilla: Another comprehensive study will be needed to see the environmental effect.

Table 1. Yield and yield parameters of ginger varieties during 2007-08 at MLT site, Trishal

Variety	Plant height (cm)	No. of tillers/plant	Diameter of rhizome (cm)	Wt. of rhizome /plant(g)	Yield (t/ha)
BARI ada -1	68.6	8	2.72	146.33	12.30
Local	72.86	7	2.55	145.33	8.26

Table 2. Economics of Ginger varieties during 2007-08 at MLT site, Trishal

Variety	Gross return (Tk./ha)	*TVC (Tk./ha)	Gross margin (Tk./ha)	BCR
BARI ada -1	430500	105725	324775	4.07
Local	426300 (289100 + 137200*)	219500	206800	1.94

*TVC includes cost of seed, fertilizer, pesticide, man and animal labour cost
Seed rate: 1500 kg/ha (BARI ada -1), 5600 kg/ha (Local) of which 70% was harvested as pilai
Price : Rhizome: Tk. 35.00/kg, Urea : Tk. 6.5/kg, TSP : Tk.18.00/kg, MP : Tk. 15.00/kg, Gypsum: 6.00 Tk./kg, Zinc: 40.00 Tk./kg and Cowdung : Tk. 1.00/kg.
* Price of pilai

Table 3. Yield and yield attributes of two promising gingers line at Comilla, 2007

Treatment	Plant height (cm)	Number of leaves	Number of tillers	Yield/plant (g)	Yield/m^2 (kg)	Yield/ha (t)
GOO-21	73.97	199.67	18.44	880.55	4.84	48.43
GOO-22	70.54	182.56	15.0	868.89	3.81	38.1

Effect of High Speed Rotary Tiller for Dry Land Preparation of Onion Production in Faridpur Region

Introduction

Wheat Research Centre and CIMMYT Bangladesh had a program to introduce Chinese made power tiller operated minimum tillage seeder for sowing wheat earlier. They have already distributed about 100 units of the seeder among the farmers of wheat growing areas. Due to its high-speed rotary action on soil surface, tilth quality is very fine in sandy to clay loam soil. For dry land crop cultivation, this high speed rotary tiller can be a good option for land preparation. Faridpur is an onion growing area. Fine tilth is needed for its transplanting. Considering the benefits of new tiller, an observation trial was conducted in the farmers' field under Faridpur district to test the high speed rotary tiller for ploughing dry land.

Materials and Methods

The trial was conducted in medium low land in Patpasha –Gotti of Nagarkanda upazilla under AEZ 12. Two treatments were used namely-

T_1: Land prepared by normal power tiller, and

T_2: Land prepared by high-speed rotary tiller.

The trial was done following RCB design with five dispersed replication. The land was prepared using high-speed rotary by one passing only. On the other hand, 5 to 6 passing were required for normal power tiller. Fifty days old onion seedlings of local onion varieties were transplanted on third week of January 2008. The unit plot size was 20-25 decimal for each replication. Recommended fertilizer dose @ 80-40-40-25-1 kg N-P-K-S-B/ha was applied. Full dose of TSP, gypsum and boron and half urea and MOP were applied as basal and rest half urea and MOP was applied as top dress after first irrigation after 25 to 30 days of transplanting. The unit plot size was 20-25 decimal for each replication. The local variety of onion of 50 days old seedling was used as test variety. The seedling was transplanted on third week of January 2008. Other cultural operations were done as and when necessary. The bulb was harvested on 10-15 April 2008.

Results and Discussion

The comparative study of high-speed rotary tiller (HSRT) to traditional tiller for onion cultivation has been sown in Table 1. The plant population per square meter (81.5) was increased by HSRT than conventional tiller (72.7). This incident might be due to better tilth of land by HSRT as a result seedling was easily touched in soil. Besides, labor requirement for weeding was less in HSRT than conventional tillering. The yield was observed 11.3 t/ha in HSRT and 9.5 t/ha was in conventional tiller in 2007-08 and 15.26 t/ha and 12.27 t/ha in 2006-07 respectively. The yield of onion was increased by 19% and 24% in the respective years using HSRT over traditional method. The yield was increased due to optimum plant population as well as good tilth of the soil. The same phenomena was observed by Wohab et. al (2003). In economic analysis, the high-speed rotary tiller gave highest gross return (Tk.166000/-) and gross margin (Tk.163000/-) than conventional tiller. It might be due to higher yield (21.9%) of onion and low production cost (Tk. 3000/-) in high-speed rotary tiller. The MBCR was obtained 39.8 that means one taka additional investment would yield taka about forty in return.

Farmers' reactions

- Farmers were satisfied for higher yield and low operation cost (labor/ploughing cost).
- Farmers' interested to use HSRT in next year but tiller is not available and purchasing cost also high.
- High skill is needed to operate of HSRT.

Table 1: Onion bulb yield as affected by different tillage methods, Faridpur, 2007-08.

Location	High speed rotary tiller				Conventional tiller			
	No of plants/m^2		Yield (t/ha)		No of plants/m^2		Yield (t/ha)	
	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07
Saltha (Mean of 5 farmer)	81.50	92.64	11.30	15.26	72.70	80.28	9.50	12.27
Mean yield increase using HSRT:21.95%								

Table 2: Cost and return analysis of onion bulb yield as affected by different tillage methods, Faridpur, 2007-08

Treatment	Mean yield (t/ha)	Gross return (Tk/ha)	*Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR
High speed rotary tiller	13.28	166000	3000	163000	39.8
Conventional tiller	10.89	136125	3750	132375	

VC (Tillering cost) : Price :Tk.12.5 /kg Onion, HSRT cost:Tk 12.15/dec/ploughing
Conventional tillering cost:Tk 5.06/dec/ploughing

Production of Disease Free Seed Potato at Farmer's Level through Informal System

Introduction

Potato is an important cash crop in Bangladesh. In Bangladesh potato is an important cash crop which is occupied 3rd position after rice and wheat. Lack of quality seed at farm level, is one of the most important factors for low yield of potato. Therefore the present program was undertaken to increase the availability of quality seed at farm level. Seed plot technique is a very good technology for quality seed potato production at farmers' level. So, the present program was undertaken to increase the availability of quality seed potato at farm level to promote potato production as intercrop with hybrid maize.

Objectives

i) To improve the quality of farmers seed potato
ii) To increase the availability of quality seed at farm level.

Materials and Methods

The seed potato production program was conducted at FSRD site, Pushpapara, Pabna and FSRD site Kadamsahar, Rajshahi (Barind)during rabi season of 2007-08. Five co-operator farmers were involved at Pabna while at Barind 15 farmers were involved with the program and each of them was supplied 50 kg diamant and 50 kg cardinal variety seed through Root Crop Research Centre (TCRC) of BARI. But the supplied seed was not homogenous and also not optimum in size. Land area of each farmer was 10 decimal of which 5 decimal was under diamant cultivation and 5 for cardinal variety cultivation. Before conducting the program, an intensive training was provided to the related farmers and scientific stuff with the help of TCRC scientist. Moreover, the OFRD scientist and scientific staff provided technical support to the farmers, for producing quality seed. Fertilization was done as per recommendation of TCRC, BARI (161-44-130-22-1kg, N-P-K-S-B ha $^{-1}$ with 10 t CD ha^{-1}, 15 kg furadan ha^{-1} and 20 kg staple bleaching powder ha^{-1}). All amounts of cowdung and bleaching powder were applied during final land preparation. Half urea and all other fertilizers and furadan were applied according to individual potato line and covered with soil before seed sowing. The rest half urea was top dressed at 31 DAS. Regular spray was done by Dithane M-45 and Ridomil gold at 10 days interval as preventive measure and Diazinon was applied against control of cutworm. Due to continuous rain fall during the Root formation stage two times Sobicron+Ridomil Gold and Acrobat+Melodidue were sprayed to prevent the fungal disease. Other operations viz. earthing up, weeding, irrigation etc. were done when necessary. Seed potato was sown on 13 December, 2007 at Pabna and 22 November-2 December/07 at Barind. Two weeks before harvest of seed potato all potato plants were removed from the field to prevent the contamination of fungus disease to the seed potato. Finally, potato Root was harvested on 26 February, 2008 at Pabna and2-15 March/08 at Barind . After harvesting and processing of potato, the storable seeds were stored in cold storage for own cultivation and sell to other potato growers in the next year.

Results and Discussion

Pabna

Performance of two varieties viz. Cardinal and Dimant were more or less similar (Table 1). In case of variety diamant highest Root yield (20.83 t ha^{-1}) was produced by Md. Ramzan Ali and lowest yield (16.66 t ha^{-1}) was by Md Abbas Ali. On the other hand, in case of cardinal the maximum Root yield (26.25 t ha^{-1}) was produced by Md. Amzad Hossain and lowest yield (17.33 t ha^{-1}) was produced by Md. Abbas Ali. All others disease was low in respect of varieties and farmers except scab. Scab disease was commonly occurred and it might be due to higher dose of cowdung. Farmers preserved cumulative 1935 kg seed in the cold storage for large scale adoption in the next season.

Barind

More or less similar performance was observed between two varieties viz. Cardinal and Dimant (Table 2 and 3) In case of variety cardinal maximum Root yield (20.83 t/ha) was produced by *Lal Chad* and lowest yield (13.33 t/ha) was by *Amirul Islam* and their average yield was 17.44 t/ha. On the other hand, in case of diamant the highest Root yield was produced by *Hafijur Rahman* (24.61 t/ha) and lowest yield was obtained from *Dulal Mia* (13.33 t/ha) and their mean yield was 17.78 t/ha. Disease and pest attack was low in respect of varieties and farmers. In both varieties, maximum diseases were found in the field of Amirul Islam and so comparatively lower yield was produced by him.

Farmers reaction-Pabna

Pre-expectation by farmers	Post- achievement by Farmers
1. High yielding	1. Achieved
2. Less disease and insect infestation	2. Negligible amount potato borer and other disease but scab disease was found commonly.

Farmers opined that seed production technology is very good but supplied seed size was not homogenous (mixed with bigger and smaller size), so, their seed yield might not be potential amount. They stored about 1935 kg Diamant and Cardinal seed in the cold storage.

Farmer's reaction-Barind

Farmer own set of selection criteria (Before implementation)	**Farmer achievement** (Post implementation)
i) Should be higher yield	i) Most of the farmer are very much happy to get higher from both variety
ii) Quality seed will be obtained	ii) Farmers had produced disease free seed as the seed was treated and thus the crops were less infested by the any kind of pest.
iii) Economically profitable	iii) As higher yield was produced that resulting higher return because of high selling price of quality seed. So it would be economically viable.

Conclusion

It is found that seed plot technique is very effective method to produce good quality potato seed at farmers' level.

Table 1. Performance of seed potato production under seed plot techniques at FSRD site, Pushpapara, Pabna during the year of 2007-08

SL. No.	Farmers Name and Fathers Name	Variety	Yield		Seed stored at cold storage (kg)	Disease record			
			kg 5 dec.$^{-1}$	t ha^{-1}		Late blight (# plants)	Viral (# plants)	Scab	
								kg	%
1.	Md. Ramzan Ali	Diamant	421.60	20.83	200	5	Nil	30	7.12
	S/o Md. Abdul Karim	Cardinal	371.00	18.33	200	8	Nil	28	7.55
2.	Md. Baki Billah	Diamant	404.80	20.00	200	3	Nil	37	9.14
	S/o Md Abdul Karim	Cardinal	396.30	19.58	200	4	Nil	51	12.87
3.	Md. Afsar Pramanic	Diamant	344.08	17.00	200	7	2	42	12.21
	S/o Late-Barek pra	Cardinal	425.04	21.00	200	6	1	29	6.82
4.	Md Abbas Ali	Diamant	337.20	16.66	200	5	Nil	33	9.79
	S/o Late-Barek Pra	Cardinal	350.76	17.33	200	3	1	32	9.12
5.	Md Amjad Hossain	Diamant	410.87	20.30	135	6	Nil	26	6.33
	S/o Late-Mogreb pra	Cardinal	531.30	26.25	200	4	Nil	28	5.27

Table 2: Yield and yield attributes of potato var. cardinal, Barind, Rajshahi during 2007-08

Name of Farmer	Root/plant (No.)	Unit Root wt. (g)	Root wt./ plant (g)	Root yield (t/ha)	Disease record
1. Jul Mohammad	16.40	84.70	880	18.51	No disease infestation
2. Sadar Ali	11.00	86.15	350	16.66	do
3. Hafijur Rahman	14.12	77.11	405	15.72	do
4. Amirul Islam	10.00	116.00	640	13.33	10 and 3 plants were infested by virus and late blight respectively.
5. Abdus Salam	13.80	92.12	640	18.05	No disease infestation
6. Golam Rasul	9.80	80.33	610	19.39	do
7. Dulal Mia	9.00	124.11	600	16.04	3 plants were infested by virus
8. Sukur Mohammad	9.60	106.00	630	18.13	No disease infestation
9. Lutfar Rahman	12.00	140.43	860	17.22	do
10. Rojob Ali	13.00	114.13	690	18.75	do
11. Lal Chad	13.40	126.08	670	20.83	do
13. Abu Taher	12.60	132.20	600	16.66	3 plants were infested by late blight
	Mean yield			17.44	

Table 3: Yield and yield attributes of potato var. diamant , Barind, Rajshahi during 2007-08

Name of Farmer	Root/ plant (No.)	Unit Root wt. (g)	Root wt./ plant (g)	Root yield (t/ha)	Disease record
1. Jul Mohammad	20.00	102.40	790	20.00	No disease infestation
2. Sadar Ali	14.80	94.20	530	18.36	do
3. Hafijur Rahman	9.00	86.10	610	24.61	do
4. Amirul Islam	10.80	84.44	360	14.44	5and 7 plants were infested by virus and late blight respectively
5. Abdus Salam	11.00	124.15	590	15.55	11 and 2 plants were infested by virus and late blight respectively
6. Golam Rasul	8.00	82.11	440	18.18	No disease infestation
7. Dulal Mia	7.20	92.00	650	13.33	15 plants were infested by virus
8. Sukur Mohammad	10.20	110.00	552	18.83	No disease infestation
9. Lutfar Rahman	11.40	98.41	570	17.36	do
10. Rojob Ali	12.20	121.33	474	17.50	do
11. Lal Chad	12.20	106.10	650	18.05	do
13. Abu Taher	13.60	80.09	660	17.17	do
	Mean yield			**17.78**	

Control of Soft Rot Disease and Rhizome Fly of Turmeric by Pesticide and Soil Amendments

Abstract

The experiment was carried out at Goneshpur, Shibganj, Bogra during 2007 to find out the efficacy of different fungicides for controlling soft rot and rhizome rot of turmeric under farmers field conditions. Six different treatments Viz.- T_1 : knowin + poultry refuse + lorsban 15G, T_2 : knowin + poultry refuse + Dursban, T_3 : knowin + poultry refuse + Furadan, T_4 : knowin + Mustard oil cake + Furadan, T_5 : knowin + Mustard oil cake + lorsban 15G. T_6 : Control. Number of infected plant per bed was less in the treatment T_3. It was found that treatment T_4 (24.12 t/ha) gave the highest yield which was similar with T_5 and the lowest yield as well as highest number of infected plant was obtained from the treatment T_6 (control).

Introduction

Turmeric is a very important spice, in Bangladesh. It is used as dye in textile mills, ingredient in the preparation of medicine and cosmetics. Further, it is also regarded by Hindus as something "Sacred" for the use in ceremonial and religious function (Pruthi- 1998). Soft rot & Rhizome fly of turmeric caused by *Pythium aphanidermatum* and *Mimegralla coeruleifroms* is a very common and widespread disease in turmeric growing areas of Bangladesh. The disease causes serious constraint for turmeric production in Bangladesh. The crop is affected in conducible soil for recurrent cultivation. So, study on controlling rhizome they and soft rot of turmeric is as urgent demand. Thus, the present study was undertaken to find out the efficacy of different fungicides to control soft rot and rhizome fly under farmer's field conditions.

Materials and Methods

The experiment was conducted at Goneshpur, Shibganj, Bogra during 2007. The crop was raised in ridge system planting in a randomized block design with 1 replication and six treatments Viz. T_1 : knowin + poultry refuse + lorsban 15G, T_2 : knowin + poultry refuse + Dursban, T_3 : knowin + poultry refuse + Furadan, T_4 : knowin + Mustard oil cake + Furadan, T_5 : knowin + Mustard oil cake + lorsban 15G. T_6 : Control. The uniform size of seed rhizome was planted at June 07, 2007. A local cultivar of turmeric highly susceptible to the soft rot, and rhizome fly. The unit plot size was 4m × 10m with spacing was 50cm from row to row and 25 cm from plant to plant. Fertilizer was used at the rate of 220 kg/ha , 180, 170, 110, 2.5, 5 kg/ha, of urea, TSP, MP, gypsum zinc oxide, and cowdung, respectively, Half of the amount of urea and the entire amount of cowdung, TSP, MP, gypsum, zinc were applied at final land preparation. The rest urea was top dressed at 80 and 110 days after planting. Soil was drenched at 90 days after planting. Cultural management practices were done as recommendation. Data were collected on disease incidence % of insect infestation when the symptom appeared on the foliage. The crop was harvested on 9, January 2008.

Result and Discussion

The highest rhizome weight (355g) per plant found in T_3 (knowin + poultry refuse + Furadan) which followed by T_5 (knowin + Mustard oil cake + lorsban 15G). The lowest rhizome weight (245g) per plant found in T_6 (control). The maximum yield (26.54 t/ha) was obtained from the treatment T_3 (Table 1)and the lowest yield (18.26) was found in control treatment T_6. There were no insect infestation in treatments T_3, T_4 and T_5. But the highest insect population (6%) was found in control treatment T_6.

Farmer's reaction

Farmers were very much interested to use pesticide and soil amendments with treatment T_3 (knowin + poultry refuse + Furadan). Rhizome fly and soft rot disease was reduced which facilitated to harvest best yield.

Conclusion

From the result, it may be mentioned that T_3 (Ridomil + Furadan 5G + Poultry refuse) was highly effective in controlling the disease as well as in increasing the yield. This was a non replicated trial, so the experiment may be repeated with more number of replications to have real picture of pest and disease reduction at Shibganj MLT site.

Table 1. Control of soft rot disease and rhizome fly of turmeric by pesticide and soil amendments.

Treatment	Plant height (cm)	Ave. no. of tiller/plant	Rhizome wt./ plant (g)	Yield (t/ha)	Disease (%)	Insect (%)
T_1 (KPL)	98.2	3.0	315	23.24	10	2
T_2 (KPD)	98.0	3.0	324	24.25	7	1
T_3 (KPF)	99.0	3.2	355	26.54	6	-
T_4 (KMF)	96.7	3.0	322	23.96	8	-
T_5 (KML)	97.8	3.1	342	25.23	7	-
T_6 (Control)	93.5	2.8	245	18.20	25	6

NB. T_1 : knowin + poultry refuse + lorsban 15G
T_2 : knowin + poultry refuse + Dursban
T_3 : knowin + poultry refuse + Furadan
T_4 : knowin + Mustard oil cake + Furadan
T_5 : knowin + Mustard oil cake + lorsban 15G
T_6 : Control (Absolute control).

Control of Soft Rot Disease and Rhizome Fly of Ginger by Pesticides and Soil Amendments

Abstract

The experiment was carried out at Goneshpur, Shibganj, Bogra during 2007 to find out the efficacy of different pesticides for controlling soft rot and rhizome fly of ginger under farmers field conditions. Six different treatments Viz.- T_1 : Ridomil+ Poultry refuse + Lorsban. T_2 : Ridomil + poultry refuse + Dursban, T_4 : Ridomil + Furadan 5G + Poultry refuse T_4 : Ridomil + Neem oil cake +Lorsban, T_5 : Ridomil + Neem oil cake + Dursban and T_6 : Control. The lowest percent of disease incidence and insect obtained in the treatment T_5 (Ridomil + Neem oil cake + Dursban). The highest yield was followed by T_5 (Ridomil + Neem oil cake + Dursban). The treatment T_2 (Ridomil + poultry refuse + Dursban) and T_1 (Ridomil+ Poultry refuse + Lorsban) which was similar to T_5 and the lowest yield as well as highest percent of disease incidence and insect was obtained in the treatment T_6 (control).

Introduction

Ginger (*Gingiber officinale.* Rose) is one of the most important spice and cash crop in Bangladesh. It is one of the earliest ornamental spices know to Europe and it is still in large demand to day (Parsegtove *et al*., 1981). Ginger is used for manufacturing different food products like, gingerbread, confectionery and drinks like ginger brandy, wine and foodstuff in many western countries. It has also varied use in medicine purpose. Ginger has basic antiseptic properties and issued as a carminative and stimulant. In Bangladesh, it occupies an estimated area of about 7692 hectares with the production of 43,000 metric tons (BBS, -2003). It is meant that the average yield of this crop is 5.59 t/ha, which is very low as compared to other ginger producing countries of the world. Soft rot & Rhizome fly of ginger caused by *Pythium aphanidermatum* and *Mimegralla coeruleifrons* is a very common and widespread disease in ginger growing areas of Bangladesh. The initiation of the disease, rhizome fly occurs, causing damage of rhizome and yield is drastically reduced. Therefore, a joint work has been taken with Entomology Division to find out suitable control measure of disease and insect to save the crop. The disease causes serious constraint for ginger production in Bangladesh. The crop is affected in conducible soil for recurrent cultivation. The country depends on import of ginger and hence the trend of price is being increased always. So, study on controlling rhizome fly and soft rot of ginger is an urgent demand. Thus, the present study was undertaken to find out the efficacy of different pesticides to control soft rot and rhizome fly under farmer's field condition.

Objective

To find out appropriate control measure for controlling soft rot disease and rhizome fly of ginger.

Materials and Methods

The non replicated trial was conducted following RCB design at Goneshpur, Shibganj, Bogra during 2007. The crop was raised in the ridges and was accommodated in 10m × 4m sized unit plot and planted in rows 50 cm apart and 25 cm between plants. The treatments were Viz. T_1 : Ridomil+ Poultry refuse + Lorsban, T_2 : Ridomil + Poultry refuse + Dursban, T_3 : Ridomil + Furadan 5G + Poultry refuse, T_4 : Ridomil + Neem oil cake +Lorsban, T_5 : Ridomil + Neem oil cake + Dursban and T_6 : Control. The test cultivar of ginger (local) which is highly susceptible to the soft rot, and rhizome fly. The crop was fertilized with Urea, TSP, MOP, Zinc, Gypsum and Cow dung @ 304, 267, 233, 3, 111kg/ha and 5t/ha respectively. The entire quantity of Cow dung, TSP, Gypsum and half of MOP were applied during land preparation. The half of the urea was given at 50 days after sowing (DAS). Remaining MP and urea were applied in two equal splits at 80 and 110 DAS. Rhizomes were dipped for 30 minutes in ridomil (.2% conc. solution) and dried in open air before planting. The uniform size of seed rhizome was planted at June 07, 2007. Soil was drenched at 90 DAS and other cultural management practices were done as and when necessary. The crop was harvested was on January-9, 2008. Data were collected on disease incidence and % of insect infestation when the symptom appeared on the foliage. Again data on yield and yield attributes were collected and presented in (Table 1).

Results and discussion

Data on yield and other characters of different pesticides are presented in Table-1. Percent of disease incidence on Ginger ranged form 0 to 30%, where the highest was recorded in control and the lowest (0) was recorded in Ridomil + Neem oil cake + Dursban. The highest disease reduction was observed T_5 . Percent of insect of Ginger ranged from 0 to 20%.The highest insect percent was observed in control treatment and the lowest (0) was observed in T_5 Ridomil + poultry refuse + Dursban. The highest yield was produced by treatment T_5 : Ridomil + Neem oil cake + Dursban, (23.43 t/ha) which was followed by treatment T_4 Ridomil + Neem oil cake + Lorsban, (22.44 t/ha). T_3 : Ridomil + Furadan + Poultry refuse, (21.81 t/ha) and T_1 Ridomil + Poultry refuse + Lors ban (20.24 t/ha). The lowest yield was obtained from treatment T_6 : control (Without insecticide + fungicide), 15.50 t/ha

Farmer's reaction

Farmers were highly interested to grow ginger crop and its demand and market price is always high.

Conclusion

From the result, it may be mentioned that T_5 (Ridomil + Neem oil cake+ Dursban) was highly effective to inhibit the insect (Rhizome fly). Thus controlled the disease rhizome rot that resulted highest yield. As this was a non replicated trial, so, the experiment may be repeated with more number of replications to have real scenario about pest and disease reduction at Shibganj, Bogra.

Table 1. Performance of ginger at varying combinations of pesticides and organic manures at Goneshpur, Bogra during 2007

Treatment	Plant height (cm)	No. of tiller/ plant	No of leaves/ plant	Wt. of primary rhizome/ pant (g)	Wt. of secondary rhizome/ plant (g)	Yield/ plant (g)	Yield (t/ha)	Disease incidence %	Insect %
T_1 :(R+P+L)	47.6	19.5	145	35	263	298	20.32	10	3
T_2 :(R+P+D)	47.8	15.0	120	34	218	252	17.96	15	2
T_3 :(R+F5g+D)	48.5	22.5	130	50	257	307	21.81	8	4
T_4: (R+N+L)	48.3	26.2	158	59	261	320	22.44	4	2
T_5: R+N+D)	48.7	26.0	182	73	266	339	23.43	0	0
T_6: Control	43.8	22.0	145	58	159	217	15.50	30	20

NB. T_1 : Ridomil + Poultry refuse + Lorsban (2g/l +3.0 t/ha + 5ml/l)
T_2 : Ridomil + Poultry refuse + Dursban (2g/l + 3.0 t/ha + 5ml/l)
T_3 : Ridomil + Furadan 5G + Poultry refuse (2g/l + 20 kg/ha + 3.0 t/ha)
T_4 : Ridomil + Neem oil cake + Lorsban (2g/l + 0.5 t/ha + 5 ml/l)
T_5 : Ridomil + Neem oil cake + Dursban (2g/l + 0.5 t/ha + 5ml/l)
T_6 : Control. (Without pesticides)

Farmers Participatory Research on Integrated Farming for Improved Livelihood of Resource Poor Farmers households

Introduction

The subsistence farms of Bangladesh are highly diversified with complex relationships among the various sub-system and the enterprises within a subsystem. While there are different production alternatives, farmers have a limited set of resources. These resources must be utilized in such a manner that maximize farm productivity, farmers benefit and resource use efficiency in an environmentally sound and sustainable way. A holistic approach is needed for technology generation, packaging and transfer to the stakeholder to achieve this result through maximizing the complementary interactions among the different farming enterprises/production system and the biophysical and socio-economic environment. In this regard an integrated effort was made for livelihood improvement of the resource poor farm households with the following objectives

i. To utilize available farm resources in a better way
ii. To maximize income and improve livelihood of the resource poor farm households

Methodology

The integrated farming system program was initiated at FSRD site, Pushpapara, Pabna during 2007-08. Before initiating the program at the site several steps were followed to execute the program such as i) farmers group selection from the stakeholders through participatory approach, ii) identifying different aspects of livelihood like the resource base, technology used, income, expenditure, resource utilization pattern and other socio-economic factors through group discussion, iii) need assessment of the stakeholders considering return from present practices and expected potential return, iv) Planning for implementation of the alternatives, v) Implementation of the planned intervention and vi) review and evaluation. Potentials that lead to improve livelihood were identified through participatory discussion with the clientele groups. Based on the potentials suitable technological options were addressed to the farmers and accordingly farmers selected suitable technologies adjusting with their need for livelihood improvement. Year round vegetable production in homestead, beef fattening, improved fish cultivation, fruit tree management was identified as their major potential areas. Five cooperator farmers were selected for the program. On-Farm Research Division (OFRD) team facilitated the cooperators for technological intervention to maximize the productivity of the components. Farmers were formed groups for planning, implementation, monitoring and evaluation of their activities with competitive behavior. The data on production, farm level utilization, economic return and other socio-economic parameters were recorded and tabulated accordingly.

Results and Discussion

Vegetable production and income

More or less nine production niches of the homestead were brought under cultivation with the Goyeshpur vegetable model under different farm categories at FSRD site Pushpapara during the rabi season of 2007 to kharif season 2008. It was observed that the production of vegetables was higher at open sunny space. Among the season, more crops and production units were covered in rabi season. The total production was recorded 716.64 kg from all production units per farm (Table 1). The average net income from homestead vegetable per farm was achieved Tk.3445 which contributed to the total income of the resource poor farm households (Table 2).

Nutrient uptake and supplementation from vegetables

Nutrient uptake especially protein, iron, carotene, vit.B_1 and vit. C by the family member of integrated farming was estimated. Nutrient uptake was varied with different vegetable growing months. Uptake of nutrient was positively correlated with vegetable consumption. Regarding the daily nutritional requirement of an adult, nutrients such as protein, iron, carotene, vit.B_1 and vit. C was supplemented 8.22, 55.88, 24.70, 24.54 and 115.09% from the homestead vegetable production (Table 3).

Vaccination to poultry

Poultry birds reared by poor households were vaccinated. The result indicated that due to application of vaccine to poultry the mortality rate was significantly reduced by 95.67% (Table 4). Poultry mortality is a common aspect for poultry rearing in the rural farm households and sometimes they face a great loss from this component. Proper vaccination in time can reduce mortality to great extent and additional income can be achieved.

Beef fattening

The body weights of the treated cattle's were increased due to feeding with UMS diet. After two month the average body weight increased by 10% over initial weight. The average body weight gained per day was around 333 g. which was encouraging for the cattle growers. The selling price increased by 26% over initial price. The average profit obtained from each cattle was Tk.3448 (Table 5).

Improved fish cultivation

Improved management practices were provided for fish cultivation in integrated farming. Through sampling it was observed that the growth of different fish species were satisfactory probably due to better pond preparation, maintaining proper stocking ratio with area and layer of water bodies and optimum feed management. Farmers still have not harvested their fishes but they are hopeful for getting higher production (Table 6).

Improvement of fruit tree management

Effort was made with regard to varietal improvement, fertilizer management and pest and disease control of the fruit trees at the site. Introducing BARI developed variety by replacing low productive traditional variety and some cases improvement of existing trees through grafting with high yielding variety. A positive impact on quality fruit production and income generation was achieved. In some cases farmers being taken initiative to raise sapling of different quality fruit trees for dissemination and income generation (Table 7).

Farmers' reaction

The resource poor farmers are interested to adopt those technologies which can provide quick return in terms of cash income. They are mostly vulnerable to their decision and shift to other activities. Due to adoption of integrated farming they are hopeful to maintain their family with farm income. The increased productivity and nutrition from the homestead source made them confident for livelihood improvement.

Limitations of the study

1. Tedious, laborious and continuous work, so efficient skilled labour in production techniques of different components are needed.
2. Lack of strong multidisciplinary scientific team to implement the program
3. Lack in easy analytical tool to interpret data comfortably. (Needs a computer programming on Analysis of results)
4. Skill of site level staff and the farm family members were not as effective as required for optimum production and accurate information

Conclusion

- Multidisciplinary well experienced strong scientific team is needed for successful integration of technologies
- The integrated farming system through livelihood approach seems to be difficult which needs intensive care, proper guidance and accountability.

Table 1: Round the year vegetables production from different niches of homestead under integrated farming at FSRD site, Pushpapara, Pabna during April 2007 to March 2008

Space		Rabi	Kharif-1	Kharif-2	Total production (kg)
		Aasheen-Falgun	Chaitra-Jaistha	Aashar-Bhadra	
Open sunny space	Bed 1	48.5	42.67	33.92	125.09
	Bed 2	49.5	15.83	23.17	88.50
	Bed 3	62.00	28.67	14.67	105.34
Roof top		43.30	-	-	43.30
Trellis		66.33	15.17	11.83	93.33
Shady place		3.75	3.500	31.33	38.58
Marshy land		0.750	47.00	11.25	59.00
Unproductive tree		6.33	1.000	-	7.33
Fence		1.08	17.92	28.17	47.17
Back yard		-	21.000	23.500	44.500
Boundary		60.00	-	4.500	64.500
Total					716.64

Table 2: Cost and return from year round vegetable production at FSRD site, Pushpapara, Pabna during April 2007 to March 2008

Cash income (Tk)	Total income (Tk)	Total cost (Tk)	Net income (Tk.)
1481.00	3895.00	452.00	3445.00

Table 3: Nutrient intake by a family of under integrated farming at FSRD site, Pushpapara, Pabna during April 2007 to March 2008

Bengali month	Protein(gm)	Iron(mg)	Carotene (microgram)	Vit-B_1(mg)	Vit-C(mg)
Baishakh	548.23	817.06	36178.26	16.34	3197
Jaistha	732.24	4739.50	45559.89	134.47	6513.8
Aashar	1041.68	3660.7	22227.6	159.89	9320.9
Sraban	761.44	3494.00	25603.3	74.47	6985.00
Bhadra	503.5	993.25	8412.65	13.92	2132.5
Aasheen	171.25	279.25	2612.78	2.6	1120.00
Kartik	120.75	104.25	55.98	1.65	-
Agrahaon	474.90	629.2	7922.65	9.3	5599.00
Poush	1048.97	1536.79	24038.95	21.87	16232.3
Magh	674.12	349.61	15852.40	17.48	4419.7
Falgun	680.77	264.07	49831.4	26.08	4552.4
Chaitra	738.82	467.54	45701.5	23.4	2944.00
Total	7496.67	17333.22	283997.39	501.47	63016.60
Nutrient supplementation (%)	**8.22**	**55.88**	**24.70**	**24.54**	**115.09**

Table 4. Number of birds vaccinated and mortality rate before and after vaccination under integrated farming at FSRD site, Pushpapara, Pabna during April 2007 to March 2008

Date of vaccination	Name of vaccine	Number of birds vaccinated	Mortality rate before vaccination (%)	Mortality rate after vaccination (%)	Mortality rate reduced (%)
07.01.08	RDV	278	72	4	95.67
08.01.08	RDV	236	78	4	
15.01.08	RDV	174	75	5	
18.01.08	BCRDV	153	74	5	
19.01.08	BCRDV	287	75	4	
17.03.08	RDV	54	79	4	

Table 5. Beef fattening with Urea Molasses Straw diet, Vaccination and Deworming program at FSRD site, Pushpapara, Pabna during the year of 2007-08

Name of farmers	No. of cattle	Age (years)	Initial body wt. (kg)	Duration of feeding with UMS diet (Days)	Body wt. gained (kg)	Av. body wt. gain day (g)	Purchasing cost (Tk.) + variable cost cattle	Sell price (Tk.) estd.	Profit estd. (Tk.)	Remarks
Abbas Ali	1	2	229	60	250	350	16750	19900	3150	Before starting the program all cattle were dewormed and vaccinated
Md. Zinnah	1	2	247	60	265	300	17250	20700	3450	
Azim uddin	1	2	221	60	235	233	15760	19500	3740	
Omar Ali	1	1.5	95	60	117	367	9720	13400	3680	
Bazlur Rahman	1	2	250	60	275	417	23780	27000	3220	

Table 6. Polyculture of fish with improved management at FSRD site, Pushpapara, Pabna during the year of 2007-08

No. of ponds (Area in dec.)	Fish species	Stocking density (no. of fish $dec.^{-1}$)	Cost (Tk $dec.^{-1}$)	Management
5 (57)	Catla	07-08	30	♦Before stocking finger-lings undesirable fish species was removed ♦Lime applied for increasing pH of water bodies ♦Recommended fertilizer applied for optimum growth of phyto and zoo planktons ♦Proper fish feed was provided at recommended ratios.
	Ruhi	07-08	35	
	Silver carp	10-12	15	
	Nilotica	05-07	10	
	Japani ruhi	07-10	25	
	Rajpunti	10-15	30	

Table 7. Improvement of fruit tree management in integrated farming at FSRD site, Pushpapara, Pabna during 2007-08

Name of fruit	Number	Management	Present status
Mango	24	Fertilizer and irrigation management, removing of pest and disease infested plant parts, top working, pest and disease control with bio pesticides	Plants bearing satisfactory fruits
Guava	10	Fertilizer management and removing of pest and disease infested plant parts, pest and disease control with bio pesticides	Plants initiated fruiting this year
Jackfruit	3	Fertilizer management, pest and disease control with bio pesticides	Plants bearing satisfactory fruits
Jujubee	8	Fertilizer management, grafting, Pest and disease control with bio pesticides	Fruits harvested. New branches developed after pruning
Litchi	3	Fertilizer management, removing infested plant parts	Better growing stage
Coconut	22	Removing dead leaves, fertilizer management	Better growing stage
Pamelo	6	Fertilizer management, removing infested plant parts	Better growing stage
Pomegranate	2	Fertilizer management, removing infested plant parts	Plants initiated fruiting

Farmers Participatory Research on Integrated Farming for Improved Livelihood of Resource Poor Farm Households

Abstract

The integrated farming for resource poor farm household activities was conducted at FSRD site Hatgobindopur, Faridpur during 2007-08. The ultimate purposes of the activities were to disseminate the proven technologies from livelihood perspective to resource poor farmers. Ten resource poor farmers were selected on the basis of their own land in the study area. Out of which 5 were marginal and 5 small households. Interventions were made in homestead area, cropland, poultry, livestock and fruit trees management. In homestead, "Ishangopalpur model" was followed with maximum utilization of all possible production units aiming increases the number of vegetables and productivity after the intervention. Intervention in replacement of local low yielding poor quality vegetables by improved high yielding vegetables rich in protein and vitamins has increased income and nutrition level of the farm household members. The most popular three cropping patterns were practice involving modern crop production technologies against existing practices. Besides block demonstration of different crops were also implemented to increase yield per unit area. In livestock sub system, vaccination, vitamin feeding, deworming, layer rearing for egg production were adopted. BARI developed different fruit tree saplings were supplied with recommended management packages. The vegetable production was increased by 210 and 120% in marginal and small farm family, respectively. The vegetable consumption also increased than before intervention. The vegetable consumption increased from 49 and 73 g/day/person to 156 and 149 g/day/person in marginal and small farm household, respectively. The yield of crop has increased (20-23%) substantially. In livestock, mortality rate was less after intervention of different program. In fruit tree management, fruit bearing was also increased than before. After all, the income, family nutrition, employment opportunities, social status has increased than any earlier time of all household categories.

Introduction

Bangladesh an overwhelmingly agricultural economy is one of the most densely populated countries in the world. About half of the populations live in hard-core poverty. The majority of the populations in Bangladesh are small holders of rice farmers and more than 60 percent farmers of this country is resource poor.

Farmers limited source of resources should be utilized in such a manner that maximizes farmers' benefit as well as improve their existing livelihood but traditional commodity oriented agricultural research does not consider the interactions between different components, production system and the environment which are very much essential but the farmer dose not consider actively. Most of the farmers have not adopted many of the technologies developed by different research institutes. Their major constraints are lack of technical know how, inputs and money. Their risks are market and natural calamities.

Objectives

1. Utilization of homestead resources and make availability of vegetables round the year to met up the farmers' family nutrition.
2. Adoption of suitable high yielding varieties of different crops to fit into the existing cropping pattern for higher yield and economic return.
3. Improvement of farmer's social status through intervention of new and profitable technologies (livestock, fruit tree management program etc.) as Income Generating Activities (IGA).

Methodology

The activities were carried out at FSRD site, Hatgobindapur, Faridpur since July 2007. On the basis of farmer's traditional practices, their needs and choices, the site team considered several alternatives of technologies of crops, livestock, fisheries and other components as per available resources of the farm with active participation of the farmers. Two categories of farmer i.e. marginal and small were targeted and only ten farm households were selected (five of each category). Before going to implement the project activities a case study of individual households was carried out and detail information in respect of livelihoods maintained by the selected households were documented. Total resources inventory, liabilities, technology used, level of input used, output obtained income and expenditure status, labor availability of the farms of previous year was accounted by detail households case study with intensive visit. After analysis of existing system, the technologies were selected for intervention in priority basis. Then the farmers were motivated through all possible ways to utilize their own resources to adopt the technologies. Under this project different farming component i.e. crop, homestead, fruit tree management were integrated and a holistic approach was taken for improvement of households.

Program I: Gender utilization and family nutrition program

The vegetables cultivation program at homestead area was carried out at FSRD site, Hatgobindapur, Faridpur by " Ishangopalpur Model". Before initiation of activities an individual case study of each household was conducted to identify the resource base and potentials of different farm category. Finally 10 households of marginal and small groups were selected for this program. The vegetables crops were selected according to the performance of the farmers through participatory method. Before conducting the activities a comprehensive training was provided to the selected farmers on fruit and vegetables cultivation following "Ishangopalpur Model". The FSRD team provided regular technical assistance of vegetables cultivation to the co-operators.

Objectives

1. Optimization of homestead resources for making availability of vegetables round the year.
2. Utilization of family labour specially women and children.

Result and Discussion

Vegetable production

The performances of vegetables crops grown in homestead area from **marginal group** are presented in Table 1. After intervention of "Ishangopalpur Model", the total vegetable production was 153 kg, of which 111 and 42.0 kg were from open space and creeper vegetables, respectively during rabi season (2007-2008). Before the intervention, the vegetable production was only 47 kg. Therefore, the production was increased by 225 %. In Kharif season, after intervention, the production was 151 kg and before intervention it was 51 kg and thus the production was increased by 196 %. However, over all vegetables production were increased by 210% during the year from marginal farmer.

Table 1. Year round average vegetable production of a marginal farmer in homestead area at FSRD site, Hatgobindapur, Faridpur during 2007-08

Season	Before Intervention			After Intervention			% Increased
	Open space vegetables (kg)	Creeper vegetables (kg)	Total	Open space vegetables (kg)	Creeper vegetables (kg)	Total	
Rabi	22	25	47	111	42	153	225
Kharif	18	33	51	78	73	151	196
Total =	40	58	98	189	115	304	**'. 210**

From **small farmer group** after intervention of "Ishangopalpur Model" the total vegetable production was 213 kg of which open space and creeper vegetables contributed 128 and 85 kg, respectively during Rabi season (2007-2008). On the other hand, before intervention, the production was only 87 kg in rabi season. Therefore, the production was increased about 144%. In kharif season, the production was 180 and 92 kg, before and after intervention, respectively. The production was increased about 95% in kharif season (Table 2). However, over all vegetables production were increased by 120% during the year.

Table 2. Year round average vegetable production of a small farmer in homestead at FSRD site, Hatgobindapur, Faridpur during 2007-08

Season	Before Intervention			After Intervention			% Increased
	Open Space vegetables (kg)	Creeper vegetables (kg)	Total	Open Space vegetables (kg)	Creeper vegetables (kg)	Total	
Rabi	32	55	87	128	85	213	144
Kharif	29	63	92	97	83	180	95
Total	61	118	179	404	168	393	**Av. 120**

Disposal pattern of vegetables

From marginal group, the total vegetables production was 98 kg of which 77, 6 and 15 kg were consumption, distribution and sold, respectively and the consumption per person per day was 49 g during before intervention. On the other hand, after intervention, the production was 304 kg of which the consumption, distribution and sold amount were 246, 18 and 40 kg, respectively and the consumption per person per day was 156 g (Table 3).

Table 3. Disposal pattern of vegetables of marginal farmer during the kharif & rabi season of 2007-08

Vegetables	Total harvest (kg)	Consumption		Distribution (kg)	Sold (kg)
		Amount (kg)	Per person/day (g)		
Before					
a. Open space	40	35		2.00	3.00
b. Creeper	58	42	49	4.0	12.0
Total =	98	77		6.00	15.0
After					
a. Open space	189	152		10	27
b. Creeper	115	94	156	8	13
Total =	304	246		18	40

* Average household size: 4.33

The total homestead vegetable production was 179 kg, which was divided among the consumption, distribution and sold as 159, 5.0 and 15 kg, respectively and consumption per person per day was 73 g during before intervention. On the other hand, after intervention, vegetables production was 393 kg of which 326, 11 and 56 kg were used as consumption distribution and sold, respectively and the consumption was 149 g per person per day (Table 4).

Table 4. Disposal pattern of vegetables of a small farmer during the kharif & rabi season of 2007-08

Vegetables	Total harvest (kg)	Consumption		Distribution (kg)	Sold (kg)
		Amount (kg)	Per person/day (g)		
Before					
a. Open space	87	77		3.0	7.0
b. Creeper	92	82	73	2.0	8.0
Total	179	159		5.0	15.0
After					
a. Open space	213	179		7.0	27.0
b. Creeper	180	147	149	4.0	29.0
Total	393	326		11.0	56

Farmer's reaction

Farmers were very much interested to involve themselves in homestead gardening to earn some cash money and harvest fresh vegetables daily to meet up their daily demand.

Program II: Pilot production program of different cropping patterns

A. Cropping Pattern Based Activities

The production program was conducted at FSRD site, Hatgobindapur,Faridpur from the Aman season of 2007-08. Three rice based cropping pattern viz., i) Wheat-Jute-T.aman, ii) Potato-Jute-T.aman and iii) Mustard-Jute--T.aman were included in the program. The crop varieties namely BRRI Dhan 32, BARI Sharisa-11, Shatabdi (Wheat) and Cardinal (Potato) were used. The fertilizer dose, sowing and harvesting time were presented in Table 5. The area of 50 to 60 decimal cropping lands of two-category farmers (small and marginal) was included under this production program.

The performances of three patterns are given in Table 6. The overall performance of crops under each pattern was good and satisfactory. The wheat, T.aman mustard and potato yield were 3.10, 3.60-3.75, 1.56 and 26 t/ha, respectively. The crop of jute (var.O-9897) is now on field.

Table 5. Name of the crops and their management practices during 2007-08

Name of crops	Variety	Fertilizer dose (N-P-K-S-Zn-CD kg/ha)	Sowing time	Harvesting time
1. Wheat	Shatabdi	70-25-20-10-2+10 ton	7- 10 Dec 07	02-05 April 08
2. Jute	0-9897	85-12-50-5	10-12 April 08	-
3. T.aman	BRRI dhan 32	78-10-33-2	20-25 July 07	05 -08 Nov 07
4. Mustard	BARI Sarisha-11	84-18-22-14-1	12-15 Nov 07	27-29 Feb 07
5. Potato	Cardinal	96-16-32-8-1.5	02-05 Dec 07	10 -15 March 07

Table 6. Area and performance of crops under different cropping patterns during 2007- 08 (up to July 2007 to May 2008)

Cropping pattern	Area covered (dec)	No. & category of co-operator	Mean yield (t/ha)
1. Wheat-Jute-T.aman	50	2 (1 small & 1 marginal)	Wheat = 3.10 T.aman = 3.60
2. Potato-Jute-T.aman	60	2 (1 small & 1 marginal)	Potato= 26.0 T.aman= 3.70
3. Mustard-Jute-T.aman	50	2 (1 small & 1 marginal)	Mustard= 1.56 T.aman= 3.75

Farmer's reaction

Farmers opined very much positively for high yield of different crops and enhanced cash return.

B. Block demonstration program

Crops	Variety	Numbers of farmers	Date of sowing	Area (dec)	Yield (kg/ha)	Remarks
Mustard	BARI sarisha 11	15	26-29.10.07	750	1100-1800	Farmers preserved seed
Lentil (MLT Site, Rajbari)	BARI mashur 4	07	7-27.11.07	705	880-1736	Early sowing seedling damaged due to SIDR
Lentil (FSRD site, Faridpur)	BARI mashur 4	10	2-8.11.07	735	870-1120	Seedling damaged by SIDR and mycoplasma
Onion MLT site, Rajbari	BARI piaz 2	01	15.10.07	60	25000	Highly seed demand & low keeping quality
Onion FSRD site, Faridpur	BARI piaz 1	02	24.1.08	45	6400	Late planting due to SIDR
Cabbage	Autumn queen	03	11-26.11.07	33	59500	Late planting due to SIDR
Radish	BARI mula 1 & 2	02	29-30.10.07	45	65000 & 63000	Farmers happy
Wheat through seeder	Prodip & Bijoy	04	26-30.11.07	45	3250 & 2850	Bijoy infested by bipolaris
Tomato	Hybrid & Ruma-VF	04	20-30.11.07	45	70000 & 64500	Farmers happy
Potato	Cardinal & Diamant	02	11-15.12.07	20	27500 & 28000	Farmers preserve seed for next year
Maize	BARI hybrid maize 2	02	9-10.12.2007	65	7600	Farmers happy & got high market price. Farmers meet up dietary demand as ATTA mix with wheat.
	BARI hybrid maize 3	03	8-10.12.2007	55	6930	
Sesame	BARI til 3	06	3-6.03.2008	335	1508	Farmers happy due to high yield

Program III: Plantation of fruit tree and management of existing fruit tree

Existing fruit trees are also resources to the farmers. By using different types of management practices these turned into fruit bearing condition and earn cash money as well as meet up the demand of family nutrition. Mango hopper is common cause for low yield of mango. Again there are a lot of wild varieties jujube plants from which farmer do not get economic benefit. Therefore, different management practices like mango hopper control and jujube budding were included under this program. The activities carried out as a development work with BARI recommended technologies that are given below.

1. Mango hopper control

- No. of Co-operator : 12 (6 Small & 6 Marginal)
- No. of tree : 25
- Date of Spraying :
  - 1st Spraying : 12-18 Dec 2007
  - 2nd Spraying : 12- 15 Jan 2007
- Name of Insecticide : Cythrin @ 1ml/L and Dithene M-45 2 g/L
- Present condition : Sprayed trees are bearing a good number of fruits

3. Plantation of different fruit sapling

- No. of Co-operator : 115
- No. of tree : 170
- Date of distribution : July - August 2007
- Name of fruit tree : Mango (25) & Litchi (10). Guava (20), Neem (40), Grass (20), Drumstick (240)
- Present condition : All of mango sapling has alive but others sapling more or less good

Program IV: Livestock program (Vaccination, deworming and layering)

Introduction

Livestock is an important and useful resource of the households in our rural Bangladesh. It contributes about 2.93% of GDP (BER 2006). It plays a vital role for improvement of livelihood of the household of providing proteins and calories. In spite of its important in our economy this sector has been suffering from different types of problems. Among them disease and quality feed/fodder are major problems that were faced by the farmers for their livestock rearing. From different research findings it was revealed that proper vaccination can reduce the mortality rate and quality feed can ensure proper growth and development of cattle and poultry birds. Considering the above circumstances vaccination and poultry birds rearing program were included with the following objectives.

(i) To reduce mortality rate of livestock population.
(ii) To improve family nutrition.
(iii) To increase farmer's income as well as create employment opportunity.

The results of the vaccination program are presented in Table 7. The results showed that after vaccination program mortality percentage become very low compared to before vaccination in case of all livestock population. This program has created awareness and interest among the co-operator farmers.

Table 7. Livestock activities

Activities	Household no	Breed	No. of bird/cattle	Present condition
Layer rearing	2	Faomi	60	Egg production started
Vaccination of poultry	100	Local	200	Mortality decreased
Dewarming of cattle	50	Local	80	Good
Vitamin feeding	40	Local	60	Good

Farmers' reaction

- Farmers positively opined due to low mortality rate of their livestock.
- Farmers are highly interested to layer rearing

Utilization of Fisheries Gher Boundaries through Vegetable Production in Coastal Area

Abstract

The experiment was conducted at the MLT site Bagerhat during 2007-08 to find out suitable vegetable and fruit species for planting in the bound around fisheries gher. Five vegetable patterns were designed. Among vegetables, cabbage gave better yield.

Introduction

The medium lowland and lower portion of medium high land occupies a considerable available area of the district. The dominant cropping pattern of the area is Fallow–T.Aman–Fallow. Because farmers are getting very low crop yield from the land, and are shifting over from crop to fish production. A number of fisheries gher has copped up around district of Khulna, Bagerhat and Satkhira. The bunds around the ghers occupy a reasonable area and are underutilized. The area is deficit in vegetables and there is acute shortage of fuel and fruit. Attempt was made to utilize the bunds through crop culture and tree plantation to increase the local production by utilizing the gher bunds. The present study was undertaken to find out suitable vegetable and fruit species for planting in the bund around fisheries gher and to increase production and consumption of vegetables and fruits round the year.

Materials and Methods

Different vegetables and fruit growing patterns at fisheries gher area round the year. Five different vegetables patterns were studied. The patterns were as follows:

Pattern	Rabi (planting date)	Kharif
1	Knokhol (18-20 Nov.'07)	Okra/Red amaranth (Edge **:** Bitter gourd)
2	Tomato (15-18 Nov'07)	Chilli
3	Cabbage (16-18 Nov.'07)	Bottle gourd
4	Brinjal (25-29 Nov.'07)	Indian spinach
5	Chilli (14-17 Nov.'07)	Country bean

The experiment was carried out at seven farmer's field. The plot size was 6m$\times$1m. Recommended spacing fertilizer dose and other standard management were used for each crop production. Data on yield, cost, return and utilization of vegetables were recorded.

Result and Discussion

Performance of rabi vegetable has been presented in Table 1. From the result it was found that cabbage gave the highest yield. The second highest yield was obtained from tomato. After completion of whole pattern, final conclusion can be done.

Farmers' reaction

Farmers' are interested to cultivate cabbage due to its good taste, high yield and satisfactory market price. Knolkhol and tomato are also liked by farmer for their medium yield and good taste. Production of brinjal and its market price was low due to infestation of brinjal shoot and fruit borer.

Table 1. Yield of different vegetables crops during 2007-08

Vegetable pattern		Field duration (day's)		Yield (t/ha)	
Rabi (C_1)	Kharif (C_2)	C_1	C_2	C_1	C_2
Knolkhol	Okra/Red amaranths	77	Not	23.33	Not
Tomato	Chilli	105	yet	33.66	yet
Cabbage	Bottle gourd	77	harvest	55.00	harvest
Brinjal	Indian spinach	130	-	07.62	-
Chilli	Country bean	110	-	06.43	-

Table 2. Economic performance of different vegetables patterns at MLT site, Bagerhat

Vegetable pattern		Gross return (Tk/ha)		TVC (Tk/ha)		Gross margin
Rabi	Kharif	C_1	C_2	C_1	C_2	
Knolkhol	Okra/Red amaranths	18640	Not	72000	Not	114640
Tomato	Chilli	201960	yet	65560	yet	136400
Cabbage	Bottle gourd	220000	harvest	80000	harvest	140000
Brinjal	Indian spinach	106680	--	89935	--	16745
Chilli	Country bean	102880	--	88750	--	14130

Price : Knolkhol Tk 8/kg, Tomato Tk 6/kg, Cabbage Tk 4/kg, Brinjal Tk 14/kg and Chilli Tk 16/kg

Table 3. Disposal pattern of vegetable in gher boundary (Average of 7 families) during 2007-08

Name of vegetables	Quantity harvested (kg/42m^2/Family)	Consumption (kg/Family)	Amount distribution (kg/Family)	Amount sold (kg/Family)	Value (Tk.)
Knolkhol	14	04	03	07	112
Tomato	28	07	04	17	140
Cabbage	33	06	04	23	132
Brinjal	05	04	01	--	70
Chilli	04	03	01	--	64

No. of family : 07

Adoption and Impact of Homestead Vegetables Production Model in FSRD site of Palima under Tangail District

Abstract

The study was conducted at the FSRD site, Palima, Tangail to assess the adoption and impact of homestead vegetables production module of Palima model of Palima during April-May 2008. A total of ten farmers as well as homestead vegetables production models were selected purposively as sample to collect necessary information for the present study. The study showed that the level of adoption of the technologies was medium to low. The vegetables production rate was 42 percent lower compared to project period (2003). The over all impact on socio-economic parameters of the farmers increased by 24 percent for practicing the homestead vegetables production model. About seventy percent farmers reported that they did not get BARI vegetable seeds in proper time.

Introduction

Homestead land has been defined as the land owned by the dwelling units of the households surrounding the dwelling units including kitchen, cowshed, court yard, pond, roads, space around homestead, space used for cultivation of trees and vegetables. The government of Bangladesh has placed great emphasis on vegetables, especially, homestead vegetables production round the year to meet the nutritional and caloric need of the growing population and for increasing employment opportunities and income of the farmers. The land area available for crop production is decreasing rapidly due to construction of roads, building and industries, but at the same time the demand for all agricultural products is increasing. Thus it is needed to open new avenues for increasing production. Though the homestead of Bangladesh are already in use, renewed intervention for their intensive utilization system for their potentials in employment and income generation, poverty alleviation and improvement of nutritional food security and other benefits. Vegetables are rich in vitamin and mineral. Regular intake of vegetables can effectively protect people of all ages against mal and under nutrition, an in ability to see normally in dim light (night blindness), which is caused by vitamin A deficiency in the body (Sabur, 1990). Per capita consumption of vegetable is only 80 g/day (HRC, BARI, 2007), in comparison to daily requirement of 220 g/day/head (FAO, 1999). Intensive vegetables production can provide not only nutritional security but also be helpful for employment generation and higher farm income. Female labor can also be used in the homestead vegetables production unit. On-Farm Research Division has developed some location specific homestead vegetables model over the country under different AEZs. These models are practicing by the farmer during the last five year and supplying fresh vegetables round the year. By using the model many unutilized/under utilized area has come to under vegetables growing unit with planned and productive way. Considering this context the impact status of these vegetables model should be assessed in the farmer's level. Therefore, the present study is under taken to meet up the following objectives.

Objectives

i) To see the adoption status of homestead vegetable model.
ii) To assess the impact of homestead vegetables production model.
iii) To know the vegetable utilization pattern.
iv) To identify the constrains of vegetables production model.

Methodology

The study was conducted at the FSRD site, Palima, Tangail during April-May 2008 to assess the adoption and impact of homestead vegetables production module of Palima model. Ten farmers as well as homestead vegetables production models were brought during the project year 2003. All these 10 homestead vegetables production models were selected as sample to collect necessary information for the present study. The selected farmers were under marginal (0.1 -0.50 ha) farm group. Data were collected by pre tested survey schedule, face to face interview method and participatory approach from all the farmers who were practicing vegetable model. The impact and adoption level were tested with the result during project period (2003) and five years later of the project period i.e. present situation (2008). The problems were identified with Focus Group Discussion (FGD) approach. Purposive sampling technique was followed for selecting sample farmers. The collected data were than tabulated, summarized, analyzed and presented in tabular form.

Calculation of Gross Return and Net return

Gross return of each technology was calculated by multiplying the yield with their unit price. Net return is the difference between gross return and total production cost.

Calculation of PIS

Perceived Impact Score (PIS) technique was used to highlight overall impact of technologies PIS was computed for each changed item by summing the weights for responses of all the sample farmers against that change item (Khatun, 1999). The weights assigned were 3, 2, 1 and 0 for excellent change, moderate change, average change and no change, respectively. In order to make a meaningful comparison of data, the PIS for a particular change item was standardized by using the following formula;

$$\text{SPIS} = \frac{\text{Observed perceived impact score}}{\text{Possible perceived impact score}} \times 100$$

Level of Adoption

The level of adoption was measured by computing adoption scores for recommended technologies. Score was given to each technology that varied from 1 to 4 according to the adoption of the suggested technology. A respondent farmer could get a score of 4 for adopting cent percent of technologies. On the other hand farmers could receive a score of 3 for 75% adopting, 2 for 50% adopting and 1 for 25% adopting (Hossain, 1997). The mean score became the index of level of adoption of the recommended technologies. On the basis of the score that earned by the farmers were categorized as high=$\geq$3, medium=$\geq$2, low = $\geq$1 and very low= $\leq$1 level of adopters respectively.

Results and Discussion

Socio-economic characteristics of the sample farmers

Socio-economic characteristics affect the production, management practice and other activities of homestead vegetables production. The characteristics were considered as age, education, family size occupation etc.

Age group of the sample farmers

Age itself is an influencing factor for the acceptance of improved technology and in taking risk. It was showed that 40 percent farmers were under 30-40 age group and 30 percent under 41-50 and 51-60 age group (Table-1).

Educational status of the sample farmers

About 30 percent farmers were able to sign their name. Another 60 percent belonged to the education level of class I-V and VI-X. The rest 10 percent were XI-XII class (Table-1).

Family size of the sample farmers

The average family size (5.6) in the study area was 17 percent higher than that of national average (4.8) of Bangladesh (BBS, 2001). The percentage of male was 55 and female was 45 in the study area (Table 1).

Occupation of the sample farmers

Table-1 showed that 60 percent of the sample farmers were engaged with agriculture and 30 percent with agriculture+ business. The rest 10 percent were engaged with agriculture+ service in the study area.

Homestead area and land use pattern

On an average the sample farmers had 0.11 ha homestead area of which 0.03 ha was for vegetable growing purpose, 0.07 ha was occupied by houses, roads, trees, ponds etc. and 0.01 ha was unutilized area. The average cultivated area was found to be 0.26 ha (Table 2).

Technology intervened in homestead vegetables production model

Farmers produced different types of vegetables in homestead area primarily for family consumption and surplus to sell. Farmers were producing vegetables into 8 resources/ production units during both the project period (2003) and present situation (2008).The resources were open sunny place, house roof, trellis, shady area, marshy land, tree support, pond bank and back yard/ house boundary etc. Farmers produced vegetables from each and every possible production units efficiently for own consumption and surplus to sell for more cash income during the project period (2003). It was found that farmers got 2079 kg/farm vegetables. Gross return was Tk.17809, Total variable cost was Tk.2255 and gross margin was Tk. 15730 during project period (2003) (Table 3). On the other hand, after five years of the project (at present situation) they could produce 880 kg/farm vegetables which was 42 percent lower than project period may be due to assigning lower priority in homestead gardening. Gross return (Tk. 8245) and gross margin (Tk. 5483) also found lower in the present situation (2008) (Table 5). The result indicated that higher yield as well as gross margin was possible to the project period for adopting of more new technologies and optimized use of resources.

Disposal pattern of vegetables grown in Palima Model

Farmers in the study area produced vegetables in homestead for home consumption and good economic return also. It was found that during project period (2003) 50% of the total production was consumed by farmers followed by sold (42%) and distributed to the relatives (8%) (Table 4). It was also observed that 48 percent of the total production of vegetables was sold by the farmers. About 41 percent vegetables were consumed and rest 11 percent was distributed to the neighbor and relatives (Table 6). It was also noticed that per family member consumed 164 g vegetables per day which was lower than recommendation (220 g/day/person: FAO, 1999).

Adoption level of intervened technologies

For adoption level, the sample farmers were classified into 4 categories based on the mean scores of the farmers in respect of technologies given in each production unit. The mean score and adoption categories were shown in Table 7. The highest score was found in trellis (2.5) which indicated medium level of adoption. The adoption level of the rest technologies were in low level.

Socio-economic impact of homestead vegetables production model

Ten socio-economic parameters were considered for describing the impact of homestead vegetables production model such as social status, health condition, household micro environment, food habit, technical knowledge, income, employment, savings, education and resource use etc. It was observed that minimum of 20 percent to maximum of 40 percent for moderate change of these social parameters and minimum of 20 percent to maximum of 60 percent for average change. No change constituted 10-80 percent for all the social parameters. No excellent or remarkable change was found in the social parameters of the sample farmers (Table 8). The overall SPIS of ten social parameters was found to be 24 percent indicating that over all change in social parameter of the farmers increased by 24 percent for involving himself in the homestead vegetable production model. The highest observed SPIS was 16.39 percent for intensive use of resources and the lowest 2.87 percent for employment (Table 9).

Problems faced by the sample farmers

Problems were identified through focus group discussion with the sample farmers. Most of the farmers (70%) reported that they did not get BARI vegetables seeds timely for vegetable production. About 60 percent farmers opined that they had lack of technical knowledge, extension service, high input price and poultry birds damaged their vegetables. About 40 percent farmers reported that they did not get technical support for withdraw of FSRD site office and many of the family members went outside of the family for education and service or business oriented activities (Table 10).The sample farmers also identified some constraints of the vegetable production model as i) approach of the model was top down ii) farmer's choice was not considered for variety/seed selection iii) participatory approach did not work efficiently and iv) land less and marginal farmers were considered mainly as cooperator farmers for implementing the program.

Conclusion

Homestead vegetables production model is a model for natural fridge of vegetables which able to supply fresh vegetables as well as nutrition round the year and source of good economic benefit for the marginal farmers. The result of project period (2003) showed the model was profitable but present study showed in sufficient use of unused resources as well as low vegetables production due to above mentioned constrains which caused low yield and benefit. The study also revealed that the technology adoption level was medium to low in the study area. Presently, vegetables consumption rate was found low compared to project period due to low vegetables production.

Recommendations

On the basis of the findings of the study the following recommendations were made with a view to improve the vegetables production model

- Vegetables seeds of high yielding variety should be ensured to the farmers with low cost of price.
- Training program should be arranged to improve the technical knowledge of the male and female farmers.
- Linkage should be increased and strengthened between extension, NGOs and farmers.
- Motivational program should be arranged to encourage the farmers towards vegetables production model.

So, by minimizing the constraints of vegetables production model, research-extension and non government organizations could give more attention for better living style of the farmers.

References

Annual Report 2007. Horticulture Research Centre, BARI, Gazipur-1701

FAO (Food and Agriculture Organization). 1999. FAO Production Year Book. Basic Data Unit. Statistic Division, FAO, Rome, Italy.

Hossain, MA and et al. 1997. Adoption of recommended package of technology for Uttara Brinjal: A farm level study in Bangladesh. Bangladesh Journal of Extension. Education. Vol. 9. pp. 99-104.

Khatun, S. 1999. A socio-economic study on the impact of Association for Social Advancement (ASA) Credit Program of Women Beneficiaries in a selected Area of Mymensingh, District MS Thesis, Dept. of Agril. Finance. BAU, Mymensingh.

Sabur, S.A. 1990. Production and price behaviour of vegetables in Bangladesh. The Bangladesh Journal of Agricultural Economic. Vol. VIII, No. 182.

Table 1. Socio-economic characteristics of the sample farmers at the FSRD site, Palima, Tangail during 2008

Socio-economic parameter		No. of farmers	Percentage (%)
Age group (years)	30-40 years	4	40
	41-50 years	3	30
	51-60 years	3	30
	Total	10	100
Education level	Able to sign	3	30
	I-V	3	30
	VI-X	3	30
	XI-XII	1	10
	Total	10	100
Family size (No.)	Male	3.1	55
	Female	2.5	45
	Total	5.6	100
Occupation (No.)	Agriculture	6	60
	Agriculture + business	3	30
	Agriculture + service	1	10
Total		10	100

Table 2. Homestead land use pattern by the sample farmers at the FSRD site, Palima, Tangail during 2008

Land use pattern	Area occupied (ha)	Percentage (%)
A. Homestead area	0.11	30
- Vegetable growing area	0.03	8
- Land occupied by house, road, trees, pond etc.	0.07	19
- Unutilized area	0.01	3
B. Cultivated area	0.26	70
Total	0.37	100

Table 3. No. of technologies intervened, yield, return and gross margin in homestead during Project period (2003) at the FSRD site, Palima, Tangail

Resource area	Project period (2003)					
	Technology used	Area/No.	Yield (kg)	GR (Tk)	TVC(Tk)	GM(Tk)
Open sunny place	Tomato-Indian spinach-Chill	1 dec.	74	824	215	607
	Lalshak-Lalshak-Indian spinach	1 dec.	53	378	50	338
	Amaranth-Amaranth-Lalshak	1 dec.	68	505	60	435
	Tomato-Lalshak/okra	1 dec.	60	495	70	425
	Potato-Okra-Gimakalmi	1 dec.	130	875	150	725
	G.kalim-G.kalmi-Gimakalmi	1 dec.	120	720	50	670
	Tomato-Okra-Gimakalmi	1 dec.	131	1800	300	1500
	Total		636	5597	895	4702
House roof	Country bean-Sweet/Ash gourd	1 no.	105	1016	200	186
	Country bean-Ash gourd	1 no.	98	676	200	476
Trellis	BARI lau-1 Sweet gourd	1 no.	75	450	150	300
	Bitter gourd round the year	1 no.	40	600	100	500
	Country bean -sweet gourd	1 no.	70	510	150	340
	Country bean -cucumber	1 no.	45	350	150	200
Shady area	Ginger/chilli	2 dec.	80	1200	60	540
Marshy area	Latiraj /Kachu	1 no.	80	960	50	910
Tree support	Potato yam	2 no.	12	120	-	120
Pond bank	Sweet gourd	3 dec.	100	560	50	510
	BARI sheem-1		40	320	50	270
Back yard	Seedless lemon		200 no.	400	-	400
	Papaya	2 dec.	680	4780	200	270
	Year round drumstick		18	270	410	7600
	Total		2079	17809	2255	15730

Source: Annual Research Report 2002-03, OFRD, Tangail

Table 4. Vegetable consumption pattern by the sample farmers during project period (2003) at the FSRD site, Palima, Tangail

Production unit/Resource	Total production (kg)	Consumed (kg)	Distributed (kg)	Sold (kg)
Open place	636	318	51	267
House roof	203	102	16	85
Trellis	230	115	18	97
Shady area	80	40	6	34
Marshy land	80	30	8	42
Tree support	12	8	1	3
Pond bank	140	72	8	60
Backyard	698	350	55	293
Total	2079 (100%)	1035 (50%)	163 (8%)	881 (42%)

Table 5. No. of technologies intervened, yield, return and gross margin in homestead during Present situation (2008) at the FSRD site, Palima, Tangail during 2008

Resource area	Area/ No.	Present situation (2008)				
		Technology used	Yield (Kg)	GR (Tk)	TVC (Tk)	GM (Tk)
Open sunny place						
Bed-1	1 dec.	Tomato -Okra-I. Spinach	166	1326	260	1066
Bed-2	1 dec.	Brinjal + Lalshak	55	400	80	320
Bed-3	1 dec.	Spinach	68	340	60	280
Bed-4	1 dec.	Amaranth	64	256	45	211
House roof	Roof-1	White gourd	53	530	150	380
	Roof-2	Sweet gourd-White gourd-White gourd	32	384	80	304
Trellis	1 no.	BARI Lau-White gourd- Sponge gourd	92	864	365	499
	1 no.	Lau-Lau-snake gourd	30	360	230	130
	1 no.	Lau-Sweet gourd-white gourd	96	1072	412	660
Shady area	0.25 dec.	Ginger-Ginger-Ginger	16	240	50	190
		Turmeric-Turmeric-Turmeric	12	144	50	94
Marshy land	1 no.	Latiraj	23	230	60	170
Tree support	1 no.	Metealu-Sponge gourd-Sponge gourd	12	144	35	109
Pond Bank	3 dec.	Lau-Black gram-Black gram	94	940	620	320
Back yard	2 dec.	Aroid, Banana, Papaya, lemon	67 80 (no.)	1015	265	750
	Total		880 (42%)	8245	2762	5483

Table 6. Vegetables utilization pattern by the sample farmers at the FSRD site, Palima, Tangail during 2008

Production unit/ Resources	Total production (kg)	Consumed (kg)	Distributed (kg)	Sold (kg)
Open place	353	128	32	160
House roof	85	30	10	40
Trellis	218	80	30	110
Shady area	28	6	3	19
Marshy land	23	5	2	16
Tree support	12	7	2	3
Pond Bank	94	31	10	41
Back yard	67	22	10	32
Total	880 (100)	360(41%)	99(11%)	421(48%)

Table 7. Adoption level of intervened technologies used by the sample farmers at the FSRD site, Palima, Tangail during 2008

Resource area	Weighted Score (N = 10)	Mean Score	*Adoption level	Reasons
Open place	17	1.7	Low	Reluctant for making bed to grow vegetables
House roof	17	1.7	Low	For decreasing the longevity of the roof
Trellis	25	2.5	Medium	Adopting from the beginning
Shady area	13	1.3	Low	Lack of motivation and low income
Marshy land	15	1.5	Low	Lack of motivation and low income
Tree support	14	1.4	Low	Unavailability of non fruit trees
Pond Bank	19	1.9	Low	High cost involved for trellis
Back yard	18	1.8	Low	Lack of inspiration or consciousness

*Adoption level: ≥ 3= high, ≥ 2 = Medium, ≥ 1=Low and ≤ 1= very low

Table 8. Socioeconomic impact of homestead vegetable production model at the FSRD site, Palima, Tangail during 2008

Parameters	No change	Average change	Moderate change	Excellent change	Total
Social status	50	30	20	-	100
Health condition	60	40	-	-	100
Resource use	10	60	30	-	100
Saving	70	-	30	-	100
Technical knowledge	30	40	30	-	100
Income	40	40	20	-	100
Employment	80	20	-	-	100
Food habit	50	20	30	-	100
Education	60	-	40	-	100
Household micro environment	50	20	30	-	100

Table 9. Impact of homestead vegetable production model on the basis of PIS at the FSRD site, Palima, Tangail during 2008

Parameters	Perceived impact score (PIS)	Standardized perceived impact core (SPIS)	Percentage (%)	Rank
Social status	7	23	9.43	4
Health condition	4	13	5.33	6
Resource use	12	40	16.39	1
Saving	6	20	8.20	5
Technical knowledge	10	33	13.52	2
Income	8	27	11.07	3
Employment	2	7	2.89	7
Food habit	8	27	11.07	3
Education	8	27	11.07	3
Household micro environment	8	27	11.07	3
Over all SPIS		24		

Table 10. Problems faced by the sample farmers at the FSRD site, Palima, Tangail during 2008

Sl. No	Nature of problems	% farmers responded	Ranks of problem
1.	Non-availability of BARI vegetables seed timely	70	1
2.	Lack of technical knowledge	60	2
3.	Lack of extension service	60	2
4.	Vegetables are damaged by the poultry	60	2
5.	Lack of proper utilization of land	30	6
6.	Model is labor intensive	40	5
7.	High price of input	60	2
8.	Attack of insect/pests	40	4
9.	Family members are not in pack with the family	50	3
10.	Withdraw of FSRD site office	50	3

Input Use and Profitability of Different Crops under Major Cropping Pattern in Some Selected Areas of Bangladesh

Abstract

The study was conducted at the FSRD site, Elenga, Tangail and FSRD site, Sherpur, Jamalpur during April-May, 2008 to document the input use level and to estimate the profitability of crops in major cropping patterns. A total of 100 sample farmers (50 farmers from each location) were selected to collect necessary primary data with the help of pre-designed survey schedule by group discussion, participatory approach and face to face interview method. Purposive sampling technique was followed for selecting the sample farmers. Data were collected from total 7 major cropping patterns of both the locations of which 3 major cropping patterns (Boro-T.aman, Wheat-Jute-T.aman and Mustard- Boro-T.aman) from Elenga, Tangail and the rest 4 major cropping patterns (Boro-T.aman, Mustard- Boro-T.aman, Wheat-Jute-T.aman and Potato-Boro-T.aman) from Sherpur, Jamalpur. The study revealed from Elenga, Tangail that considering the Boro-T.aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.114421, Tk.173096, Tk.58675 and 1.51, respectively. In Wheat-Jute-T.aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.108780, Tk.198777, Tk.89997 and 1.83, respectively. In Mustard-Boro-T.aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.135794, Tk.211563, Tk.75769 and 1.55, respectively in the study area. On the other hand, it was observed from Sherpur, Jamalpur that considering Boro-T.aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.120014, Tk.179662, Tk.52084 and 1.49, respectively. In Mustard-Boro-T.aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.145374, Tk.214609, Tk.238512and 1.64, respectively. Considering the Wheat-Jute-T.aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.130663, Tk.176021, Tk.45358 and 1.35, respectively. In Potato-Boro-T.aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.262286, Tk.392347, Tk.130061 and 1.49, respectively in the study area. The study also revealed that farmers used lower amount of K in most of the crops in major cropping pattern in the study areas. Most of the farmers did not use manure and did not apply recommended dose of fertilizer in their crops under major cropping patterns.

Introduction

The crop sector of Bangladesh agriculture is trying to produce more food to meet the requirements of ever growing population. The need of the hour is to achieve substantially higher crop yield than the present yield levels from our limited land resources on a sustainable basis. A crop production system with high yield targets cannot be sustainable unless proper nutrient inputs are applied in crop field. Although per unit cost and returns in the agricultural field is important for farm management. The basic understanding of cost and return is the understanding and knowledge concerning with the relationship between products/outputs and the cost incurred for input factors. This relationship depends on time, price and variable and fixed factors of production. Cost and return related information is important to assess the profitability of crop cultivation. Profitability of a crop depends on yield, price of the product and cost of inputs. Any variation in any of the above factors will change the profitability. Yield, price and cost are also changed over time, place and different management practices.

Information about input use level, yield cost and return of different crops in major cropping pattern play a significant role in agriculture sector of Bangladesh. It is also important and demand full to researchers, extension workers, policy makers and NGOs to plan new enterprises for future agriculture production. The wage rate, price of different inputs and output are changing over the time. So, current and updated information is needed to calculate the cost and return of different major crops. No effort was given yet before to consolidate the relevant information on cost and return of different crops in major cropping patterns. Therefore, the present study is under taken to meet up the following objectives.

Objectives

- To document the input use level of different crops under major cropping patterns.
- To estimate the profitability of the crops in major cropping pattern.

Methodology

The study was conducted at the FSRD site, Elenga, Tangail and FSRD site, Sherpur, Jamalpur during April-May, 2008 to document the input use level and to estimate the profitability of crops in major cropping pattern. A total of 100 sample farmers (50 farmers from each location) were selected to collect necessary primary data with the help of pre-designed survey schedule by group discussion, participatory approach and face to face interview method. Purposive sampling technique was followed for selecting the sample farmers. Data were collected from 7 major cropping patterns of both the locations of which 3 major cropping patterns (Boro-T.aman, Wheat-Jute-T.aman and Mustard- Boro-T.aman) from Elenga, Tangail and the rest 4 major cropping patterns (Boro-T.aman, Mustard- Boro-T.aman, Wheat-Jute-T.aman and Potato-Boro-T.aman) from Sherpur, Jamalpur.Cost and return were calculated based on the prevailing market price of each input and output for all crops in major cropping pattern in each location. Interest on operating capital was calculated at the rate of ten percent interest rate. Farmers provided the primary information from their memories during interview. The collected data were tabulated, summarized, analyzed and presented in tabular form. Farmers were interviewed by the researcher himself and Scientific Assistants or Senior Scientific Assistants who were employed in the mentioned FSRD sites. Enterprise costing technique was followed in calculating cost and return. Profitability was done based on net return analysis according to Dillion and Hardaker (1980). Per hectare cost and return was calculated in single crop and also whole pattern basis.

Results and Discussion

Location : FSRD site Elenga, Tangail

Boro-T.aman: It was the first major cropping pattern in the study area. Farmers used BRRI dhan 29 as the variety for Boro and BR11/Pajam for T.aman. They did not apply any manure in Boro and T.aman. Nitrogen was top dressed in two installments in Boro and T.aman. They used 118-30-44-13-6-1 kg N-P-K-S-Zn-B ha^{-1} in Boro and 76-8-12-2 kg N-P-K-S ha^{-1} in T.aman rice. The average yields were 6349 kg ha^{-1} and 3093 kg ha^{-1} from Boro and T.aman, respectively. It was observed that all the nutrients were applied in higher rate accept S in Boro and K&S in T.aman of Boro-T.aman cropping pattern compared to recommendation (120-18-36-10-1 kg NPKSZn ha^{-1} for Boro and 66-5-18-8-0.5 kg NPKSZn ha^{-1} for T.aman according to FRG 2005).

It was observed that the total production cost of Boro was Tk.82609 while it was Tk.31812 per hectare for T.aman rice. The gross return was Tk. 123393 and Tk. 49703 per hectare for Boro and T.aman, respectively. The net return received by the farmers was Tk.40784 from Boro and Tk.17891 per hectare from T.aman rice. The benefit cost ratio was 1.49 and 1.56 for Boro and T.aman, respectively. The study revealed that per kg Boro production cost was Tk.13.00 while it was Tk. 10.29 for T.aman rice (Table 1). Considering the Boro-T.Aman cropping pattern, the total production cost, gross return, net return and BCR were Tk.114421, Tk.173096, Tk.58675 and 1.51, respectively in the study area.

Wheat-Jute-T.aman: It was the second major cropping pattern in the study area. Farmers used Shatabdi /Bijoy as a variety of wheat, Tossa as the variety of jute and BR11/ Pajam as T.aman. No organic fertilizer was found to use in this cropping pattern. They used N twice in T.aman as top-dress and once in Wheat and Jute. They applied 97-26-35-8-1-1 kg N-P-K-S Zn B ha^{-1} in Wheat, 48-10-6-1 kg N-P-K-S ha^{-1} in Jute and 68-7-5-2 kg N-P-K-S ha^{-1} in T.aman. The average yield was 2524 kg, 2059 kg and 3250 kg ha^{-1} from Wheat, Jute and T.aman rice, respectively. It was observed that all the nutrients used by the farmers were higher except K&S in Jute and T.aman than the recommendation. (90-20-38-5-1 kg NPKSB ha^{-1} for Wheat, 42-6-18-4 kg NPKS ha^{-1} for Jute and 66-5-18-8-0.5 kg NPKSZn ha^{-1} for T.aman according to FRG 2005).

It was observed that the per hectare total production cost of Wheat was Tk.40203 while it was Tk.32423 for Jute and Tk.36154 per hectare for T.aman rice. The gross return was Tk.79326, Tk.55785 and Tk.52866 per hectare for Wheat, Jute and T.aman, respectively. The net return received by the farmers was 39123 from Wheat, Tk.23362 from Jute and Tk.16712 per hectare from T.aman rice. The benefit cost ratio was 1.97, 1.72 and 1.46 for Wheat, Jute and T.aman, respectively. The study revealed that per kg Wheat production cost was Tk.15.93 while it was Tk. 15.75 for Jute and Tk.11.12 for T.aman rice (Table 2). Considering the whole pattern the total production cost, gross return, net return and BCR were Tk.108780, Tk.187977, Tk.79197 and 1.73, respectively.

Mustard-Boro-T.aman: Farmers cultivated the crops under Mustard-Boro-T.aman cropping pattern in medium high land in the study area. Farmers used Tori-7 as a variety of mustard, BRRI dhan 29 as the variety of Boro and BR11/ Pajam as T.aman. They did not use manure in this pattern. N was applied as top dress once in Mustard and twice in Boro and T.aman. They applied 103-34-40-12 -2-1 kg N-P-K-S-Zn-B ha^{-1} in Mustard, 125-25-29-9 kg N-P-K-S ha^{-1} in Boro and 82-9-13-2 kg N-P-K-S ha^{-1} in T.aman. Yield was estimated 1342 kg ha^{-1} for Mustard 5586 kg ha^{-1} for Boro and 3212 kg ha^{-1} for T.aman. Yield was satisfactory for all crops in the cropping pattern. Farmers applied higher amount of N in this pattern in all crops compared to recommendation (54-15-24-10-1 kg NPKSB ha^{-1} for Mustard, 96-7-27-8-1 kg NPKSZn ha^{-1} for Boro and 66-5-18-8-1 kg NPKSZn ha^{-1} for T.aman according to FRG 2005).

It was observed that the per hectare total production cost of mustard was Tk.29223 while it was Tk.71750 for Boro and Tk.34821 per hectare for T.aman rice. The gross return was Tk. 62193, Tk.95139 and Tk. 54231 per hectare for mustard, Boro and T.aman, respectively. The net return received by the farmers was Tk.32970 from mustard, Tk.23398 from Boro and Tk.19410 per hectare from T.aman rice. The benefit cost ratio was 2.13, 1.33 and 1.55 for mustard, Boro and T.aman, respectively. The study revealed that per kg mustard production cost was Tk.21.78 while it was Tk. 12.84 for Boro and Tk.10.84 for T.aman rice (Table 3). Considering the whole cropping pattern the total production cost, gross return, net return and BCR were Tk.135794, Tk.211563, Tk.75769 and 1.55, respectively in the study area.

Location: FSRD site, Sherpur, Jamalpur

Boro-T.aman: It was identified as first major cropping pattern in the study area where farmers used BRRI dhan 28 as the variety of Boro and BRRI dhan 32/ BRRI dhan 33 as T.aman. They applied manure @ 9262 kg ha^{-1} in Boro crop. Fertilizer application rate was observed 132-19-31-9-5 kg NPKSZn ha^{-1} in Boro and 66-3-6-2 kg NPKS ha^{-1} in T.aman. N was applied in three splits in Boro and in two splits in T.aman. Average yield was 5943 kg ha^{-1} for Boro and 3311 kg ha^{-1} for T.aman. It was noticed that farmers were using higher dose of all nutrients except K in Boro and lower dose in T.aman compared to recommended dose (120-14-58-10-1 kg NPKSZn ha^{-1} for Boro and 66-4-29-6-1 kg NPKSZn ha^{-1} for T.aman according to FRG 2005).

It was observed that the total production cost of Boro was Tk.85420 while it was Tk.34594 per hectare for T.aman rice. The gross return was Tk. 114538 and Tk. 65124 per hectare for Boro and T.aman, respectively. The net return received by the farmers was Tk.21554 from Boro and Tk.30530 per hectare from T.aman rice. The benefit cost ratio was 1.34 and 1.88 for Boro and T.aman, respectively. The study revealed that per kg Boro production cost was Tk.14.37 while it was Tk. 10.45 for T.aman rice (Table 4). Considering the whole cropping pattern the total production cost, gross return, net return and BCR were Tk.120014, Tk.179662, Tk.52084 and 1.49, respectively in the study area.

Mustard-Boro-T.aman: It was identified as second major cropping pattern in the study area by the sample farmers. Tori-7, BRRI dhan 28 and BRRI dhan 32/ BRRI dhan 33 were used as variety of Mustard, Boro and T.aman crops, respectively. Manure was applied @ 2167 kg ha^{-1} in Boro. Fertilizer application rate was recorded 42-8-12-8-4-1 kg NPKSZnB ha^{-1} in Mustard, 120-11-24-3-2 kg NPKSZn ha^{-1} in Boro and 62-7-5 kg NPS ha^{-1} in T.aman crop. All the nutrients and one-half of N was applied in final land preparation and remaining N was applied at the time of flower initiation as top dress in Mustard. Incase of Boro and T.aman, N was applied in two installments. Average yield was estimated 1158kg, 5092kg and 3770 kg per hectare for Mustard, Boro and T.aman, respectively.

The study revealed that farmers used lower fertilizer dose in mustard, K in Boro and also lower dose in T.aman. The yield was lower in Mustard and T.aman crops compared to recommended dose and yield. (Recommended fertilizer dose was 54-12-38-8-1 kg NPKS Zn ha^{-1} for Mustard. 96-6-40-6-1 kg NPKSZn ha^{-1} for Boro and 66-4-29-6-1 kg NPKSZn ha^{-1} for T.aman according to FRG 2005).

It was observed that the total production cost of mustard was Tk.30728 while it was Tk.73930 for Boro and Tk.40716 per hectare for T.aman rice. The gross return was Tk.53394, Tk.96401 and Tk. 64814 per hectare for mustard, Boro and T.aman, respectively. The net return received by the farmers was Tk.22666 from mustard, Tk.22471 from Boro and Tk.24098 per hectare from T.aman rice. The benefit cost ratio was 1.74, 1.30 and 1.59 for mustard, Boro and T.aman, respectively. The study revealed that per kg mustard production cost was Tk.26.54 while it was Tk. 14.52 for Boro and Tk.10.78 for T.aman rice (Table 5). Considering the whole cropping pattern, the total production cost, gross return, net return and BCR were Tk.145374, Tk.214609, Tk.238512 and 1.64, respectively in the study area.

Wheat-Jute-T.aman: It was identified as third major cropping pattern in the study area by the sample farmers. Farmers used Shatabdi as a variety of wheat, Tossa as the variety of jute and BRRI dhan 32/ BRRI dhan 39/BR11 as T.aman. They applied manure @ 2340 kg ha^{-1} in wheat and @ 4160 kg ha^{-1} in Jute. Fertilizer application rate was 99-23-43-12-1 kg NPKSB ha^{-1} for wheat, 42-5-10 kg NPK ha^{-1} for Jute and 89-7-13-1 kg NPKS ha^{-1} for T.aman crop. N was applied in three splits in wheat and jute crops. Average yield was 2886 kg, 2444 kg and 3578 kg per hectare from Wheat, Jute and T.aman, respectively. It was observed that farmers used lower dose of K in this cropping pattern but average yield was found low compared to recommended dose. (Recommended dose was 90-16-63-4-1 kg NPKSB ha^{-1} for Wheat, 42-4-29-3 kg NPKS ha^{-1} for Jute and 66-4-29-6-1 kg NPKSZn ha^{-1} for T.aman according to FRG 2005).

It was observed that the total production cost of Wheat was Tk.46893 while it was Tk.43300 for Jute and Tk.40470 per hectare for T.aman rice. The gross return was Tk. 60385, Tk.53716 and Tk. 61920 per hectare for Wheat, Jute and T.aman, respectively. The net return received by the farmers was Tk. 13492 from Wheat, Tk.10416 from Jute and Tk.21450 per hectare from T.aman rice. The benefit cost ratio was 1.29, 1.24 and 1.53 for Wheat, Jute and T.aman, respectively. The study revealed that per kg Wheat production cost was Tk.16.25 while it was Tk. 17.72 for Jute and Tk.11.31 for T.aman rice (Table 6). Considering the whole cropping pattern the total production cost, gross return, net return and BCR were Tk.130663, Tk.176021, Tk.45358 and 1.35, respectively in the study area.

Potato-Boro-T.aman: It was the fourth major cropping pattern in the study area. Farmers used Diamant/Cardinal, BRRI dhan-28 and BRRI dhan 32/BRRI dhan 33 as the varieties of Potato, Boro and T.aman rice, respectively. They applied manure @ 9528 kg ha^{-1} in potato and @ 2646 kg ha^{-1} in Boro. Fertilizer application rate was 114-17-48-3-1-1 kg NPKSZnB ha^{-1} for Potato, 162-13-31-6 kg NPKS ha^{-1} for Boro and 49 kg ha^{-1} N for T.aman. N was applied in three splits in Potato, Boro and T.aman crops. Average yield was 22444 kg, 5081 kg and 2805 kg per hectare for Potato, Boro and T.aman, respectively. Farmers used higher dose of all nutrients in Boro and lower dose of K&S in Potato and N in T.aman compared to recommended dose. (Recommended dose 96-16-80-8-1.50-1 kg NPKSZnB ha^{-1} for Potato, 96-6-29-6-1 kg NPKSZn for Boro and 66-4-22-6-1 kg NPKSZn ha^{-1} for T.aman).

The total production cost of Potato was Tk.152417 while it was Tk.78133 for Boro and Tk.31736 per hectare for T.aman rice. The gross return was Tk.246884, Tk.97016 and Tk. 48447 per hectare for Potato, Boro and T.aman, respectively. The net return received by the farmers was Tk.94467 from Potato, Tk.18883 from Boro and Tk.16711 per hectare from T.aman rice. The benefit cost ratio was 1.62, 1.24 and 1.53 for Potato, Boro and T.aman, respectively. The study revealed that per kg Potato production cost was Tk.6.79 while it was Tk. 15.37 for Boro and Tk.11.31 for T.aman rice (Table 7). Considering the whole cropping pattern the total production cost, gross return, net return and BCR were Tk.262286, Tk.392347, Tk.130061 and 1.49, respectively.

Conclusion

The productivity and the yield of major crops under different cropping patterns had been changed over time due to application of imbalanced fertilizer and traditional management practice. The study revealed that farmers used lower amount of K in most of the crops in major cropping patterns in the study areas. Most of the farmers did not use manure and recommended dose of fertilizer in their crops for major cropping patterns. Per hectare production cost, gross return and net return were found higher than previous year due to high cost of input and output in the study areas though the government has paid diesel price for irrigation cost as subsidy in this year. Government should ensure subsidy on other production inputs to minimize the production cost of the crops for giving incentive to crop production as well as better living of the farmers.

Reference

Dillion, J. L and J. B. Hardaker. 1980. Farm Management Research for Small Farmer Development, Agricultural Services, Bulletin 14, FAO, Rome, Italy.

Table 1. Per hectare cost of production and return of Boro and T.aman rice under Boro-T.aman rice cropping pattern at FSRD site, Elenga, Tangail during 2007-08

Items	Boro			T.aman			Boro-T.aman
	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	
Human Labour (Man-days):	180	100	18000	139	100	13900	-
Hired	123	-	-	98	-	-	-
Family	57	-	-	41	-	-	-
Ploughing by power tiller (No.)	3		3705	3		3705	-
Seed rate (kg)	85	25	2125	57	25	1425	-
Fertilizer dose (kg):							
N	118	13	1534	76	13	988	-
P	30	175	5250	8	175	1400	-
K	44	60	2640	12	60	720	-
S	13	36	468	2	36	72	-
Zn	6	38	228	-	-	-	-
B	1	235	235	-	-	-	-
Irrigation cost (Tk.)	-	-	38119	-	-	-	-
Insecticides/ pesticides cost (Tk.)	-	-	635	-	-	1785	-
Interest on operating capital (Tk.)	-	-	3030	-	-	958	-
Rental value of land (Tk.)	-	-	6864	-	-	6864	-
Total production cost (Tk.)	-	-	82609	-	-	31812	114421
Yield (t/ha):							
Main product	6.349	18	114282	3.093	13	42809	-
By-product	6.074	1.5	9111	3.447	2	6894	-
Gross return (Tk.)	-	-	123393	-	-	49703	173096
Net return (Tk.)	-	-	40784	-	-	17891	58675
BCR	-	-	1.49	-	-	1.56	1.51
Per kg production cost (Tk.)	-	-	13.00	-	-	10.29	-

Table 2. Per hectare cost of production and return of Wheat, Jute and T.aman rice under Wheat-Jute-T.aman rice cropping pattern at FSRD site, Elenga, Tangail during 2007-08

Items	Wheat			Jute			T.aman			Wheat-Jute-T.aman
	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	
Human Labour (Man-days):	113	100	11300	172	100	17200	98	100	9800	-
Hired	55			112			50			-
Family	58			60			39			-
Ploughing by power tiller (No.)	3-4		4322	3-4		3705	3		3705	-
Seed rate (kg)	126	40	5040	9	100	900	39	30	1170	-
Fertilizer dose (kg):										
N	97	13	1261	48	13	624	68	13	884	-
P	26	175	4550	10	175	1750	7	175	1225	-
K	35	60	2100	6	60	360	5	60	300	-
S	8	36	288	1	36	36	2	36	72	-
Zn	1	38	38	-	-	-				-
B	1	235	235	-	-	-				-
Irrigation cost (Tk.)			2494	-		-			2470	-
Insecticides/ pesticides cost (Tk.)			199	-		-			3086	-
Interest on operating capital (Tk.)			1334			1022			947	-
Rental value of land (Tk.)			6864			6864			6864	-
Total production cost (Tk.)			40203			32423			36154	108780
Yield (t/ha):										
Main product	2.524	30	75720	2.059	20	41180	3.250	15	48750	-
By-product	3.606	1	3606	2.921	5	14605	4.116	1	4116	-
Gross return (Tk.)			79326			55785			52866	187977
Net return (Tk.)			39123			23362			16712	79197
BCR			1.97			1.72			1.46	1.73
Per kg production cost (Tk.)			15.93			15.75			11.12	-

Table 3. Per hectare cost of production and return of Mustard, Boro and T.aman under Mustard-Boro-T.aman rice cropping pattern at FSRD site, Elenga, Tangail during 2007-08

Items	Mustard			Boro			T.aman			Mustard-Boro-T.aman
	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	
Human Labour (Man-days):	64	100	6400	154	100	15400	153	100	15300	-
Hired	35	-	-	117	-	-	102	-	-	-
Family	39	-	-	37	-	-	51	-	-	-
Ploughing by power tiller (No.)	3		3705	3	-	3705	3	-	3705	-
Seed rate (kg)	10	45	450	82	45	1640	75	25	1875	-
Fertilizer dose (kg):										
N	103	13	1339	125	13	1625	82	13	1066	-
P	34	175	5950	25	175	4375	9	175	1575	-
K	40	60	2400	29	60	1740	13	60	70	-
S	12	36	432	9	36	324	2	36	72	-
Zn	2	38	76	-	-	-	-	-	-	-
B	1	235	235	-	-	-	-	-	-	-
Irrigation cost (Tk.)	1-2 times	-	205	-	-	33463	-	-	1578	-
Insecticides/ pesticides cost (Tk.)	-	-	321	-	-	-	-	-	763	-
Interest on operating capital (Tk.)			894			2475			1118	-
Rental value of land (Tk.)			6864			6864			6864	-
Total production cost (Tk.)	-	-	29223	-	-	71750	-	-	34821	135794
Yield (t/ha):										
Main product	1.342	45	60390	5.586	16	89376	3.212	15	48186	-
By-product	1.803	1	1803	5.763	1	5763	4.034	1.5	6051	-
Gross return (Tk.)	-	-	62193	-	-	95139	-	-	54231	211563
Net return (Tk.)	-	-	32970	-	-	23389	-	-	19410	75769
BCR	-	-	2.13	-	-	1.33	-	-	1.55	1.55
Per kg production cost (Tk.)	-	-	21.78	-	-	12.84	-	-	10.84	-

Table 4. Per hectare cost of production and return of Boro and T.aman rice under Boro-T.aman cropping pattern at FSRD site, Sherpur, Jamalpur during 2007-08

Items	Boro			T.aman			Boro-T.aman
	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	
Human Labour (Man-days):	185	100	18500	110	100	11000	-
Hired	111	-	-	61	-	-	-
Family	74	-	-	49	-	-	-
Ploughing by power tiller (No.)	3-4	-	4323	3		3705	-
Seed rate (kg)	71	22	1562	68	22	1496	-
Manure (kg)	9262	0.5	4631	-	-	-	-
Fertilizer dose (kg):							
N	132	13	1716	66	13	858	-
P	19	150	2850	3	150	450	-
K	31	52	1612	6	52	312	-
S	9	35	315	2	35	70	-
Zn	5	77	385	-	-	-	-
Irrigation cost (Tk.)	3-4 times	-	30658	-	-	-	-
Insecticides/ pesticides cost (Tk.)	-	-	841	-	-	710	-
Interest on operating capital (Tk.)			2817			775	-
Rental value of land (Tk.)			15210			15210	-
Total production cost (Tk.)			85420			34594	120014
Yield (t/ha):							
Main product	5.943	18	106974	3.311	18	59598	-
By-product	7.564	0.75	7564	5.526	1	5526	-
Gross return (Tk.)	-	-	114538	-	-	65124	179662
Net return (Tk.)	-	-	21554	-	-	30530	52084
BCR	-	-	1.34	-	-	1.88	1.49
Per kg production cost (Tk.)	-	-	14.37	-	-	10.45	-

Table 5. Per hectare cost of production and return of Mustard, Boro and T.aman rice under Mustard-Boro-T.aman rice cropping pattern at FSRD site, Sherpur, Jamalpur during 2007-08

Items	Mustard			Boro			T.aman			Mustard-Boro-T.aman
	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	
Human Labour (Man-days):	65	100	6500	152	100	15200	140	100	14000	-
Hired	22	-	-	54	-	-	32	-	-	-
Family	43	-	-	98	-	-	55	-	-	-
Ploughing by power tiller (No.)	3	-	3705	3	-	3705	3	-	3705	-
Seed rate (kg)	11	60	660	68	20	1360	71	20	1420	-
Manure (kg)	-	-	-	2167	0.5	1084	-	-	-	-
Fertilizer dose (kg):										
N	42	13	546	120	13	1560	79	13	1027	-
P	8	150	1200	11	150	1620	7	150	1050	-
K	12	52	624	24	52	1248	5	52	260	-
S	8	35	280	3	35	105	-	-	-	-
Zn	4	77	308	2	77	154	-	-	-	-
B	1	470	470	-	-	-	-	-	-	-
Irrigation cost (Tk.)	1 time	-	425	-	-	29967	-	-	-	-
Insecticides/ pesticides cost (Tk.)	-	-	524	-	-	520	-	-	2650	-
Interest on operating capital (Tk.)			621			2354			1004	-
Rental value of land (Tk.)			15210		-	15080		-	15600	-
Total production cost (Tk.)	-	-	30728	-		73930	-	-	40716	145374
Yield (t/ha):										
Main product	1.158	45	52110	5.092	18	91656	3.776	16	60416	-
By-product	1.284	1	1284	6.327	0.75	4745	4.398	1	4398	-
Gross return (Tk.)	-	-	53394	-	-	96401	-	-	64814	214609
Net return (Tk.)	-	-	22666	-	-	22471	-	-	24098	238512
BCR	-	-	1.74	-	-	1.30	-	-	1.59	1.64
Per kg production cost (Tk.)	-	-	26.54	-	-	14.52	-	-	10.78	-

Table 6. Per hectare cost of production and return of Wheat, Jute and T.aman rice under Wheat-Jute-T.aman rice cropping pattern at FSRD site, Sherpur, Jamalpur during 2007-08

Items	Wheat			Jute			T.aman			Wheat-Jute-T.aman
	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	
Human Labour (Man-days):	123	100	12300	175	100	17500	151	100	15100	-
Hired	77	-	-	131	-	-	113	-	-	-
Family	46	-	-	44	-	-	38	-	-	-
Ploughing by power tiller (No.)	3	-	3705	3	-	3705	3	-	3705	-
Seed rate (kg)	137	21.75	2979	9	175	1575	76	20	1520	-
Manure (kg)	2340	0.5	1170	4160	0.5	2080	-	-	-	-
Fertilizer dose (kg):										
N	89	13	1157	42	13	546	89	13	1158	-
P	23	150	3450	5	150	750	7	150	1050	-
K	43	52	2236	10	52	520	13	52	676	-
S	12	35	420	-	-	-	1	35	35	-
B	1	470	520	-	-	-	-	-	-	-
Irrigation cost (Tk.)	1-2 times	-	1625	-	-	-	-	-	-	-
Insecticides/ pesticides cost (Tk.)	-	-	526	-	-	260	-	-	1014	-
Interest on operating capital (Tk.)		-	1267		-	1124		-	1010	-
Rental value of land (Tk.)		-	15210		-	15210	-	-	15216	-
Total production cost (Tk.)	-	-	46893	-	-	43300	-	-	40470	130663
Yield (t/ha):										
Main product	2.886	20	57720	2.444	16	39104	3.578	16	57248	-
By-product	2.665	1	2665	3.653	4	14612	4.672	1	4672	-
Gross return (Tk.)	-	-	60385	-	-	53716	-	-	61920	176021
Net return (Tk.)	-	-	13492	-	-	10416	-	-	21450	45358
BCR	-	-	1.29	-	-	1.24	-	-	1.53	1.35
Per kg production cost (Tk.)	-	-	16.25	-	-	17.72	-	-	11.31	-

Table 7. Per hectare cost of production and return of Potato, Boro and T.aman rice under Potato-Boro-T.aman rice cropping pattern at FSRD site, Sherpur, Jamalpur during 2007-08

Items	Potato			Boro			T.aman			Potato-Boro-T.aman
	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	Quantity	Unit price	Cost and return	
Human Labour (Man-days):	214	100	21400	179	100	17900	98	100	9800	
Hired	144	-	-	123	-	-	30	-		-
Family	70	-	-	56	-	-	68	-		-
Ploughing by power tiller (No.)	4		4940	3	-	3705	3	-	3705	
Seed rate (kg)	2293	30	68790	63	20	1260	56	20	1105	
Manure (kg)	9528	0.5	4764	2646	0.5	1323	-	-		-
Fertilizer dose (kg):										
N	114	13	1482	162	13	2106	49	13	637	
P	17	150	2550	13	150	1950	-	-		-
K	48	52	2470	31	52	1612	-	-		-
S	3	35	105	31	35	1085	-			-
Zn	1	77	74	6	77	462	-	-		-
B	1	470	470	-	-	-	-	-		-
Irrigation cost (Tk.)	2-3 times	-	9246	-	-	29981	-	-		-
Insecticides/ pesticides cost (Tk.)	-	-	24350	-	-	-	-	-	243	-
Interest on operating capital (Tk.)		-	2530			2501			646	-
Rental value of land (Tk.)			15600			15600			15600	-
Total production cost (Tk.)	-	-	152417	-	-	78133	-	-	31736	262286
Yield (t/ha):										
Main product	22.444	11	246884	5.081	18	91458	2.805	16	44880	-
By-product	-	-	-	7.411	0.75	5558	3.567	1	3567	-
Gross return (Tk.)	-	-	246884	-	-	97016	-	-	48447	392347
Net return (Tk.)	-	-	94467	-	-	18883	-	-	16711	130061
BCR	-	-	1.62	-	-	1.24	-	-	1.53	1.49
Per kg production cost (Tk.)	-	-	6.79	-	-	15.37	-	-	11.31	-

Study of Moringa (Drumstick) Based Homestead Agroforestry System in the High Barind Tract

Abstract

Moringa oleifera (drumstick) based homestead agroforestry system was studied in three locations of High Barind Tract (Godagari, Chapai-Nawabganj and Shapahar) and Rajshahi city during 2007 to assess the agronomic and economic performance of existing agroforestry system and to identify its problems and prospect. Averaged over locations each household has seven drumstick trees, of them slightly more than one tree is above five years. Above five years tree produces more than 2.5 times (41 kg/tree) in comparison to younger aged tree (16 kg/tree).From the year round tree (*baromasi*) pods could be harvested three times (Chaitra to Magh, i.e. March to January) in a year. Average total production of drumstick pod/homestead/year is about 116 kg of which 35% is consumed, 54% is sold and 11% is free distributed among relatives and neighbors. Growers earn about Tk.1559/homestead/year by selling pods. Its leaves are also consumed by 82% growers containing high amount of vitamin A. Major production constraints were pest (hairy caterpillar and stem borer) and diseases (Gummosis and fungal attack on flowers).

Introduction

Moringa oleifera Lam (Drumstick) is a soft wood tree, grown widely all over Bangladesh except the coastal belt. Moringa is fast growing, drought tolerant and easily adapted to varied ecosystems (Rajangam et al. 2001). This is a tree for daily use in millions of homestead of Bangladesh, particularly in the High Barind Tract and Rajshahi region. Ancient Indian literature makes mention of Moringa an interesting plant due to its widespread use in agriculture, medicine and industry. Modern research findings have showed that Moringa extract is useful against prevention of cancer (Cordell et al. 1992). Its pod is widely used as vegetable across Bangladesh, besides pod, its leaves contain high amount of Vit A (11,500 IU/100 g). In recent years Moringa has gained high economic value in the Barind area. Even in remote village of Barind, Moringa pods are selling at a price of Tk. 20-50/kg. Some farmers are also selling Moringa leaves as vegetable. Particularly, the year round (three times per year) i.e. Baromasi Moringa has high economic importance, as it becomes available in off-season. However, very few information is available regarding Moringa. Before undertaking any research program, it is an urgent need to document the relevant information and problems on production of Moringa for the High Barind Tract area and elsewhere. Therefore, the study was undertaken with the following objectives: i) to see the agronomic and economic performance of Moringa based homestead agroforestry systems, ii) to identify problems and prospect of Moringa.

Methodology

The study was conducted at three areas of High Barind Tract (HBT) viz. Godagari, Chapai-Nawabganj and Shapahar and in Rajshahi city during April to May, 2007. A total of 80 drumstick growers were selected randomly as sample to collect necessary information. From each four locations 20 samples growers were interviewed through pre-tested survey schedule. Also the problems and prospect and other information were collected and verified through Focus Group Discussion (FGD).Purposive sampling technique was followed for selecting sample farmers. The collected data were summarized, analyzed and presented in tabular form.

Results and Discussion

Average family size, occupation and land holdings

Chapai-Nawabganj has the highest family size (6.14) and family size of other three areas was 5+, which is almost common situation for unitary family (Table 1). Average occupation of 69.5 %

respondent was agriculture followed by business and service. Among the location agriculture was the occupation of 96 % respondent of Godagari followed by 92 % at Shapahar, while in Rajshahi city major occupation was business and service. Average homestead area was 15.64 decimal which was higher than other areas but in case of cultivable land most of the respondent belongs to marginal and small categories.

Age-wise drumstick population

Farmers of Shapahar and Chapai-Nawabganj are cultivating drumstick for more years than those of Rajshahi city and Godagari (Table 2). Average number of drumstick tree per household was 7.05, Chapai-Nawabganj farmers possess the highest number (9.64) followed by Godagari while Shapahar farmers had the lowest number of plants (4.22). The number of old trees (>5 years) are less, but highest number of 0-3 years indicate that farmers interest are increasing for drumstick. Chapai-Nawabganj respondents have the highest number of aged trees.

Propagation technology

In general 1-1.5 year old stem cutting is used as planting material, the height of the stem would be 170-220 cm (Table 3), planted mostly in Chaittra to Ashar in 37-46 cm soil depth. The top edge of the stem is covered with fresh cow dung to prevent water loss. After planting localized hand irrigation is applied 1-2 days interval until the initiation of new leaves. Even the sometimes the lower part of the planting stem is covered with fresh cow dung to avoid the attack of goat from eating the bark. Average survival percentage of planting material was about 77. Research work should be initiated to find out technology for increasing the survival rate of new plant.

Management practices

No respondents applied any types of fertilizer as the tree is generally grown in backyard, generally where soil nutrient status is high due to dumping of household waste (Table 4). Hand irrigation is provided during planting time, but few farmers applied irrigation during early hot summer (at flowering time) for good flower retention. Hairy caterpillar (eats leaf and bark); stem borer (damage woody part) and gummosis of main trunk are the major pest and diseases of drumstick. Further, at flowering time during winter, fungus attack on flower occurred under foggy weather resulting in flower dropping. For hairy caterpillar and stem borer very few respondents took control measure. But for controlling hairy caterpillar small number of farmers fired the insect and killed it by beating. Kerosene and other pesticides were also sometimes applied along with hand-picking (Table 5).

Flowering and fruiting time of drumstick

In general 1st flushing comes in Magh-Chaitra and producing pod in Chaitra-Jaistha while 2nd flushing comes in Chaitra-Jaistha and producing pod in Baisakh to Vadhra. Third flushing of flowers did not occur in Shapahar but it happened in other three locations, might be due to genotype or environment. Third flushing comes in Ashin–Kartic and giving fruit in Agrahaoin to Magh. Actually the year round or Baromasi type of drumstick tree produces flowers and pods continuously, however maximum flower flushes in a certain time for each tree depending on age, soil fertility, environment and type of each plant (Table 6).

Yield of drumstick pod age-wise

Compared to 0-3 and 3-5 years age groups >5 years age group of drumstick tree gave about 2.5 times more pod yield (Table 7). Plants of Rajshahi city produced higher yield in comparison to trees of Barind area, probably due to good soil moisture and fertility of High Ganges Floodplains (AEZ-11) compared to low residual soil moisture, less soil fertility and dry environment (Ali, 2007) of High Tract Barind region (AEZ-26).

Total production and disposal pattern of drumstick pod

Highest pod yield/homestead was obtained from Chapai-Nawabganj (138 kg/year) and the lowest from Shapahar. The low yield in Shapahar could be due to extreme high temperature and low soil moisture in deeper Barind area (locally *Tha Barenra*). Rajshahi city respondents free distributed more while Shapahar people distributed the lowest. Averaged over locations respondents consumed

34.61 %, sold major portion (54.17 %) and free distributed 11.22 % of their produced pods. Drumstick growers earned cash of Tk.1559/year by selling the products. Among the locations Chapai-Nawabganj (Tk.1950) and Shapahar farmers (Tk.1907) earned higher and Rajshahi city growers earned the lowest (Tk.1051). Selling of more than 50% of produced pods and a good cash generation from a marginal household tree indicates that drumstick is gaining increased popularity as well as lucrative price.

Use of drumstick leaves

Respondents of all the locations are consuming leaves as vegetable (Table 9). Averaged over locations 82 % growers are using leaves as vegetable, however at Shapahar only 36 % are using leaves, but at Godagari and Chapai-Nawabganj 100 % growers are using drumstick leaves, indicating its popularity. Thus in vegetable deficit Barind area people are getting supply of Vitamin A from drumstick, as its leaves contains huge amount of the said vitamin (11,500 IU/100 g). Except Rajshahi city, growers of other three locations consume leaves in rainy days (Ashar to Ashin) when leaves production are maximum and scarcity of vegetable prevails. Among the four locations only Chapai-Nawabganj growers (40 %) sold drumstick leaves. Though growers of Rajshahi region are consuming leaves but only 21 % (mean) growers know and conscious about nutritional and medicinal values of leaves.

Agroforestry system of drumstick

Only in Godagari vegetables are grown within drumstick garden, the followed cropping pattern is Drumstick+ country bean-brinjal-winter vegetable. In Rajshahi city intercropping scope is limited due to space crisis and it is grown mostly outside the house boundary. But in Chapai-Nawabganj and Shapahar there is scope of intercropping of vegetable with drumstick. Agronomically it is quite feasible to grow other crops with drumstick, as it leaves are small as well as less busy and sunlight can penetrate through it.

Problems of drumstick production

Gummosis (in old tree) and leaf eating caterpillar are the major problems of drumstick production in Rajshahi city and Barind area (Table 11). Sudden storm is also a problem as it breaks the stem (as soft wood) and sometimes uproots the tree (mean 21 %). Chapai-Nawabganj growers face most (40%) with the storm and least by Rajshahi city growers, as it is saved by walls and buildings. Some other problems such as stem borer (35 %) and flower dropping in foggy weather because of fungus attack also prevails. Preventive measure could reduce the detrimental effects of different pest and diseases.

Cost of production

Generally growers collect planting materials from their neighbors and relatives, and plants near the homestead. In general no cash cost is needed except some family labor, as only few trees are planted. However, for commercial production cash cost would be needed.

Conclusion

Drumstick is a medicinal as well as vegetable producing tree liked by all walks of people across city and village. Rajshahi region including High Barind Tract area are the major hubs of year round (baromasi) drumstick pod production. Its value is increasing day by day and becoming lucrative for commercial production. It has also export value. In this context local germplasm may be enriched through introduction of dwarf yearly drumstick tree from Srilanka and South India, which is propagated through seeds. Suitable agroforestry systems of drumstick with vegetable and other crops may be developed for making it commercially viable. Moreover, packages of technology should be developed for drumstick production including managing of detrimental pest and diseases.

References

Ali, M. Y., S. Ahmed, C. Johansen, D. Harris and JVDK Kumar Rao.2007. Root traits of different crops under rainfed conditions in the High Barind Tract of Bangladesh. J.Plant Nutr.Soil Sci, 170: 296-302.

Cordell, G. A., N. R. Farnvorth, C. W. W. Kinghhorn. 1992. Plant derived anti cancer agents for therapy (absr), 4 th International Congress on Physiotherapy, PLI, Munich, Germany.

Rajangam, J., R. S. A. Manavalan, T. Thangaraj, A. Vijayakumar and N. Muthukrishan. 1991. Conference on development potential of Moringa products, 29 October-2 November, 2001, Dar es Salaam, Tanzania.

Table 1. Average family size, occupation, homestead area and cultivable land in Rajshahi, 2007

Location	Family size	Occupation (%)				Homestead area (decimal)	Cultivable land (decimal)
		Agric.	Service	Business	Others		
Rajshahi city	5.18	18	32	36	14	5.42	34.68
Godagari	5.14	96	4	-	-	15.91	152.00
Chapai Nawabgang	6.14	72	12	16	-	17.27	217.95
Shapahar	5.86	92	4	4	-	24.77	180.00
Mean of locations	5.58	69.5	13	14	3.5	15.64	146.16

Table 2. Per household age wise drumstick tree population in Rajshahi, 2007

Location	Duration of drumstick cultivation (year)	Total no. of drumstick tree	No. of tree at 0-3 year	No. of tree at 3-5 year	No. of tree at above 5 year
Rajshahi city	6.05	5.95	3.45	1.68	0.82
Godagari	7.00	8.41	5.00	2.55	0.86
Chapai Nawabgang	9.55	9.64	5.77	2.05	1.82
Shapahar	10.00	4.22	1.45	1.27	1.50
Mean of locations	8.15	7.05	3.92	1.88	1.25

Table 3. Propagation technology of drumstick in Rajshahi, 2007

Location	Age of planting material (month)	Height of planting material (cm)	Planting depth (cm)	Survival percentage (%)	Planting time (Bengali month)
Rajshahi city	18.77	169.77	46.36	80.68	Falgun-Jaistha
Godagari	11.36	198.41	38.55	79.09	Chaitra-Ashar
Chapai Nawabgang	11.73	232.50	36.82	74.55	Chaitra- Jaistha
Shapahar	15.00	218.18	45.68	74.59	Chaitra-Ashar
Mean of locations	14.21	2.04.71	41.85	77.23	-

Table 4. Management practices of drumstick at Rajshahi, 2007

Location	Fertilizer use (kg)	Hand irrigation (no.)	Hairy caterpillar control (times/yr)	Stem borer control (times/yr)	Gummosis control (times/yr)	Fungicide spray at flowering (times/yr)#
Rajshahi city	No use	7.73	0.59	0.14	No control measure	No control measure
Godagari	do	3.82	0.73	0.59	do	0.18
Chapai Nawabgang	do	5.36	0.64	0.14	do	No control measure
Shapahar	do	0.86	0.18	0.09	do	do
Mean of locations	No use	4.44	0.53	0.24	No control	-

At flowering stage, Dithane M-45 is sprayed.

Table 5. Management practices of Hairy caterpillar of drumstick in Rajshahi, 2007

Location	Firing (times/yr)	Beating (times/yr)	Other control
Chapai Nawabgang	0.54	0.03	Hand keeping, kerosene and insecticide spray
Rajshahi city	0.52	0.02	Hand keeping, kerosene and insecticide spray
Mean of locations	0.46	0.03	-
Shapahar	0.15	0.02	Hand keeping, kerosene and insecticide spray
Godagari	0.65	0.05	Hand keeping, kerosene and insecticide spray

Sometimes Darsburn is applied both the control of Hairy caterpillar and stem borer.

Table 6. Flowering and fruiting of drumstick at Rajshahi, 2007

Location	Time of flushing and fruiting (Bengali month)					
	1st flushing	1st fruiting	2nd flushing	2nd fruiting	3rd flushing	3rd fruiting
Rajshahi city	*Falgun-Chaitra*	*Baishakh-Jaistha*	*Jaistha-Ashar*	*Sraban-Vadra*	*Ashin-Kartic*	*Agrahaon-Poush*
Godagari	*Magh-Falgun*	*Chaitra-Baishakh*	*Baishakh-Jaistha*	*Sraban-Vadra*	*Ashin-Kartic*	*Poush-Magh*
Chapai Nawabgang	*Magh-Falgun*	*Chaitra-Baishakh*	*Baishakh-Jaistha*	*Sraban-Vadra*	*Ashin-Kartic*	*Poush-Magh*
Shapahar	*Magh-Falgun*	*Falgun -Chaitra*	*Chaitra-Baishakh*	*Baishakh-Jaistha*	-	-

Table 7. Production of drumstick pod from different aged trees of Rajshahi, 2007

Location	0-3 year tree (kg)	3-5 year tree (kg)	Above 5 year tree (kg)
Rajshahi city	27.00	40.00	57.92
Godagari	14.00	23.41	35.17
Chapai Nawabgang	14.45	20.68	33.75
Shapahar	8.95	16.95	39.08
Mean of locations	16.1	16.26	41.48

Table 8. Total production and disposal pattern of drumstick pods in Rajshahi, 2007

(Per year/ family)

Location	Total production (kg)	Intake (kg)	Sold/year/ family (kg)	Free distribution (kg)	Total return from drumstick (Taka)	Cash return from drumstick (Taka)
Rajshahi city	111.78	46.82	42.05	22.91	2794	1051
Godagari	122.55	59.82	53.18	9.55	3064	1329
Chapai Nawabgang	138.05	43.41	78.00	16.64	3451	1950
Shapahar	91.06	11.77	76.29	3.00	2276	1907
Mean of locations	115.86	40.45	62.38	13.02	2896.25	1559.25

Drumstick price: Range- 20-30 Taka/kg, Mean- 25 Taka/kg

Table 9. Use of drumstick leaves in Rajshahi, 2007

Location	% of farmer eating leaves	Name of month of leaves eating	% of farmer sold drumstick leaves	% of farmer know about the medicinal and nutritional value of drumstick leaves
Rajshahi city	92	Falgun-Ashar (whole the year)	Not sold	8
Godagari	100	Ashar-Ashin (whole the year)	Not sold	36
Chapai Nawabgang	100	Ashar-Poush (whole the year)	40	36
Shapahar	36	Ashar-Srabon	Not sold	4
Mean of locations	82	-	10	21

Table 10. Agroforestry system of drumstick in Rajshahi, 2007

Location	Cropping pattern
Rajshahi city	-
Godagari	Drumstick + country bean-brinjal-winter vegetable
Chapai Nawabgang	-
Shapahar	-

Table 11. Drumstick production problem in different locations of Rajshahi, 2007

Location	Caterpillar (% farmer)	Stem borer (% farmer)	Gummosis (% farmer)	Strom (% farmer)	Others (% farmer)
Rajshahi city	72	20	96	4	-
Godagari	86	73	100	32	27
Chapai Nawabgang	100	24	100	40	48
Shapahar	48	24	32	8	24
Mean of locations	76.5	35.25	82	21	24.75

Others problem

1. Flower dropping by heavy fogging
2. Homestead vegetables attacked by caterpillar
3. Tip of the drumstick pod dried in dry season

Caterpillar

Leaves, phloem and flower of drumstick eaten by caterpillar

Stem borer

Xylem of drumstick stem was eaten by stem borer. So that, drumstick tree broken and ultimately died

Yield Gap Analysis of Mustard Production under Different Management Practices

Abstract

The trail was conducted at Oparchar, Homna of Comilla district during 2007-08. The trial was laid out in block approach with researcher managed plot and farmers managed plot. The variety BARI sarisha-11 was used in this study. The trial revealed that BARI developed variety of mustard gave higher yield (1068 kg/ha) in researcher managed plot compared to farmers managed plot which was 30% less than researcher management plot, it might be due to adoption of recommended package of production technology and intensive monitoring during mustard cultivation.

Introduction

Mustard is one of the most important oil crops in Bangladesh. It occupies the highest acreage and production. The yield of this crop in Bangladesh is found lower compared to other countries. Bangladesh is deficit in edible oil, which cost valuable foreign currency for importing seeds and oil. Recently BARI has been released some mustard varieties, which have high yield potential. But farmers are not getting potential yield at their condition. The reason behind this lower yield is genetically low yield potentialities of local varieties and poor crop management practices. Thus, it is needed to increase production of oil seed for increased population of the country. High yielding varieties have a bold seed size high oil content (44%) and attractive color, which may be sold in market at hike price. So, it is necessary to replace local varieties by high yielding variety and introduce improve management to achieve potential yield. Keeping these views in mind this program was undertaken.

Objectives

1. To minimize the yield gap between researcher's managed plot and farmers managed plot
2. To introduce BARI released variety of Mustard
3. To observe farmer's reaction about the new technologies.

Materials and Methods

The trail was conducted at Oparchar, Homna of Comilla district during 2007-08 to minimize the yield gap between researchers managed plot and farmers managed plot of mustard. The trial was laid out in block approach with research managed plot and farmers managed plot. The variety BARI sarisha-11 was introduced with the help of six co-operative farmers. The plot size was 0.80 ha. For researcher managed plot fertilizer was applied at the rate of 260, 190, 100, 160, 5 and 10 kg urea, TSP, MP, Gypsum, Zinc sulphate and Boric acid/ha. On the other hand in farmers managed plot 250, 190 and 100 kg urea, TSP and MP/ha were applied. Half of N and the total amount of other fertilizers were applied during the final land preparation. Remaining N was applied at 20 DAS. The seeds were sown on 25-29 November 2007 @ 6 kg/ha in researcher managed plot (RMP) whereas 10 kg/ha in farmers' managed plot (FMP). Subsequent spraying of Rovral @ 0.2% was done to control *Alternaria* leaf spot from 35 DAS at 10 days interval. To control aphid, Nimbicidin, Rison @ 0.3% was sprayed. The Mustard was harvested on 2nd week of February 2008. Data on yield and yield components were recorded from research managed plot and farmers managed plot (Table 1 and 2).

Results and Discussion

The results were showed in Table 1 and 2. About 1068 kg/ha seed yield was obtained from researcher managed plot due to adoption of improved management practice. Gross return and gross margin were Tk.32043/ha and Tk. 13081/ha form researcher managed plot. On the other hand, in farmers managed plot mustard yield was 750 kg/ha. They got lower yield due to late sowing time and lower fertilizer dose. It was noticed that the seed yield was increased about 30%. About 20% increased total cost caused 43% benefit gap and 30 % yield gap.

Farmers' reaction

Farmer's reacted very positively with new high yielding variety BARI sarisha-11. Farmers' expressed their satisfaction considering this variety with high yield, bold size seed, high percent of oil content and maximum stover yield compared to any local variety. It is note worthy that this variety was perform well even in late sowing condition, with the improve management condition. The farmers' have stored huge quantity of seeds of the variety for large area extension in the next season.

Conclusion

From the study it was noticed that about 30% yield gap and 43% benefit gap remained between researcher managed plot and farmers managed plot. In order to minimize the yield gap, monitoring and motivational program should be increased and strengthened from the research and extension department to encourage the farmers to follow the recommended package of mustard cultivation.

Table 1. Level of technology employed and yield obtain in mustard cultivation under researchers and farmers management plot at Homna, Comilla during 2007-08

Management practices	Level of technology employed	
	Researcher managed plot (RMP)	Farmer managed plot (FMP)
Variety	BARI sarisha-11	BARI sarisha-11
Seed rate (kg/ha)	6	10
Tillage (Power tiller)	2	2
Labour (weeding, thinning etc)	35	25
Fertilizer (kg/ha)		
Urea	260	250
TSP	190	190
MP	100	100
Gypsum	160	-
Zinc sulphate	5	-
Boric acid	10	-
Fungicide (g/ha)	1000	700
Insecticide (m1/ha)	1000	700
Irrigation	1	-
Weeding	2	-
Seed yield (kg/ha)	1068	750
Yield gap (kg/ha)	318 (30%)	

Table 2 Per hectare cost and return (Tk. /ha) of mustard production under researchers and farmers management plot at Homna, Comilla during 2007-08

Items	Researcher managed plot (RMP)	Farmer managed plot (FMP)
Seed cost	240	400
Tillage operation cost	2000	2000
Human labour cost	3500	3000
Fertilizer		
Urea	1560	1500
TSP	3562	3562
MP	1650	1650
Gypsum	800	-
Zinc sulphate	450	-
Boric acid	1000	-
Fungicide	1600	1500
Insecticide	1600	1500
Irrigation	1000	-
Total variable cost (Tk/ha)	18962	15112 (20%)
Gross return (Tk/ha)	32043	22504
Gross margin (Tk/ha)	13081	7392 (43%)

Price (Tk/kg): Human labour = Tk. 100, Seed =40, Urea = 6, TSP= 18.75, MP = 16.50, Gypsum = 5, Zinc sulphate = 90, Boric acid = 100, Seed = Tk. 30/kg

Yield Gap Analysis of Sesame (BARI Til -2) under Different Management Practices

Abstract

The trail was conducted at Oparchar, Homna of Comilla district during 2007-08. The trial was laid out in block approach with researcher managed plot and farmers managed plot. The variety BARI Til -2 was used in this study. The trial revealed that BARI developed variety of sesame showed higher yield (1463 kg/ha) in researcher managed plot compared to farmers managed plot which was 13% lower than researcher management plot it might be due to adoption of recommended package of production technology and intensive monitoring during sesame cultivation.

Introduction

Sesame *(Sesamum indicum)* is an important oilseed crop of the tropic and subtropics. It has been cultivated round the year but two third areas are covered by early kharif season. Farmers usually cultivate local variety of sesame which is low yielding and has low oil content (30%). Recently BARI has released some sesame varieties, which have high yield potential. Among them BARI Til-2 is high yielder and has high oil content (44%). But farmers are not getting potential yield at their condition. The reason is poor crop management practices. So, it is necessary to introduce improved management to achieve potential yield. Keeping these views in mind this program was undertaken.

Objectives

1. To minimize the yield gap between researcher's managed plot and farmers managed plot
2. To introduce BARI released variety of sesame
3. To observe farmer's reaction about the new technologies

Materials and Methods

The trail was conducted at Oparchar, Homna of Comilla district during 2007-08 to minimize the yield gap between research station and farmers field of sesame. The trial was laid out in block approach with research managed plot and farmers managed plot. The variety BARI Till-2 was introduced with the help of 10 co-operative farmers. The plot size was 0.75 ha. For researcher managed plot fertilizer was applied at the rate of 115, 104, 45, 105, 5 and 10 kg urea, TSP, MP, Gypsum, Zinc sulphate and Boric acid/ha. On the other hand in farmers managed plot 150, 140 and 180 kg urea, TSP and MP/ha were applied. Half of N and the total amount of other fertilizers were applied during the final land preparation. Remaining N was applied at 25 DAS. The seeds were sown on 2nd week February, 2008 @ 6 kg/ha in researcher managed plot (RMP) whereas 10 kg/ha in farmers' managed plot (FMP). Subsequent spraying of Sevin @ 0.2% and Decis @ 0.1% was done to control hawk month at 35-40 DAS. To control aphid, Nimbicidin, Rison @ 0.3% was sprayed. The crop was harvested on 3rd week of May 2008. Data on yield and yield components were recorded from research managed plot and farmers managed plot (Table 1& 2).

Results and Discussion

The results are presented in Table 1 and 2. About 1463 kg/ha seed yield was obtained from researcher managed plot due to adoption of improved management practice. Gross return and gross margin were Tk.29260/ha and Tk.13388/ha from researcher managed plot. On the other hand, from farmers managed plot sesame yield was 1279 kg/ha. They got lower yield due to late sowing and imbalance fertilizer application. It was noticed that the seed yield was increased about 13%. About 4 % increased total cost caused 11 % benefit gap and 13 % yield gap.

Farmers' reaction

Farmers' reacted very positively with high yielding variety of BARI Til-2. They have stored a good quantity of seeds for large area extension in the next season.

Conclusion

Yield of sesame can be increased by following recommended package of production technology and yield gap could also be minimized.

Table 1 Level of technology employed and yield obtain in sesame cultivation under researchers and farmers management plot at Homna, Comilla, 2008

Management practices	Level of technology employed	
	Researcher managed plot (RMP)	Farmer managed plot (FMP)
Seed rate (kg/ha)	6	10
Tillage operation by power tiller (no.)	2	2
Human labour (man day)	30	25
Fertilizer (kg/ha):		
Urea	115	150
TSP	104	140
MP	45	80
Gypsum	105	-
Zinc sulphate	5	-
Boric acid	10	-
Insecticide (ml/ha)	1500	1800
Irrigation (no.)	2	-
Weeding and thinning (no.)	2	-
Seed yield (kg/ha)	1463	1279
Yield gap (kg)	184 (13%)	

Table 2 Per hectare cost and return (Tk. /ha) of sesame (BARI Til-2) production under researchers and farmers management plot at Homna, Comilla during 2008

Items	RMP	FMP	Difference between RMP and FMP
Seed cost	240	400	-160
Tillage operation cost	2000	2000	-
Human labour cost	6000	5000	1000
Fertilizer			
Urea	690	900	-210
TSP	1950	2625	-675
MP	742	1320	-578
Gypsum	800	-	800
Zinc sulphate	450	-	450
Boric acid	1000	-	1000
Fungicide	500	1500	-1000
Insecticide	500	1500	-1000
Irrigation	1000	-	1000
Total variable cost (Tk.)	15872	15245	627 (4%)
Gross return (Tk.)	29260	27144	2116 (7%)
Gross margin (Tk.)	13388	11899	1489 (11%)

Input price : Human labour Tk. 100, Seed = Tk. 40/kg, Urea= Tk. 6/kg, TSP=Tk. 18.75/kg, MP= Tk. 16.50/kg, Gypsum= Tk. 5/kg, Zinc sulphate = Tk. 90/kg, Boric acid= Tk. 100/kg

Output price : Seed = Tk. 20/kg

MATURE TECHNOLOGIES

1. Name of Technology	**:**	**Effect of Boron on the yield and yield attributes of rapeseed in High Barind Tract (2006-07 to 2007-08)**
2. Name of Organization	:	Bangladesh Agricultural Research Institute (BARI)
3. Contact division/person/unit	:	CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4. Location of application	:	High Barind Tract (HBT) with similar soils of AEZ 26
5. Key characteristics of technology	:	Fertilization with 1.5 kg Boron/ha produced higher yield (38% yield increases) and economic return in rapeseed.
6. Production guideline	:	
Crop	:	Rapeseed
Variety	:	BARI sarisha 6, BARI sarisha 9 and BARI sarisha 13
Seed rate	:	10 kg
Spacing	:	30 cm × continues
Sowing/ Planting time	:	1st week of November
Fertilizer dose	:	N- P-K- S- Zn-B kg/ha 127-35-45-31-2-1.5
Variety	:	Yield (t/ha)
BARI Sarisha-6		1.4-1.45
BARI Sarisha-9		1.05-1.07
BARI Sarisha-13		1.48-1.73
7. Risk involvement in adopting the technology	:	No risk involvement
8. Impact on environment	:	No harmful effects on environment
9. Procedure of transfer	:	Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10. Expected outcome	:	Increase productivity and profitability of rapeseed in HBT.
11. Socio-economic aspects	:	Farmers could be benefited by using Boron in rapeseed
Total variable cost	:	Tk.2250/ha
Gross margin	:	Tk.80020/ha
MBCR	:	13.44
12. Recommendation	:	BARI sarisha 13 & BARI sarisha 6 could be grown in HBT and the optimum and economic dose of boron is 1.5 kg/ha for rapeseed.

1. Name of Technology	**:**	**Integrated nutrient management for tomato production in High Barind Tract (2006-07 to 2007-08)**
2. Name of Organization	:	Bangladesh Agricultural Research Institute (BARI)
3. Contact division/person/unit	:	CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4. Location of application	:	Area of High Barind Tract with similar soils of AEZ 26.
5. Key characteristics of technology	:	• IPNS based fertilizer recommendation produced higher yield and profit and will improve long term soil fertility for sustainable productivity at Barind area • Application of organic manure (cowdung) @ 5 t/ha for sustainable higher yield
6. Production guideline	:	
Crop	:	Tomato
Variety	:	Surrakha
Spacing	:	60 cm × 50 cm
Planting time	:	1st week of November
Fertilizer application	:	Triple Super Phosphate, MP, Gypsum, Zinc Oxide, Cowdung (CD) and one fourth of urea should be applied as basal and rest of urea should be applied as top dress at 21, 35 and 45 DAT, respectively.
Yield (t/ha)	:	43 t/ha
7. Risk involvement in adopting the technology	:	No risk involvement
8. Impact on environment	:	No harmful effects on environment
9. Procedure of transfer	:	Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10. Expected outcome	:	Improve soil fertility and increase crop productivity and profitability
11. Socio-economic aspects	:	
Fertilizer cost	:	Tk. 14240/ha
Gross margin	:	Tk.290020/ha
MBCR	:	13.94 (over control)

12. Recommendation :

Crop	Nutrient dose N-P-K-S-Zn (kg/ha) + CD t/ha	Remarks:
Tomato	124 -33-74 -30-4 + 5	Well decomposed cowdung should be applied at least 7 days before transplanting.

1. Name of Technology	:	**Effect of Different levels of Nitrogen and Sulphur on the yield of Summer Onion (2006-07 to 2007-08)**
2. Name of Organization	:	Bangladesh Agricultural Research Institute (BARI)
3. Contact division/person/unit	:	CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4. Location of application	:	Areas of High Barind Tract with similar soils of AEZ 26
5. Key characteristics of technology	:	Yield of summer onion (var. BARI Peaj 2) increased with 100 kg Na and 40 kg S/ha
6. Production guideline	:	
Crop	:	Summer onion
Variety	:	BARI Peaj-2
Seed rate/spacing	:	20 cm × 10 cm
Fertilizer dose(kg/ha)	:	N - P – K- S – CD 100-40-100-40-5 t/ha
Sowing/ Planting time	:	4th week of September (40 days old seedling)
Fertilizer application	:	Triple Super Phosphate, MP, Gypsum and cowdung should be applied as basal and urea should be applied as top dress at 15, 35 and 45 DAT, respectively
Yield (t/ha)	:	12-16
7. Risk involvement in adopting the technology	:	No risk involvement
8. Impact on environment	:	No harmful effects on environment
9. Procedure of transfer	:	Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10. Expected outcome	:	Increase productivity and profitability of summer onion
11. Socio-economic aspects	:	Farmers could be benefited economically considering N and S application and to get larger bulb size and yield
12. Recommendation	:	Summer onion could be grown with 100 kg N and 40 kg S/ha in the High Barind Tract with similar soils of AEZ 26.

1. Name of Technology	**:**	**Effect of Urea Super Granule (USG) as a source of Nitrogen on Cabbage**
2. Name of Organization	:	Bangladesh Agricultural Research Institute (BARI)
3. Contact division/person/unit	:	CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4. Location of application	:	Irrigated medium highland areas of Tangail, Pabna, Kishoreganj, Mymensingh, Rangpur, Kushtia, Jessore, Comilla and similar soils of AEZ 3, 8, 9, 11 & 19.
5. Key characteristics of technology	:	• Al least 10-20% nitrogen could be saved by using USG instead of prilled urea. • N-use efficiency increased by application of USG over prilled urea.
6. Production guideline	:	
Crop	:	Cabbage
Variety	:	Hybrid (Green crown/KK cross/Atlas 70/Autumn Queen/ Green 60)
Seed rate/spacing	:	60 cm × 60 cm
Sowing/ Planting time	:	1st week of November
Fertilizer application	:	Urea Super Granule (USG) should be applied at 7-10 DAT in 8-10 cm apart from base of each plant and 7-8 cm deep as ring method.
Yield (t/ha)	:	80-110
7. Risk involvement in adopting the technology	:	No risk involvement
8. Impact on environment	:	No harmful effects on environment
9. Procedure of transfer	:	Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10. Expected outcome	:	Higher yield could be achieved by using USG

11. Socio-economic aspects :

Total variable cost (Tk./ha)	Gross margin (Tk/ha)
52780 - 76320	115969 - 375925

12. Recommendation :

Location	Nutrient dose N-P-K-S-Zn-B (kg/ha)
Tangail (AEZ 8)	175-57-110-13-0-1
Pabna (AEZ 11)	150-50-125-28-2-1
Kishoreganj (AEZ 9)	150-36-85-35-0-1
Mymensingh (AEZ 9)	200-46-87-42-0-0
Rangpur (AEZ 3)	175-25-70-38-2-1
Kushtia (AEZ 11)	175-40-125-13-2-0
Jessore (AEZ 11)	175-120-70-35-4-1
Comilla (AEZ 19)	175-50-70-20-2-1

1.	**Name of Technology**	**: Effect of Urea Super Granule (USG) as a source of Nitrogen on Cauliflower**
2.	Name of Organization	: Bangladesh Agricultural Research Institute (BARI)
3.	Contact division/person/unit	: CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4.	Location of application	: Irrigated medium highland areas of Jamalpur, Mymensingh, Kushtia, Jessore, Shyampur, Rangpur and similar soils of AEZ 3, 9, 11 & 25.
5.	Key characteristics of technology	: • Al least 10-20% nitrogen could be saved by using USG instead of prilled urea. • N-use efficiency increased by application of USG over prilled urea.
6.	Production guideline	:
	Crop	: Cauliflower
	Variety	: BARI Fulcopi-1/White marble/Kashmir/snow crown
	Seed rate/spacing	: 60 cm × 60 cm
	Sowing/ Planting time	: 1st week of November
	Fertilizer application	: Urea Super Granule (USG) should be applied at 7-10 DAT in 8-10 cm apart from base of each plant and 7-8 cm deep as ring method.
	Yield (t/ha)	: 55-60
7.	Risk involvement in adopting the technology	: No risk involvement
8.	Impact on environment	: No harmful effects on environment
9.	Procedure of transfer	: Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10.	Expected outcome	: Higher yield could be achieved by using balanced fertilizer
11.	Socio-economic aspects	:

Crop	Total variable cost (Tk/ha)	Gross margin (Tk/ha)
Cauliflower	59710-62675	215145-390410

12. Recommendation :

Location	Nutrient dose N-P-K-S-Zn-B (kg/ha)
Jamalpur (AEZ 9)	150- 105-50-30-3-1
Mymensingh (AEZ 9)	150- 84-80-34-0-0
Shyampur (AEZ 25)	100- 40-80-16-2-1
Kushtia (AEZ 11)	100- 40-100-10-2-0
Rangpur (AEZ 3)	150- 35-110-20-2-1
Jessore (AEZ 11)	125- 70-140-30-2-1

1. Name of Technology	**:**	**Effect of Urea Super Granule (USG) as a source of Nitrogen on Tomato**
2. Name of Organization	:	Bangladesh Agricultural Research Institute (BARI)
3. Contact division/person/unit	:	CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4. Location of application	:	Irrigated medium highland areas of Tangail, Jamalpur, Kishoreganj, Mymensingh, Pabna, Patuakhali, Rangpur and similar soils of AEZ 3, 8, 9, 11 & 13.
5. Key characteristics of technology	:	• Al least 10-20% nitrogen could be saved by using USG instead of prilled urea. • N-use efficiency increased by application of USG over prilled urea.
6. Production guideline	:	
Crop	:	Tomato
Variety	:	Hybrid (Roma VF/Sonali/Surrakha/BARI Tomato-2/BARI Tomato-8/Epox)
Seed rate/spacing	:	60 cm × 40 cm
Sowing/ Planting time	:	3rd week of November
Fertilizer application	:	Urea Super Granule (USG) should be applied at 7-10 DAT in 8-10 cm apart from base of each plant and 7-8 cm deep as ring method.
Yield (t/ha)	:	75-95
7. Risk involvement in adopting the technology	:	No risk involvement
8. Impact on environment	:	No harmful effects on environment
9. Procedure of transfer	:	Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10. Expected outcome	:	Higher yield could be achieved by using balanced fertilizer

11. Socio-economic aspects :

Crop	Total variable cost (Tk./ha)	Gross margin (Tk./ha)
Tomato	62780-73500	419045-390410

12. Recommendation :

Location	Nutrient dose N-P-K-S-Zn-B (kg/ha)
Tangail (AEZ 8)	175- 20-160-35-0-0
Pabna (AEZ 11)	150- 60- 75- 40-2-1
Jamalpur (AEZ 9)	200- 75- 95- 20-2-1
Kishoreganj (AEZ 9)	150- 50- 130- 20-0-1
Mymensingh (AEZ 9)	150- 50- 108- 21-0-0
Patuakhali (AEZ 13)	175- 80- 100- 18-1-1
Rangpur (AEZ 3)	150- 50- 100- 30-2-1

1. Name of Technology	**:**	**Effect of Urea Super Granule (USG) as a source of Nitrogen on Hybrid Maize.**
2. Name of Organization	:	Bangladesh Agricultural Research Institute (BARI)
3. Contact division/person/unit	:	CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4. Location of application	:	Irrigated medium highland soils of Tangail, Rangpur, Comilla, Rajshahi, Pabna and similar soils of AEZ 3, 8, 11, 19 & 25
5. Key characteristics of technology	:	• Al least 10-20% nitrogen could be saved by using USG instead of prilled urea. • N-use efficiency increased by application of USG over prilled urea.
6. Production guideline	:	
Crop	:	Hybrid Maize
Variety	:	BARI Hybrid Maize 5 & NK 40
Seed rate/spacing	:	75 cm × 25 cm
Sowing/Planting time	:	Last week of November
Fertilizer application	:	Urea Super Granule (USG) should be applied at 15-20 DAE into 7-8 cm depth of soil by making 8-10 cm apart furrow from the maize plant at both side of a maize row.
Yield (t/ha)	:	8-10
7. Risk involvement in adopting the technology	:	No risk involvement
8. Impact on environment	:	No harmful effects on environment
9. Procedure of transfer	:	Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10. Expected outcome	:	Higher yield could be achieved by using balanced fertilizer

11. Socio-economic aspects :

Total variable cost (Tk/ha)	Gross margin (Tk/ha)
42242 to 47470	95756 to104148

12. Recommendation :

Location	Nutrient dose N-P-K-S-Zn-B (kg/ha)
Tangail (AEZ 8)	225-52-110-47-3-1
Rajshahi (AEZ 25)	175- 37-58-24-2-1
Pabna (AEZ 11)	225-52-110-47-2-1
Rangpur (AEZ 3)	250-50-90-45-2-1
Comilla (AEZ 19)	225-40-110-20-2-1

1. Name of Technology	**:**	**Intercropping Chilli with Garlic and Onion in Manikganj (AEZ 8) area (2006-07 to 2007-08)**
2. Name of Organization	:	Bangladesh Agricultural Research Institute (BARI)
3. Contact division/person/unit	:	CSO, On-Farm Research Division, BARI, Joydebpur, Gazipur
4. Location of application	:	Medium highland areas of Manikganj with similar soils of AEZ-8
5. Key characteristics of technology	:	Two rows of garlic or onion in between 100% of Chilli as intercropped found suitable and profitable than the sole Chilli.
6. Production guideline	:	
Crop	:	Chilli, Onion and Garlic
Variety	:	Local
Seed rate/spacing	:	Chilli 40 cm $\times$15 cm, Garlic : 15 cm $\times$ 10 cm and onion 15 cm $\times$10 cm
Sowing/Planting time	:	2nd week of November
Fertilizer application (N-P-K-S kg/ha)	:	100-60-30-30 Triple super phosphate, MP, Gypsum, $^1/_3$rd urea should be applied as basal and rest of urea should be applied as top dress in two equal splits at 25 and 50 DAT, respectively.
Yield (t/ha)	:	Chilli 1.01; Onion 6.35; Garlic 5.66
7. Risk involvement in adopting the technology	:	No risk involvement
8. Impact on environment	:	No harmful effects on environment
9. Procedure of transfer	:	Block demonstration, Farmers training, Field day, Booklet/ leaflet, Radio talk etc.
10. Expected outcome	:	Total productivity and profitability could be increased
11. Socio-economic aspects	:	

Crop	Total variable cost (Tk/ha)	Gross margin (Tk/ha)	BCR
Sole Chilli	50330	91670	1.55
Chilli + 2 rows of onion	91575	98725	1.93
Chilli + 2 rows of garlic	74090	120110	1.78

12. Recommendation	:	This technology should be disseminated in the Chilli growing areas and farmers should be suggested to grow onion or garlic with Chilli as intercropping instead of growing sole Chilli.

On-Farm Technology Transfer through Farmers Participation

Background

Bangladesh Agricultural Research Institute (BARI) has been developed a huge number of good technologies which is beneficial for different categories of farmers. Department of Agricultural Extension (DAE) is trying to disseminate these technologies among the farmers. On the other had On-Farm Research Division, BARI is also trying to disseminate technologies among the farmers in their FSRD & MLT sites. OFRD is working directly with the farmers and there is a good scope to transfer technologies under direct supervision of the scientists. With this point of view, different FSRD sites of OFRD are engaged in technology transfer through of Technology Village, Crop Museum, block demonstration, adaptive trial, training and field days. Considering the above circumstances the present study was implemented at the five (05) existing FSRD site viz. Rangpur, Barind, Rajshahi, Faridpur, Patuakhali and Noakhali, respectively.

The project activities were carried out at five FSRD site viz. Rangpur, Barind, Rajshahi, Faridpur, Patuakhali and Noakhali since June 2006. On the basis of farmer's traditional practices, their needs and choices, the site team considered several alternatives of technologies of crops, livestock and other components as per available resource of the farm with active participation of the farmers. According to the aim of the project, three categories of farmer i.e. Landless, marginal and small were selected. Before going to implement the project activities a case study of individual households was carried out and detail information in respect of livelihoods maintained by the selected households were documented. Total resources inventory, liabilities, technology used, level of input used, output obtained income and expenditure status, labor availability of the farms of previous year was accounted by detail households case study with intensive visit & cross examinations for authentication of the data before intervention. After analysis of existing system, the technologies were selected for intervention in priority basis. Then the farmers were motivated through all possible ways to utilize their own resources to adopt the technologies. Under this project different program i.e. year round vegetable and creeper production in homestead, plantation and management of existing fruit trees, livestock program and production of different cropping pattern were undertaken for improvement of livelihood of farmers.

A. Gender utilization and family nutrition program

1. Year Round Vegetable and Creeper Production in Homestead

Introduction

Vegetables play an important role in human diet. But per day per head vegetable consumption is very low (about 30 g/day/head) compare to that of in the neighboring countries like Nepal (42 g), Pakistan (91 g), India (135 g) and Sri Lanka (120 g). For proper nutrition of human body a person should take about 200 g vegetables per day. Intensive vegetable production could provide not only nutritional security but also higher total farm income and lower dependency on cereal foods. Farmers in rural areas especially low-income groups are seriously suffering from malnutrition such as iron deficiency, anemia and exophthalmia etc. These problems can be reduced by regular intake of green and yellow leafy vegetables. It is a great opportunity to employ the female labour in the homestead vegetable production system. In Bangladesh, female labours are not interested to work with male in the crop fields. The school going children can also help in home gardening. With the ever increasing problems of malnutrition and limited land holding particularly for the small holders, a good option to grow vegetables intensively in the homestead. So, increased production of vegetable is urgently needed. Hence, a year round homestead vegetable production programme was undertaken with the following objectives:

i) To supply fresh vegetables for family consumption
ii) To ensure vegetables round the year from homestead and improve family nutrition as well as income of the family
iii) To utilize women and children labour in income generating activities

Methodology

The programmes were carried out at the FSRD sites of Rangpur, Barind (Rajshahi), Faridpur, Patuakhali and Noakhali during kharif II of 2007 and Rabi season of 2007-08 to popularize different vegetable model at different locations through use of homestead area.

FSRD site, Kadamshahar, Rajshahi (Barind Model)

The vegetables cultivation program at homestead area was carried out at FSRD site, Kadamshahar, Rajshahi by “Barind Model”. Before initiation of activities an individual case study of each household was conducted to identify the resource base and potentials of different farm category. Finally 10 households of marginal and small group were selected for this program. The vegetables crops were selected according to the choice of the farmers through participatory method. Before conducting the activities a comprehensive training was provided to the selected farmers on fruit and vegetables cultivation following Barind Model. The FSRD team provided technical assistance to the cooperators regularly to cultivate vegetables successfully.

The Barind model includes the following cropping patterns

Niche/space		Year round homestead vegetable pattern		
		Rabi	Kharif I	Kharif II
Open sunny place	Bed-1	Red amaranth + Brinjal	Kangkong	Kangkong
	Bed-2	Spinach	Indian spinach	Red amaranth
	Bed-3	Radish	Stem amaranth	Jute leaf (*Pat Shak*)
	Bed-4	Batishak	Okra + Red amaranth	Onion + Red amaranth
	Bed-5	Bushbean	Chili + Red amaranth	Chili
Roof top		Country bean, bottle gourd	Sweet gourd, White gourd	-
Trellis		Country bean, bottle gourd	Sweet gourd, yard long bean, bitter gourd	-
Muddy wall		Country bean	Ribbed gourd, Indian spinach	-
Homestead areas		Brinjal, onion, garlic	Plantain banana, papaya, drumstick	-
Pond/ditch banks and slope		Bottle gourd, country bean	Sweet gourd, bitter gourd	-

FSRD site, Faridpur (Ishangopalpur Model)

The vegetables cultivation program at homestead area was carried out at FSRD site, Hatgobindapur, Faridpur by “Ishangopalpur Model”. Before initiation of activities an individual case study of each household was conducted to identify the resource base and potentials of different farm category. Finally 25 households of landless (10), marginal (10) and small (5) group were selected for this program. The vegetables crops were selected according to the choice of the farmers through participatory method. Before conducting the activities a comprehensive training was provided to the selected farmers on fruit and vegetables cultivation. There were seven beds and the size of each bed was 5m x 1m.

The year round homestead vegetable production programme was done following Ishangopalpur Model.

Niche/space	Year round homestead vegetable pattern			
	Bed	Rabi	Kharif I	Kharif-2
Open sunny place	Bed-1	Cabbage	Lalshak	Gimakalmi
	Bed-2	Brinjal	Okra	Okra
	Bed-3	Cauliflower	Amaranth	Indian spinach
	Bed-4	Potato	Okra	Okra
	Bed-5	Bush bean	Lalshak	Indian spinach
	Bed-6	Tomato	Okra	Okra
	Bed-7	Radish	Lalshak	Amaranth
Trellis	i)	BARI shim-1	Sponge gourd	-
	ii)	BARI shim-2	Ribbed gourd	-
	iii)	Bottle gourd	Cucumber	-
	iv)	Bottle gourd	Snake gourd	-
	v)	BARI shim-1	Sponge gourd	-
	vi)	BARI shim-2	Ash gourd	-
Roof top	-	Country bean	Ash gourd	-
Partial shade	-	-	Turmeric, Elephant foot	-
On support	-	Country bean	Yam	-
Marshy land	-	-	Taro (Latiraj)	-

FSRD site, Lahirirhat, Rangpur

The vegetables cultivation at homestead area was conducted at FSRD site, Lahirirhat, Rangpur by Syedpur Model. Twelve (12) homesteads were selected for vegetable gardening. The participatory farmers utilized the open space, partially shady places and boundary (ail) of the homestead, which were previously remained either unutilized or underutilized. There were five beds and the unit bed size was 5m x 1m in each homestead. Vegetables like lalshak, data, okra, gimakalmi, indian spinach, snake gourd, sponge gourd, ribbed gourd, ash gourd and cucumber grown in summer. Cabbage, cauliflower, tomato, radish, garlic, spinach, napa shak, brinjal, carrot, pepper, coriander shak and country bean were grown in winter season at their homestead. They also produced bitter gourd, ribbed gourd as fenced crop and papaya (Shahi) as boundary crop (homestead boundary) successfully. The farmers utilized partial shady place for ginger and turmeric production with proper management.

Niche/space			Year round homestead vegetable pattern		
			Rabi	Kharif-1	Kharif-2
Open sunny space	Bed 1	:	Radish	Lalshak	Kangkong
	Bed 2	:	Cabbage	Data	Coriander shak
	Bed 3	:	Brinjal + Lalshak	Spinach	Indian spinach
	Bed 4	:	Tomato + Napashak	Okra	Lalshak
	Bed 5	:	Garlic	Patshak	Okra
2. Roof top		:	Bottle gourd	Ash gourd	
		:	BARI Shim 1	Sweet gourd	
3. Trellis/fence		:	Bitter gourd	Ribbed gourd	
4. Boundary/Ail		:	5-15 papaya plantation		
5. Slightly Marshy land		:	Kachu		
6. Partially shady place		:	Ginger and Turmeric		

FSRD site, Hazirhat, Noakhali (Atkapalia Model)

Homestead gardening was introduced among the 15 landless and marginal farmers for year round vegetable production in 25-35 m^2 homestead area. There were five beds and each unit bed size was 5m x 1m. Vegetable likes red amaranth, batishak, radish, spinach, tomato, danta, Indian spinach and brinjal were cultivated in the homestead area. Vegetables were cultivated round the year one after another. The vegetables were produced in the FSRD site, Hazirhat, Noakhali on different types of space following Atkapalia model.

Niche/space		Year round homestead vegetable pattern		
		Rabi	Kharif I	Kharif II
Open sunny space	Bed 1	Lalshak-Radish-Tomato	Amaranths	Indian spinach
	Bed 2	Batishak-Tomato	Okra	Danta
	Bed 3	Cauliflower-Lalshak + Brinjal	Gimakalmi	Gimakalmi
	Bed 4	Cabbage-Spinach	Okra	Lalshak
	Bed 5	Radish-Batishak	Indian spinach	Amaranths
Roof top		Country bean/Bottle gourd	Ash gourd	
Trellis		Bottle Gourd	Ribbed gourd/Cucumber/Bitter gourd	

FSRD site, Razakhali, Patuakhali (Lebukhali Model)

Five beds of each 8 m × 1.5 m were taken for year round homestead gardening programme under Lebukhali model. Vegetables were cultivated round the year one after another. Fifteen (15) homesteads were used for this purpose situated at FSRD site, Razakhali, Patuakhali. For vegetable production the open sunny place and other spaces of homestead were utilized in a systematic way following Lebukhali Model.

Niche/space		Year round homestead vegetable pattern		
		Rabi	Kharif I	Kharif II
Open sunny space	Bed-1	Red amaranth + Radish	Brinjal	Summer onion
	Bed-2	Bush bean	Okra	Indian spinach
	Bed-3	Coriander leaf + cabbage	Stem amaranth	Kangkong
	Bed-4	Red amaranth – Potato	Stem amaranth	Kangkong
	Bed-5	Red amaranth + Tomato	Indian spinach	Indian spinach
Roof		-	Wax gourd	-
Fence		Bitter gourd	Yard long bean	-
Trellis		Country bean	Ribbed gourd	-
Non-fruit trees		-	Sponge gourd	Sponge gourd
Pond/ditch slope		Bottle gourd	Bitter gourd	-

Sorjan method of vegetable cultivation round the year

Barisal-Patuakhali region is a vegetable deficit area. Considerable portion of the land inundate twice a day by tidal water from May to 1st week of December. On the other hand, T.aman rice harvesting becomes late even up to 1st week of January in few fields. As a result vegetable becomes late and it would not be profitable. Therefore, OFRD, BARI, Patuakhali has developed Sorjan method of cropping system for vegetable and fruit cultivation round the year to solve this problems. Under the program, eight farmers were selected for year round vegetables production in Sorjan method at Razakhali, Patuakhali.

For Sorjan method, five raised beds each measuring 23m × 2m was considered 1m above the ground level. Four furrows each measuring 23 m × 1.5 m were excavated in between the beds. Total land area was 23 m × 26 m. In summer season, okra, yard long bean, bitter gourd, ribbed gourd, snake gourd, cucumber, kangkong, Indian spinach were grown using the following patterns. In 2007-08 five new Sorjans are being established.

Sorjan Method

Niche	Year round vegetable production in sorgan		
	Rabi	Kharif-I	Kharif-II
Bed-1	Red amaranth + Radish	Yard long bean	Sponge gourd
Bed-2	Bush bean	Okra	Indian spinach
Bed-3	Coriander leaf + cabbage	Summer onion	Summer onion
Bed-4	Red amaranth – Potato	Stem amaranth	Kangkong
Bed-5	Red amaranth + Tomato	Indian spinach	Indian spinach
Bed edge (Trellis between two beds)	Bitter gourd	Bitter gourd	-
	Bitter gourd	Ribbed gourd	-
	Bitter gourd	cucumber	-

Results and Discussion

A. Gender utilization and family nutrition program

FSRD stie, Kadamshahar, Rajshahi (Barind Model)

The performances of vegetables crops grown in homestead area from marginal group are presented in Table 1. After intervention of "Barind Model" the total vegetable production was 333.42 kg, of which 180.72 kg and 152.70 kg were from open space and creeper vegetables, respectively during 2007-08. Before intervention, the vegetable production was only 106.19 kg. Therefore the production was increased by 214% (Table 1).

From small farmer group after intervention of Barind Model the total vegetable production was 326.28 kg of which open space and creeper vegetables contributed 170.90 and 155.30 kg during 2006-2007 respectively. On the other hand, before intervention, the production was only 117.61 kg. Therefore, the production was increased about 177% (Table 2).

Table 1. Year round average vegetable production of a marginal farmer in homestead area at FSRD site, Kadamshahar, Rajshahi during 2007-08

Season	Before Intervention			After Intervention			Increased (%)
	Open space vegetables (kg)	Creeper vegetables (kg)	Total	Open space vegetables (kg)	Creeper vegetables (kg)	Total	
Rabi	11.90	36.24	48.14	85.35	75.00	160.35	214
Kharif-I	17.67	22.30	39.97	40.25	17.25	57.50	
Kharif-II	-	18.25	18.25	55.12	60.45	115.57	
Total	29.57	76.79	106.19	180.72	152.70	333.42	

Table 2. Year round average vegetable production of a small farmer in homestead at FSRD site, Kadamshahar, Rajshahi during 2007-08

Season	Before Intervention			After Intervention			Increased (%)
	Open Space vegetables (kg)	Creeper vegetables (kg)	Total	Open Space vegetables (kg)	Creeper vegetables (kg)	Total	
Rabi	12.79	31.22	40.01	75.65	66.45	142.10	77
Kharif-I	20.67	40.27	60.94	35.12	17.65	52.77	
Kharif-II	-	12.66	12.66	60.23	71.20	131.43	
Total	33.46	84.15	117.6	170.90	155.30	326.28	

Disposal pattern of vegetables

From marginal group, total vegetables production was 106.19 kg of which 90.93, 3.0 and 12.26 kg were consumed, distributed and sold, respectively and on the basis of the disposal pattern the consumption per person per day was 50 g before intervention of the model. On the other hand, after intervention the total production of vegetable was 333.42 kg, of which 237.85, 25.48 and 70.09 kg were disposed as consumed, distributed and sold, respectively. Consumption per person per day was 130 g (Table 3). In case of small farmer the total production of vegetables was 117.61 kg, which was divided among the consumption, distribution and sold as 95.54, 4.53 and 17.54 kg, respectively and consumption per person per day was 52 kg before intervention. On the other hand, after intervention of model total vegetables production was 326.28 kg of which 258.38, 31.0 and 37.82 kg were consumed, distributed and sold, respectively and the consumption was 142 g per person per day (Table 4).

Table 3. Disposal pattern of vegetables of marginal farmer during 2007-08

Vegetables	Total harvest (kg)	Consumed (kg)	Distributed (kg)	Sold (kg)	Consumed per person/day (g)
Before intervention					
a. Open space	29.57	24.57	1.00	4.00	51
b. Creeper	76.62	66.36	2.0	8.26	
Total =	106.19	90.93	3.00	12.26	
After intervention					
a. Open space	180.72	142.50	10.35	27.87	130
b. Creeper	152.70	95.35	15.13	42.22	
Total =	333.42	237.85 (71)	25.48 (8)	70.09 (21)	

* Five members in a family were considered

Table 4. Disposal pattern of vegetables of a small farmer during 2007-08

Vegetables	Total harvest (kg)	Consumed (kg)	Distributed (kg)	Sold (kg)	Consumed per person/day (g)
Before intervention					
a. Open space	33.46	27.12	1.33	5.01	52
b. Creeper	84.15	68.42	3.20	12.53	
Total =	117.61	95.54	4.53	17.54	
After intervention					
a. Open space	170.90	135.25	17.50	18.15	142
b. Creeper	155.30	123.13	13.50	19.67	
Total =	326.28	258.38 (79)	31.00 (10)	37.82 (11)	

* Five members in a family were considered

Intake of vitamins and energy

After intervention, the consumption of food energy as well as vitamins were increased remarkably because of increasing vegetable production at homestead area in both farm category (Table 5 & 6). Before intervention the consumption of food energy, Vit-C, Vit-A, Vit-B_1 and Vit-B_2 of marginal farmer for per person per day were 17.58 kcal, 8.8 mg, 1893.34 µg, 0.02 mg and 0.04 mg, respectively. After intervention these were increased as 52.39 kcal, 50.47 mg, 8878.05µg, 0.16 mg and 0.23 mg, respectively. With the intervention of "Barind Model" rapidly increased the consumption of food value as well as vitamins simultaneously in a small farmer group. Before intervention consumption of food energy, Vit-C, Vit-A, Vit-B_1 and Vit-B_2 for a person per day were 16.42 kcal, 8.36 mg, 1828 µg, 0.03 mg and 0.04 mg, respectively and after intervention that were increased to 52.39 kcal, 46.68 mg, 9894 µg, 0.18 mg and 0.17 mg, respectively.

Table 5. Nutrient intake by a family member of marginal farmer during 2007-08

Nutrient category	Before Intervention		After Intervention	
	Total	Per person/day	Total	Per person/day
Food energy (kcal)	32088	17.58	95617	52.39
Vit-C (mg)	16060	8.8	92112	50.47
Vit-A/Carotene (µg)	3455351	1893.34	16202451	8878.05
Vit-B_1 (mg)	40	0.02	285	0.16
Vit-B_2 (mg)	74	0.04	425	0.23

Table 6. Nutrient intake by a family member of small farmer during 2007-08

Nutrient category	Before Intervention		After Intervention	
	Total	Per person/day	Total	Per person/day
Food energy (kcal)	29958	16.42	110698	52.39
Vit-C (mg)	15262	8.36	851859	46.68
Vit- A/Carotene (μg)	3336354	1828.14	18057114	9894.31
Vit-B_1 (mg)	46	0.03	325	0.18
Vit-B_2 (mg)	66	0.04	312	0.17

Farmer's reaction

Farmers were very much interested to involve themselves in homestead gardening due to earn cash money and harvest fresh vegetables daily to meet up their daily demand.

FSRD site, Hatgovindapur, Faridpur (Ishangopalpur Model)

The performances of vegetables crops grown in homestead area of marginal farmer group are presented in Table 7. After intervention of Ishangopalpur Model the total vegetable production was 153 kg, of which 111 and 42.0 kg were from open space and creeper vegetables, respectively during rabi season of 2007-08. Before the intervention the vegetable production was only 47 kg. Therefore the production was increased by 225 %. In Kharif-I season, after intervention, the production was 151 kg and before intervention it was 51 kg and thus the production was increased by 196 %.

Table 7. Year round average vegetable production of a marginal farmer in homestead area at FSRD site, Hatgobindapur, Faridpur during 2007-08

Season	Before Intervention			After Intervention			Increased (%)
	Open space vegetables (kg)	Creeper vegetables (kg)	Total	Open space vegetables (kg)	Creeper vegetables (kg)	Total	
Rabi	22	25	47	111	42	153	225
Kharif-I	18	33	51	78	73	151	196
Total =	40	58	98	189	115	304	210

The performance of vegetables grown in homestead area of small farm group area presented in Table 8. After intervention of Ishangopalpur Model the total vegetable production was 213 kg of which open space and creeper vegetables contributed 128 and 85 kg, respectively during Rabi season of 2007-08. On the other hand, before intervention, the production was only 87 kg in rabi season. Therefore the production was increased about 144%. In kharif-I season; the production was 180 and 92 kg, before and after intervention, respectively. The production was increased about 95% in kharif-I season.

Table 8. Year round average vegetable production of a small farmer in homestead at FSRD site, Hatgobindapur, Faridpur during 2007-08

Season	Before Intervention			After Intervention			% Increased
	Open space vegetables (kg)	Creeper vegetables (kg)	Total	Open Space vegetables (kg)	Creeper vegetables (kg)	Total	
Rabi	32	55	87	128	85	213	144
Kharif-I	29	63	92	97	83	180	95
Kharif-II	-	-	-	-	-	-	-
Total	61	118	179	404	168	393	120

Disposal pattern of vegetables

Incase of marginal group, the total vegetables production was 98 kg, of which 77, 6 and 15 kg were consumed, distributed and sold, respectively and on the basis of the disposal pattern the consumption per person per day was 49 g before intervention. On the other hand, after intervention the production was 304 kg, of which the consumed, distributed and sold amount were 246, 18 and 40 kg, respectively and the consumption per person per day was 156 g (Table 9).

Table 9. Disposal pattern of vegetables of marginal farmer during kharif & rabi seasons of 2007-08

Vegetables	Total harvest (kg)	Consumed (kg)	Distributed (kg)	Sold (kg)	Consumed per person/day (g)
Before intervention					
a. Open space	40	35	2.00	3.00	49
b. Creeper	58	42	4.0	12.0	
Total =	98	77	6.00	15.0	
After intervention					
a. Open space	189	152	10	27	156
b. Creeper	115	94	8	13	
Total =	304	246	18	40	

Increase of small farmer group the total production homestead vegetables were 179 kg, which was divided among the consumption, distribution and sold as 159, 5.0 and 15 kg, respectively and consumption per person per day was 73 g during before intervention. On the other hand, after intervention of model vegetables production was 393 kg, of which 326, 11 and 56 kg were used as consumption distribution and sold, respectively and the consumption was 149 g per person per day (Table 10).

Table 10. Disposal pattern of vegetables of a small farmer during the kharif and rabi seasons of 2007-08

Vegetables	Total harvest (kg)	Consumed (kg)	Distributed (kg)	Sold (kg)	Consumed per person/day (g)
Before intervention					
a. Open space	87	77	3.0	7.0	73
b. Creeper	92	82	2.0	8.0	
Total =	179	159	5.0	15.0	
After intervention					
a. Open space	213	179	7.0	27.0	149
b. Creeper	180	147	4.0	29.0	
Total =	393	326	11.0	56	

Farmer's reaction

Farmers were very much interested to involve themselves in homestead gardening due to earn some cash money and harvest fresh vegetables daily to meet up their demand.

FSRD site, Lahirirhat, Rangpur (Syedpur Model)

The performance of vegetables crops grown in homestead area are presented in Table 11. After intervention of Syedpur Model the total vegetable production was 197 kg of which 132 and 65 kg were from open sunny place and creeper vegetables, respectively during rabi season of 2007-08. Before the intervention the vegetable production was only 54 kg. Therefore, the production was increased by 265%. In kharif-I season, after intervention, the production was 195 kg and before intervention it was 58 kg and thus the production was increased by 236%. The beneficiaries produced 26 kg ginger and turmeric from shady place per homestead.

After intervention no vegetables have to be purchased from the market for their own consumption. Besides farm families' consumed more vegetables, which lead them better calorie, vitamins and minerals intake. Their consumption percentage increase 305 % (Table 12). The cooperator farmers used the farm waste effectively for compost preparation and utilized the compost for vegetables and potato production. Now, neighbours of target farm families are motivated to grow more vegetables at their homestead with modern varieties and proper management.

Table 11. Year round average vegetable production in homestead area at FSRD site, Lahirirhat, Rangpur during 2007-08

Season	Before Intervention			After Intervention			Increased (%)
	Open space vegetables (kg)	Creeper vegetables (kg)	Total	Open space vegetables (kg)	Creeper vegetables (kg)	Total	
Rabi	24	30	54	132	65	197	265
Kharif-I	22	36	58	85	110	195	236
Total	46	66	112	217	175	392	253

Table 12. Disposal pattern of vegetables to the cooperative farmers before and after intervention

Vegetables	Total harvest (kg)	Consumed (kg)	Distributed (kg)	Sold (kg)	Consumed per person/day (g)
Before intervention	112	80	17	15	305
After intervention	392	300	42	50	

FSRD site, Hazirhat, Noakhali (Atkapalia Model)

The average vegetable production in every homestead was given in Table 16. In each homestead, the total vegetables production was 332.97 kg. Farmers consumed, distributed and sold 188.83, 51.0 and 135.0 kg of vegetables, respectively. They also earned Tk. 2999 cash from each homestead. The area of homestead is very small but from nutritional point of view its importance is more. Though the amount of vegetables is small but it created positive impact to meet up the daily requirement of the family nutrient. Among the farmers, it was observed that dietary habit has been changed which was found more pronounced among the landless and marginal farmers. In addition, it is created a very positive impact on family member, neighbors and visitors due to good performance and yield, which helped, in family nutrition and proper utilization of homestead area.

Table 13. Production and utilization patterns of homestead vegetables at FSRD site, Noakhali during 2007-08

Vegetable	Total harvest (kg)	Consumed	Distributed (kg)	Sold (kg)	Total income (Tk)
R. Amaranth	44.47	22.0	8.0	12.0	534
Batishak	61.52	37.0	11.0	13.0	492
Spinach	48.28	29.83	6.0	11.0	628
Radish	53.67	28.0	7.0	17.0	403
Tomato	68.44	40.0	11.0	16.0	548
Brinjal	56.59	32.0	8.0	15.0	396
Total	332.97	188.83	51	135	2999

FSRD site, Razakhali, Patuakhali (Lebukhali Model)

The total vegetable production in each homestead (average of ten homesteads) was 536 kg, of which the farmer family consumed, distributed and sold 282, 62 and 192 kg vegetables, respectively. The also earned Tk. 2035 cash from each homestead (Table 14). From the study it was observed that each family member consumed vegetables of 169 g/day (considering 5 member families).

Table 14. Vegetables production and utilization pattern of homestead (average of ten homesteads) at FSRD site, Razakhali, Patuakhali from July 2007 to April 2008

Month	Name of vegetables	Total production (kg)	Vegetables utilization (kg)			Cash income (Tk)	Total income (Tk)
			Consumption	Distribution	Sold		
July	Spinach, Sponge gourd, Ribbed gourd, Kang	32	18	2	12	108/-	288/-
Aug.	Sponge gourd, Bitter gourd, Wax gourd	24	16	2	6	66/-	264/-
Sept.	Bitter gourd, Summer onion, Sponge gourd	15	10	1	4	60/-	225/-
Oct.	Summer onion, Bitter gourd	10	9	1	-	-	150/-
Nov.	Bottle gourd, Bean, Bitter gourd, amaranth	42	26	4	12	120/-	420/-
Dec.	Bottle gourd, Bean, Bitter gourd, Red amaranth, Radish	53	30	6	17	170/-	530/-
Jan.	Radish, Bottle gourd, Bean, Bitter gourd, Red amaranth, Cabbage,	90	34	12	44	440/-	900/-
Feb.	Tomato, Bush bean, Bitter gourd, Cabbage,	75	36	8	31	279/-	675/-
March	Tomato, Potato, Bitter gourd, Brinjal	82	35	12	35	420/-	984/-
April	Yard long bean, Stem amaranth, Bitter gourd, Brinjal	48	25	5	18	216/-	576/-
May	Yard long bean, Stem amaranth, Brinjal, Spinach, Kangkong, Okra	65	43	9	13	156	780/-
Total		536	282	62	192	2035/-	5792/-

Sorjan method of vegetable cultivation round the year

It was observed that total production of vegetable was 745 kg from June 2007 to May 2008 (Table 15). The sorjan farmer consumed 309 kg vegetables, distributed and sold the amount of 78 and 358 kg vegetables, respectively. The farmer also earned Tk. 2035 per sorjan.

Table 15. Round the year vegetables production and utilization pattern in Sorjan (average of 5 Sorjan) at FSRD site, Razakhali, Patuakhali at Kharif-I, 2006-07

Month	Name of vegetables	Total production (kg)	Vegetables utilization (kg)			Cash income (Tk)	Total income (Tk)
			Intake	Distribution	Sold		
July	Spinach, Sponge gourd, Ribbed gourd, Kangkong, Wax gourd	45	22	4	19	228/-	540/-
Aug.	Sponge gourd, Bitter gourd, Wax gourd	41	18	3	20	240/-	492/-
Sept.	Bitter gourd, Summer onion, Sponge gourd	32	19	5	8	96/-	384/-
Oct.	Summer onion, Bitter gourd	28	12	4	12	144	336/-
Nov.	Bottle gourd, Bean, Bitter gourd, Red amaranth	52	26	4	22	264/-	624/-
Dec.	Bottle gourd, Bean, Bitter gourd, Red amaranth, Radish	68	31	8	29	348/-	816/-
Jan.	Radish, Bottle gourd, Bean, Bitter gourd, Red amaranth, Cabbage, Cauliflower	130	34	12	84	1008/-	1560/-
Feb.	Tomato, Bush bean, Bitter gourd, Cabbage, Cauliflower	88	36	8	44	528/-	1056/-
March	Tomato, Potato, Bitter gourd, Brinjal, Cucumber	83	35	12	36	432/-	996/-
April	Yard long bean, Okra, Stem amaranth, Cucumber	58	30	3	25	300/-	696/-
May	Yard long bean, Okra, Stem amaranth, Spinach, Kangkong, Cucumber	120	46	15	59	708/-	1440/-
Total		745	309	78	358	2035/-	8940/-

Crops performance appears to be good and profitable. Vegetables are being harvested and end of the year total cost and return with yield will be estimated.

Farmers' reaction:

1. Farmers are highly satisfied to see the performance of vegetable crops in the sorjan.
2. It is difficult to bear the initial cost for the poor farmers.

Year round onion production in the homestead area (Razakhali, 2007-08)

On-station research results revealed that 70 kg summer onion could be produced through the year in a area of 5 m × 2 m in the homestead for 3 times/year or 5 m × 6 m plot for one time/year. This amount of onion is sufficient to meet up the need of 5-7 family members. Bangladesh has 2 crore homesteads (BS, 2003). Out of these 2 crore homesteads if we can grow onion in only 60 lakh homesteads in a 30 sq. m plot/year, the total production of onion will be 4 lakh 20 thousand tons. Therefore, a year round production program of onion at homestead was undertaken at FSRD site Razakhali during 2007-08.

This program was carried out in twelve homesteads at FSRD site, Razakhali, Patuakhali. Plot size was 10 m^2 in each homestead. Fertilizer was applied @ 260-220-200 kg Urea-TSP-MP/ha. First transplanting was done on 20-25 October, 2007 and it was damaged by SIDR at 15 November, 2007. Second transplanting was done on 19-30 January 2008 and harvesting was done on April 27-29, 2008. Third transplanting was done on 5-7 April 2008 and it was damaged due to seedling problem, which was carried from Gazipur. Bulb yield of twelve homesteads at 2nd transplanting was range from 8.5-10.54 t/ha (average 9.6 t/ha). In second transplanting although Thrips and purple blotch problem was occurred but protective measure was taken timely to save the crop.

Farmers' reaction

1. Farmers are interested to cultivate this variety of onion.
2. Requires irrigation for better yield.
3. Seed should be available in the local market.

2. Plantation and management of existing fruit trees

Most of the farmers grow fruit trees for their fruit consumption and forest tree for fuel and timber at their homestead. Existing fruit trees are also resources to the farmers. But the existing fruit trees in the homestead are local varieties with low quality and poor yield potential. By performing different types of management practices these turned into fruit bearing condition and earn cash money as well as meet up the demand of family nutrition. Therefore, the program was undertaken to create awareness among the farmers for growing fruit tree in their homestead and to disseminate BARI fruit variety among the farmers.

FSRD site, Kadamshahar, Rajshahi

Mango hopper is a common cause for low yield of mango. Again there are a lot of wild varieties jujube plants from which farmer are getting less economic benefit. Therefore, different management practices like mango hopper control and jujube budding were included under this program. The activities carried out at FSRD site, Kadamshahar, Rajshahi.

A. Fruit tree management

- No. of Co-operator : 5 (2 Small & 3 Marginal)
- No. of tree : 21 (Mango-7, and Jujube-14)
- Date of fertilization : August (Mango tree), April (Jujube) 2007
- Present condition : Good fruit bearing in mango

B. Mango hopper control

- No. of Co-operator : 10 (5 Small & 5 Marginal)
- No. of tree : 22
- Date of Spraying :
  - 1st Spraying : 9-10 Dec. 2007
  - 2nd Spraying : 15- 18 Jan. 2008
- Name of Insecticide : Cythrin @ 1ml/L and Dithene M-45 2 g/L
- Present condition : A good number of fruit bearing has present in the sprayed trees

C. Plantation of different fruit sapling

- No. of Co-operator : 10 (5 Small & 5 Marginal)
- No. of tree : 20
- Date of distribution : August 2006
- Name of fruit tree : Mango (5) & Litchi (5). Jujube saplings will be given.
- Present condition : All of mango sapling has alive but 2 litchi saplings were damaged.

Farmer's reaction

(i) Farmers were happy of a good number of mango tree bearing
(ii) Fertilization in jujube and mango trees creates awareness among the co-operators.

FSRD site, Hatgobindapur, Faridpur

The activities carried out as a development work with BARI recommended technologies at FSRD Site, Hatgobindapur, Faridpur are given bellow.

Activities and findings

A. Mango hopper control

- No. of Co-operator : 12 (6 Small & 6 Marginal)
- No. of tree : 25
- Date of Spraying :
  - 1st Spraying : 12-18 Dec. 2007
  - 2nd Spraying : 12- 15 Jan. 2007
- Name of Insecticide : Cythrin @ 1ml/L and Dithene M-45 2 g/L
- Present condition : A good number of fruit bearing has present in the sprayed trees

B. Plantation of different fruit sapling

- No. of Co-operator : 115
- No. of tree : 170
- Date of distribution : July - August 2007
- Name of fruit tree : Mango (25) & Litchi (10). Guava (20), Neem (40), Grass (20)Drumstick (240)
- Present condition : All of mango sapling has alive but others sapling more or less good in condition

FSRD site, Razakhali, Patuakhali

Fruit tree is a resource for poor farmer. Every household has more or less fruit trees. Some of them are poor quality and some are better quality. Plantation and management of existing fruit trees were undertaken to grow public awareness and to disseminate the BARI fruit varieties among the farmers for getting good quality and higher yield of fruits. An extra production as well as income can be brought from these existing fruit trees through proper management.

Total 1500 number of improved BARI varieties of mango, guava, litchi, lemon and coconut were planted in the homestead area of 100 farmers at Razakhali, Patuakhali during 2007-08. The fruit trees were fertilized following Krishi Projokti Hat Boi (1999).

Table 1. Fruit sapling distributed among farmers during 2007-08

Sl. No.	Name of sapling	No. of farmers	No. of fruit sapling
1	Mango	100	500
2	Coconut	80	200
3	Guava	70	200
4	Lemon	70	100
5	Papaya	40	150
6	Sapota	70	100
7	Jujube	100	300
Total			1550

Table 2. Management of existing fruit trees in the homestead at Razakhali during 2007-08

Activity	Fruit tree	No. of farmers	No. of trees
Manure & fertilizer application	Mango	24	138
	Coconut	27	308
	Guava	18	62
	Hog Palm	15	42
	Jackfruit	10	16
	Litchi	18	22
	Lemon	26	112
	Jujube	18	29
Pruning	Guava	20	46
	Jujube	10	14
	Jackfruit	10	16
	Lemon	26	112

3. Livestock program

Introduction

Livestock is an important and useful resource of the households in our rural Bangladesh. It contributes about 2.93% of GDP (BER 2006). It plays a vital role for improvement of livelihood of the household of providing proteins and calories. In spite of its important in our economy this sector has been suffering from different types of problems. Among them disease and quality feed are major problems that were faced by the farmers for their livestock rearing. From different research findings it was revealed that proper vaccination can reduce the mortality rate and quality feed can ensure proper growth and development of cattle and poultry birds. Considering the above circumstances vaccination and poultry birds rearing program were included with the following objectives.

(i) To reduce mortality rate of livestock population.
(ii) To improve family nutrition.
(iii) To increase farmer's income as well as create employment.

The results of the vaccination program and other activities are presented in Table 1. The results showed that after vaccination program mortality percentage become very low compare to before vaccination in ease of all livestock population. This program has created awareness and interest among the co-operator farmers.

Farmer's Reaction

- Farmers positively opined that mortality rate was low of their livestock due to vaccination.
- Farmers are highly interested of layer rearing

Table 1 Livestock activities at FSRD site, Hatgobindapur, Faridpur during 2007-08

Activities	No. of household	Breed	No. of bird/ cattle	Present condition
Layer rearing	2	Faomi	60	Egg production started
Vaccination of poultry	100	Local	200	Mortality decreased
Dewarming of cattle	50	Local	80	Good
Vitamin feeding	40	Local	60	Good

4a) Pilot production program of different cropping patterns

On-Farm Research division, of BARI has generated several cropping pattern, which are economically and agronomically viable. These patterns are widely accepted to the farmers. These technologies have created good impacts on farmer's income and maintained food security at household level. Among them, some cropping patterns were undertaken under the pilot production program to increase farm productivity as well as cropping intensity.

FSRD site, Lahirirhat, Rangpur

The pilot production program of four cropping pattern were conducted at FSRD site, Lahirirhat Rangpur during the Rabi season of 2007-08. Four rice based cropping patterns viz. i) Potato-Boro-T.aman, ii) Potato Maize-T.aman iii) Potato- mungbean -T.aman (iv) Wheat-mungbean-T.aman were included in this program.

The performance of four patterns was given in Table 1. All the cropping patterns have been started from Rabi/07 season. Results of the first crops were obtained. Performance of the first crops of each pattern was good and satisfactory. The highest benefit cost ratio 3.39 was obtained in wheat in Wheat – Mungbean - T.aman cropping pattern due to high price of wheat grain where as the lowest BCR 2.32 was obtained from potato in Potato + Mungbean - T.aman cropping pattern. After completion of whole pattern final conclusion will be done.

Table 1. Cropping pattern and their yield and economic return (only rabi crops) at the FSRD site, Rangpur during 2007-08

Cropping patterns	Crop	Yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Potato – Boro-T.aman	Potato	23.22	232200	98652	133548	2.35
Potato + Maize – T.aman	Potato	25.31	253100	106368	146732	2.38
Potato + mungbean -T.aman	Potato	23.49	234900	101435	133465	2.32
Wheat –Mungbean-T. aman	Wheat	2.85	85500	25208	60292	3.39

Price (Tk./kg): Wheat grain 20 & Potato 10

FSRD site, Kadamshahar Rajshahi

The pilot production program was conducted at FSRD site, Kadamshahar. Rajshahi during the rabi season of 2007-08. Three rice based cropping patterns viz., i) Chickpea-T.aman, ii) Wheat-T.aman, and iii) Potato-T.aman were included in the program. The crop varieties namely BRRI dhan 39, BARI Chola-5, Gourab (wheat) and Cardinal (potato) were used. The fertilizer dose, sowing and harvesting time were used in these trials presented in Table 2. The area of 2.2 ha land of two-category farmers (small and marginal) was included under this production program (Table 2).

The performance of four cropping patterns was given in Table 3. The overall performance of both crops under each pattern was good and satisfactory except potato. The potato yield (15 t/ha) was very low as compare to potential yield as well as national average yield of the variety.

Table 2. Name of the crops and their management practices during 2007-08

Name of crops	Variety	Fertilizer dose (Urea-TSP-MP-Gypsum-B.acid-$ZnSo_4$ kg/ha)	Sowing time	Harvesting time
T.aman	BRRI dhan 39	175-51-80-45- 0-5	01- 03 Aug. 07	25-28 Oct. 07
Chickpea	BARI Chola-5	40-80-40-0-10	13-15 Nov. 07	20-22 March 08
Wheat	Gourab	180-140-40-110-5-5	25-26 Nov. 07	28-30 March 08
Potato	Cardinal	220-120-220-100-8-8 + 8 t CD	16-20 Nov. 07	15-17 March 08

Table 3 Area and performance of crops under different cropping patterns during 2007-08

Cropping pattern	Area covered (ha)	No. & category of co-operator	Mean yield (t/ha)	Gross return (Tk/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)
1. Chickpea-T.aman	0.36	3 (1 small & 2 marginal)	Chickpea = 1.45 T.aman = 3.15	121950	41600	80350
2. Wheat-T.aman	0.33	2 (small)	Wheat = 3.40 T.aman = 3.12	151360	45800	105560
3. Potato-T.aman	0.26	2 (small)	Potato= 15.00 T.aman= 3.05	204900	98250	106650

Note: Price Chickpea = Tk.45/kg, Wheat = Tk.28/kg, Potato= Tk.10/kg and T.aman Tk.18/kg

FSRD site, Hatgobindapur, Faridpur

The high yielding variety of rice BRRI dhan 32, BARI sarisha 11, Shatabdi (wheat) and Cardinal (potato) were conducted in rabi season replacing of existing one under pilot production program only. The fertilizer dose, sowing and harvesting date were used in these trials presented in Table 4. The total area of 10.66 ha cropping land of two-category farmers (small and marginal) was included under this production program.

The performance of four patterns was given in Table 5. The overall performance of both crops under each pattern was good and satisfactory except potato. The wheat, T.aman mustard and potato yield was 3.10, 3.60-3.75, 1.56 and 26 t/ha, respectively. The crop of jute is now on field.

Table 4 Name of the crops, fertilizer dose, sowing and harvesting time of different crops during 2007-08

Name of crops	Variety	Fertilizer dose (N-P-K-S-Zn-CD kg/ha)	Sowing time	Harvesting time
Wheat	Shatabdi	70-25-20-10-2+5 ton cowdung	7- 10 Dec 07	02-05 April 08
Jute	O-9897	85-12-50-5	10-12 April 08	-
T.aman	BRRI Dhan 32	78-10-33-2	20 – 25 July 07	05 -08 Nov. 07
Mustard	BARI Sarisha-11	84-18-22-14-1	12 – 15 Nov. 07	27-29 Feb. 07
Potato	Cardinal	96-16-32-8-1.5	02 -05 Dec. 07	10 -15 March 07

Table 5. Area and performance of crops under different cropping patterns during 2007-08 (up to July 07 to May 08)

Cropping pattern	Area covered (dec.)	No. & category of co-operator	Mean yield (t/ha)	Gross return (Tk/ha)	Total cost (Tk/ha)	Gross margin (Tk/ha)	BCR
1. Wheat-Jute-T.aman	50	2 (1 small & 1 marginal)	Wheat = 3.10 T.aman = 3.60	145075	50570	94505	1.53
2. Potato-Jute-T.aman	60	2 (1 small & 1 marginal)	Potato= 26.0 T.aman= 3.70	320000	104250	215750	3.07
3. Mustard-Jute-T.aman	50	2 (1 small & 1 marginal)	Mustard= 1.56 T.aman= 3.75	126950	36500	90450	3.47

Farmer’s reaction

Farmers opined very much positively with high yield of different crop varieties and high cash return.

FSRD site, Hazirhat, Noakhali

The pilot production program of three cropping pattern were conducted at FSRD site, Hazirhat, Noakhali during 2007-08. Three rice based cropping patterns viz., i) Soybean-T. aus- T.aman cropping pattern, ii) Groundnut-T. aus-T.aman cropping pattern and iii) T. aus-T.aman cropping pattern were included in this program (Table 6).

The performance of three patterns was presented in Table 7. Two cropping patterns were started from Rabi season, 2007. Results of the first crops were obtained. Performance of the first crops of two patterns was good and satisfactory (Table 7). The highest yield of soybean (2.75 t/ha) was obtained in Soybean-T. aus- T.aman cropping pattern which is 72% higher than existing farmers practice. The highest yield of groundnut (2.96 t/ha) was obtained in Groundnut-T.aus-T.aman cropping pattern which is 58% higher than existing farmers practice. After completion of whole pattern final conclusion will be done. The yield of soybean and groundnut were increased 72% and 58% due to adoption of high yielding varieties, balanced fertilizer, insecticide and weeding.

Table 6. Pilot production program of different cropping pattern conducted at FSRD site, Hazirhat, Noakhali during 2007-08

SL No.	Cropping pattern	No. of cooperative farmers	Location
01	Soybean-T.aus- T.aman	05	Noakhali & Laxmipur
02	Groundnut-T.aus-T.aman	05	Laxmipur
03	T. aus-T.aman	05	Noakhali

Table 7. Different management practices and performance of soybean and groundnut in cropping pattern Soybean-T.aus-T.aman cropping pattern and Groundnut-T.aus-T.aman cropping pattern

Technology intervened	Management of farmers' pattern	Management of improved pattern
(i) Soybean		
Fertilizer dose (N-P-K-S kg/ha)	32-12	25-33-55-18
Variety	Sohag	BARI soyabean-5
Insecticide apply	-	Three times
Weeding	One time	Two times
Yield (kg/ha)	1600	2750
(ii) Groundnut		
Fertilizer dose (N-P-K-S kg/ha)	08-10	12-32-43-54
Variety	Dhaka-1	BARI chinabadam-6
Seed treatment	-	Provax 200 WP
Yield (kg/ha)	1875	2960

b) Pilot Production Program of different crops

Use of improved varieties, better quality seeds and recommended production practice has increased the yield of different crops. The production increased mainly due to use of better quality seed and optimum management practices by the farmers. BARI recently developed some high yielding varieties of different crops which need to be verification in the farmer's field in large area as well as disseminate and create awareness among the farmers. This programme will be helped reduce the yield gap between farmers yield and potential yield. With this point of view pilot production program on different crop varieties has been under taken.

FSRD site, Patuakhali

Sesame, Mungbean and chili are common or traditional crop in Patuakhali region. Farmers of this region grow mainly local variety which yields much less than BARI developed varieties. In the rabi season farmers of this area cultivate either few traditional rabi crops or land remain fallow. If the above crop grown profitably, the fallow land could be brought under cultivation during the rabi season. With this point of view pilot production program of BARI Til-2, BARI Til-3, BARI Mung-5, BARI Munm-6 and BARI Lanka-1 were cultivated at FSRD site Razakhali Patuakhali. BARI Til-2 produced average 700 kg/ha (570-830 kg/ha) and BARI Til-3 produced average 720 kg/ha (590-850kg/ha). The yield of Mungbean were found 1050 kg/ha and 1150 kg/ha for BARI mung-5 & 6, respectively. In BARI Lanka-1, number of green fruits (average 75 per plant) is much higher than local cultivars. Dry fruit yield was obtained 2300 kg/ha .Mustard is not a common or traditional crop in Patuakhali region. Last year mustard variety BARI sarisa-9 and BARI sarisa-11 were grown successfully. Average yield was 900 kg/ha and 1050 for BARI Sarisha-9 and BARI Sarisha-11, respectively (Table 8).

Table 8. Performance of Sesame, mustard, mungbean and Chilli variety at FSRD site, Razakhali, Patuakhali during 2007-08

Crop	Variety	No. of farmer	Total area (ha)	Yield (t/ha)
Sesame	BARI til-2	8	1.00	0.69
	BARI til-3	7	1.00	0.72
Mustard	BARI Sarisha-9	4	0.85	0.90
	BARI Sarisha-11	5	0.70	1.05
Mungbean	BARI Mung-5	16	2.23	1.05
	BARI Mung-6	10	1.68	1.15
Chilli	BARI Lanka-1	4	0.05	2.30 (dry)

Farmers' reaction

1. Farmers are highly satisfied to see the crop field and fruit bearing system.
2. They demand seeds of BARI Lanka-1.

c) Block demonstration of different crops

FSRD site, Hatgobindapur, Faridpur

A large number of diversified crops in the rabi season are grown in this area. Most of crop varieties are local and improved management practices are not followed. There are eleven varieties of seven crops were selected to observe the performance using modern technology through block demonstration at farmers field during rabi season of 2007-08. The activities were done in two locations. One was at the FSRD site, Hatgobindapur, Faridpur and another at the MLT site, Rajbari. Performance of different crops varieties were presented in Table 9.

Table 9. Area and performance of crops under block demonstration at FSRD Site, Faridpur during 2007-08

Crops	Variety	Numbers of farmers	Date of sowing	Area (ha)	Yield (t/ha)	Remarks
Mustard	BARI Sarisha 11	15	26-29.10.07	3.0	1100-1800	Farmers preserve their seed for next year
Lentil	BARI Masur 4	17	7-27.11.07	5.76	0.88-1.74	Early sowing seedling damaged due to SIDR
Onion	BARI Peaj 2	01	15.10.07	0.24	15.0	Highly seed demand & low keeping quality
Onion	BARI Peaj 1	02	24.1.08	0.18	6.40	Late planting due to SIDR
Cabbage	Autumn queen	03	11-26.11.07	0.13	59.50	Late planting due to SIDR
Radish	BARI Mula 1 & 2	02	29-30.10.07	0.18	65.0 & 63.0	Farmers happy
Wheat (Through seeder)	Prodip & Bijoy	04	26-30.11.07	0.18	3.20 & 2.85	Bijoy infested by bipolaris
Tomato	Hybrid & Ruma-VF	04	20-30.11.07	0.18	70.0 & 64.50	Farmers happy
Potato	Cardinal & Diamant	02	11-15.12.07	0.08	27.5 & 28.0	Farmers preserve seed for next year
	Total area			**9.81**		

Farmers' reaction

1. Farmers were happy for higher yield of different BARI varieties
2. They demand seeds of different BARI varieties for dissemination

d) Seed Production of different BARI varieties

FSRD site, Razakhali, Patuakhali

Seed is the key technology for a variety of a crop. It is not possible for government or research institute to supply seeds of different crop varieties year after year. Farmers should grow seeds of their own interest. Few farmers of FSRD site, Razakhali were trained up to produce seeds of few varieties in small scale. The main objective was to habitat farmers to produce and storage seeds from their own crops.

Table 1. Seed production BARI technology village at Razakhali during the rabi season of 2007-08

Crops	Varieties	No. of farmers	Total seed production (kg)
Red amaranth	BARI red amaranth-1	8	3.50
Brinjal	BARI begun-4	3	0.04
	BARI begun -5	2	0.03
	BARI begun -8	1	0.02
	Local	1	0.02
Tomato	BARI Tomato-2	1	0.02
	BARI Tomato-3	1	0.02
Mustard	BARI sarisha-9	5	10.0
	BARI sarisha-11	5	15.0
Mungbean	BARI mungbean-5	10	80.0
	BARI mungbean-6	10	60.0
Sesame	BARI Til-3	10	40.0
Chilli	BARI Lanka-1	8	8.0 (dry fruit)

Farmers' reaction

1. Farmers agreed with seed production.
2. They are interested to easy seed processing.

On-Farm Validation of Summer Onion Production Technologies at Farmers Field

Executive Summary

Onion is one of the major spices in Bangladesh. Every year the country imports thousands of tons of onion by spending huge foreign currency. Usually onion grows in the Rabi season (winter). Introduction of summer onion may be one of the options to meet up ever increasing demand. There are about two crore of homesteads in the country can play a vital role for summer onion production. Lack of knowledge of farmers, poor management, lack of availability of quality seed etc. are the major constraints for the introduction of summer onion at farmers' level. Besides the two released varieties, one promising line OF-5 was identified as potential in the summer season. On station result revealed that summer onion production from a 10 m^2 is sufficient to fulfill the demand of a medium sized family consisting of 5-7 members. On- station improved summer onion production technologies should be evaluated at field level for their adaptability. Farmers' feed back is also important to verify the technology. To develop the skillness of farmers and concerned extension and research personnel, training programs on the summer onion production were conducted and reported. Homestead and block production programs were undertaken in the different locations throughout the country during 2006-07. Three planting dates viz. September-October, February and May were considered to observe the performance of the promising line OF-5 throughout the year in different locations. Study at on-station, BARI, Joydebpur, Gazipur during 2004 to 2007 revealed that average yield of summer onion line (OF-5) was 68.75 kg/10 m^2 in a year. September planting (average yield 31.02 kg/10 m^2) showed superiority over February (average yield 22.15 kg/10 m^2) and May (average yield 20.82 kg/10 m^2) planting. The adaptability trial of summer onion was also conducted at MLT sites of 11 different district of Bangladesh in 2007-08. In September-October planting, yield varied from 13.92 to 25.70 kg/10 m^2 with an average of 21.20±3.88 kg/10 m^2. But in February planting, yield varied from 6.50 to 20.50 kg/10 m^2 with an average of 14.30 ± 4.38 kg/10 m^2 in different locations. Higher yield was found from Moulvibazar in both planting dates. Block production program for September-October and February/March planting was conducted at 6 and 5 locations, respectively. Per farm average size of the block varied was 0.040 ha in September-October planting and 0.042 ha was in February/March planting. In September-October planting, the yield varied 20.00 to 23.50 t/ha with an average of 21.58 t/ha and the duration of crop was 114 days (average). The average gross margin and BCR were Tk 251518/ha and 3.48, respectively. In February/March planting, yield varied 16.00 to 22.50 t/ha with an average of 19.00 t/ha and the duration of crop was 85 days (average). The average gross margin and BCR were Tk 217588/ha and 3.23, respectively. Farmers of these locations were very much interested to cultivate summer onion in their homestead and in field.

PROGRAM 1. SUMMER ONION PRODUCTION IN HOMESTEAD

Introduction

Onion (*Allium cepa* L.) is one of the most important spices crop in Bangladesh. It is the integral part of our daily diet. It is used to make our food palatable. It contains high medicinal values for having adequate vitamins B, C, iron and calcium. Bangladesh possesses favorable agro-ecological environments for producing onion throughout the year. Bangladesh produces only 8.09 lakh tons of onion as against the total requirement of 11.75 lakh metric tons per year on an area of 1.50 lakh hectares of land (MoA, 2005 and Krishi Dairy, 2007). So, there is an acute shortage of onion in relation to its requirement. This is why the country has to import about 4 lakh metric tons onion by spending more than 400 crore Taka. The high demand of onion can be meet up by increasing area and per hectare yield. This can be done by many ways of which the most important are the introduction of summer onion varieties, judicious application of fertilizer and crop management practices. In Bangladesh, onion is mainly grown in the Rabi season (winter). It is utmost important to increase the yield of onion and to produce it in the summer season. Usually onion is not cultivated during Kharif (summer) season in the country due to some constraints like- lack of knowledge of farmers on modern summer onion varieties and appropriate production technologies, lack of availability of quality seeds of improved varieties, poor management in post harvest handling, processing and marketing, and lack of trained manpower etc. To overcome the above constraints it is obvious that research and development activities in onion should be strengthened. Besides the two released varieties (BARI Peaj 2 and BARI Peaj-3), one promising line OF-5 was identified as potential in the summer season. As a first step, on-station improved summer onion production technologies should be evaluated at field level for their adaptability. Moreover, training is an important means to improve the skill of the concern persons. It helps clear understanding of the technologies. Hence, training courses for DAE, UAOs, SSOs, SOs, and training for SAAOs, SSAs, SAs and farmers were conducted at different locations. Through on-farm trial, valuable farmers' feedback may obtain to modify technology or to develop new technology. But on-station studies were not conclusive due to shortage of fund and not addressing some other area that needed to be unveiled before going for a recommendation to end users. Therefore, for technology transfer homestead production program and block production program of summer onion were undertaken in 15 districts by OFRD in collaboration with DAE.

Objectives:

- To validate the summer onion production technology in different locations of Bangladesh
- To test the acceptance of summer onion technologies among different categories of farmers
- To meet up the yearly onion need of 5-7 members family.
- To identify and to solve constraints in the production program of summer onion.

Expected outputs:

- Popularization of summer onion cultivation among the farmers.
- Increased production to meet up the demand of onion.
- Creation of job opportunities, raising income and reduction poverty of resource poor farmers' through summer onion cultivation

Materials and Methods

The experiment was conducted at On-station, Joydebpur, Gazipur as well as homestead of farmers at the FSRD/MLT site, Tangail, Gazipur sadar, Barind (Rajshahi), Shibpur (Narsingdi), Manikganj, Mymensingh, Kishoreganj, Moulvibazar, Comilla, and Faridpur (Figure 1). The size of experimental plot was 10m^2. The number of cooperator farmer varied from 4-10 in different locations. The seedlings were raised in central research station, BARI, Gazipur. The onion seedling aged varied from 40-45 days. The seedlings were transplanted with the spacing of 15cm x 10cm. The field was fertilized with 120-45-100-30 kg/ha of N, P, K and S, respectively along with 4-5 kg/10 m^2 cowdung or 3 kg/10 m^2 poultry manure depending upon the availability of the different locations. The fungicides Rovral 50 WP and Ridomil MZ @ 2 gm + 2 gm = 4 g/liter was sprayed every 10-12 days interval up to 2 months for controlling of purple blotch diseases. Three planting dates viz. September, February and May were considered as treatments in this study. The seedlings were transplanted in last week of September to 1st week of October and harvested in last week of January. The 2nd transplanting was done in 1st week of February and harvesting was done in 4th week of May.

Results and Discussion

On-station, BARI, Gazipur: Among the three planting dates, September planting showed higher yield than the February and May planting over the years at Joydebpur, Gazipur (Table 1).In an average of four years, the yield of September planting was 31.02 kg/10 m^2 which was 40 and 49 percent higher than that of February and May planting, respectively. It might be due to prevailing of favorable environment during this season. Lower yield was obtained from May planting over the years. Considering the whole year, the yield varied from 66.17 to 70.75 kg/10 m^2 with an average of 68.75 kg/10 m^2 from the same plot.

Table 1. Yield of summer onion at Joydebpur, Gazipur (on-station) during 2004 to 2007

Time of planting	Bulb yield (kg/10 m^2 plot)				
	2004	2005	2006	2007	Average
February	21.00	21.17	20.50	22.15	22.20
May	17.00	18.00	17.60	13.50	20.82
September	30.00	27.00	32.00	35.10	31.02
Total	68.00	66.17	70.10	70.75	68.75

On-Farm studies

Shibpur (Narsingdi)

From the Table 2, maximum bulb yield was obtained in Khorshed Alam’s field (22.25 kg/plot) and the minimum yield from Afsar Uddin’s field (18.55 kg/plot) in September planting. In February planting, maximum bulb yield was obtained from Masud Ahmed’s field (18.40 kg/plot) and minimum yield was obtained from Khorshed Alam’s field (16.00 kg/plot). On an average, onion bulb production of September planting (20.92 kg/plot) was 22% higher than February planting. The bulb yield production of two planting dates (35 to 40 kg/plot) was sufficient for the consumption of their family from February to November/December. Moreover, effective utilization of family labour especially women labour was ensured.

Table 2. Yield of year round and local onion at homestead at MLT site, Shibpur, Narsingdi during 2007-08

Name of farmer	Address	Yield (kg/ 10m^2 plot)			Requirement full fill from the month of February up to
		September planting	February planting	Total	
1. Khorshed Alam	Dhanua, Shibpur, Narsingdi	22.25	16.00	38.25	December
2. Monir Hossain	Do	20.80	17.50	38.30	December
3. Afser uddin	Do	18.55	16.50	35.05	November
4. Masud Ahmed	Do	22.10	18.40	40.50	December
Average	-	20.92	17.10	38.02	-

Manikganj

Among the six farmers, maximum onion yield was obtained from Afaz Uddin’s plot (30 kg/plot) which was followed by Babu Gobinda Bosh (28.50 kg/plot) in September planting. Minimum onion yield was obtained from Reazul Karim’s plot (18.75 kg/plot) due to prevailing of seedling mortality (Table 3). In February planting, maximum onion was found from Rezaul karim’s plot yield (12. kg/plot) and minimum onion yield from Jillur Rahman’s plot (10.00 kg/plot). On an average of six farmers, bulb yield of 24.45 kg/plot was found in September planting whereas 10.90 kg/plot was obtained from February planting. Cost of production was (Tk. 35/plot/season). The total bulb yield of two plantings was sufficient for the consumption of their family from February up to August to December. Moreover, effective utilization of family labour especially women labour was ensured.

Table 3. Yield of year round onion production at homestead at MLT site, Manikganj during 2007-08

Name of farmer	Address	Yield (kg/ 10m^2 plot)			Requirement full fill from the month of February up to
		September planting	February planting	Total	
1. Babu Gobinda Bosh	Lou Khanda, Manikganj	28.50	11.00	39.50	December
2. Md. Jillur Rahman	Boitora, Manikganj	23.00	10.00	33.00	August
3. Md. Soilaiman	Do	27.00	10.50	37.50	November
4. Md. Afaz Uddin	Gorkhi, Manikganj	30.00	11.50	41.50	December
5. Md. Rezaul Karim	Do	18.75	12.00	30.75	June
6. Md. Afzal Hossain	Kadirkandi, Manikganj	19.45	10.40	29.85	June
Average	-	24.45	10.90	35.35	-

Kishoreganj

From the following Table 4, the results indicated that maximum bulb yield was obtained from Mr. Murtaj's plot (22.15kg/plot) and minimum yield was obtained from Hassan Ali's plot (13.45 kg/plot) in September planting. In February planting, maximum onion bulb yield was found in Abu Baker's plot (8.10 kg/plot) and lower yield from Abul Kashem's plot (6.50 kg/plot). On an average of ten farmers 17.10 kg/plot was obtained in September planting and 7.18 kg/plot from February planting. The total bulb yield of two planting was sufficient for the consumption of their family for February up to August. Moreover, effective utilization of family labour especially women labour was ensured.

Table 4 Yield performance of summer onion at Kishoreganj from September 2007 to February 2008.

Sl No.	Farmers Name	Area (m^2)	Bulb yield (kg/10m^2 plot)			Requirement full fill from the month of February up to
			September	February	Total	
1.	Md Abdul Malek	10	21.45	7.85	29.30	August
2.	Md. Abu Baker	10	15.30	8.10	23.40	July
3.	Md. Murtuja	10	22.15	6.90	29.05	August
4.	Md. Abul Kashem	10	17.50	6.50	24.00	August
5.	Md. Hasen Ali	10	13.45	6.60	20.05	July
6.	Md. Abu Taher	10	18.50	7.70	26.20	August
7.	Md. Guljer Hossain	10	13.92	6.70	20.62	July
8.	Md. Minhaj Ali	10	18.20	7.35	25.55	August
9.	Md. Abdur Rashid	10	16.24	7.40	23.64	July
10.	Md. Abul Fajal	10	14.35	6.60	20.95	July
	Average	**-**	**17.10**	**7.18**	**29.30**	

Moulvibazar

The first planting was done in October in Moulvibazar. It was found that about 43% higher yield was found in October planting (21.02kg/plot) comparing the February planting (Table 5). The yield varied 19.40 to 22.60 kg/plot among the different farmers in October planting whereas 10.00 to 17.60 in February planting. Average yield of two planting was 35.64 kg/plot. In Kharif I season, crop was harvested earlier than the optimum maturity due to high rainfall, which was responsible for lower yield. It was found that advance line OF-5 has a great potentiality in the rainfall prone area like Moulvibazar. The total bulb yield of two planting was sufficient for the consumption of their family up to December. Moreover, effective utilization of family labour especially women labour was ensured.

Table 5.Yield performance of summer onion in Moulvibazar during 2007-08

Name of farmer	Yield (kg/ 10 m^2 plot)			Requirement full fill from the month of February up to
	October planting	February planting	Total	
1. Md. Kabir Miah	20.12	16.00	36.12	December
2. Md. Ankar Miah	18.45	15.32	33.77	December
3. Md. Muktar Miah	19.40	16.70	36.10	December
4. Md Mahbubuir Rahman	22.30	15.50	37.80	December
5. Md Mutaleb Miah	21.00	17.60	38.60	December
6. Md. Fakrul Islam	22.33	15.00	37.33	December
7. Md. Hafiz uddin	20.00	14.00	34.00	December
8. Md Sulaiman	23.00	10.00	33.00	November
9. Md. Abdus Salam	22.60	11.50	34.10	November
Average	21.02	14.62	35.64	-

Faridpur

The maximum onion bulb yield was obtained from Kalam Seikh's plot (24.50 kg/plot) followed by Md. Quddus plot (24.00 kg/plot) in October planting (Table 6). Minimum yield (20.00 kg/plot) was found from Md. Rustam Ali's plot. But in February planting, Kalam Seikh's plot (20.50 kg/plot) gave maximum bulb yield followed by Momin Molah's plot (18.50 kg/plot). Between the two seasons, October planting contributed higher average bulb yield (22.92 kg/plot) than that of February planting (17.78 kg/plot) due to low temperature and more duration of the crop in earlier planting. The total bulb yield of two planting was sufficient for the consumption of their family up to December. Moreover, effective utilization of family labour especially women labour was ensured.

Table 6. Yield of summer onion Production at homestead in Faridpur 2007-08

Name of Farmer	Address	Yield (kg/ 10 m^2 plot)			Requirement full fill from the month of February up to
		October Planting	February planting	Total	
1. Md. Yahia	FSR site, Faridpur	23.00	17.50	40.50	December
2. Md. Quddus	Do	24.00	18.00	42.00	December
3. Rahman Kazi	Do	22.00	17.50	39.50	December
4. Momin Molah	Do	23.50	18.50	42.00	December
5. Kalam Seikh	Do	24.50	20.50	45.00	December
6. Rustam Ali	Do	20.00	16.50	36.50	December
7. Satta Das	Do	23.50	16.00	39.50	December
Average	-	22.92	17.78	40.70	-

Mymensingh

Maximum bulb yield was obtained from Md.Ibrahim's plot (25.70 kg/plot) and minimum yield was obtained from Md. Arifur Rahman's plot (15.00 kg/plot) in September planting (Table-7). Similarly in February planting maximum bulb yield was obtained from Md. Abul Hossain's plot (18.00 kg/plot) and minimum yield was obtained from Md. Mofazzal Hossain's plot (10.50 kg/plot). On an average of seven farmers, 19.38 kg/plot and 13.27 kg/plot were obtained in September and February planting, respectively. The total bulb yield of two planting was sufficient for the consumption of their family from February up to August/December. Moreover, effective utilization of family labour especially women labour was ensured.

Table 7. Yield of summer onion production at homestead in Mymensingh during the year of 2007-08

Name of Farmer	Address	Yield (kg/ 10 m^2 plot)			Requirement full fill from the month of February up to
		September Planting	February planting	Total	
1. Md.Ibrahim Miah	Shambhuganj	25.70	13.00	38.70	December
2. Md Golam Mostafa	Do	18.00	12.00	30.00	August
3. Md. Nazim Uddin	Do	19.00	14.10	33.10	November
4. Md. Tomiz Uddin,	Trisal	20.00	13.30	33.30	November
5. Md. Abul Hossain	Do	22.00	18.00	36.00	December
6. Md. Arifur Rahman	Do	15.00	12.00	27.00	August
7. Md. Mofazzal Hossain	Do	16.00	10.50	26.50	August
Average	-	19.38	13.27	32.65	-

Dhirashram, Gazipur

From Table 8, the results indicated that maximum bulb yield (22.50 kg/plot) was obtained in Amena Begum's plot which is followed by farmer's field of Josna Begum (22.00 kg/plot) in September planting. Minimum yield was obtained from Sazeda Begum plot (21.00 kg/plot). In February planting, maximum yield was obtained from Josna Begum's plot (12.00kg/plot) and minimum yield was obtained from Amena Begum's plot (10.50 kg/plot). The September planting needs 109 days whereas February planting needs 90 days for maturity. The total bulb yield of two planting (average 33.00 kg/plot) was sufficient for the consumption of their family from February up to September to November. Moreover, effective utilization of family labour especially women labour was ensured.

Table 8. Yield of summer onion production in homestead at MLT site, Dhirashram, Gazipur, during 2007-08

Name of farmer	Address	Yield (kg/ 10 m^2 plot)			Requirement full fill from the month of February up to
		September planting	February planting	Total	
1. Sazeda Begum	Dhirashram, Gazipur	21.00	11.00	32.00	September
2. Amena Begum	Do	22.50	10.50	33.00	October
3. Imam Gazi	Do	21.50	11.50	33.00	September
4. Josna Begum	Do	22.00	12.00	34.00	November
5. Md. Salim Mian	Do	21.50	11.50	33.00	September
Average	-	21.70	11.30	33.00	-

Comilla

The first planting was done in October at Comilla (Table 9). The average yield of October planting (18.00 kg/plot) was 13% higher than the February planting. Among the five farmers, the yield varied from 15.00 to 22.00 kg/plot in October planting and 15.00 to17.60 kg/plot in February planting. The total bulb yield of two planting (average 33.80 kg/plot) was sufficient for the consumption of their family from February up to September/December. Moreover, effective utilization of family labour especially women labour was ensured.

Table 9. Yield of summer onion in Comilla during 2007-08

Name of farmers	Address	Yield (kg/ 10 m^2 plot)			Requirement full fill from th month of February up to
		October planting	February planting	Total	
1. Md. Nurul Islam	Burichong, Comilla	16.00	15.00	31.00	September
2. Md. Amir Hossain	Do	22.00	16.00	38.00	December
3. Md. Liakot Hossain	Do	20.00	17.60	37.60	November
4. Md. Helal Uddin	Do	15.00	15.00	30.00	September
5. Md. Hossain	Do	17.00	16.00	33.00	September
Average	-	18.00	15.80	33.80	-

Tangail

Among the four farmers, maximum onion yield was obtained from Md. Shadat Hossain's plot (20.00 kg/plot) which was followed by Ala Uddin's plot (18.60 kg/plot) in October planting (Table-10). Minimum onion yield was obtained from Md. Amir Hamja's plot (17.50 kg/plot) due to prevailing of seedling mortality. On an average 18.65 kg/plot onion bulb was harvested in October Planting. In February planting, the highest bulb yield (15.70 kg/plot) was obtained in Ala Uddin's plot and minimum yield (14.50kg/plot) in Amir Hamja's plot. On an average 34.10 kg/plot bulb was obtained from two planting. The total bulb yield of two plantings was sufficient for the consumption of their family from February to November. Moreover, effective utilization of family labour especially women labour was ensured.

Table 10. Yield of summer onion production at homestead in Tangail during 2007-08

Name of Farmer	Address	Yield of September Planting (kg/plot)	Yield of February Planting (kg/plot)	Total	Requirement fulfill from the month of February up to
Jsatish Chandra Sarker	Pach Bicromhati, Tangail	18.50	15.00	33.50	November
Md. Amir Hamja	Laezana, Tangail	17.50	14.50	32.00	November
Md. Shadat Hossain	Gula, Tangail	20.00	16.60	36.60	November
Md. Ala Uddin	Palima, Tangail	18.60	15.70	34.30	November
Average		18.65	15.45	34.10	

Cost of cultivation

The total variable cost of Tk. 35/season was required for cultivation of summer onion in homestead. In case of production cost assessment the price of seed, pesticides and fertilizers were considered. So, for two cropping season it needs total Tk. 70. Labour cost was not considered as the summer onion cultivation in homestead area which was maintained mostly by the idle family labour.

Employment of women

Rural women of Bangladesh can play a significant role in homestead summer onion production. It was found that the labour requirement of land preparation and pesticide application were done by mostly men and other activities like transplanting, weeding, irrigation and post harvest activities etc. were done by mostly women (Table 11). Hence, it may be said that summer onion production at homestead is a great opportunity to utilize the labour of women. It also helps to ensure a steady supply of onion for consumption throughout the year. As a part of research activities, scientists visit the homestead time to time through which knowledge and skills of women farmers can be developed.

Table 11. Participation of family members in different operations of summer onion production in homestead

Operations	Male (%)	Female (%)
Land preparation	80	20
Fertilizer applications	65	35
Transplanting	60	40
Weeding	13	87
Irrigation	15	85
Plant protection	90	10
Harvesting	12	88
Postharvest	15	85

Adaptability

The advance line OF-5 was shown wider adaptability under different agro-ecological zones of Bangladesh. Thus, cultivation of summer onion will be beneficial in different agro-ecological zones of Bangladesh. It has also a great positive role in alleviating rural poverty as well as effective utilization of homestead and family labors especially women. The summer onion seed should be made available for the farmers in all localities for its intensive cultivation.

PROGRAMME 2: SUMMER ONION SEED PRODUCTION.

The breeder seed production programme was conducted at BARI Joydebpur, Gazipur and RARS Jamalpur during 2006-08. Cultural and management practices were done as and when necessary. Advance line OF-5 was used as planting material. About 10 Kg breeder seeds were produced and maintain for future use Table-12.

Table 12 Summer onion seed production during 2006-08

Location	Amount (kg)
Gazipur 2006-07	4.10
Gazipur 2007-08	2.50
Jamalpur2007-08	3.00
Total	9.60

PROGRAM 2: BLOCK DEMONSTRATION OF SUMMER ONION

Introduction

Acute shortage of onion has been prevailing in Bangladesh during last several decades. Every year about 400 crore Taka is spent for importing onion. This amount is increasing year after year. BARI has developed a good number of summer onion varieties which are being validated through On-Farm Research Division. Most of the varieties have not yet reached at the farmers' door. Usually farmers do not apply irrigation and fertilizer for summer onion cultivation properly. So there exist huge yield gap between farmers field and research plot. There is a wide scope of increasing the total production of summer onion in the country needed to transfer modern technologies of summer onion crops to the farmers through training and block demonstration program involving all concerned agencies. This technology transfer program was carried out with the following objectives:

i) Quick dissemination of summer onion to extension personnel and farmers.
ii) Block demonstration of the latest summer onion technologies
iii) Conduction of field days in the demonstration block for the farmers to see directly the performance of the technologies.

Methodology

The block production on summer onion was undertaken during 2007-08. Two planting date September/October, 2007 and February/March, 2008 were considered as treatments in this study. Before conduction the study OFRD conducted training program to concern scientists, DAE personnel and scientific assistants. Farmers' selection was done by scientific assistant under supervision of OFRD scientists. Joint visit of SMS, UAO and SSO of OFRD was made for supervising the program. Joint meeting was made to know the progress problem in handling the program. Data were recorded by the respective scientific officer. September/October, 2007 planting was done at FSRD/MLT sites of Comilla, Kushtia, Faridpur, Barind (Rajshahi), Moulvibazar, and Shibpur whereas February/March, 2008 planting was done at MLT sites of Mymensingh, Moulvibazar, Shibpur (Narsingdi) and Monohardi (Narsingdi) and Gazipur.

Results and Discussion

The 26 and 27 farmers were involved in September/October and February/March planting, respectively. Per farm average size of the block varied was 0.040 ha in September-October planting and 0.042 ha was in February/March planting. The planting period varied from 6 September 2007 to 25 October 2007 and February/March 2008 to 7 March 2008 in different locations. The duration ranged from 112 to 115 days with an average of 114 days in September/October planting while it ranged 83 to 85 days with an overall average of 84 days in February/March planting. The maximum average onion bulb yield was obtained at Kushtia (23.50 t/ha) followed by Moulvibazar (22.00 t/ha) in

September/October planting. It was minimum at Barind (20.00 t/ha), average yield was 22.20 t/ha in September/October planting (Table-1). Comparatively lower yield performance was observed in February/March planting (Table 2). The yield varied 16.00t/ha (in Moulvibazar) to 22.50 t/ha (at Shibpur of Narsingdi district) with an average of 19.00 t/ha. Higher yield in September/October planting as compared to February/March planting may be attributed to favorable climatic condition especially more sunshine hours, increased duration of vegetative and reproductive phase provides longer period for photosynthesis in bulb formation. The results are in agreement with the findings of Ullah (2001) and Alam (2001).

In terms of economic performance, average gross return, net return and BCR were Tk. 323700/ha, 251518/ha and 3.48, respectively in September/October planting (Table 3) whereas comparatively lower economic performance was found in February/March planting due to lower yield. Average gross return, net return and BCR were Tk.285000/ha, 217588/ha and 3.23, respectively in February/March planting (Table 4).

Farmers' reaction

Moulvibazar	:	Farmers' are very much interested to cultivate summer onion. They need seed and seedling in proper time. Extension personnel need to motivate with training for the production technology of year round onion. Purple blotch is a problem for this crop. They will continue its cultivation in the next year. Pesticide is not available in the local market. More training on production technology for summer onion is needed.
Patuakhali	:	Farmers are satisfied to summer onion performance. They are interested to cultivate summer onion. Seed is not available in local market. Seedling raising and seedling establishment are critical.
Manikganj	:	Farmers showed their keen interest to grow summer onion for its higher yield. But onion Thrips should be controlled timely.
Comilla	:	Summer onion is a newly introduced crop in this area. Farmers are very happy with the homestead onion production model. The women and children can participate in the home gardening.
Kishoreganj	:	Farmers are agreed to cultivate. As a new crop in this area, farmers need more training on this aspect
Barind	:	Farmers are interested to grow it but the farmers gave emphasis for seed production technologies. High temperature, long drought and water scarcity reduce production of this crop in February planting.
Rangpur	:	Summer onion was attractive color and big size. So farmers are highly interested to grow it in large scale.
Gazipur	:	Farmers opined that there is great demand of summer onion and they are interested to adopt the technology but they are afraid of its insect infestation and adulterated insecticide.
Pabna	:	The yield of summer onion was double then local but the durability in store house of summer onion was less than local variety.
Mymensingh	:	Farmers of this area were much impressed with the summer onion for its high yield, big size and attractive color. The advance line OF-5 may be recommended for released as a variety. They desired to buy the seeds.

Problems uncounted

Though the returns from the summer onion production technologies are profitable, a number of problems prevailed that hinder the technologies acceptance by the farmers. The major constraints are as follows;

- Lack of availability of summer onion seeds
- Adulterated insecticides
- Lack of availability of pesticide in Sylhet region
- Difficulties in seedling raising
- The unfavorable climate (hailstorm and heavy rains) during seedling stage in May planting caused severe damage of seedling
- Thrips and purple blotch problem in the summer onion cultivation
- Relatively less storability than local onion

Conclusion

Summer onion production technologies in homestead and in fields were conducted at 17 locations in different agro-ecological zones of Bangladesh. The technology is viable and created great enthusiasm among the farmers specially women. Family need as well as income of the participating farmers increases after cultivation of summer onion. In production of advance line OF-5 gave 4-5 times higher yield over national average of onion.

Cultivation of summer onion in both February/March planting and September/October planting were found more profitable irrespective of different agro-ecological zones. Summer onion is a new technology. So, to make the technology sustainable, 2-3 years continuous technical back up is needed along with training of farmers and extension personnel.

The socio-economic status, land productivity and annual income of the participating farmers have increased to a considerable extent as a result of the implementation of the summer onion production program. Even though, the land productivity has increased significantly, still there is a considerable gap between the potential yields and farmers yield of summer onion.

Recommendation

Based on the findings of the study, the following recommendation could be made for future work.

- Based on the yield performance at farmers' field and farmers' preference, immediate steps are needed to release the advance lines OF-5 as a variety. This advance line could be grown through the year.
- Judicious application of pesticides should be applied to control the thrips and purple blotch.
- Homestead production of summer onion is highly profitable. So, wider scale dissemination of this technology may be recommended to other extrapolation areas. Department of Agricultural Extension may come forward for large scale demonstration.
- Lack of availability of the seeds of summer onion is a major problem. Special program should be taken to make availability of summer onion seed at farmers' level.
- More training programs should be arranged on summer onion production technology among the farmers and DAE personnel
- Research activities should be taken on storage technique and seed production techniques of summer onion.

References

Alam, K. 2001. Annual Research Report 2001. Spices Research Centre, Bangladesh Agricultural Research Institute, Bogra.

Krishi Dairy, 2007. Agricultural Information Service, Department of Agricultural Extension, Khamarbari, Farmgate, Dhaka.

MoA, 2005. Hand book of Agricultural statistics. Ministry of Agriculture. Govt. peoples Republic of Bangladesh, Dhaka.

Nasreen, S. and A.K.M. Hossain, 2000. Influence of chemical fertilizer, organic manure on the growth and yield of onion, Bangladesh. J. Agril. Res. 25(2) : 221-231.

Ullah M.M. 2003, Nutrient Management in summer onion. Ph.D. Thesis, Department of Soil Science, BSMRAU, Salna, Gazipur 1703. P.1.

Table 1. Performance of summer onion in different locations under block demonstrations in September/October planting, 2007

Locations	No. of farme	Total area (ha	Planting period	Duration (days)	Av. bulb yield (t/ha)
Comilla	5	0.15	6-9 September 2007	114	21.00
Kushtia	2	0.15	11-12 September 2007	112	23.50
Faridpur	3	0.40	13-15 September 2007	115	21.50
Barind	2	0.10	7-8 September 2007	114	20.00
Moulvibazar	8	0.15	20-25 October 2007	115	21.50
Shibpur	6	0.10	6-8 September 2007	115	22.00
Total	26	1.05	Average	114	21.58

Table 2. Performance of summer onion in different locations under block demonstrations in February/March planting, 2008

Locations	No. of farme	Total area (ha)	Planting period	Duration (days	Av. bulb yield (t/ha)
Myemsingh	6	0.30	8-10 February 2008	85	17.50
Moulbibazar	8	0.30	3-7 March 2008	84	16.00
Shibpur	9	0.40	2.-7 February 2008	85	22.50
Monohardi	4	0.15	20-25 February 2008	84	20.00
Gazipur	2	o.25	20-25 February 2008	83	22.20
Total	27	1.15	Average	84.50	19.00

Table 3. Economic performance of summer onion in different location in September/October planting, 2007

Locations	Av. bulb yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Comilla	21.00	315000	72182	242818	3.36
Kushtia	23.50	352500	72182	280318	3.88
Faridpur	21.50	322500	72182	250318	3.46
Barind	20.00	300000	72182	227818	3.15
Moulvibazar	21.50	322500	72182	250318	3.46
Shibpur	22.00	330000	72182	257818	3.57
Average	21.58	323700	72182	251518	3.48

Price: Onion bulb Tk. 15/kg

Table 4. Economic performance of summer onion in different locations in February/March planting, 2008

Locations	Av. bulb yield (t/ha)	Gross return (Tk./ha)	Total production cost (Tk./ha)	Net return (Tk./ha)	BCR
Myemsingh	17.50	262500	67412	195088	2.89
Moulbibazar	16.00	240000	67412	172588	2.56
Shibpur	22.50	337500	67412	270088	4.00
Monohardi	20.00	330000	67412	262588	3.89
Gazipur	22.20	333000	67412	265588	3.93
Average	19.00	285000	67412	217588	3.23

Price: Onion bulb Tk. 15/kg

Table 5. Cost of production of summer onion in September/October planting, 2007

Observations	Quantity	Value (Tk./ha)	% of total cost
Human labour (days/ha)	321	38520	53
Animal power (days/ha)	43	4300	6
Seed rate (kg/ha)	7	4200	6
Insecticides (L/ha)	1.2	1200	2
Rovral & Ridomil (kg/ha)	4.5	11250	15
Chemical fertilizer (kg/ha)			11
Urea	264	1584	
TSP	217	3472	
MoP	166	2656	
Cowdung (kg/ha)	5000	2000	3
Irrigation (Tk./ha)	6	3000	4
Total		72182	100

Table 6. Cost of production of summer onion in March planting, 2008

Observations	Quantity	Value (Tk./ha)	% of total cost
Human labour (days/ha)	300	36000	54
Animal power (days/ha)	43	4300	6
Seed rate (kg/ha)	7	4200	6
Insecticides (L/ha)	1.2	1200	2
Rovral & Ridomil (kg/ha)	4	10000	15
Chemical fertilizer (kg/ha)			11
Urea	264	1584	
TSP	217	3472	
MoP	166	2656	
Cowdung (kg/ha)	5000	2000	3
Irrigation (Tk./ha)	4	2000	3
Total		67412	100

Livelihood Improvement of Tribal People through Agricultural Production in High Barind Tract

Introduction

The Barind Tract is a distinctive physiographic unit in the North-West of Bangladesh, which is characterized by extreme environmental conditions for agricultural production. The High Barind tract was characterized by grey terrace soil, low organic matter, low rainfall and high temperature. Single T.aman rice crop under rainfed condition is the major cropping pattern practiced by the farmers of Barind area. Most of the lands are owned by the absentee landlords and are cultivated by the tenant farmers. Most of tenant farmers are tribal or landless farmers. There are about 70 thousand tribal farmers' lives in Barind area of Rajshahi region (ASED, 2004). Locally they are called as Saotal. They are very poor and neglected in the society. Most of them sell their labour to other land and few of them are tenant farmers. The tenant tribal has less financial capability and they have no access to any institutional loan. They are also not much interested to diverse cropping. Tribal of this area are always fighting against insecure food, malnutrition, unemployment and poverty. They do not know about the modern technology of agriculture. They have a limited knowledge to use their existing farm resources efficiently. Social problems like tenant farmer and lack of motivation hinder the vegetable production (BARI, 1999). Alam *et al*. (2005) reported that year round vegetable production in High Barind area increased the vegetable consumption of resource poor farmers. Homestead area can be utilized to grow different vegetables, which can significantly improve rural health as well as economic condition (Abdullah, 1986). Integrated farming approach provides to improve farming condition and livelihood of tribal saotal farmers by integrating their available resources. Above these circumstances, the program has been implemented by OFRD, Barind Station of BARI under technology transfer projects funded by BARC to improvement the livelihood through agricultural production for the local tribal farmers (Saotal) of High Barind Tract.

Project objectives

- To utilize the present resources of local tribal (Saotal) in a better and systematic way
- To improvement of livelihood of tribal farmers through agricultural production
- To increase the current income level of Saotal family through intervention of new and profitable agricultural technologies

Methodology

The project activities are being implemented by On-farm Research Division, Barind Station of BARI at two villages (Paitapukur and Fulbari village, Godagari, Rajshahi) with twenty Saotal farm families (10 of each location) during 2007-08. The tribal families were selected on the basis of their farm size and existing resources. Seeds of BARI released different crop varieties like vegetables, wheat, chickpea, lentil, mustard etc. were distributed to the tribal farmers for executing different pilot production programme under the project. The year round homestead vegetables production was designed following "Barind model" to fulfill the family nutrition of tribal people. In *rabi* season, bed preparation was done on 17-20 November 2007. The seed sowing was conducted on 20-25 November 2007 following "Barind Model". An adaptive trial of different modern varieties developed by BARI has also been established at the tribal farmer's field of High Barind Tract. The OFRD staffs are providing technical support for successful implementation of the project. The field and socio-economic data were collected simultaneously which were incorporated the report. The different activities under the project are to be described below in brief.

Results and Discussion

A) Pilot production programme (PPP)

The OFRD, Barind Station, Rajshahi has developed different improved cropping patterns for High Barind Tract. The pilot production programme of following three cropping patterns is being implemented in the tribal field under the project at Paitapukur and Fulbari (Table 1). The average yield of chickpea, mustard and wheat were 135, 200 and 320 kg/bigha, respectively.

Table 1. Pilot production programme of different cropping patterns implemented at Paitapukur and Fulbari village, Godagari, Rajshahi during rabi 2007-08

Sl. No.	Name of activities	Variety	Total area	No. of Saotal farmer	Date of sowing	Date of harvesting	Yield (kg/bigha)
1.	Chickpea under Chickpea -T.aman cropping pattern	BARI Chola-5	3 bigha	2	25 Nov. 2007	4 April 2008	135
2.	Mustard under Mustard -Boro-T.aman cropping pattern	BARI Sarisha-11	11 bigha	4	7-12 Nov. 2007	10-15 Feb.2008	200
3.	Wheat under Wheat-Mungbean-T.aman cropping pattern	Gourab	4 bigha	4	7 Dec. 2007	1 April 2008	320

B) Adaptive trial of BARI released crop varieties

An adaptive trial of 21 improved varieties developed by BARI under 14 crops has been executed in the tribal field of Paitapukur village during the rabi season of 2007-08 with a view to study the adaptability of that crop varieties among the Saotal farmers. Unit plot of the trial was 3m X 2m. All the crops were produced for seed production. The results of the trial are presented in Table 2. The trial may also enhance to familiar with the BARI crop varieties among the tribal farmers.

Table 2. Adaptive trial of different crop varieties at Paitapukur village during 2007-08

Sl. no.	Name of the crop	Variety	Date of sowing	Date of harvesting	Mean yield (kg/ha)
1.	Wheat	Shatabdi	28 Nov. 07	22 March 08	2750
		Gourab	Do	Do	2500
2.	Chickpea	BARI Chola-4	Do	15 March 08	1040
		BARI Chola-5	Do	Do	1250
3.	Mustard	BARI Sarisha-11	Do	10 March 08	1300
4.	Lentil	BARI Masur-4	Do	9 March 08	875
5.	Barley	BARI Barley-3	Do	21 March 08	1180
		BARI Barley-6	Do	Do	1270
6.	Maize	Popcorn	Do	10 April 08	4600
		BARI Maize-3	Do	12 April 08	5300
		BARI Maize-5	Do	13 April 08	5600
7.	Sunflower	BARI Sunflower-2	Do	25 March 08	1200
8.	Niger	BARI Niger-1	Do	20 March 08	1600
9.	Soybean	BARI Soybean-3	Do	30 March 08	1000
10.	Garden pea	BARI Motorshuti-1	Do	12 March 08	1120
11.	Batishak	BARI Batishak-1	Do	11 March 08	750
12.	Bush bean	BARI Jharseem-1	Do	12 March 08	950
13.	Linseed	Nila	Do	20 March 08	1625
14.	Radish	BARI Mula-2 (Pinki)	Do	25 March 08	700

C) Gender utilization and family nutrition programme

Homestead vegetable gardening

Homesteads are the resources that provide major share of livelihood especially for poor and marginal farmers. The farmer of droughty area faces from food and nutrition insecurity due to low production of vegetables. The OFRD, Barind Station has developed a year round vegetable gardening model which known as "Barind Model". The model comprises locally adapted low water requiring vegetables and other quick growing vegetables (Table 3). Under the tribal livelihood project, Year round homestead vegetable gardening is being executed to increase the intake of fresh vegetables by the tribal family.

Table 3. Space utilization by year round vegetables cultivation at tribal homestead area during the rabi season of 2007-08

Niche/space	Cropping pattern Barind Model		
	Rabi	*Kharif-I*	*Kharif-II*
Open sunny land			
Bed-1	Red amaranth + Brinjal	Kangkong	Kangkong
Bed-2	Spinach	Indian spinach	Red amaranth
Bed-3	Radish	Stem amaranth	Jute leaf (*Pat Shak*)
Bed-4	Batishak	Okra + Red amaranth	Onion + Red amaranth
Bed-5	Bushbean	Chili + Red amaranth	Chili
Cottage roof/top	Country bean, bottle gourd	Sweet gourd, White gourd	-
Trellis	Country bean, bottle gourd	Sweet gourd, yard long bean, bitter gourd	-
Homestead areas	Brinjal, onion, garlic	Plantain banana, papaya, drumstick	-

After harvesting in rabi season, the total vegetables production/Saotal farmer was 31.60 kg. Of the vegetables 24.60, 3.00 and 4.00 kg were consumed, distributed and sold respectively (Table 4). But before intervention of the project they produced only 5.5 kg creeper vegetables at homestead level. Most of the spaces of Saotal homestead remain fallow. That is why they are suffering from malnutrition due to lack of fresh vegetables. They have not enough money for buying vegetables from the market. It was revealed that the vegetable production satisfactory increased due to use of modern varieties and proper management practices

Table 4. Year round homestead vegetable production during rabi 2007-2008

Sl. no.	Month	No. of homestead	Average vegetable production (kg/homestead)	Consumption/family (5 member/family) (kg)	Distributed (kg)	Sold (kg)
1.	December, January and February	10	31.60	24.60	3.00	4.00

Field day on project activities

A field day was arranged by OFRD, Barind Station, Rajshahi at Paitapukur village on 26 January 2008 to disseminate the modern agricultural technology among the Saotal farmers of the locality for their livelihood improvement. About 50 tribal farmers of the locality attended the field day.

Training of tribal farmers

A training programme was organized for tribal farmers on 26 January 2008 at Paitapukur village. The farmers have given training on modern technology of homestead vegetable production, oilseed production, pulse production, seed production and storage etc. Thirty tribal farmers (male and female) of Paitapukur and Fulbari villages were participated the training programme.

Reaction of Saotal farmers

The project activities have created awareness among the Saotal farmers. They are very much interested to cultivate different field crops and vegetables in the next year. The homestead vegetable gardening has increased the intake of fresh vegetables of tribal family. They have also sold the excess vegetables in the market for earn some cash. They demanded to extend the project activities in other locality of tribal people for their better livelihood.

Out put of the project during the rabi season 2007-08

(i) The homestead vegetable production has increased due to use of modern varieties of BARI.
(ii) Saotal women employment has increased due to participation both in homestead and field crop production activities.
(iii) Increased homestead resources for homestead vegetables and crop production.
(iv) Fresh vegetables consumption by tribal family has been increased and also changed the consumption habit towards vegetables.
(v) Positive change in Saotal livelihood due to increase in crop production.

Limitations

i) Lack of knowledge of Saotal farmers' about the modern crop production technology
ii) Drought and high temperature slightly hampered the program.
iii) Lack of sufficient water for growing vegetables and field crops.
iv) Cowdung is being used as fuel purpose instead of manure in the area.
v) Lack of sufficient fund for training, mobilization etc. for Saotal farmers.

Research Need

- Research work should be undertaken to find out better-adapted crop varieties both at tribal homestead and field.
- Moreover search for other low water requiring and remunerative crops would be selected for crop rotation and diversification.

References

Abdullah T. 1986. Homestead Agricultural Production in Rural Bangladesh. The ADAB News. 13 (5): 1-17

BARI (Bangladesh Agricultural Research Institute) 1999. Annual Research Report 1998-1999. On-Farm Research Division, Barind Station, Rajshahi. Page 34-39

Robiul Alam, M., M. Shahjahan, M. S. Islam, M. R. Rahman and M. A. Salam. 2005. Year round vegetable production in the homestead area at High Barind Tract. Bangladesh j. crop sci. 16 (2): 261-267.

Pilot Production Program of Onion

Abstract

Pilot production program of onion was conducted at the MLT site, Rajbari, Faridpur during 2007-08 to disseminate the technology of onion production. The variety BARI peaj-2 was used in the pilot production program. The seedlings were transplanted on 25 September 2007 and average yield 25.50t/ha was found.

Introduction

Onion is one of the most important spices crop in Bangladesh. Bangladesh produces only 131 thousand tons of onion as against the total requirement of 450 thousand metric tons per year. So there is an acute shortage of onion in relation to its requirement. The high demand of onion can be meet up by increasing area and per hectare yield. This problem can be solved by introduction of high yielding onion variety and judicious application of fertilizer. BARI has developed high yielding onion variety and this variety need to de extended to more areas through extension services. Therefore pilot production of onion was under taken to test the acceptance of this variety and to solve the constraints for onion bulb production.

Materials and Methods

The program was conducted at the MLT site, Rajbari, Faridpur during 2007-08 to disseminate technology of onion production. Two farmers, one from in dranarayanpur and other from Matipara were selected for this program. The variety BARI peaj-2 was used in this pilot production program. Fifty days old seedlings were transplanted on 25 September 2007 with spacing of 15 x 10 cm. Fertilizers were applied at the rate of 260-220-200-180 kg Urea-TSP-MP-Gypsum per hectare, respectively. Full dose of TSP and gypsum, half of MP and one-third of urea were applied as basal. Remaining half of MP and rest of urea in two equal splits were applied. The fungicide rovral and redomil each of 2 ml/L of water was used to control fungus diseases. Other cultural operations were done as and when necessary. The bulb was harvested on 25-27 January 2008.

Results

The variety BARI peaj-2 was used in the pilot production program. The seedlings were transplanted on 25 September 2007 and average yield 25.50t/ha was found.

Farmers' reactions

The farmers are interested to cultivate BARI peaj-2 due to its higher productivity though the keeping quality of bulb was low. Farmers will be expended the area for onion cultivation with BARI peaz-2 if they get the seed in due time.

Table 1 Yield of onion under pilot production program at the MLT site, Rajbari, Faridpur 2007-08

Variety	No. of co-operator farmer	Area coverage (m^2)	Yield (t/ha)
BARI peaj- 2	2	2000	25.15

Production Program of Wheat Varieties

Abstract

Production program of wheat varieties were conducted at the FSRD site, Jalalpur, Sylhet and Hatgobindapur, Faridpur and the MLT site Kashinathpur, Pabna during the rabi season of 2007-2008. This production program was conducted with four varieties (Sourav, Gourab, Shatabdi and Bijoy) in Sylhet and two varieties (Prodip and Bijoy) in Pabna and Faridpur, respectively. The variety Shatabdi produced the highest yield (2.66 t/ha) was in Sylhet followed by Bijoy (2.33 t/ha). But in Pabna and Faridpur the highest Yield (3.65t/ha and 3.20t/ha) were recorded from prodip, respectively.

Introduction

Wheat is one of the most important cereal crops next to rice in Bangladesh. Cultivation of traditional varieties with improper management might be the cause of lower productivity of wheat. Recently BARI has been released some wheat varieties, which have high yield potential. It is necessary to replace old varieties by HYV and introduce improve management to achieve potential yield. Production program is an important and efficient way of rapid transfer of new varieties to the farmers. Block demonstrations also help make available the seeds of new varieties and rapid dissemination to other farmers. Keeping this view in mind this program was undertaken to evaluate the new wheat varieties by the farmers comparing with their widely grown varieties, preservation and rapid dissemination of seeds of farmers preferred varieties through farmers to farmers and to increase varietals diversity.

Materials and Methods

The production program was carried out at the FSRD site, Jalalpur, Sylhet and Hatgobindapur, Faridpur and the MLT site Kashinathpur, Pabna during the rabi season of 2007-08. A discussion meeting was arranged for the cooperator farmers to replace local varieties by high yielding varieties Sourav, Gourab, Shatabdi and Bijoy in Sylhet and Prodip and Bijoy in Pabna and Faridpur, respectively. In that meeting, farmer's demanded training on improve management and seed of new varieties. The site team agreed with their demand and provided training of the cooperators farmers and supplied good quality seeds for the program. One cooperator farmers was selected for each variety. The program covered 1000 m^2 of land for each variety. The crop was fertilized with 102-36-26-22-2-0.5 Kg N-P-K-S-Zn and B ha^{-1} respectively. Two third of urea and entire amount of other fertilizers were applied as basal and the rest one third urea was applied at crown root initiation (CRI) stage. Seeds were sown on November 25-27 2007 and used recommended seed rate. Two irrigations were applied at 20 and 45 days after sowing. Weeding and other intercultural operations were done when required. The crop was harvested on March 20-28, 2008.

Results and Discussion

Among the four varieties, the highest grain yield 2.66 t/ha was obtained from the variety Shatabdi which was near to Bijoy 2.33 t/ha and also the highest gross margin 30870 Tk./ha was obtained from Shatabdi in Sylhet. Among the two varieties the better performance regarding yield and economic return were recorded from Prodip and simultaneously Bijoy also exerted similar grain yield and economic return in both the locations, Pabna and Faridpur (Table 1). Farmers being impressed to get their desire yield from the two varieties and they preserved total seeds as they produced.

Farmer's reaction

From the farmers own set of selection criteria and their post evaluation about the varieties, the farmers of Pabna and Faridpur chose the varieties Prodip and Bijoy and farmers of Sylhet chose the varieties Shatabdi and Bijoy. Farmers expressed their satisfaction with high yield, bold seed, no unfilled grain and resistant to leaf rust and leaf sport disease of those varieties. Accordingly they preserved the total seed as they produced for large area production and selling to other farmers in the next coming season.

Conclusion

The varieties Prodip, Bijoy and Shatabdi performed better compare to widely grown varieties. Yield and economic return obtained from Prodip was higher than Bijoy and Shatabdi. But Bijoy and Shatabdi also performed well regarding yield and economic return over widely grown varieties.

Table 1 Production program of wheat varieties under farmers' management at the FSRD site, Jalalpur, Sylhet and Hatgobindapur, Faridpur and the MLT site Kashinathpur, Pabna during the rabi season of 2007-08

Varieties	No. of co-operator farmer			Area coverage (m^2)			Grain yield (t ha^{-1})		
	Sylhet	Pabna	Faridpur	Sylhet	Pabna	Faridpur	Sylhet	Pabna	Faridpur
Sourav	1	1	1	1000	-	-	1.89		
Gourab	1	1	1	1000	-	-	1.73	-	-
Shatabdi	1	1	1	1000	-	-	2.66	-	-
Bijoy	1	1	1	1000	1000	1000	2.33	3.45	3.10
Prodip	1	1	1	1000	1000	1000	-	3.65	3.20

Table 2 Economic performances of wheat varieties under farmers' management at the FSRD site, Jalalpur, Sylhet and Hatgobindapur, Faridpur and the MLT site Kashinathpur, Pabna during the rabi season of 2007-08

Name of varieties	Gross return (Tk.ha^{-1})			Total variable cost Tk.ha^{-1})			Gross margin(t. ha^{-1})		
	Sylhet	Pabna	Faridpur	Sylhet	Pabna	Faridpur	Sylhet	Pabna	Faridpur
Sourav	51030			40200			10830		
Gourab	46710			40000			6710		
Shatabdi	71820			40950			30870		
Bijoy	62910	93150	86800	40520	39300	37130	22390	53850	49670
Prodip		98555	89600		39970	37130		58580	52470

Wheat price 27 Tk./Kg

Production Program of Maize with Boron Fertilizer

Abstract

The production program was conducted at the MLT site Domar, Rangpur and Gobindagonj, Gaibandha during 2007-08 to observe the effect of boron on maize in the farmer's field. The treatments were T_1: Recommended fertilizer dose with out boron and T_2: Recommended fertilizer dose with boron (2.0kg/ha). The higher yield (8.32t/ha and 9.38t/ha) and gross margin (36410Tk. /ha and Tk. 40216 Tk./ha) were recorded from recommended fertilizer dose with boron (2.0kg/ha) at Domar and Gobindagonj, respectively.

Introduction

Maize is the third cereal crop in Bangladesh. Now- a -day's area under maize production is increasing sharply for poultry industry as well as fodder purposes. Boron is the essential micro nutrient for plant. Boron is responsible for proper pollination and seed formation. Most of the farmers do not apply boron fertilizer in maize cultivation. AEZ- 3 is very much boron deficit area which caused lower yields of the crop. Therefore application of boron in addition to essential major along with cowdung has gaining practical significant. The production program was under taken at farmer's field to create awareness about the effect of boron on the yield of BARI hybrid maize-5.

Materials and Methods

The production program was conducted at the MLT site Domar, Rangpur and Gobindagonj, Gaibandha during 2007-08 in irrigated medium high land belongs to AEZ 3. The treatments were T_1: Recommended fertilizer dose with out boron and T_2: Recommended fertilizer dose with boron (2.0kg/ha). The production program was conducted at four farmer's field with BARI hybrid maize-5. The unit plot size was $800m^2$ .A recommended dose of 250-55-138-33-3 Kg NPKSZn/ha was applied as blanked dose. One third of urea and other fertilizers were applied during final land preparation as basal dose and rest of urea applied in two equal split as topdressing at 8-10 leaf stage and at tasseling stage. Seeds were sown with a spacing of 75cmx25cm during first week of December. Irrigation, plant protective measure and other intercultural operations were done as and when required. The crop was harvested on 23 to 28 May, 2008.

Result and Discussion

The yield and economic performance of maize as influenced by boron are presented in the Table1. The higher grain yield (8.32 and 9.38 t/ha), Gross return (83200 and 93800 Tk./ha) and Gross margin (36410 and 40216 Tk./ha) were recorded from recommended fertilizer dose with boron (2Kg/ha) at Domar and Gobindagonj MLT site, respectively.

Farmer's reaction

Farmers were satisfied with reasonable good yield of maize from boron application. They realized the effect of boron on maize production.

Conclusion

Application of boron has positive effect on grain yield of maize. For production of maize the farmer should use 2Kg B/ha in the Rangpur region.

Table 1 Yield and economic performance of maize as influenced by boron fertilizer at the MLT site Gobindaganj, Gaibandha during 2007-08

Treatments	Yield (t/ha)		Gross return (Tk/ ha)		Total cost of cultivation (Tk/ha)		Gross margin (Tk/ha)	
	Domar	Gobindaganj	Domar	Gobindaganj	Domar	Gobindaganj	Domar	Gobindaganj
T_1= Recommended fertilizer dose with out boron	5.48	6.80	54800	93800	45230	53584	9570	40216
T_2 =Recommended fertilizer dose with boron (2.0kg/ha)	8.32	9.38	83200	68000	46790	51979	36410	16021

Maize=10 Tk/kg, Urea= 6 Tk/kg, TSP=38 Tk/kg, MP=35 Tk/kg, Gypsum= 6.5 Tk/kg, Zinc sulphate= 135 Tk/kg and Boric acid = Tk/kg 130

Production Program of Mungbean with Boron Fertilizer

Abstract

The production program was conducted at the MLT site Domar, Rangpur during 2007-08 to observe the effect of boron on mungbean in the farmers' field. The treatments were T_1: Recommended fertilizer dose with out boron and T_2: Recommended fertilizer dose with boron (1.0kg/ha). BARI mung -6 were used in the production program. The higher yield (1.335t/ha) and gross margin (52410 Tk./ha) were recorded from recommended fertilizer dose with boron (1.0 kg/ha).

Introduction

Mungbean is the second most popular pulse crop in Bangladesh. With the introduction of newly released photo period insensitive short duration verities like BARI mung-6 the farmers interest in mungbean cultivation. Agro ecological zone- 3 is very much boron deficit area which caused lower yields of mungbean. Boron is essential micronutrient for plant. It is notated that Boron is responsible for pod and seed formation. Therefore application of boron in addition to essential major elements and cowdung has gaining practical significance. The production program was under taken at farmer's field to create awareness about the effect of boron on the yield of mungbean.

Materials and methods

The production program was conducted at the MLT site Domar, Rangpur during 2007-08 in medium high land belongs to AEZ- 3. The treatments were T_1= Recommended fertilizer dose with out boron and T_2= Recommended fertilizer dose with boron (1.0kg/ha). The production program was conducted at four farmer's field with BARI mungbean-6. The unit plot size was 800m^2 .A recommended dose of 20-20-28-18-2 Kg NPKSZn/ ha were applied as blanked dose. All the fertilizers were applied during final land preparation as basal dose. Seeds were sown with a spacing of 75cmx25cm during first week of March 2008. Plant protective measure and other intercultural operations were done as and when required. The crop was harvested on 25 to 30 May, 2008.

Result and discussion

The yield and economic performance of mungbean as influenced by boron are presented in the Table1. The higher seed yield (1.335t/ha), Gross return (80100 Tk./ha) and Gross margin (52410 Tk./ha) were recorded from recommended fertilizer dose with boron (1Kg/ha).

Farmer's reaction

Farmers were satisfied with better yield of mungbean from boron applied fields. They realized the benefit of boron application in mungbean production.

Conclusion

Application of boron has positive effect on seed yield of mungbean. For production of mungbean the farmer should use 1Kg B/ha in the Rangpur region.

Table 1 Yield and economic performance of mungbean as influenced by boron at the MLT site Domar, Rangpur during 2007-08

Treatments	Yield (t/ha)	Gross return (Tk/ha)	Total cost of cultivation (Tk/ha)	Gross margin (Tk/ha)
T_1= Recommended fertilizer dose without boron	0.702	42120	26910	15210
T_2= Recommended fertilizer dose+ with boron (1.0 kg/ha)	1.335	80100	27690	52410

Mungbean =60 Tk/kg, Urea= 6 Tk/kg, TSP=38 Tk/kg, MP=35 Tk/kg, Gypsum= 6.5 Tk/kg, Zinc sulphate= 135 Tk/kg and Boric acid = Tk/kg 130

Pilot Production Program in different Locations under OFRD in 2007-08

Crop	Location	Variety	Area (ha)	Yield (t/ha)
Wheat	Kaliganj, Jhenaidah	Prodip	-	3.90
	Kuadabazar, Jessore	Shatabdi	-	4.40
	Kadamshahar, Rajshahi	Gourab	6.6	3.33
	Amnura, Chapainawadgong	Gourab	0.66	3.23
	Sapahar, Naogon	Gourab	0.72	1.80
	Bharamara, Kushtia	Bijoy	0.5	4.34
	Bharamara, Kushtia	Prodip	0.5	4.38
	FSRD site Ellenga, Tangail	Bijoy	.066	4.19
	FSRD site Ellenga, Tangail	Shatabdi	0.66	3.34
	FSRD site Ellenga, Tangail	Kanchan	0.66	4.72
Chickpea	Kadamshahar, Rajshahi	BARI Chola-5	6.6	1.25
	Amnura, Chapainawadgong	BARI Chola-5	3.3	1.70
	Sapahar, Naogon	BARI Chola-5	4.48	1.20
Mustard	FSRD site Ellenga, Tangail	BARI Sharisha-9	1.0	1.48
	FSRD site Ellenga, Tangail	Tori-7	1.0	1.11
	Rajakhali, Pautakhali	BARI Sharisha-9	0.49	0.90
	Atghoria, Pabna	BARI Sharisha-11	1.60	2.28
	Rajakhali, Pautakhali	BARI Sharisha-11	0.49	1.05
	MLT site, Gangni, Kushtia	BARI Sharisha-11	1.58	1.95
	MLT site,Damurhuda,	BARI Sharisha-11	0.39	2.0
	MLT site Bharamara, Kushtia	BARI Sharisha-11	1.98	1.80
	Tularampur, Narail	BARI Sharisha-12		1.37
Barley	Laudove,Dacopa, Khulna	BARI Barley-4	0.10	2.06
Lentil	Ellenga, Tangail	BARI Masur-4	0.60	0.822
	Damurhuda,Chuadanga	BARI Masur-4	1.0	1.0
	Bharamara,Kushtia	BARI Masur-5	1.0	1.25
Maize	MLT site Bhuapur, Tangail	BARI Hybrid Maize-2	9.6	6.80
	MLT site Bhuapur, Tangail	Pacific- 984	4.8	7.95
	Laudove,Dacopa, Khulna	BARI Hybrid Maize-5	0.065	7.04
Mungbean	Bharamara, Kushtia	BARI Mung-5	4.0	1.05
	Kuakata, Pautakhali	BARI Mung-5	3.24	1.05
	Bharamara, Kushtia	BARI Mung -6	8.0	1.20
	Gangni, Meherpur	BARI Mung -6	8.0	1.35
	Laudove,Dacopa, Khulna	BARI Mung-5		1.00
	Kushtia sadar, Kushtia	BARI Mung-6	4.0	1.10
	Rajakhali, Pautakhali	BARI Mung-6	2.73	1.15
Sesame	Rajakhali, Pautakhali	BARI Til-2	2.02	0.70
	Gangni, Meherpur	BARI Til-2	1.0	1.50
	Kushtia sadar, Kushtia	BARI Til-2	1.0	1.50
	Bharamara, Kushtia	BARI Til-3	6.0	1.2
	Atghoria, Pabna	BARI Til-3	1.33	1.31
	Laudove,Dacopa, Khulna	BARI Til-3		0.825
	Lebukhali, Pautakhali	BARI Til-3	0.36	0.72
Chilli	Rajakhali, Pautakhali	BARI Lanka-1	0.8	2.3 (dry chilli)
Summer Tomato	Rajakhali, Pautakhali	BARI hyberid tomato-4	0.023	35.43

Activities of BARI Technology Village under OFRD, 2007-08

Crop Museum

FSRD site, Barind, Rajshahi

Crops	Variety	Plot size	Date of sowing/ transplanting	Date of harvest	Mean yield (t/ha)
Wheat	Gourab	2.5m x 3m	7 November	12 March	2.56
	Sourav	Do	Do	Do	3.20
	Shatabdi	Do	Do	Do	3.36
Barley	BARI Barley-1	Do	Do	Do	2.50
	BARI Barley-3	Do	Do	Do	2.00
	BARI Barley-6	Do	Do	Do	2.50
Maize	BARI Hybrid Maize-3	Do	Do	30 March	5.60
	BARI Hybrid Maize-5	Do	Do	Do	6.00
	Khoi Bhutta	Do	Do	Do	4.80
Chickpea	BARI Chola-4	Do	Do	21 March	0.90
	BARI Chola-5	Do	Do	Do	1.18
	BARI Chola-6	Do	Do	Do	0.97
	BARI Chola-7	Do	Do	24 March	0.98
	BARI Chola-8	Do	Do	Do	1.01
Lentil	BARI Masur-4	Do	Do	11 March	1.20
Mustard	BARI sarisha-6	Do	Do	7 February	1.08
	Tori -7	Do	Do	8 February	0.99
	BARI sarisha -8	Do	Do	7 February	1.04
	BARI sarisha -9	Do	Do	8 February	1.12
	BARI sarisha -10	Do	Do	Do	1.04
	BARI sarisha -11	Do	Do	19 February	1.37
	BARI sarisha -12	Do	Do	Do	1.06
	BARI sarisha -13	Do	Do	Do	1.12
	BARI sarisha -14	Do	Do	10 Feb. 2008	1.12
	BARI sarisha -15	Do	Do	Do	1.04
Lin seed	Nila	Do	Do	12 March	1.10
Niger	Shova	Do	Do	07 March	1.07
Sunflower	BARI Sunflower-2	Do	Do	23 February	1.04
Soybean	Bangladesh Soybean-4	Do	Do	12 March	1.44
	BARI Soybean-5	Do	Do	15 March	2.28
Coriander	BARI Dhania-1	Do	Do	11 March	1.02
Chili	BARI Marich-1	Do	Do	4-30 March	7500
Garden pea	BARI Motorshuti-1	Do	Do	10 Feb.-8 March	12.25
	BARI Motorshuti-3	Do	Do	5 Feb.-8 March	13.50
Tomato	BARI Tomato-2	Do	Do	20 Feb-10 March	38.00
	BARI Tomato-3	Do	Do	Do	37.00
	BARI Tomato-8	Do	Do	Do	35.00
	BARI Tomato-9	Do	Do	Do	40.00
Potato	Cardinal	Do	25 Nov.	25 February	17.60
	Diamant	Do	Do	Do	16.50
Red amaranth	BARI Lalshak-1	Do	Do	23 March	16.00
Bush bean	BARI Jharseem-1	Do	Do	8 March	12.80
Radish	BARI Mula-1 (Tasakisan)	Do	Do	1-15 February	26.00
	BARI Mula-2 (Pinki)	Do	Do	Do	21.50
	BARI Mula-3 (Druti)	Do	Do	Do	24.00
Brinjal	BARI Begun-8	Do	Do	2 Mar-28 March	30.00

FSRD site, Faridpur

Crops	Variety	Date of sowing/ transplanting	Date of harvest	Mean yield (t/ha)
Wheat	Prodip Shatabdi Sufi Bijoy	27.11.06	14-20.3.07	3.30 3.25 3.20 3.10
Radish	BARI mula 2	10.11.2007	4-20.01-08	60
Potato	BARI alu 7 BARI alu 8	27.11.07	25.02.08	25 26.5
Tomato	BARI tomato 2 BARI tomato 3	05.11.07	24.2.08	75.20 78.10
Motorshuti	BARI motorshuti 2	10.11.2007	2-25.2.08	11.20
Maize	BARI hybrid maize 2	7-9.12.2007	8-12-08	7.7
	BARI hybrid maize 3	Do	9-12-08	8.3
	BARI hybrid maize 5	Do	11-12-08	7.5

FSRD site, Sylhet

Crops	Varieties	Area	Mean yield (t/ha)
Wheat	Shatabdi	5m×4m	2.72
	Bijoy		2.57
	Sourav		1.94
Mustard	BARI sarisha-8	5m×4m	1.63
	BARI sarisha-9		1.38
	BARI sarisha-11		1.56
	BARI sarisha-13		1.66
Chickpea	BARI chola-3	Do	1.26
	BARI chola-5		0.94
	BARI chola-8		1.31
Tomato	BARI tomato-6	Do	42.54
	BARI tomato-8		45.53
	BARI tomato-9		37.35
Garden pea	BARI motorshuti-1	Do	8.23
	BARI motorshuti-2		6.91
	BARI motorshuti-3		5.76
Bush bean	BARI Jarshim-1	Do	13.21
Brinjal	BARI begun -4	Do	31.25
	BARI begun -5		26.33
Radish	BARI mula-1	Do	57.62
	BARI mula-2		42.58
	BARI mula-3		35.64
Lalshak	BARI lalshak-1	Do	8.53
Gimakalmi	BARI Gimakalmi-1	Do	22.85
Sunflower	BARI sunflower-2	Do	1.12
Maize	BARI hybrid maize-4	Do	4.32
	BARI hybrid maize-5		5.64

FSRD site, Pabna

Crops	Variety	Date of sowing/ Planting	Date of harvest	Mean yield (t/ha)
Radish	BARI Mula-3	02-12-07	30-01-08	39.0
Garden pea	BARI Motorshuti-2	02-12-07	04-02-08	6.4
	BARI Motorshuti-3	10-12-07	21-02-08	6.2
Bushbean	BARI Jharshim-1	10-12-07	22-02-08	12.0
Potato	Diamant	10-12-07	09-03-08	24.0
	Cardinal	10-12-07	09-03-08	24.0
Coriander	BARI Dhania-1	10-12-08	24-03-08	1.75
Onion	BARI Peaj-1	09-01-08	08-04-08	9.5
Wheat	Shatabdi	11-12-07	30-03-08	4.2
	Bijoy	11-12-07	30-03-08	4.4
Maize+ Potato	Maize (NK-40)	12-12-07	14-05-08	10.33
	Diamant	11-12-07	09-3-08	18.0
Maize+ Bushbean	Maize (NK-40)	12-12-07	14-05-08	11.13
	BARI Jharshim-1	11-12-07	22-2-08	11.75
Maize + Garden pea	Maize (NK-40)	12-12-07	14-05-08	9.63
	BARI Motorshuti -3	11-12-07	21-3-08	6.1
Maize	BARI Hybrid Maize-2	13-12-07	14-05-08	8.17
	B ARI Hybrid Maize-3	Do	Do	8.67
	B ARI Hybrid Maize-5	Do	Do	8.50

FSRD site, Patuakhali

Crops	Variety	Area (dec.)	Date of sowing/planting	Date of harvest	Mean yield (t/ha)
Radish	BARI mula-1	20	25-30 Nov. 07	22.01.08	50.5
	BARI mula-2	20	25-30 Nov. 07	22.01.08	37.3
	BARI mula-3	22	25-30 Nov. 07	22.01.08	33.2
Bushbean	BARI bushbean -1	10	25-30 Nov. 07	12.01.08	9.4
Motorshuti	BARI Motorshuti -1	10	25-30 Nov. 07	24.02.08	6.1
	BARI Motorshuti -2	8	25-30 Nov. 07	24.02.08	7.2
Cabbage	BARI phul kopi-2	50	6-11 Dec. 07	30.01.08	41.5
Tomato	BARI tomato-2	40	1-8 Dec. 07	27.02.08	89.5
	BARI tomato -3	40	15-10 Dec. 07	27.02.08	48.4
	BARI tomato -8	18	15-10 Dec. 07	27.02.08	46.5
	BARI tomato -9	15	15-10 Dec. 07	27.02.08	45.8
Brinjal	BARI begun-4	48	20-25 Dec. 07	28.02.08	35.9
	BARI begun -5	35	20-25 Dec. 07	28.02.08	39.7
	BARI begun -6	26	20-25 Dec. 07	28.02.08	34.8
	BARI begun -7	10	20-25 Dec. 07	28.02.08	29.2
	BARI begun -8	15	20-25 Dec. 07	28.02.08	27.8
Potato	Diamant	160	24-30 Dec. 07	22.03.08	26.5
	Cardinal	195	25-30 Dec. 07	22.03.08	25.3
Maize	BMH-3	68	3-15 Jan. 08	02.05.08	8.7
	BMH-5	75	3-15 Jan. 08	02.05.08	7.9
Mustard	BARI sarisha-9	30	4-8 Dec. 07	03.03.08	0.9
	BARI sarisha-11	50	4-8 Dec. 07	03.03.08	1.0
Lalshak	BARI lalshak-1	34	25-30 Nov. 07	22.12.07	9.2

Distribution of BARI fruit saplings

FSRD site, Barind, Rajshahi

Fruit sapling	Sapling Distributed	Survivability (%)	Present status
Mango (BARI Aam-1, 2, 3, 4)	140	80	Vegetative stage
Litchi (BARI Litchi-1)	70	45	Do
Guava (BARI Pyara-2)	60	85	Do
Lemon (BARI Lebu-1, 2)	80	95	Do
Total =	350	-	-

FSRD site, Faridpur

Fruit sapling	Varieties	No of sapling	No of cooperators	Remarks
Mango	BARI aam 1	18	10	Saplings are in good condition
	BARI aam 2	16	10	
	BARI aam 3	18	15	
	BARI aam 4	03	03	
Litchi	BARI litchi 1	20	20	
Coconut	BARI coconut 1	10	10	
	BARI coconut 2	11	10	
Jujube	BARI kul 1	01	01	

FSRD site, Pabna

Fruit sapling	Year wise distribution		Total No.	Survivability (%)
	2006	2007		
Mango	27	48 (Garden)	75	65
Litchi	26	21	47	26
Coconut	26	25	51	42
Lemon	26	10 (Garden)	36	28
Batabi lebu	-	35	35	29
BARI guava- 2	-	200	200	190

Intercropping of high value fruit trees with different crops

Farmers Name	Village	Fruit tree	Area (dec.)	Date of sowing/ planting	Crop	Variety	Yield (kg)	Present condition
Md. Abdur Razzak	Modhupur	Mango+guava Litchi + guava	66	1-9-07 4-12-07	Black gram + Lentil + Mustard	Local BARI-4 BARI-9	140 140 35	Good
Md. Salim	Do	Mango	66	25-12-07	Mustard	Local	240	Good
Md. Moktar	Do	Mango+ guava	30	-	Turmeric	Local	400	Good
Md. Amzad Hossain	Do	Mango+ guava	50	23-11-07	Lentil	BARI-	240	Good

Top working of mango trees for varietal improvement

FSRD site, Pabna

Farmers Name	Village	No. of trees	Date of pruning
Md. Azizul Haque	Mothergasi	1	Jan 30 to Feb 29, 2008
Md. Moksed Ali	Do	2	
Md. Abdul Alim	Do,	1	
Md Razab Ali	Modhupur	1	
Md. Bakibellah	Do	2	
Md. Rafiqul	Do	1	
Md. Shadullah dulal	Do	1	
Md. Karamoth Ali	Do	1	

Block demonstration program

FSRD site, Faridpur

Crop	Variety	Area (dec)	Farmers involved (no)	Date of sowing/ Transplanting	Date of harvesting	Mean yield (t/ha)
Mustard	BARI sarisha 11	140	03	28-29.10.07	5-7.2.08	1.69
Potato	Diamant	30	03	6-8.12.07	7-10.3.08	26.0
	Cardinal	20	02	6-9.12.07	7-9.3.08	25.6
Radish	BARI mula-1	20	01	29-30.10.07	15-20.12.08	62.5
	BARI mula-2	15	01	Do	Do	66.7
Wheat	Shatabdi	115	03	27-29.11.07	18-23.3.08	3.11
	Bijoy	106	03	Do	Do	3.09
Onion	BARI piaj-1	150	06	3-5.01.08	3-8.4.08	7.7
Lentil	BARI mushur-3	115	02	28-29.10.07	26-28.2.08	1.12
	BARI mushur-4	135	03	4-07.11.07	2-03.3.08	1.14

FSRD site, Pabna

Crop	Variety	No. of farmers involved	Land Area (dec.)	Date of sowing/ Planting	Date of harvest	Yield (t/ha)
Wheat	Shatabdi	2	99	Dec.19, 2007	March. 29-08	3.93
	Bijoy	2	99	Dec.19, 2007	March. 30-08	3.94
Lentil	BARI Moshur-4	3	182	Nov.21 2007	March. 10- 08	1.28
Mustard	BARI sarisha-9	5	190	Oct 29 2007	Jan. 20 2008	2.01
	BARI sarisha-13	1	45	Oct. 30, 2007	Jan. 31, 2008	2.45
Maize	BHM-2	1	33	Dec. 05, 2008	May 27, 2008	7.96
	BHM-3	1	33	Dec. 06, 2008	May 27, 2008	8.46
	BHM-5	1	40	Dec. 06, 2008	May 27, 2008	8.65

Taratpara, Dhirashram, Gazipur

Crops	Variety	No of Farmer	Sowing date	Mean yield (t/ha)	Remarks
Radish	BARI mula 1	5	Nov 5-11/07	33.56-49.96	Should be cultivated early, otherwise very less price
Radish	BARI mula 2	3	Nov 21-26/07	24-36	Color is liked by farmer and has good market price
Potato	Diamant	5	Nov 26-Dec 6/07	21-38.93	Farmers want to keep seed in cold storage for next year cultivation-but crisis of space in nearby cold storage
Potato	Cardinal	5	Nov 26-Dec 6/07	17-31.73	Do
Tomato	BARI tomato 2	3	Nov 12-15/07	28.33-34.72	Good yield along with good market price
Mustard	BARI sarisha 11	1	Nov 13/07	1.52	Need block production to popularize B. juncea
Wheat	Bijoy Shatabdi	5	Dec 13/07	2.28-2.53 1.91-2.30	Due to food crisis farmers now want to cultivate wheat
Garden pea	BARI motorshuti 1 BARI motorshuti 2	2 1	Nov 10-12/07	8.54-9.72 7.8-9.0	Liked by farmers along with good market price
Red amaranth	BARI lalshak 1	2	Dec 9-15/07	4.18-4.38	Palatable to farmer's, also has good market
Mungbean	BARI mung 6	3	March 20-25/08	0.81-0.86	In Kharif II newly introduced, need more block production program

Seed production of BARI varieties

FSRD site, Sylhet

Crops	Variety	No. of cooperative farmers	Area (m2)	Seed production and storage (kg/20m2)
Wheat	Shatabdi	3	20	5.21
	Bijoy	3	20	5.11
	Sourav	3	20	3.54
Mustard	BARI sarisha-8	3	20	5.0
	BARI sarisha-9	3	20	3.5
	BARI sarisha-11	3	20	4.5
Chickpea	BARI chola-3	3	20	4.7
	BARI chola-8	3	20	5.8
Garden pea	BARI motorshuti-3	3	20	15.0
Bush bean	BARI Jarshim-1	3	20	5.0

FSRD site, Pabna

Crop	No. of cooperative farmers	Area (m^2)	Sowing	Harvest	Yield /400m2(kg)		Seed stored at cold storage (kg)
					Diamant	Cardinal	
Potato	1	400	13/12/07	26/208	833	733	400
	1	400			800	784	400
	1	400			680	840	400
	1	400			668	692	400
	1	400			800	1052	335

Activities of Sorjan method, FSRD site, Pabna

Table 1. Performance of different crops grown in bed under Sorjan method

Crop	Variety	Sowing/planting date	Area (dec.)	Yield (Kg)	Gross return (Tk)	TVC (Tk)	Gross margin (Tk)
Spinach	Kupi palong	17 Sept. and 28-30 Oct. 2007	15	511.00	4123	1560	2563
Radish	BARI mula-1	Sept. 17, 2007	3	52.00	520	357	163
Carrot	New coroda	Sept. 20, 2007	3	82.50	1198	405	793
Red amaranth	Altapati	Oct.15 to 25, 2007	5	168.50	1610	388	1222
Cauliflower	White contessa	Sept. 20, 2007	3	299.00	3394	414	2980
Cabbage	Atlas-70	Sept. 20, 2007	3	394.00	1720	477	1243
Onion	BARI Piaz-1&2 BARI Piaz-2	Jan. 9, 2008 Jan. 11, 2008	5.5	130.00	1690	792	898
Potato	Diamant	Dec.18, 2007	0.38	28.00	245	137	108
Tomato	BARI tomato-2	Nov. 12 to 15, 2007	9.	1211	7530	1341	6189
Summer tomato	BARI tomato-4	Oct.10, 2007	2	118.00	2260	1150	1110

Table 2. Performance of different creeper vegetables grown on trellis under Sorjan method

Crops	Variety	Sowing/planting date	Area (dec.)	Total yield (kg)	Gross return (Tk)	TVC (Tk)	Gross margin (Tk)
Bottle gourd	Khetlau	Sept.6, 2007	5	411	5053	1470	3583
Country bean	BARI shim-1&2	Sept. 9, 2007	5	228	1906	1330	576
Bitter gourd	Gojkorola	Sept. 21, 2007	2.5	13.000	223	725	-502
Cucumber	Shahi-50	Sept. 21, 2007	2.5	18.500	185	715	-530
Yard long bean	Kagarnatoki	Sept. 21, 2007	2.5	32.500	340	740	-400

Table 3. Seedling/sapling raising and income of sorjan area

Name of seedling/sapling	Sale	Gross return (Tk)	TVC (Tk)	Gross margin (Tk)
Onion	29 kg	812	500	312
Jujubee	852 pieces	17744	2630	15114

Table 4. Performance of fish component under Sorjan method

Name of fish	Yield (kg)	Gross return (Tk)	TVC (Tk)	Gross margin (Tk)
Telapia, Ruhi, Mrigel, Mirrorcurp & Bata	15.55	1097	775	322

Table 5. Establishment of BARI developed high value fruits garden at Madhupur village

Farmers Name	Area (dec.)	Date of planting	Fruit Sapling	Variety	Number of plant	Date of planting	Date of fertilizer application	Present condition
Md. Abdur Razzak	33	4-9-07	Mango	BARI aam-2	24	4-9-07	2-9-07	Good
			Guava	BARI-2	150		4-12-07	Started flowering
Md. Abdur Razzak	33	4-9-07	Litchi	BARI-1,2,3	18	4-9-07	2-9-07	Good
			Guava	BARI-2	150		4-12-07	30% at flowering stage
Md. Salim	66	26-9-07	Mango	BARI-2	21	26-9-07	22-12-07	Good
			Mango	BARI-3	70		7-4-08	Good
Md. Mokbul Hossain	50	26-9-07	Mango	BARI-2	28	26-9-07	25-12-07	,,
			Mango	BARI-3	63		10-4-08	,,
Md. Mokter	33	13-9-07	Mango	BARI-2	21	13-9-07	24-12-07	,,
			Mango	BARI-3	11			,,
			Guava	BARI-2	160		7-4-08	
Md. Razob Ali	33	26-9-07	Mango	BARI-2	22	26-9-07	4-12-07. 10-4-08	Good
Md. Shadullah dulal	33	4-9-07	Mango	BARI-3	82	4-9-07	7-12-07 10-4-08	Good
Md. Amzad Hossain	50	13-9-07	Mango	BARI-3	105	13-9-07	7-12-07	Good
			Guava	BARI-2	300			
Md. Bakibillah	30	4-9-07	Mango	BARI-3	115	4-9-07	10-12-07	Good

Training, Workshop, Networking meeting, Field days and Publications, 2007-08

Project: Agriculture Sector Programme Support Phase II (AEC-BARI)

Training for scientists

Training programme	Venue	Duration	Participants
Integrated Crop Management	BARI, Joydebpur, Gazipur	5 days	33
Integrated Crop Management	ARS, OFRD, BARI, Rangpur	5 days	24

Orientation Training for field staff

One day orientation training programme was held at the different locations to orient the scientific assistant/senior scientific assistants. In those training programmes, sub assistant agriculture officers of DAE of respective sites were participated.

Venue	No. of participants		
	SA/SSA	SAAO	Total
ARS, BARI, Rangpur	37	4	41
OFRD, BARI, Barind, Rajshahi	34	6	40
BARI, Gazipur	33	8	41
OFRD, BARI, Comilla	35	6	41
RARS, BARI, Jamalpur	29	6	35
	168	30	198

Training programme for co-operator farmers

Four hundred cooperator farmers of 14 locations were oriented on the on-going experiment

Locations	No. of farmers
Rangpur	45
Barind	25
Shyampur	35
Pabna	35
Bogra	35
Tangail	35
Jamalpur	30
Mymensingh	30
Kishoreganj	25
Noakhlai	25
Patuakhali	25
Sylhet	20
Comilla	25
Manikganj	10
Total	**400**

Organization of Workshops, Networking Meeting and Field Days:

Altogether 8 regional workshops were organized where 491 participants from DAE, NARS institutes, AEC, NGOs and agricultural organizations attended. There were 13 networking group meetings with 204 participants include DD, DTO, SMS and SAAO of DAE, scientists from OFRD and farmers representatives. There were 55 field days held where 4400 participants attended (80% of them are farmers both male and female).

Regional research review and program planning workshop 2008

Regions	Venue	No. of participants
Rangpur	WRC, BARI, Nashipur, Dinajpur	64
Rajshahi	RARS, BARI, Ishurdi	72
Jamalpur	RARS, BARI, Jamalpur	52
Comilla-Sylhet	BRRI, Comilla	55
Dhaka	BARI, Gazipur	67
Jessore	RARS, BARI, Jessore	67
Barisal	RARS, BARI, Barisal	67
Chittagong	RARS, BARI, Hathazari, Chittagong	47
	Total	**491**

Networking group meeting

Locations	No. of participants
Rangpur	22
Barind and Shyampur, Rajshahi	21
Pabna	18
Bogra	18
Tangail	14
Jamalpur	13
Mymensingh	12
Kishoreganj	11
Noakhlai	17
Patuakhali	15
Sylhet	14
Comilla	13
Manikganj	16
Total	**204**

Field days

Location	No. of filed days	No. of participants
Rangpur	7	7 x 80 = 560
Barind	3	3 x 80 = 240
Shyampur	6	6 x 80 = 480
Pabna	6	6 x 80 = 480
Bogra	4	4 x 80 = 320
Tangail	5	5 x 80 = 400
Jamalpur	3	3 x 80 = 240
Mymensingh	4	4 x 80 = 320
Kishoreganj	3	3 x 80 = 240
Noakhali	3	3 x 80 = 240
Patuakhali	3	3 x 80 = 240
Sylhet	3	3 x 80 = 240
Comilla	3	3 x 80 = 240
Manikganj	2	2 x 80 = 160
Total	55	55 x 80 = 4400

v) Publication

AEC/OFRD published two booklets on (a) requirement of boron on maize, and (b) requirement of boron on mungbean.

Project: On-Farm technology transfer through farmers' participation

Field day

Subject	Venue	Date	Categories of participants	Number of Participants
Field day on the activities of ATT project	FSRD site, Rangpur	28-05-08	BARI, DAE, NGO and Farmers	80
Field day on year round vegetable production	FSRD site, Rajshahi	28-05-08	BARI, DAE, NGO and Farmers	100
Field day on BARI Mung	FSRD site, Faridpur	15-05-08	BARI, DAE, NGO and Farmers	120
Field day on BARI Mung	FSRD site, Patuakhali	06-05-08	BARI, DAE, NGO and Farmers	80
Field day on Soybean	FSRD site, Noakhali	28-05-08	BARI, DAE and NGO and Farmers	160

Training

Venue	Title of training	Number of Participants	Categories of participants
FSRD site Laharirhat, Rangpur	Training on Agricultural Technology Transfer	30 (one batch) 30 (one batch)	SA/SSA/SAAO Farmers
FSRD site, Kadamshahar, Rajshahi	Training on Agricultural Technology Transfer	30 (one batch) 30 (one batch)	SA/SSA/SAAO Farmers
FSRD site, Hatgobindapur, Faridpur	Training on Agricultural Technology Transfer	30 (one batch) 30 (one batch)	SA/SSA/SAAO Farmers
FSRD site, Razakhali, Patuakhali	Training on Agricultural Technology Transfer	30 (one batch) 30 (one batch)	SA/SSA/SAAO Farmers
FSRD site, Noakhali	Training on Agricultural Technology Transfer	30 (one batch) 30 (one batch)	SA/SSA/SAAO Farmers

Networking group meeting

Venue	Date	Number of member
FSRD site Laharirhat, Ranrpur,	17-05-08	15
FSRD site, Kadamshahar, Rajshahi	30-05-08	15
FSRD site, Hatgobindapur, Faridpur	08-06-08	15
FSRD site, Razakhali, Patuakhali	06-05-08	15
FSRD site, Hazirhat, Noakhali	02-06-05	12

Project: On-Farm Validation of Summer Onion Production Technologies at Farmers Field

Field days on summer onion production technologies, 2007-08

Location	Date	Category of participants	No. of participants
Dhirshram, Gazipur	20, January, 2008	BARI, DAE, NGO & Farmers	60
Sylhet	20 January, 2008	"	40
Camilla	22 January, 2008	"	56
Faridpur	23 January 2008	"	82

Training and Field days

Station	Date	Training/Field day	Category of participants
Barind	26-01-08	Training on Production technology	30 farmers (male & female)
	26-01-08	Field day	42 farmers, scientist, DAE & NGO personnel
	26-06-08	Training on homestead vegetable production	30 farmers
	27-06-08	Field day	50 farmers, scientist, DAE & NGO personnel
Patuakhali	03-02-08	Field day on homestead vegetable production	80 farmers, scientist, DAE & NGO personnel
	06-03-08	Field day on Potato	80 farmers, scientist, DAE & NGO personnel
	31-03-08	Field day on Mungbean	80 farmers, scientist, DAE & NGO personnel
	17-04-08	Field day on Sweet potato	80 farmers, scientist, DAE & NGO personnel
	20-05-08	Field day on Sesame	80 farmers, scientist, DAE & NGO personnel
Rangpur	16-06-08	Field day on different cropping patterns	70 farmers, scientists, DAE & NGO personnel
Faridpur	05-02-08	Field day on mustard	100 farmers, scientist, DAE & NGO personnel
	08-02-08	Training on different cropping patterns	30 farmers (male and female)
	09-04-08	Field day on onion	250 farmers, scientist, DAE & NGO personnel

List of Scientists Involved With On-Farm Research Division (2007-08)

Head Quarter, Gazipur
Dr. M Baridul Islam, CSO (A/C)
Dr. M Yusuf Ali, PSO
Dr. M Mohabbat Ullah, SSO
Dr. A S M Mahbubur Rahman Khan, SSO
Md. Rafiqul Islam*, SSO
Dilwar A Choudhury*, SSO
Quamrun-Naher, SO
Md. Akhtar Hossain, SO
Md. Kamrul Hasan, SO

Shibpur
Md. Asaduzzaman, SO

Tangail
Md. Mohi Uddin, SSO
Md. Mahmudul Islam Nazrul*, SSO
Md. Aminur Rahman, SO
Md. Mahmudur Rahman, SO
Mostak Ahmed, SO
Md. Khairul Alam, SO

Jamalpur
Md. Golam Moula, PSO
Md. Rajab Ali*, SO

Mymensingh
Dr. N C Basak, SSO
Nargis Sultana*, SO
Shamim Ara Begum, SO
Sonali Dey, SO

Kishoreganj
M A Helim Khan, SO

Shyampur, Rajshahi
Dr. Naresh Chandra Deb Barma, PSO (RWRC)
Md. Nur-E-Alam Siddquie, SO
Md. Abdullah-Al- Mamun, SO
Md. Mostafizur Rahman Shah, SO

Barind, Rajshahi
Md. Shafiqul Islam, SSO
Md. Alimur Rahman*, SO
Md. Abdus Salam*, SO
Md. Faruque Hossain, SO
Md. Shakhawat Hossain, SO

Pabna
Dr. Md. Abdul Momin, PSO
Dr. Md. Akkas Ali, SSO
Md. Rabiul Alam, SO
Md. Shamim Hossain Mollah, SO
Md. Bahauddin Ahmed, SO

Bogra
Md. Jamiul Islam, PSO (LPR)
Dr. Md. Abdur Rashid**, PSO
Md. Shahidullah, SSO
Md. Rahmat Ali Mollah, SO
Most. Arzuman Akther, SO

Dinajpur
S M A Jabber*, SO

Rangpur
Md. Abdul Mannaf, PSO
Dr. Md. Kalim Uddin, SSO
Ashish Kumar Saha*, SSO
A H M Mostofa Kamal, SO
Selina Hasan, SO
Md. Masud Karim**, SO
Shohag Mahfuz, SO
Md. Jannatul Ferdouse, SO

Jessore
Md. Abdur Rahim, PSO
Md. Asraf Hossain, SSO
Md. Kawser Uddin Ahmed*, SSO
Jahan Al Mahmud, SO
Md. Golam Azam, SO

Patuakhali
Md. Idris Ali Hawlader, SSO (A/C)
Md. Shahidul Islam, SO
H M Khairul Basher, SO
Mahmud Hossain-al-Mamun, SO

Faridpur
Dr. M Sirajul Islam, SSO
Selim Ahmed, SO

Khulna
Sheikh Mostafa Zaman, SSO
Md. Mosharraf Hossain, SO

Kushtia
M M Kamrozzaman, SSO
Most. Nazma Pervin, SO

Barisal
Md. Shahidul Islam Khan*, SSO
Md. Abdur Razzaque, SO (RARS)

Hathazari
Parimal C Sarker*, SO
Md. Mizanur Rahman, SO (RARS)

Noakhali
Dr. Mohammed Amin, SSO
Md. Zahangir Hossain, SO
Md. Sarfuddin Bhuiyan, SO
Md. Asiqur Rahaman, SO
Abul Hasnat Md. Amir Faisal, SO

Sylhet
Apurba K Choudhury*, SSO
Md. Jamal Hossain, SSO (AC)
Md. Mamunur Rashid Sarker, SO
Mohammad Ali, SO
Mohammad Hossain Sarker, SO

Comilla
Dr. Md. Nazrul islam, SSO
Mia Md. Bashir, SO

Bandarban
Md. Jamal Uddin*, SO
Md. Moktadir Alam, SO

---

*Higher study, **Transfer to other Division

List of SSA/SA Involved With On-Farm Research Division (2007-08)

Head Quarter, Gazipur
Md. Nasimul Haque, SSA, HQ
Md. Abul Basher, SA, HQ
S M Obaidur Rahman, SA, HQ
Md. Shah Alam, SA, BTV ,Taratpara
Md. Nurun Nabi, SA, MLT, Dherashram
Md. Shafiqul Alam, SA, MLT, Dherashram
Md. Mustafizur Rahman, SA, MLT, Dherashram
M A Malek, SA, MLT, Manikganj
Md. Saijudding, SA, MLT, Manikganj
Md. Mahbubur Rahman, SA, MLT, Munshiganj

Shibpur, Narsingdi
Md. Nasiruddin Ahmed, SSA
Md. Anwar Hossain, SA
Md. Mubarak Hossain, SA
Nur Jahan, SA

Jamalpur
Md. Abul Kalam Azad, SSA, FSRD, Kushumhati
Md. Selim Zahangir, SA, FSRD, Kushumhati
Md. Babul Hossain, SA, FSRD, Kushumhati
Md. Shahidullah Haque, SA, FSRD, Kushumhati
Sharifa, SA, FSRD, Kushumhati
Miss. Rubia Begum, SA, FSRD, Kushumhati
Khon. Md. Zafar Iqbal, SA, FSRD, Kushumhati
Md. Mahbubur Rahman, SA, FSRD, Kushumhati
Md. Abdus Sattar, SSA, MLT, Jhenaigati
Md. Abul Hossain, SA, MLT, Jhenaigati
Farid Ahmed, SSA, MLT, Malancha
Md. Aminul Islam, SA, MLT, Malancha
Md. Hafizur Rahman, SA, On-Station
Khon. Md. Mojibur Rahman, SA, On-Station

Mymensingh
Md. Shamsul Alam Khan, SSA, MLT, Netrakona
Md. Saiful Islam, SA, MLT, Netrakona
Md. Rafiqul Islam, SA, MLT, Netrakona
Md. Rafiqul Islam, SSA, MLT, Trishal
Md. Abdul Quayum, SA, MLT, Trishal
Faruque Ahmed, SA, MLT, Mym. Sadar
Md. Abdul Haye, SA, MLT, Mym. Sadar
Md. Harisur Rahman, SA, MLT, Mym. Sadar

Kishoreganj
Md. Serajul Islam Bhuiyan, SA, MLT, Kendua
Mr. Ratan Kumer Sarker, SA, MLT, Kendua
M. A. Kyuim, SA, MLT, Sadar
Md. Shahidullah, SA, MLT, Sadar
Jahanara Dipu, SA, MLT, Sadar
Md. Nazrul Islam, SA, MLT, Hossainpur

Tangail
Ajit Baran Nandi, SSA, MLT, Tangail Sadar
K.M.A Aziz Talukder, SA, FSRD, Ellenga
Md. Afaz Uddin, SA, FSRD, Ellenga
Md. Baha Uddin, SA, FSRD, Ellenga
Md. Mosharaff Hossain, SA, FSRD, Ellenga
Md. Abdul. Matin, SA, FSRD, Ellenga
Md. Nurul Islam, SA, FSRD, Ellenga
Md. Shamsul Alam Mia, SSA, MLT, Ghatail
Md. Habibur Rahman, SA, MLT, Ghatail
Md. Abdus Samad, SSA, MLT, Madhupur
Suma Akter, SA, MLT, Madhupur
Md. Lutful Haque, SA, MLT, Bhuyapur
Md. Abdul Mannan, SA, MLT, Bhuyapur

Sylhet
Md. Kamal Hossain, SA, FSRD, Jalalpur
Syed Abu Rayhan, SA, FSRD, Jalalpur
Md. Kamrul Islam Khan, SA, FSRD, Jalalpur
Asma Khatun, SA, FSRD, Jalalpur
Md. Mofijur Rahman, SA, MLT, Sunamgonj
Md. Enayet Sharif, SA, MLT, Moulvibazar

Pabna
Mr. Chandi Das Kundu, SSA, FSRD, Puspapara
Mr. Amirul Islam, SSA, FSRD, Puspapara
Mr. Anwarul Kabir, SSA, FSRD, Puspapara
Mr. Md. Abdul Gani, SA, FSRD, Puspapara
Mr. Md. Moniruzzaman Siddique, SA, FSRD, Puspapara
Mr. Md. Abdus Samad, SA, FSRD, Puspapara
Mr. Md. Fazlar Rahman, SSA, MLT, Kahsinathpur
Mr. Md. Abdul Gani Sheikh, SSA, MLT, Sujanagor
Mr. Md. Abu Bakar Siddique, SA, MLT, Chatmohor
Mr. Md.Monsur Rahman, SA, MLT, Chatmohor
Mr. ASM Zahidul Alam, SA, MLT, Pakshi, Ishurdi
Mr. Azizul Islam, SA, On-station
Mr. Md. Mohsin Alam, SA, On-station
Mr. Md. Noymul Islam, SA, On-station

Barind, Rajshahi
Md. Rezaul Habib Sarker, SSA, FSRD, Kadamshahar
Md. Abul Kalam Azad, SSA, MLT, Amnura, Nawabgonj
Md. Moshiur Rahman, SSA, FSRD, Kadamshahar
Md. Golam Arif, SA, FSRD, Kadamshahar
Md. Jakir Hossain, SA, FSRD, Kadamshahar
Md. Mostafizar Rahman, SA, FSRD, Kadamshahar
Md. Abdul Mannan, SA, FSRD, Kadamshahar
Md. Mofidul Islam, SA, FSRD, Kadamshahar
Md. Solaiman Goni, SA, FSRD, Kadamshahar
Md. Saifuzzaman, SA, FSRD, Kadamshahar
Md. Ansar Ali, SA, FSRD, Kadamshahar
Md. Rezaul Karim Mondol, SA, MLT, Amnura, Nawabgonj
Md. Golam Rabbani Raton, SA, MLT, Sapahar, Naogaon
Mrs. Mahmuda Khatun, SA, On-Station

Bogra
Md. Ruhul Amin, SSA, MLT, Joypurhat
Md. Resabul Haque, SA, MLT, Joypurhat
Md. Saifur Rahman, SA, MLT, Shibganj
Md. Abdul Jabber, SA, MLT, Shibganj
Md. Abul Kalam Azad, SA, MLT, Gabtali
A B M Mohmudul Islam, SA, MLT, Gabtali
Faruk Ahmed, SA, MLT, Sherpur/Nandigram
Md. Amzad Hossain, SA, MLT, Sherpur/Nandigra
Samir Kumar Das, SSA, On-station
Md. Saiful Islam, SSA, on-station
Md. Saidul Islam, SSA, On-station
Md. Waresh, SA, MLT, On-station
Md. Anwar Hossain, SA, On-station
Md. Shahjahan Ali, SA, On-station
Md. Abdus Sobhan, SA, On-station
A K M Nazrul Islam, SA, On-station
Rozina Khatun, SA, On-station
Md. Abu Hena, SA, On-station
Sumona Parvin, SA, On-station

Rajbari, Dinajpur
M Abul Hossain, SSA
M Lutfor Rahman, SA
M Mojnun Naher, SA

Rangpur

M Jainul Abedin, SSA
M Abdur Rahim, SSA
M Shamsul Haque, SSA
Syed Mafijul Islam, SSA
M Ali Mondal, SSA
M Abdul Hadi, SSA
M Nousher Ali, SA
M Mizanur Rahman, SA
M Ataur Rahman, SA
M Sharowar Jahan, SA
M Wahidur Rahman, SA
M Aziz Ahmed, SA
M Jahidul Islam, SA
M Faisal Alam Sarker, SA
M Mominul Islam, SA
M Shafiqul Islam, SA
M A Goffer Sarker, SA

Comilla

Md. Abul Khair, SSA, MLT, Sultanpur
Md. Moniruzzaman, SA, MLT, Sultanpur
Md. Sakander Ali, SSA, MLT, Shaharasti
Md. Harunur Rashid, SSA, MLT, Debiddar
Md. Habibur Rahaman, SA, MLT, Debiddar
Mrs. Rijwana Parvin, SA, MLT, Debiddar
Mrs. Nasima Akhter, SA, MLT, Debiddar
Abdur Razzak Dewanzi, SA, Sadar, Comilla
Md. Monir Hossain, SA, MLT,Sadar, Comilla
Md. Mahabubur Rahaman, SA, MLT, Barura
Shuma Akhter, SA, Sadar, Comilla
Shirin Akter, SA, Sadar Comilla
Irin Sultana, SA, Sadar, Comilla
Farida Yasmin, SA, Sadar, Comilla

Noakhali

Md. Anwarul Haque, SSA, FSRD, Noakhali
Md. Ismail, SA, , FSRD, Noakhali
Md. Noor Hossain, SA, FSRD, Noakhali
Md. Abul Hossain, SA, FSRD, Noakhali
Md. Nasir Uddin Al Mahmud, SA, FSRD, Noakhali
Tajrian Begum, SA, FSRD, Noakhali
Md. Mahabubur Rahman, SA, FSRD, Noakhali
Md. Sadequr Rahman, SA, FSRD, Noakhali
Mohammad Jamal Hossain, SA, FSRD, Noakhali
Md. Shamsuddin, SSA, MLT, Laxmipur
Md. Main Uddin Mahmud, SA, MLT, Feni

Patuakhali

Md. Habibur Rahman, SSA
Ambika Kumar, SA
Md. Rabiul Awal, SA
Md. Shahidul Islam, SA
K. M. Enamul Haque, SA
Dheman Howlader, SA
Md. Delwar Hossain, SA
Dilruba Yasmin, SA
Md. Mirazur Rahman, SA
Md. Afzal Hossain, SA

Hathazari, Chittagong

M Shahidul Alam, SA
M Ear Hossain, SA
M Mujibur Rahman, SA
Ratna Choudhury, SA
M Akram Hossain Siddique, SA
Shahanara Khatun, SA
Md. Asaduzzaman, SA
Md. Kamal Mahmud Sharif, SA

Barisal

M Dilwar Hossain, SSA, MLT, Gournadi
Sanjay Kumar Mondal, SA, MLT, Nazirpur
M Ashraful Alam, SSA, Rahmatpur
Zakir Hossain, SA, Sadar
Abdullah Al Mamun, SA
M Saifur Rahman, SA, Sadar
M Yakub Ali, SA, Sadar
M Kabir Hossain, SA, Sadar
Asia Khatun, SA, Sadar
Jannatul Ferdouse, SA, Sadar

Jessore

Md. Ansar Ali, SSA
Md. Abul Hossain, SSA
Md. Abdur Razzak, SSA
Niranjan Sarker, SSA
Ambika Kumar, SSA
Bimol Kumar Roy, SSA
Md. Mokaddes Khan, SSA
Aghni Kumar Sikder, SA
Md. Sahabuddin, SA
Md. Abdur Rouf, SA
A B S M Sobhan, SA
Sohel Ahmed Sabbir, SA
Md. Shamsul Alam, SA
Md. Nazmul Kabir, SA

Khulna

Md. Tabibur Rahman, SSA, Dumuria MLT, Khulna
Mr. Amaresh Chandra Sarker, SA, MLT, Satkhira
Md. Moshiur Rahman, SA, Banerpota Farm, Satkhira
S.M. Asaduzzaman, SA, Dacope, Khulna
S.M. Motiar Rahman, SA, MLT, Dumuria Khulna
Mr. Swapan Ray, SA, Sub-Station, Daulatpur, Khulna
Md. Abdus Samad, SA, MLT, Satkhira
Abu Md. Khairul Anam, SA, MLT, Dumuria, Khulna
S.M. Delower Hossain, SA, MLT, Bagerhat
Md. Moniruzzaman, SA, MLT, Bagerhat
Mr. Gagendra Nath Mondal, SA, MLT, Satkhira
Md. Sadequr Rahman, SA, Banerpota Farm, Satkhira
Md. Yaqub Ali, SA, Banerpota Farm, Satkhira

Kushtia

Md. Atiul Islam, SSA
Md. Sorour Uddin, SA
Sk. Yousuf Harun, SA
Md. Rashel Kabir Tarafder, SA
Dipongkar Biswas, SA

Faridpur

Md. Nurul Islam, SSA (MLT site, Rajbari)
Md. Jamal Uddin, SA
Md. Humayun Kabir, SA
Md. Farid Ahmed, SA
Md. Abu Baker Siddik, SA
Md.Alauddin,SA
Mohammad Alauddin,SA
Md. Golam Mostafa, SA
Md. Rezaul Karim, SA
Md.Masud Rana, SA
Md.Harun-or-Rashid, SA

Shyampur, Rajshahi

Shree Jamuna Ray, SSA
Md. Mozahar Ali Mollah, SSA
Md. Jamatullah, SA
M M Khurshid Alam, SA
M Yeasin Mollah, SA

List of Farming Systems Research and Development (FSRD) and Multilocation Testing (MLT) sites

A. FSRD SITES

1. Kushumhati, Sherpur sadar, Sherpur
2. Jalalpur, Sylhet sadar, Sylhet
3. Ellenga, Kalihati, Tangail
4. Lahirirhat, Rangpur
5. Pushpapara, Pabna sadar, Pabna
6. Hatgobindapur, Faridpur sadar, Faridpur
7. Rajakhali, Dumki, Patuakhali
8. Hazirhat, Noakhali sadar, Noakhali
9. Kadamshahar, Godagari, Barind, Rajshahi

B. MLT SITES

Region-1

Pabna	:	Pakshi, Sadar, Bhabanipur-Sujanagar, Khaloibhara-Sathia, Atgoria
Shyampur, Rajahahi	:	Noudapara-Paba, Baneshar-charagata, Rajshahi
Barind, Rajshahi	:	Aamnura-Chapai nawabganj sadar, Sapahar, Naogaon
Rangpur	:	Domar-Nilphamari, Ulipur-Kurigram, Gobindaganj-Gaibandha
Bogra	:	Sherpur, Shibganj, Joypurhat, Gabtali
Rajbari, Dinajpur	:	Biral, Sadar (Takurgaon)

Region-2

Jamalpur	:	Tatultala-Jhenaigati, Maloncha-Melandah
Tangail	:	Gatail, Madhupur, Gobindadasi-Bhuyapur
Mymensingh	:	Trishal, Netrakona sadar, Mymensingh sadar
Kishoreganj	:	Karimganj, Pirijpur, Sadar, Hossenpur

Region-3

Jessore	:	Tularampur-Narail, Shalikha-Magura, Kaliganj-Jhenaidah, Jikargacha-Jessore, Kuadabazar-Monirampur
Khulna	:	Satkhira sadar (Gopinampur Magura), Bagherhat sadar (Srighat), Dumuria (Sajiara), Laodop-Daccope (Khulna)
Kushtia	:	Bamondi, Alamdanga, Kazirhat-Bharamara
Faridpur	:	Rajbari sadar, Mostafapur-Madaripur
Patuakhali	:	Aamtali, Alipur/Mohipur
Barisal	:	Goranadi-Barisal, Dakkin Ratanpur-Bhola, Nazirhat-Pirojpur

Region-4

Hathazari	:	Rasangiri, Samitirhat-Fatikchari, Kharan, Junglekhail-Patiy, Jilonja-Cox's bazar, Sadaha-Satkanya
Noakhali	:	Dagonbhuiya-Celumia, Turapganj & Laxmipur sadar
Comilla	:	Sadar, Chadpur sadar, B. Baria sadar, Debidder, Borura, Choddagram
Sylhet	:	Sadar, Jahangirnagar-Sunamganj, Islampur-Moulvibazar, Jakiganj
Bandarban	:	Lemujiri-Buhalong

Region-5

Gazipur	:	Manikganj sadar, Munshiganj sadar, Dhirashram, Gazipur sadar
Shibpur, Narsingdi	:	Shibpur, Narsingdi

THE END