ANNUAL RESEARCH REPORT
2004-05

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August 2005

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FSRDS = Farming System Research and Development Site and MLTS = Multilocation Testing Site

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A. PLAIN LAND

Performance of improved cropping pattern Tomato-Okra-T.Aman rice under rainfed condition

Abstract

Performance of improved cropping Tomato-Okra-T.Aman rice tested against the farmers existing cropping pattern (Tomato-Okra-T.Aman) under rainfed condition at medium highland of Kishoregonj sadar, MLT site during 2003-04. Fruit yield of tomato and Okra in improved cropping pattern were about 52 and 38 % higher than farmers existing cropping pattern. The grain yield of T.Aman was about 19 % higher than farmers pattern due to introduction of new varieties and improved management practices. Total gross margin obtained from improved cropping pattern was Tk. 210874/ha against Tk. 105687/ha from existing pattern. Similarly BCR (6.43) of whole pattern was also higher in improved cropping pattern. The improved cropping pattern performed well both agronomically and economically.

Introduction

In Bangladesh, per capita vegetable consumption is only 28 g against the daily requirement of 200 g (Chadha *et al*., 1994). Over 30 thousands infants become blind every year due to vitamin A deficiency (BARC, 1990). Vitamin C, iron and other mineral nutritional deficiency are widespread resulting in different types of diseases, hampering physical growth and retarding brain development. Rabi crop-Summer vegetable-T.Aman is one of the important cropping pattern under rainfed MHL of Old Brahmaputra Floodplain soil of Kishoregonj. In existing cropping pattern farmers cultivate local varieties of these crops and their yield is very low resulting in huge deficit of vegetables. Consequently the resource poor farmers cannot affords to buy the deficit vegetables and suffers from associated health problems due to reduced intake of vegetables which can fulfill the deficit of vegetables of resource poor farmers. There is a scope to develop a vegetable based cropping pattern such as Tomato-Okra-T.Aman rice. In recent years many farmers grow these vegetable scatteredly. In such situation Tomato-Okra-T.Aman rice cropping pattern can be feasible for vegetable production as well as total productivity and income can be increased for the farmers. Considering the above circumstances, a new cropping pattern Tomato-Okra-T.Aman rice has been designed for testing at Kishoregonj site.

Objectives

- To test the suitability of improved vegetable based cropping pattern.
- To increase the total productivity and income of the farmers of the locality.

Materials and Methods

The improved cropping pattern Tomato- Okra- T.Aman was tested against farmers existing cropping pattern (Tomato- Okra- T.Aman) under rainfed condition at sadar MLT site, kishoregonj during 2003-04. The soil of the experimental field belongs to Sonatola Soil Series under the Agro-ecological region Old Brahmaputra Floodplain (AEZ-9). The surface soil was loamy to clayey with pH value ranges from 6.64 to 6.75. The average maximum and minimum ambient temperature and total rainfall are presented in (Appendix-2) during the period of study.

The improved cropping pattern was tested with six dispersed replication across the farmers field under same land type. The unit plot size was 10 decimal. Tomato, Okra and T.Aman were grown during mid November to 3rd week of March, last week of March to1st week of July and last week of July to November. Each crop was grown in the same plot. The variety was Raton, BARI Derosh-1 and BRRI Dhan-32 of Tomato, Okra and T.Aman, respectively. In tomato the fertilizer dose was 250-90-125 kg NPK/ha and cowdung 10 t/ha. One half of cowdung and all phosphorus fertilizer were broadcast and incorporated during final land preparation. Remaining one half of cowdung was applied in pits prior to planting. Nitrogen and potasium fertilizers were applied as ring method in equal installments at 15 and 35 days after planting followed by weeding.

The second crop Okra (*Lycopersicon esculentum*) was seeding at last week of March and harvested on 3rd week of April to 1st week of July. The spacing was 50 ×45 cm a part row and seed rate was 5 kg/ha. In okra the fertilizer dose was 70-24-55 kg of NPK/ha and cowdung 5 t/ha. One half of N and full doses of other fertilizers were applied during final land preparation. Remaining N fertilizer was applied around the plant and incorporated with soil at 3rd and 5th week after seeding.

Thirty-five days-old seedlings of 3rd crop T.Aman rice (BRRI Dhan32) was transplanted at 3rd week of July and harvested on 3nd week of November, respectively. The spacing was 20 ×15cm a part row and seed rate was 35 kg/ha. In T.Aman rice the fertilizer dose was 70-16-30-3 kg of NPKS/ha. Except N the full doses of other fertilizers were applied during final land preparation. The N fertilizer was applied as top dress in three equal splits i.e. seedling establishment (15 DAT), rapid tillering stage (30-35 DAT) and 5-7 days before panicle initiation (65-70 DAT) stage. Intercultural operations such as weeding, thinning, and pest control were done properly as and when necessary.

Data on agronomic practices, human labour cost, animal power cost, input cost were recorded from the experimental plots and ten farmers plots were evaluated as compare to improved pattern.

Results and Discussions

In the improved cropping pattern the yield of tomato, okra and T.Aman were 52, 38 and 19 % higher than farmers existing cropping pattern, respectively. The improved cropping pattern achieved higher yield due to introduce of modern variety, use of balanced fertilizer and other agronomic practices. Rice equivalent yield in improved cropping pattern was 35.30 t/ha and in farmers cropping pattern it was 18.56 t/ha. In improved cropping pattern rice equivalent yield was about 90 % higher than farmers existing pattern due to introduce of high yielding varieties. On an average, the field duration of tomato and okra were 104 and 105 days, respectively. So, a short durated T.Aman rice variety grown successfully after okra cultivation. Turn around time between tomato-okra, okra-T.Aman and T.Aman-tomato were 5, 15 and 6 days in improved pattern and 10, 15, and 20 days in farmers existing pattern, respectively which indicated that the crops could be grown easily without disturbing the succeeding crop.

Cost and return analysis

The total variable cost of improved and farmers existing cropping pattern were Tk.55781and 40623 per hectare, respectively. The total variable cost was 37 % higher in improved pattern due to higher production cost involved in modern (HYV) varieties. The gross margin of improved and farmers existing pattern were Tk.210874 and 105687 per hectare, respectively. The gross margin was double in improved pattern though total variable cost was 37 % higher than farmers existing pattern. Benefit cost ratio (BCR) was calculated 6.43 in improved pattern while 4.68 in farmers existing pattern which indicated higher monetary advantages in improved pattern as well as enhance the total productivity of the farmers.

Farmer reaction

Farmers opined that the variety of tomato, okra and T.Aman were good due higher yield, disease resistant and high market value. They are very much impressive about higher yield and return of improved cropping pattern.

Conclusion and Recommendation

It is observed that the improved cropping pattern (Tomato-Okra-T.Aman) was economically profitable and higher remunerative than farmer existing pattern. The experiment needs to be continued at least further two years study for final recommendation.

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Table 1. Crop management of Improved cropping pattern as compared to farmers existing pattern under rainfed condition in MHL at Kishoregonj sadar MLT site during 2003-04

Parameters	Farmers existing cropping pattern			Improved cropping pattern		
	Crop-1	Crop-2	Crop-3	Crop-1	Crop-2	Crop-3
Crop	Tomato	Okra	T.aman	Tomato	Okra	T.aman
Variety	Local	Local	Pajam	Raton	BARI Dherosh-1	BRRI Dhan-32
No. of ploughing	4	4	4	4	4	4
Seed rate (kg/ha)	350 g.	8 kg	60 kg	200 g.	5 kg	35 kg
Fertilizer (kg/ha) N-P-K-S-CD.	55-25-37-0-8000	CD-5000	76-0-0-0-0-	250-90-125-0-10000	70-24-55-0-5000	70-16-30-0-0
Seedling age (days)	35-40	-	35-40	25-30	-	30-35
Sowing/Planting date (range)	05-15 Dec.	10-20 April.	05-15 July.	05-12 Dec.	20-25 Mar.	20-25 July
Spacing (cm)	50 × 40	haphazard	haphazard	60 × 40	50 × 45	20×15
Weeding (No.)	2	1	1	2	2	2
Pest control	-	-	-	IPM	IPM	-
Harvesting date (range)	05-30 Mar.	30 May-25 June	25-30 Nov.	10 Feb-20 Mar	25 April-05 July	25-27 Nov.
Field duration (days)	101	107	136	104	105	130
Turn around time (days)	5	10	10	9	5	15

Table 2. Agro-economic performance of improved cropping pattern as compared to farmers existing pattern under rainfed condition in MHL at Kishoregonj sadar MLT site during 2003-04

Parameters	Farmers existing cropping pattern			Total of whole pattern	Improved cropping pattern			Total of whole pattern
	Tomato	Okra	T.aman		Tomato	Okra	T.aman	
Main yield (t/ha)	22	5.6	2.56	18.56	46	9.1	3.15	35.30
By-product yield (t/ha)	-	-	3.14	*(REY)	-	-	3.77	*(REY)
Total variable cost (Tk/ha)	14005	11178	15440	40623	22570	15405	17806	55781
Gross return (Tk/ha)	132000	28000	30310	190310	276000	45500	37155	358655
Gross margin (Tk/ha)	117995	16822	14870	105687	253430	30095	19349	210874
BCR	9.43	2.50	1.96	4.68	12.21	2.95	2.07	6.43

* REY= Rice Equivalent Yield,

Input price (Tk./kg): Urea =6.00, TSP= 15.00, MP= 14.00, Gypsum= 4.00, Zinc sulphate= 55.00
Alpha Boron = 110.00, Cowdung = 0.50
Output price (Tk./kg): Tomato =6.00, Okra = 5.00, T.aman rice= 10.00, T.aman Straw = 1.50

Appendix 1. Month-wise weather data of the experimental site from January to December, 2004

Months	Temperature (°C)		Rainfall (mm)	Rainy days
	Maximum	Minimum		
January	20.9	14.47	-	-
February	24.06	18.82	-	-
March	31.03	23.70	22	2
April	30.33	25.76	377	15
May	32.45	27.93	149	6
June	30.26	27.36	545	16
July	32.32	28.03	849	24
August	32.35	30.64	343	16
September	30.60	26.66	426	13
October	29.06	25.03	251	5
November	25.56	21.00	-	-
December	23.61	17.67	-	-

Performance of alternate cropping pattern Jute-T.Aman-Khira under rainfed condition

Abstract

Performance of improved cropping Jute-T.Aman-Khira tested against the farmers existing cropping pattern (Jute-T.Aman) under rainfed condition at medium highland of Katiadi MLT site, Kishoregonj during 2004. Fibre yield of jute and grain yield of T.Aman rice in improved cropping pattern were about 18, and 16 % higher than farmers existing cropping pattern. The rice equivalent yield of improved pattern was (18.43 t/ha) which was about 53 % higher than farmers existing pattern (8.69 t/ha). The yield of improved pattern was higher than farmers existing pattern due to introduction of new varieties and improved management practices. Total gross return obtained from improved cropping pattern was Tk.171857/ha which was 51 % higher than farmers existing pattern (Tk. 84013/ha). Similarly BCR of whole pattern was also higher (3.19) in improved cropping pattern. The improved cropping pattern performed well both agronomically and economically.

Introduction

The existing cropping pattern under rainfed medium high land of Katiadi MLT site, Kishoregonj Old Brahmaputra Floodplain soil a vast area is Jute–T.aman. Farmers are used the local varieties of jute and T.aman and the land remain fallow. There is a scope to introduce high yielding varieties of jute and T.Aman and thereafter Khira. The productivity of jute and T.Aman could be increased by increasing improve varieties. Considering the above circumstances, a new cropping pattern Jute – T.Aman – Khira has been designed for testing at Katiadi MLT site, Kishoregong .

Objective:

- To test the suitability of proposed cropping pattern.
- To increase the total productivity of the locality.
- To increase the cropping intensity

Materials and Methods

The improved cropping pattern Jute-T.aman-Khira was tested against farmers existing cropping pattern (Jute-T.aman) at MLT site Katiadi, kishoregonj during 2004. The soil of the experimental field belongs to Sonatola Soil Series under the Agro-ecological region Old Brahmaputra Floodplain (AEZ-9). The surface soil was sandy loam to loamy with pH value ranges from 6.5 to 6.85. The average maximum and minimum ambient temperature and total rainfall are presented in (Appendix-1) during the period of study.

The improve pattern was tested with six dispersed replications across the farmers field under same land type. The unit plot size was 10 decimal. Jute, T.aman and Khira were grown during April to July, August to last week of November and December to March. Each crop was grown in the same plot. The variety were O-9897, BRRI Dhan-32 and Khira (local,), respectively. In jute the fertilizer dose was 57-12-38-14 kg/ha of NPKS and cowdung 5 t/ha. One half of urea and all other fertilizers were applied at the time of final land preparation. Another one half of urea was top dressed at 30-45 DAS followed by weeding.

Thirty-five days-old seedlings of second crop T.aman rice (BRRI Dhan32) was transplanted at 1st week of August and harvested on 3nd week of November, respectively. The spacing was 20 ×15cm a part with seed rate 30 kg/ha. In T.aman the fertilizer dose was 57-15-25-3 kg/ha of NPKS. Except N, the full doses of other fertilizers were applied during final land preparation. The N fertilizer was applied as top dress in three equal splits i.e. after seedling establishment (15 DAT), rapid tillering stage (30-35 DAT) and 5-7 days before panicle initiation (65-70 DAT) stage. Intercultural operation such as weeding, thinning, and pest control were done properly as and when necessary.

Third crop Khira (local) was sowing at 1st week of December and harvested on February to 3nd week of March. The spacing was 2×2m a part row and pit size was 50×50 cm. Seed rate was 1.5 kg/ha. In Khira, the fertilizer dose was 46-30-50 kg/ha of NPK and cowdung 5t/ha. Except N the full doses of other fertilizers were applied during prepared pit. Intercultural operation such as weeding, thinning, and pest control were done properly.

Data on agronomic practice, human labour cost, animal power cost, input cost were recorded from the experimental plots and ten farmers plots were evaluated as compare to improved pattern.

Results and Discussions

In the improved cropping pattern, the fibre yield of Jute and T.Aman rice were about 18, and 16 % higher than farmers existing cropping pattern. The rice equivalent yield of improved pattern was 18.43 t/ha which was about 53 % higher than farmers existing pattern (8.69 t/ha). The improved cropping pattern achieved higher yield due to introduction of modern variety, use of balanced fertilizer and other agronomic practices. On an average, the field duration of Jute and T.Aman were 110 and 105 days, respectively. So, Khira could be grown successfully after T.Aman cultivation.

Cost and return analysis

The total variable cost of improved and farmers existing cropping pattern were Tk.53932 and 37425 per hectare, respectively. The total variable cost was 31% higher in improved pattern due to higher production cost involved in modern (HYV) varieties. The gross margin of improved and farmers existing pattern were Tk.117925 and 46588 per hectare, respectively. The gross margin was 61% higher in improved pattern though total variable cost was 31% higher than farmers existing pattern. Benefit cost ratio of the whole pattern was 3.19 in improved pattern while 2.24 in farmers existing pattern which indicated higher monetary advantages in improved pattern as well as enhance the total productivity of the farmers.

Farmer reaction

Farmers opined that the variety of Jute, T.Aman and Khira were good but quality seed of jute and Khira are not available in farmers level. They are very much impressive about higher yield and return of improved cropping pattern.

Conclusion and Recommendation

It is observed that the improved cropping pattern (Jute-T.Aman-Khira) was economically profitable and higher remunerative than farmer existing pattern. The experiment needs to be continued at least further two years study for final recommendation.

Table 1. Agro-economic performance of improved cropping pattern as compared to farmers' pattern under rainfed MHL of Katadi MLT site, Kishoregonj during 2004-05

parameters	Farmers cropping pattern			Improved cropping pattern		
	Crop-1	Crop-2	Crop-3	Crop-1	Crop-2	Crop-3
Crop	Jute	T.aman	-	Jute	T.aman	Khira
Variety	Local	Pajam	-	O-9897	BRRI Dhan321	local
No. of ploughing	4	3	-	4	4	4
Seed rate (kg/ha)	8	40	-	6	30	1.5
Fertilizer(kg/ha) N-P-K-S-CD.	32-11-17-0-5000	65-17-28-0	-	57-12-38-14-5000	57-15-25-0	46-30-50-0-5000
Seedling age (days)	-	35-40	-	-	30-35	-
Transplanting date (range)	1st week of April	10-15 Aug.	-	1st week of April	06-10 Aug.	1st week of Dec.
Spacing (cm)	broad cast	20x15	-	broad cast	20x15	200x200
Weeding (No.)	3	1	-	2	2	4
Pest control	-	-	-	-	IPM	IPM
Harvesting date(range)	1st week of Aug	25-30 Nov.	-	Last week of July	17-25 Nov	22Feb-20 Mar.
Field duration (days)	115	112	-	110	105	110

Table 2. Agro-economic performance of improved cropping pattern as compared to farmers existing pattern under rainfed condition in MHL of Katiadi MLT site, Kishoregonj during 2004-05

Parameters	Farmers existing cropping pattern			Total of whole pattern	Improved cropping pattern			Total of whole pattern
	Jute	T.Aman	Khira		Jute	T.Aman	Khira	
Main yield (t/ha)	2.82	3.26	9.26	8.69	3.45	3.88	14.11	18.43
By-product yield (t/ha)	4.23	3.86	-	**(REY)	4.45	3.95	-	**(REY)
Total variable cost (Tk/ha)	27447	9978	-	37425	28216	11371	14345	53932
Gross return (Tk/ha)	48883	39839	-	84013	60411	40875	70571	171857
Gross margin (Tk/ha)	21436	29861	-	46588	32195	29504	56226	117925
BCR	1.78	3.99		2.24	2.14	3.59	4.92	3.19

**REY= Rice Equivalent Yield

Input price (Tk./kg): Urea =6.00, TSP= 16.00, MP= 15.00, Gypsum= 4.00, Cowdung = 0.25
Output price (Tk./kg): Fibre= 15.00, Stick = 1.5, T.aman rice= 9.00, T.aman Straw = 1.50, Khira= 5.00

Intercropping of Groundnut with different short duration vegetable crops

Abstract

The experiment was conducted at MLT site Katiadi, Kishoregonj during rabi season of 2004-05. The experiment was laid out in RCB design with four replications. There was five treatments viz. T_1 = Monoculture groundnut, T_2= Two rows of lalshak in between two 40 cm apart rows of groundnut T_3= Two rows of spinach in between two 40 cm apart rows of groundnut T_4= Two rows of amaranth in between two 40 cm apart rows of groundnut and T_5= Two rows of bushbean in between two 40 cm apart rows of groundnut. Higher groundnut equivalent yield was obtained from the treatment groundnut+ spinach (3.54 t/ha) and groundnut+lalshak (3.08 t/ha) which were were 47 % and 28 % higher than sole groundnut, respectively. The highest gross return obtained from groundnut+ spinach intercropping system which was 47 % higher than sole groundnut.

Introduction

Intercropping is a very common practice throughout the country. It is the practice of growing two or more crops simultaneously in the same land area. It paves the way for increasing crop production per unit land area. This has been reported from many countries viz. Bangladesh, India, China, Sri. Lanka, Taiwan.In Bangladesh continued population expansion has been facing the farm household to utilize the available crop land more intensively to produce more food. Because significant expansion of cultivated area in Bangladesh is not an economically or environmentally sound option like most countries of the world.

Groundnut (*Arachis hypogaea*) is a oilseed crop having high energy index. On the other hand, leguminous crops are highly nutritious and improve soil fertility by fixing atmospheric nitrogen. Vegetable like Lalshak, Spinach, Data, Bushbean are grown in the marginal lands and the yield of these crops is low. In Kishoregonj district, groundnut is a major oilseed crop generally grown as sole crop. Now a days groundnut is grown sporadic and in some pocket areas due to expansion of Boro rice cultivation. So, to increase the production of vegetable, intercropping with groundnut may be good practice. Therefore, the experiment was designed to study the feasibility of growing different rabi vegetables with groundnut with the following objectives-

1. To find out the agro-economic performance of inter cropping vegetable with groundnut.
2. To increase vegetable production of the locality.

Materials and Methods

The experiment was conducted at MLT site Katiadi, Kishoregonj during rabi season of 2004-05. The experiment was laid out in RCB design with four replications. The unit plot size was 5 m x 4.0 m. There was five treatments viz. T_1 = Monoculture groundnut T_2= Two rows of lalshak in between two

40 cm apart rows of groundnut T_3= Two rows of spinach in between two 40 cm apart rows of groundnut T_4= Two rows of amaranth in between two 40 cm apart rows of groundnut and T_5= Two rows of bushbean in between two 40 cm apart rows of groundnut. Spacing of groundnut was maintained at 40 cm x 10 cm. The plot was fertilized with 30-44-83-30-4-1 kg of NPKSZnB/ha. Additional 60 kg N/ha was applied in intercropping plots as top dressing in 20 and 35 days after emergence (DAE) of groundnut. The variety of groundnut was Dhaka-1. Seeds of groundnut and vegetable were sown on 9, December 2003 and harvested on 30 April 2004. Groundnut plant characters were recorded and analyzed statistically.

Result and Discussion

Table1 shows the results of yield and yield contributing characters of groundnut. The plant height, number of pods/plant, seed/pod and 1000-kernal weight were statistical significant at 5% level. Pod yield of sole groundnut was statistically higher than other intercrop treatment. The lowest pod yield was obtained from groundnutn + bushbean intercrop due to pods/plant, seed/pod and 1000 kernal weight of groundnut were lower in this combination.

Groundnut equivalent yield and economic analysis of different treatments have been shown in Table2&3. Higher groundnut equivalent yield was obtained from the treatment groundnut+ spinach (3.54 t/ha) and groundnut+lalshak (3.08 t/ha). The lowest groundnut equivalent yield (2.10 t/ha) was obtained from the combination of groundnut+bushbean. Groundnut+ spinach and groundnut+lalshak equivalent yield were 47 % and 28 % higher than sole groundnut, respectively. Gross return varied from Tk. 42,090.00 to Tk. 70,840.00/ha. The highest gross return obtained from groundnut+ spinach intercropping system which was 47 % higher than sole groundnut. The benefit cost ratio in the intercrop varied from 1.32 to 2.26. The highest benefit cost ratio was in groundnut+spinach and the lowest in groundnut+ bushbean. The experiment needs to be continue for another year for confirmation.

Farmers reaction

Farmers opined that Spinach and lalshak in between two rows of groundnut was more suitable combination due to moderate yield of groundnut with additional higher yield of spinach and lalshak. They also opined that if they can sow vegetable in early then it might be more profitable.

Table 1. Yield and yield components of groundnut as affected by intercropping with vegetable at MLT site Katiadi during rabi 2004-05

Treatment	Plant pop. /m^2	Maturity (days)	plant height (cm)	pods/plant (No.)	Seed/pod (No.)	1000-kernal wt. (g)	Yield (t/ha)
T_1	22	160	61.7a	25.16a	1.70a	258a	2.41a
T_2	22	164	55.83b	18.06c	1.70a	247ab	1.78b
T_3	22	166	59.1ab	23.36b	1.60b	248ab	1.87b
T_4	22	164	55.76b	16.10d	1.70a	231bc	1.40c
T_5	21	164	50.3c	12.50e	1.60b	223c	1.20c
LSD (0.05)	ns	ns	4.77	1.34	0.042	21.16	0.13
CV (%)	1.16	3.45	5.47	4.57	1.61	5.68	6.22

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

Table 2. Yield of groundnut, onion, garlic and groundnut equivalent yield of groundnut intercropping with garlic and onion at MLT site Katiadi during rabi 2004-05

Treatment	Yield (t/ha)					Groundnut equivalent yield (t/ha)
	Groundnut	Lalshak	Spinach	Amaranth	Bushbean	
T_1	2.41	-	-	-	-	2.41
T_2	1.78	6.50	-	-	-	3.08
T_3	1.87	-	8.36	-	-	3.54
T_4	1.40	-	-	7.43	-	2.51
T_5	1.20	-	-	-	6.03	2.10

Table 3. Cost and return analysis of groundnut intercropping with vegetable at MLT site Katiadi during rabi 2004-05

Treatment	Gross return (Tk/ha)	Cost of cultivation (Tk/ha)	Gross margin (Tk/ha)	BCR
T_1	48200	29525	18675	1.63
T_2	61600	31235	30365	1.97
T_3	70840	31405	39435	2.26
T_4	56290	31825	24465	1.77
T_5	42090	31995	10095	1.32

Input price (Tk./kg): Urea =6, TSP= 15, MP= 14, Gypsum=5, Zinc sulphate= 4, Alpha Boron = 100, Amaranth seed= 200, Bushbean seed= 140, Lalshak seed = 140, Spinach = 40
Output price (Tk./kg): Amaranth = 3, Bushbean = 3, Lalshak = 4, Spinach = 4, Groundnut= 20

Performance of intercropping Banana with vegetables and spices

Abstract

The experiment was conducted at MLT site, Modhupur, Tangail for the year 2003-04 in medium high land under AEZ-28 to observe the suitable as well as profitable crops for banana intercropping. There were four treatment combinations viz. T_1 = Banana (Sole), T_2 = Banana + Okra, T_3 = Banana + Sweet gourd and T_4 = Banana + Bitter gourd. The result showed that highest banana equivalent yield (72.40 t/ha) was recorded from the treatment combination Banana + Sweet gourd. The result revealed that the highest BCR (4.57) was obtained from Banana + Sweet gourd combination.

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 advantages compared to sole crop (Singh *et al.*, 1992). Banana (*Musa sapientum*) is nutritional fruit in Bangladesh. In Bangladesh, Banana occupies a total of 97465 acres of land producing 561770 metric ton (BBS, 1999). Banana is largely grown in Modhupur,Tangail which occupies 3440 acres of land producing19960 metric tons (BBS,1999). Banana is largely grown in well drained high land, which is also suitable for growing other cash crops. In the early growing period of Banana, the inter row spaces remains under utilized. During this period short duration crops may be grown as intercrop in banana. Most of the farmers of Modhupur, Tangail, grow garlic, onion and coriander and short growing vegetables as intercrop in Banana with inadequate knowledge of agronomic practices as well as economics of the crop. Intercrop should be selected in such a manners so, that they have 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 evaluate the potential of intercropping in Banana to increase production as well as profitability of farmers.

Materials and Methods

The experiment was carried out at MLT site, Modhupur, Tangail for the year of 2003-2004 in the medium highland under AEZ-28. The experiment was laid out having RCB design with four replications. The unit plot size was 6 m X 6 m, with spacing 2 m X 2 m. The variety Amrit Sagar was used in this experiment. The suckers were planted in 60 cm x 60 cm x 60 cm size of pit. The four treatments were considered as T_1=Banana (sole), T_2= Banana + Okra, T_3 = Banana + Sweet gourd and T_4 = Banana + Bitter gourd. Soil samples were collected and its chemical analysis was done, before setting of the experiments. The soil values based on chemical analysis were P^H (5.01), OM (1.55 %), N (0.10 %), P (21.94 µg), K (0.05 meq/100g soil), S (4.12µg/g) , B (0.08µg/g) and Zn (1.00µg/g). The values showed that NKS and B very low, P optimum, Zn medium respectively.

Fertilizer dose were calculated on the basis of soil test values followed by FRG, BARC, 1997. Urea, TSP, MP, Gypsum, Zinc sulphate and Boric acid were applied at the rate of 0.650-0.400-0.300-0.127-0.0036-0.00056 kg/plant (STB). Fifty percent TSP and one half of potassium, sulphur and zinc were applied in the pit during pit preparation. Remaining urea, TSP and MP was applied as ring method 30 cm, 60 cm and 90 cm from plant stalk for 1, 2 and 3 top dress of fertilizer respectively and 7.5-10 cm depth in soil. No additional fertilizer was applied for intercrops but plant protection measured and intercultural operations have been taken. Straw mulch was used incase of Bitter gourd and sweet gourd intercropping plot. Three irrigations were applied after three times top dressed of fertilizer. Thrice weeding and earthing up were done at 60, 135 days after planting (DAP) and before flowering. Fyfanon (0.2%) were sprayed four times for controlling sigatoga and furadan 5G was used for control banana beetle respectively, in cropping season. Collected data were analyzed statistically using computer package MSTATC.

Results and Discussion

A. Banana with vegetables intercropping

The yield and yield contributing characters were studied and presented in Table 1. Results revealed that maximum number of suckers (25.25) and leaves per plant (9.30) was counted in T_4 treatment, which was statistically different from other treatments. Higher number of banana /chari was obtained from T_2 treatment combination but significant variation was not found in case of other treatments combinations except T_4 treatment. The highest weight of chari (17.0 kg) and length of banana was calculated in Banana + sweet gourd intercropping, which was statistically identical to T_2 (Banana + Okra) treatment. Statistically similar yield was found in the treatments T_2 and T_3, which was followed by T_1 treatment.

Intercropping significantly influenced fruit length, fruit weight and yield. Fruit yield was increased with intercropping than sole except banana +bitter gourd intercropping (Table -1).The higher yield (42.50t/ha) was obtained from T3 than other treatment combinations due to add of mulch and higher crop residues in soil which increased the soil moisture, organic matter and keeps the soil temperature as a results to enhance the normal growth and gave the higher yield. All the intercropping systems showed higher equivalent yield than sole crop. The highest banana equivalent yield (72.40 t/ha) was obtained from banana with sweet gourd intercropping and the lowest banana equivalent yield (45.32 t/ha) was obtained from banana with okra intercropping (Table 2).The sole crop banana gave the yield 38.94 t/ha.

Economics

From the Table 3, it was found that the highest gross return and gross margin was recorded from T3 treatment combination, but higher cost was involved except treatment T4. Though total cost was less in sole crop but low yield of banana as well as no intercrop yield was added. Higher BCR was recorded from Banana with sweet gourd and other treatments are lower return.

Farmers' reaction

- Farmers are interested to grow intercrop in Banana cultivation
- Extra income can be earned
- Organic matter can be add in soil through intercrop residues

Table 1. Effect of intercrop on yield and yield contributing characters of Banana in Madhupur, Tangail, 2003-2004

Treatments	No. of sucker/plant	No. of leaves/plant	No. of Banana/chari	Length of Banana(cm)	Wt. of chari (kg)	Yield (t/ha)
Banana (Sole)	7.50b	22.45b	85.50a	15.93b	15.57b	38.94b
Banana + Okra	7.15b	22.55b	88.27a	16.50a	16.42a	41.06a
Banana + Sweet gourd	7.37b	23.13b	85.80a	16.75a	17.00a	42.50a
Banana + Bitter gourd	9.30a	25.25a	78.68b	15.02c	15.57b	36.88c
CV (%)	4.62	1.94	2.19	2.06	3.07	3.07

Means followed by same letter is not significantly different at 5% level by DMRT

Table 2. Yield of Banana, intercrop and equivalent yield of Banana at Modhupur, Tangail 2003-2004

Treatments	Banana yield (t/ha)	Inter crop yield (t/ha)	Intercrop equivalent yield of banana (t/ha)	Banana equivalent yield (t/ha)
Banana (Sole)	38.94b	--	--	38.94
Banana + Okra	41.06a	2.34	4.26	45.32
Banana + Sweet gourd	42.50a	23.0	29.90	72.40
Banana + Bitter gourd	36.88c	8.33	21.66	58.54

Table 3. Cost and return analysis of intercrop with Banana at Modhupur,Tangail, 2003-04

Treatment	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)	BCR
Banana (Sole)	149919	44169	105750	3.39
Banana + Okra	174482	48752	125730	3.57
Banana + Sweet gourd	278740	60974	217766	4.57
Banana + Bitter gourd	225379	61169	164210	3.68

Input price (Tk./kg): Urea = 6, TSP = 14, MP = 10, Gypsum = 4, Zinc sulphate = 35, Boric acid = 80
Outpur price (Tk./kg): Banana = 3.85, Okra = 7.00, Sweet gourd = 6.46, Bitter gourd = 10.00

B. Banana with spices intercropping

The yield and yield contributing characters were studied and presented in Table 1. Results revealed that maximum number of suckers (8.42) and leaves per plant (24.48) was counted in T_4 treatment, which was statistically different from other treatments. Higher number of banana/chari was obtained from T_3 treatment combination but significant variation was not found among the treatments combinations except T_4. The higher weight of chari (15.48 kg) was calculated in Banana + BARI chili but statistically at par to other treatments except T_4. Fruit yield was increased with intercropping than sole except banana +Ginger intercropping (Table 1).The higher yield (38.69 t/ha) was obtained from T_3 followed by T_2. The lowest yield was recorded from the treatment Banana + Ginger intercropping due to life cycle was higher than chili as a results to share the nutrient from sole crop long time and gave the lower yield. All the intercropping systems showed higher equivalent yield than sole crop. The highest banana equivalent yield (81.55 t/ha) was obtained from banana with Ginger intercropping and the lowest banana equivalent yield (40.21 t/ha) was obtained from banana with chili local variety (Table 2). The sole crop banana gave the lowest yield of 37.50 t/ha.

Economics

From the Table 3, it was found that the highest gross return and margin (Tk. 191742.95/ha) was recorded from T4 treatment combination. Though higher margin was obtained from treatment T4, but due to higher cost return, less MBCR was recorded. In this context, Banana + BARI chilli-1 showed higher BCR than other treatments.

Farmers' reaction

- Farmers are interested to grow intercrop in Banana cultivation
- Extra income can be earned
- Ginger was diseases susceptible and cost of cultivation was high.

Table 1. Effect of intercrop on yield and yield contributing characters of Banana in Modhupur, Tangail, 2003-04

Treatments	No. of sucker/plant	No. of leaves/plant	No. of Banana/chari	Length of Banana(cm)	Wt. of chari (kg)	Fruit yield (t/ha)
Banana (Sole)	7.57b	22.48b	85.88	16.90a	15.00a	37.50b
Banana + Chili(local)	7.50b	22.35b	84.40	16.40ab	15.20a	37.88ab
Banana + BARI chilli	6.80c	21.23c	86.63	16.17bc	15.48a	38.69a
Banana + Ginger	8.42a	24.48a	82.80	15.65c	14.23b	35.56c
CV (%)	3.06	3.04	3.18	2.36	2.00	1.89

Means followed by same letter is not significantly different at 5% level by DMRT

Table 2. Yield of Banana, intercrop, intercrop equivalent yield and Banana equivalent yield at Modhupur, Tangail 2003-04

Treatments	Banana yield (t/ha)	Inter crop yield (t/ha)	Intercrop equivalent yield of banana (t/ha)	Banana equivalent yield (t/ha)
Banana (Sole)	37.50b	--	--	37.50
Banana + Chili(local)	37.88ab	0.28	2.33	40.21
Banana + BARI chilli	38.69a	0.38	3.16	41.85
Banana + Ginger	35.56c	2.92	45.55	81.55
(CV %)	1.89	--	--	--

Means followed by same letter is not significantly different at 5% level by DMRT

Table 3. Cost and return analysis of intercrop with Banana at Modhupur Tangail, 2003-04

Treatment	Gross return (Tk./ha)	Total cost (Tk./ha)	Net return(Tk./ha)	BCR
Banana (Sole)	144375	44169	100206	-
Banana + Chili (local)	154808	48127	106681	2.64
Banana + BARI chilli	161122	48127	112995	4.23
Banana + Ginger	313967	119377	191743	2.25

Input price (Tk./kg): Urea = 6, TSP = 14, MP = 10, Gypsum = 4, Zinc sulphate = 35, Boric acid = 80
Outpur price (Tk./kg): Banana = 3.85, Chilli = 32.00, Ginger = 60

Appendix Table A. Initial soil test values of the experimental plots.

Parameters	p^H	OM (%)	N (%) Total	P (µg/g)	K (meq/100g)	S (µg/g)	Zn (µg/g)	B (µg/g)
Value	5.01 Sl. acidic	1.55 Medium	0.10 V. low	21.94 optimum	0.05 Very Low	4.12 V. Low	1.00 Medium	0.08 Low

Study on the performance of Wheat varieties developed by BARI

Abstract

On-farm performance of wheat varieties after T.Aman harvest was evaluated at Goyanghat Upazila under Sylhet district during rabi 2004-05 to find out suitable variety(s) of wheat. Five varieties viz. Shatabdi, Protiva, Sourav, Gourab, and Kanchan were evaluated. The variety Shatabdi produced the highest yield (3.638 t/ha) followed by Protiva (3.410 t/ha). The check variety Kanchan yielded 3.100 t/ha. The variety Gourab gave lower yield (3.053 t/ha) due to lower spikes/m^2.

Introduction

Wheat is the second cereal crop of Bangladesh. But its yield is lower in our country than that of other wheat growing countries. In Sylhet region, a vast area of land remains fallow after harvesting of T.Aman. Limited area in Sylhet region is utilized for wheat cultivation. It is cultivated mainly in rainfed condition. Wheat is cultivated at Goyainghat and Jaintapur upazilas as a single crop. But there may be abundant scope for wheat cultivation after harvest of T.Aman rice in the fallow land. The fatmers in Sylhet region use the variety Kanchan only. Recently the Wheat Research Center of BARI has developed four new varieties with considerable advantages over Kanchan. It is, therefore, needed to find out the performance of wheat varieties after T.Aman harvest for improvement of the cropping pattern.

Materials and Methods

The experiment was conducted at Goyanghat Upazila under Sylhet district at the farmers' field in rabi season of 2003-04 and 2004-2005. The varieties Satabdi, Protiva, Gourab, Sourav and Kanchan were used. It was laid out in RCB design with 3 replications. The seeds were sown through power tiller operated wheat seeder on 6 December, 2003 and 25-27 November 2004. The crop was fertilized @ 82-36-20-16 kg N, P, K and S/ha. Single irrigation (not sufficiently) was given at CRI stage. Crop was harvested on 16-24 March 2004 and 15-21 March 2005.

Results and Discussion

There were significant variations in all the characters under studied except plant height and spikes/m^2. The days to maturity ranged from 103 DAS to 108 DAS. The earliest variety was Gourab which took only 103 days to maturity. The maximum spikes/m^2 was obtained from Shatabdi (297) which was at par to other varieties. The variety Gourab produced the lowest (263) spikes/m^2 due to less seed germination. Higher grains/spike was obtained from Shatabdi which was followed by Protiva and the lowest from Gourav and Kanchan. Shatabdi variety showed higher seed weight than all other variety. Higher grain yield was recorded from Shatabdi due to higher grains/spike and seed weight.

From two years results showed that variety Shatabdi (3.12 t/ha) was found best followed by Protiva (3.07 t/ha) in terms of yield performance. So, the variety Shatabdi recommended for large scale production in this region.

Table 2. Yield and yield contributing characters of five wheat varieties at Goyanghat Upazila under Sylhet district during rabi 2004-05

Variety	Maturity (Days)	Plant height (cm)	Spikes/m^2 (no.)	Grains/ spike (no)	1000 - grains wt (g)	Grain yield (kg/ha)	Average Yield (t/ha)	Straw yield (kg/ha)
Shatabdi	108	93.36	297.0	38.25	41.79	3.63	3.12	4.61
Protiva	105	81.49	279.3	37.00	37.32	3.41	3.07	4.10
Gourab	103	86.86	262.5	35.25	38.44	3.05	2.39	3.87
Sourav	105	85.86	277.3	36.75	38.61	3.38	2.78	4.00
Kanchan	106	96.19	273.0	35.25	36.25	3.10	2.80	3.66
LSD (0.05)	3.27	NS	NS	2.04	3.67	0.41	-	0.58
CV (%)	2.01	10.7	5.86	3.64	6.20	8.07	-	9.38

Yield maximization of Mustard through various fertilizer levels

Abstract

An experiment was conducted at Charkalibari village of Mymensingh Sadar MLT site during rabi 2004 – 05 to find out the effect of three mustard varieties under three different fertilizer doses. The treatments were three BARI developed mustard varieties as: V_1 = Tori-7, V_2= BARI Sarisha –9 and V_3= BARI Sarisha –12 and three fertilizer doses as: F_1 = 54-60-15 kg NPK/ha (Farmers practice), F_2= 120-34-64-32-1.0 kg NPKSB /ha (HYG) and F_3= 86-26-44-26-1.5 kg NPKSB/ha. The effect of fertilizer doses on yield and yield contributing characters was statistically significant but the effect of variety and interaction were not significant. The fertilizer level of HYG gave higher seed (1011 kg/ha) and stover (2150 kg/ha) yields and this was identical to MYG fertilizer level. The variety BARI sarisha-9 gave higher seed and stover yields of 894 kg/ha and 1983 kg/ha, respectively. Higher gross return (Tk. 22365/ha) and gross margin (Tk.15419 /ha) were also obtained from BARI Sarisha –9 with HYG fertilizer level.

Introduction

Mustard is an important oil seed crop in Bangladesh. The area under mustard is declining due to increase of boro rice cultivation. As a result production of edible oil is being decreased. The shortage of edible oil in the country has become an acute problem. To meet up the oil shortage, Bangladesh has to import a large amount of edible oil every year at the cost of huge amount of foreign exchange. The present per capita oil consumption is only 8 g/day as compared to the total need of 40 g. To meet up the shortage, it should be needed to increase production through developing high yielding varieties and better management practices. Oil seed Research Centre of BARI has already developed some high yielding varieties of mustard. These varieties should be tested at farmers field under different management practices. So, the experiment was under taken to find out economic dose of fertilizer and to identify a suitable variety of mustard for Mymensingh area.

Materials and Methods

The experiment was conducted at Charkalibari village of Mymensingh Sadar MLT site during rabi 2004-05. The soils of the experimental field belongs to medium low land of Old Brahmaputra Flood plain soil (AEZ-9), The design of the experiment was randomized complete block with three replications. The unit plot size was 5 × 4 m. The treatments of the experiment were three varieties viz, V_1= Tori-7, V_2= BARI Sarisha-9 and V_3= BARI Sarisha -12 and three fertilizer doses viz., $F_{1=}$ 54-60-15 kg NPK/ha (Farmers practice), F_2= 120-34-64-32-1.0 kg NPKSB/ha (High Yield Goal) and F_3= 86-26-44-26-1.5 kg NPKSB/ha (Medium Yield Goal). Full amount of PKS and B and 1/3rd of urea were applied as basal. Rest amount of urea was top dressed in two equal splits at 25 and 45 DAS. The seeds were sown on 6 November 2004 with seed rate @ 9.0 kg/ha following broadcast method. Intercultural operations were done as and when necessary. The crop was harvested on 19 January 2005. Data on yield and yield contributing characters were recorded and analyzed statistically. Mean differences were adjudged by LSD. Economic analysis was done on the basis of prevailing market price of input and output.

Results and discussion

Effect of variety: Table 1 shows that only the plant height of mustard varieties varied significantly. Other plant characters, seed and stover yields did not vary significantly. However, slightly higher grain (894/kg .ha) and straw (1983 kg/ha) yields were obtained from the variety BARI Sarisha-9.

Effect of fertilizer: Table 1 shows that all the plant characters and seed and stover yields varied significantly due to effect of fertilizers doses. The fertilizer levels of High Yield Goal (F_2) and Moderate Yield Goal (F_3) gave identical values both for plant characters and yields. Farmers fertilizer dose (F_1) gave significantly lower plant height, number of siliqua / plant, number of seed / siliqua, 1000 seed weight and grain and stover yields. The higher plant height (84.68 cm), number of siliqua/plant (50.27), number of seed/siliqua (13.90), 1000- seed weight (2.92 g) and seed yield 1011 kg/ha and stover yield 2150 kg/ha were obtained from the High Yield Goal fertilizer level and these were identical to Medium Yield Goal fertilizer level.

Interaction effect of variety and fertilizer: The results of interaction effect of variety and fertilizer have been shown in Table 1. Except plant height all other plant characters and yields were not varied significantly. However, all the varieties with high fertilizer dose gave higher seed and stover yields. The varieties Tori-7 (V_1), BARI sarisha –9 (V_2) and BARI sarisha –12 (V_3) gave higher seed yield of 950 kg/ha, 1066 kg / ha and 1016 kg/ha, respectively with high fertilizer dose. Similar trend was followed in case of stover yield.

Economic performance: Higher gross return (Tk. 22365/ha) and gross margin (Tk. 15419/ha) were obtained from BARI Sarisha –9 with HYG fertilizer level. But benefit cost (B/C) ratio was the highest (3.65) in BARI sarisha –9 with MYG fertilizer level (V_2F_3) due to lower variable cost. Medium Yield Goal fertilizer level also gave better B/C ratio (3.59) in Tori-7 with MYG. The farmers fertilizer dose with BARI sarisha-12 also showed reasonable benefit cost ratio. But over all, farmers fertilizer dose showed lower yield as well as BCR. Over all BARI sarisha-12 gave higher BCR in all fertilizer levels as compared to other varieties (Table 2).

Table 1. Yield and yield parameters of some short duration mustard varieties as influenced by various doses of fertilizers at Mymensingh sadar Upazila, 2004-05

Treatment	No. of Plants/m^2	Plant height (cm)	No. of siliqua / plant	No. of seed / siliqua	1000 seed weight (g)	Seed yield (kg / ha.)	Stover yield (kg/ha)
Variety							
V_1	113.78	80.62a	42.77	13.20	2.77	861	1950
V_2	114.00	79.91a	42.53	13.14	2.80	894	1983
V_3	112.44	75.43b	43.44	13.31	2.77	894	1811
LSD (1%)	NS	3.321	NS	NS	NS	NS	NS
Fertilizer doses (kg/ ha)							
F_1	114.56	68.36b	31.13b	12.24b	2.50b	672b	1583b
F_2	113.67	84.68a	50.27a	13.90a	2.92a	1011a	2150a
F_3	112.00	83.93a	47.34a	13.51a	2.91a	916a	2011a
LSD(0.01)	NS	3.32a	5.653	0.5261	0.1152	105	236
Variety × Fertilizers							
V_1F_1	112.67	66.20c	29.90	12.30	2.40	683	1600
V_1F_2	116.33	80.07a	49.83	13.73	2.97	950	2133
V_1F_3	112.33	87.06a	48.57	13.57	2.93	950	2116
V_2F_1	116.33	69.47c	30.67	12.27	2.60	700	1566
V_2F_2	114.33	87.07a	50.68	13.77	2.90	1066	2050
V_2F_3	111.33	83.20ab	46.27	13.40	2.90	966	2116
V_3F_1	114.67	69.40c	32.83	12.17	2.50	633	1583
V_3F_2	110.33	78.90b	50.30	14.20	2.90	1016	2266
V_3F_3	112.33	78.00b	47.20	13.57	2.90	833	1800
LSD(0.01)	NS	5.752	NS	NS	NS	NS	NS
CV (%)	4.83	3.07	9.57	2.90	3.03	8.86	8.57

Table 2. Cost and return analysis of different fertilizer dose on three mustard varieties

Treatment	Gross return (Tk,/ha)	*Variable cost (Tk./ha)	Gross margin (Tk./ha)	BCR
V_1F_1	14460	5309	9151	2.72
V_1F_2	20067	6946	13121	2.89
V_1F_3	20058	5582	14476	3.59
V_2F_1	14783	5309	9474	2.78
V_2F_2	22365	6946	15419	3.22
V_2F_3	20378	5582	14767	3.65
V_3F_1	13452	5309	8143	3.53
V_3F_2	21453	6946	14507	3.09
V_3F_3	17560	5582	11978	3.15

* Variable cost includes only the fertilizer costs.

Performance of different improved Mungbean varieties in the farmers field at summer

Abstract

The experiment was conducted at MLT site Chowgacha during 2004-05. Three mungbean varieties viz. BARI mung-2, BARI mung-4 and BARI mung-5 were studied. Among the varieties BARI mung-5 produced significantly the highest grain yield (1.85 t/ha). BARI mung-2 produced the lowest yield (1.73 t/ha) which was statistically identical with BARI mung-4 (1.75 t/ha). The highest yield of BARI mung-5 was mainly influenced by higher pods/plant, seeds/pod and 1000-grain weight.

Introduction

In Bangladesh most of the pulses are grown in rabi season. But in fact, due to cultivation of wheat and other high yielding rice crops, the farmers have lost their interest to produce pulses because of low output per unit of resource investment. Availability of irrigation facilities increase area under boro rice thereby further reduces the area. Mungbean (*Vigna radiata* L.Wilezek) is an important pulse crop and can be grown both in rabi and kharif growing seasons. These characteristics have made a great opportunity for mungbean to be fitted will it in fallow period of the cropping pattern Aus/Jute-Fallow-Rabi and Boro-Fallow-T.aman under medium high land and high land condition. The experiment was undertaken to find out the potential of summer mungbean variety at Jessore region and to create interest of the farmers to growing mungbean at summer in this area.

Materials and Methods

The experiment was conducted at MLT site Chowgacha during 2004-05. The experiment was laid out in RCBD with six replications. Three mungbean varieties viz. BARI mung-2, BARI mung-4 and BARI mung-5 were studied. Unit plot size was 8m x 5m. Seeds were sown during 10-20 March. All fertilizer were used as basal during final land preparation. Weeding and thinning were done at 15 DAS and 30 DAS. The crop was irrigated once at vegetative stage. Decis 10 EC was sprayed twice or thrice for controlling leaf borer. The crop was harvested at maturity during 12 May to 13 June. Data on yield and yield components were recorded and analyzed statistically.

Results and Discussion

Performance of mungbean varieties is presented in the Table 1. Plant height, seeds/pod, 1000-seed weight and grain yields were significantly influenced by variety (Table 1). The variety BARI Mung 4 and 5 showed similar pods/plant and higher than BARI Mung 2. Similar trend was followed in case of seeds/pod but significantly the highest seed weight was recorded from BARI Mung 5. Among the varieties BARI mung-5 produced the highest grain yield (1.85 t/ha). BARI mung-2 produced the lowest yield (1.73 t/ha) which was identical with BARI mung-4 (1.75 t/ha). The highest yield of BARI mung-5 was mainly influenced by higher pods/plant, seeds/pod and 1000-grain weight.

Farmer's comments

Farmer's of the area were so much impressed with the mungbean variety BARI mung-5 for its high yielding potential. They are interested to grow it because of no disease and higher yield.

Table 1. Yield and yield attributes of mungbean at MLT site, Chowgacha during rabi 2004-05

Treatment	Plant Pop./m^2 (no.)	Plant height (cm)	Pods/plant	Seeds/ pod	1000-seed wt. (g)	Grain yield (t/ha)
BARI mug-5	25	72.93a	64.75a	11.46a	41.94a	1.85a
BARI mug-4	26	70.04b	65.00a	11.48a	39.69b	1.75b
BARI mug-2	25	71.61ab	62.40b	11.25b	33.98c	1.73b
CV (%)	5.52	6.41	5.38	7.42	8.35	9.58
LSD (0.05)	-	1.484	2.321	0.172	0.5572	0.897

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B. Coastal

Screening of different oil crops in saline area during rabi season

Abstract

The experiment was initiated at Banerpota farm, Satkhira during the Rabi season, 2002–03 to screen the different salt tolerant varieties of different oil crops. Three year's results showed that soybean variety BARI Soybean-5, Linseed variety Lin-1, Niger variety Shova, Safflower variety Saf-1 and Groundnut variety Jhingabadam performed better at Banerpota farm. Sesame did not perform well.

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 of oilseed crops. The present study was therefore, undertaken to find out the suitable varieties of oilseeds in saline area.

Materials and Methods

The trial was initiated at Banerpota farm, Satkhira during rabi season 2002-03. Six different crops were sown on 07 December 2004 at Banerpota farm. Three varieties of Soybean (Shohag, Bangladesh soybean-4 and BARI soybean-5), four variety/lines of Linseed (Lin-1, BSRI-25, BSRI-26 and BSRI-27), four variety/lines of Niger (Shova, Nawalpur, Acc-104 and Acc-108), three varieties of Sesame (BARI Til-2, BARI Til-3 and T-6) one variety of Safflower (Saf-1) and four varieties of Groundnut (Dhaka-1, BARI badam-5,BARI badam-6 and Jhingabadam) were included in the study. The unit plot size was 2m x 1m. Seeds were sown following RCB design with three replications. The seeds were sown in line sowing. One irrigation was given. The detail particulars of materials and methods are presented in Table 1. Intercultural operations were followed as and when necessary. The soil salinity level at the site during 06Dec'04, 21Dec.'04, 05Jan'05, 20Jan'05, 04Feb'05, 19Feb'05, 06Mar'05, 21Mar'05, 04Apr'05, 19Apr'05 and 03May'05 were 3.00, 4.05, 6.10, 7.85, 9.10, 10.40, 10.75, 9.95, 8.50, 8.15 and 6.75mmhos/cm respectively. Sesame crop damaged in late January.

Table 1. Crop, sowing method, spacing and fertilizer dose for the crops, 2004-05

Name of crops	Method of sowing	Spacing	Fertilizer dose (kg/ha)			
			N	P	K	S
Soybean	Line	30 cm	25	35	55	18
Linseed	Line	30 cm	35	25	23	--
Niger	Line	30 cm	35	25	25	--
Sesame	Line	30 cm	50	28	23	20
Safflower	Line	40 cm	45	20	25	--
Groundnut	Line	30 cm	12	32	43	54

Results and Discussion

Soybean: Performance of different oil crop varieties has been presented in table-2. Plant height, pod/plant, 100 seed weight and seed yield of soybean differed significantly by variety/line. BARI Soybean –5 produced highest seed yield could be due to seed weight in 2004-05. Shohag produced lowest yield could be due minimum plant population/m^2. On an average of three years results, higher seed yield (1144 kg/ha) was obtained from BARI Soybean 5. The yield level in 2002 –2003 was much higher than this year which might be due to low salinity level. The soil salinity range during the crop growing season in current year was 3.00 to 10.75mmhos/cm. The soil salinity range during the crop growing season in 2002-03 was 1.74 to 3.54mmhos/cm.

Linseed: Plant population/m^2, plant height, capsule/plant and seed yield of linseed differed significantly by variety/lines. The highest seed yield produced by Lin-1 in 2004 –'05 could be due to maximum capsule/plant. On an average of three years results, the highest seed yield (1061kg/ha) was obtained from Lin-1. The yield level in 2002 –2003 was much higher than this year might be due to low salinity level.

Niger: Plant population/m^2, plant height, head/plant, seed/head and seed yield of Niger differed significantly by variety/lines. Shova produced the highest seed yield in 2004 –'05 could be due to maximum plant/m^2. On an average of three years results, the highest seed yield (938kg/ha) was obtained from Shova. The yield level in 2002 –2003 was much higher than this year might be due to low salinity level.

Safflower: On an average, a safflower variety Saf-1 was introduced which yielded 1557 kg/ha.

Groundnut: Plant height, pod/plant, seed/pod, 100 seed weight and pod yield (kg/ha) differed significantly by varieties. Jhingabadam produced the highest pod yield followed by BARI badam-6. Jhingabadam produced the highest pod yield could be due to maximum seed/pod.

Conclusion

On an average of three year's results showed that Soybean variety BARI Soybean –5, Linseed variety Lin-1, Niger variety Shova, Safflower variety Saf-1 and Groundnut variety Jhingabadam showed better adaptability in saline area. Production program could be undertaken in next year for greater expansion of these varieties in coastal area.

Table 2. Yield and yield attributes of different oil crops tested at Banerpota farm, Satkhira during Rabi, 2004-05

a) Soybean

Variety/line	Days to maturity	Plant pop. /m^2(No.)	Plant height (cm)	Pod/ plant (no.)	Seed/ pod (no.)	100 seed wt. (g)	Seed yield (kg/ha)			
							2002-03	2003-04	2004-05	Mean
Shohag	118	12.00	48.67	57.33	2.23	9.67	1560	760	733	1018
Bangladesh soybean-4	121	12.33	54.33	56.00	2.23	8.97	1471	825	763	1020
BARI soybean-5	121	14.33	51.33	51.33	2.03	10.60	1537	925	970	1144
LSD(0.05)	--	NS	2.72	1.51	NS	0.35	72.63	23.08	76.66	--
CV (%)	--	11.27	2.34	1.21	9.04	1.62	2.95	1.76	4.11	--

b) Linseed

Variety/ line	Days to maturity	Plant pop./m^2(no.)	Plant height (cm)	Capsule/ plant (no.)	Seed/ Capsule (no.)	1000 seed wt. (g)	Seed yield (kg/ha)			
							2002-03	2003-04	2004-05	Mean
Neela	104	44.67	64.67	76.33	8.00	3.83	1483	725	976	1061
BSRI-25	101	44.67	53.33	69.67	8.33	3.50	--	--	825	--
BSRI-26	101	66.67	51.33	51.67	8.00	3.67	--	--	970	--
BSRI-27	101	42.67	65.00	61.00	8.33	3.50	--	--	667	--
LSD(0.05)	--	6.89	1.59	4.48	NS	NS	75.76	72.99	30.47	--
CV (%)	--	6.95	1.36	3.75	5.40	6.50	2.89	5.45	1.77	--

c) Niger

Variety/ line	Days to maturity	Plant pop. /m^2 (no.)	Plant height (cm)	Head/ plant (no.)	Seed/ head (no.)	1000 seed wt. (g)	Seed yield (kg/ha)			
							2002-03	2003-04	2004-05	Mean
Shova	100	33.67	82.67	26.00	23.33	4.33	1232	950	633	938
Nawalpur	98	23.33	67.00	21.33	21.33	4.33	1125	787	579	830
Acc-104	99	20.33	69.67	28.67	28.69	4.50	1140	937	635	904
Acc-108	99	24.00	72.00	30.67	22.67	4.00	1045	812	578	812
LSD(0.05)	--	3.03	1.85	3.54	2.18	NS	58.92	59.97	19.98	--
CV (%)	--	5.99	1.27	6.64	4.55	5.14	3.24	4.30	1.65	--

d) Safflower

Variety/ line	Days to maturity	Plant population /m^2(No.)	Plant height (cm)	Head/ plant (No.)	Seed/ head (No.)	1000 seed wt. (g)	Seed yield (kg/ha)			
							2002-03	2003-04	2004-05	Mean
Saf–1	119	25	88	47	21	34	1840	1620	1212	1557

e) Groundnut

Variety/ line	Days to maturity	Plant pop. /m^2 (no.)	Plant height (cm)	Pod/ plant	Seed/ pod	100 seed wt. (g)	Pod yield (kg/ha)			
							2002-03	2003-04	2004-05	Mean
Dhaka-1	143	18.33	38.67	21.67	1.84	33.67	1603	1471	1429	1501
Jhingabadam	147	16.67	36.67	18.33	2.89	43.67	2106	2030	1847	1994
BARI badam-5	143	19.33	43.00	17.67	1.96	47.00	1739	--	1630	1679
BARI badam-6	143	20.00	41.00	19.00	1.92	47.33	1958	1807	1820	1862
LSD(0.05)		3.03	2.46	3.24	0.17	3.14	271	58	116	
CV (%)		8.17	3.10	8.48	3.86	3.66	7.32	2.30	3.45	

Performance of Cowpea varieties at coastal area

Abstract

Performance of two cowpea varieties namely BARI Falon-1 and Patuakhali local were evaluated at Banerpota farm, Satkhira during the rabi season 2004-'05. BARI Falon-1 produced higher yield (1350kg/ha) than local one (1260 kg/ha). Further investigation in relation to management practices should be done in future.

Introduction

A vast coastal and offshore area (2.85m ha.) in the southern part of Bangladesh exhibit soil salinity of various magnitudes due to onrush of salt water form the Bay. However, during the dry season (November through March) surface layer of the soil dries up due to evaporation and the saline water form the underground moves up by capillary forces. Thus a considerable amount of salt from the subsoil is carries to the surface and accumulates as salt crust. So, cultivation of winter crops is very limited due to absence of irrigation water. As a result, most of the areas remain fallow during dry months. It is assumed that cowpea perform well in this situation. Recently BARI released one high yielding variety of cowpea. So, the present study was undertaken to see the performance of cowpea in coastal area.

Materials and Methods

The trial was conducted at Banerpota farm, Satkhira during Rabi season, 2004-2005 with two cowpea varieties namely BARI Falon-1 and Patuakhali local following RCB design with four replications. The unit plot size was 3m 52m. The crop was sown on 13 December, 2004 as line sowing. Line to line spacing was 30cm. Fertilizer were applied at the rate of 20-40-20 kg/ha of N, P_2O_5, and K_2O respectively. All Urea, TSP and MP were applied as basal. One irrigation was given at initial growth stage. All the intercultural operations were done as and when necessary. Data on yield and yield attributes were collected. The soil salinity level during 06 Dec'04, 21 Dec.'04, 05 Jan'05, 20 Jan'05, 04 Feb'05, 19 Feb'05, 06 Mar'05, 21 Mar'05, 04 Apr'05, 19 Apr'05 and 03 May'05 were 3.00, 4.05, 6.10, 7.85, 9.10, 10.40, 10.75, 9.95, 8.50, 8.15 and 6.75mmhos/cm respectively.

Results and Discussion

Yield and yield attributes were almost same for both the variety. But slightly higher yield was recorded from BARI Felon 1 due to plants/m^2 and seed weight.

Conclusion

From the study it was observed that the variety BARI Falon-1 performed better in saline area. Falon can be grown in Fallow-Fallow-Fallow or Fallow-T.Aman-Fallow cropping pattern. For more confirmation the experiment should be repeated in next year.

Table 1. Yield and yield attributes of cowpea as affected by varieties at Banerpota farm, Satkhira during 2004-05

Variety	Days to maturity	Plant pop. / m^2	Plant height (cm)	Pod/ plant	Seed/ pod	1000-seed weight (g)	Seed yield (kg/ha)
BARI Falon-1	141	34	50	8	15	96	1350
Patuakhali local	141	31	47	8	14	93	1260

Yield performance of Mungbean as affected by salinity in coastal area

Abstract

The experiment was conducted at Banerpota farm, Satkhira during 2005 to select the salt tolerant variety of mungbean. The result showed that 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 2005. Mungbean was sown on 13 February 2005 at Banerpota farm. Five varieties/lines of mungbean (BARI Mung-2, BARI Mung-4, BARI Mung-5, BM-01 and local) were included in the study. The unit plot size was 1.2m51m. Seeds were sown following RCB design with three replications. The seeds were sown as line sowing. Line to line spacing was 30cm 20-16-15kg/ha of N-P-K was applied as basal. Intercultural operations were followed as and when necessary. The soil salinity level at the site were 04Feb'05, 19Feb'05, 06Mar'05, 21Mar'05, 04Apr'05, 19Apr'05 and 03May'05 were 6.90, 8.00, 8.30, 6.85, 5.80, 5.72 and 5.55mmhos/cm respectively. 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/m^2 at harvest, plant height, pod/plant, seed/pod and seed yield (kg/ha) differed significantly by variety/line. The result revealed that the significantly the highest seed yield (844 kg/ha) was obtained from BM-01. The highest seed yield was produced by BM-01 could be due to maximum plant/m^2, pod/plant and heavier seed weight. The lowest yield produced by BARI mung-5 could be due to less pod/plant, seed/pod and seed weight. No viral disease infestation was observed in any variety except local one. Aphid infestation was observed in the field.

Conclusion

It was observed that mungbean line BM-01 showed better adaptability at Banerpota farm. 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, 2004-05

Variety/Line	Days to maturity	Plant pop. /m^2 at harvest	Plant height (cm)	Pod/plant	Seed/pod	1000 seed weight (g)	Seed yield (kg/ha)
BARI Mung-2	65	19.00	49.67	14.33	10.00	34.00	766
BARI Mung-4	68	11.33	53.33	17.00	10.33	33.33	467
BARI Mung-5	68	21.00	44.00	9.67	8.67	33.33	389
BM-01	65	25.00	49.00	12.33	9.67	34.67	844
Local	68	22.00	47.00	12.33	10.00	34.67	728
LSD (0.05)	--	2.10	1.75	1.65	1.49	NS	67.30
CV (%)	--	5.67	1.92	6.67	8.18	2.76	5.60

Performance of hull-less Barley for saline area

Abstract

The experiment was conducted at MLT site, Paikgacha, Khulna to find out the potential variety for saline area. There were four entries/varieties viz. BL-1, BHL-03, BB-3 and BB-4. Among these lines, BB-4 gave higher yield but yield is low as compared to its potential.

Introduction

This trial would be helpful to popularize the barley cultivation among the farmers at saline area.

Materials and Methods

The study was conducted at the MLT Site, Paikgacha, Khulna to observe the performance of four entries/varieties namely BL-1, BHL-03, BB-3 and BB-4. The plot size was 10m × 10m. The crop was sown on 27 November, 2004 as line sowing. Line to line spacing was 30cm. Fertilizer were applied at the rate of 100-60-40kg/ha of N, P_2O_5 and K_2O respectively. All urea, TSP and MP were applied as basal. The crop was harvested during the 3rd week of March, 2005. Data on yield and yield attributes were recorded.

Results and Discussion

Results were present in Table 1. The line BB-4 produced the highest grain yield. The highest yield produced by BB-4 could be due to maximum number of spike/m^2 and maximum grain/spike. The lowest yield produced by BHL-3 could be due to minimum number of spike/m^2, shortest spike and minimum number of grain/spike. Rat infestation was observed in the field.

Farmers reaction :

Farmers dislike barley cultivation due to rat infestation and poor market price.

Table 1. Yield and yield attributes of barley lines/varieties at Paikgacha MLT Site, Khulna during 2004-05

Line/ variety	Days to maturity	Plant height (cm)	Spike/m^2	Spike length (cm)	Grains/spike	1000-seed wt. (g)	Grain yield (kg/ha)
BL-1	110	67	180	7.0	32	30.10	950
BHL-03	110	54	120	5.7	28	31.20	610
BB-3	110	69	151	6.8	30	30.00	780
BB-4	110	65	191	9.0	33	29.00	1075

Screening of different rabi crops against tolerance to varying soil salinity level

Abstract

Different rabi crops specially vegetables were screened in saline area under rainfed condition at FSRD site, Atkapalia, Noakhali during rabi season 2004-05. Four farmers' fields were used for the study. Among the vegetable crops cabbage showed better performance followed by batishak. In case of spices onion produced the highest yield. But the highest BCR was recorded from Batishak followed by garlic.

Introduction

Out of 2.83 million hectares in the 13 districts of Bangladesh, about 0.84 million hectares are affected varying degrees of soil salinity (Karim & Iqbal, 2001). From the SRDI soil testing report it was observed that salinity concentration vary 0-16 ds/ m from May to November. During the rabi season salinity level increased which resulted very difficult to grow rabi crops. So, that experiment was conducted to evaluate the variability in salinity tolerance of different rabi crops in coastal area.

Materials and Methods

The experiment was conducted in farmer's field at FSRD site, Atkapalia, Noakhali. Four farmers field were used for the study. Vegetable crops namely batishak, cabbage, cowpea and brinjal; spices crops viz. onion, garlic and chili and oil seed crops soybean, mustard were tested in the selected farmer's field. Seedlings of different crops were raised at the seedbed. Seedlings of different crops at optimum age were transplanted in the main field having unit plot size 5m x 2m. Transplanting was done on last week of November 2004. Recommended spacing and fertilizer doses were maintained depending upon the nature of crops. Weeding was done as and when necessary. Harvesting was done depending upon the crops. During the experimental period salinity ranged from 1.8 to 6.2 ds/m. Partial irrigation was done on last week of December for vegetative growth and crop establishment.

Results and Discussion

Yield of different crops against varying degree of salinity are presented in table 1. Nine different crops were screened out. Among them cabbage showed better performance in all the field crops which gave highest yield (42.28 t /ha) followed by batishak (34.65 t/ ha.) and brinjal (24.56 t/ha.).Out of three spices crops onion produced highest yield and it was 8.74 t/ ha and then garlic (5.93 t/ ha.). Soybean, cowpea and mustard produced 1.64 t/ha 1.48 t/ha and 960 kg/ha, respectively. Among the crops, the highest gross return was obtained from onion followed by garlic and the lowest from mustard and cowpea. But higher cost was involved in onion followed by garlic and chilli. As a result, higher BCR was recorded from Batishak due to lower cost of cultivation with reasonable good yield.

Conclusion

From one year result it could be concluded that both cabbage and batishak can tolerate soil salinity. For more confirmation further research programme should be taken including more crops or varieties.

Table 1. Yield performance and economics of different rabi crops against tolerance to soil salinity

Crops	Varieties	Yield (t/ha.)	TVC (Tk./ha.)	Gross return (Tk./ha.)	Unit price (Tk/kg)	Benefit Cost ratio
Cabbage	Provati	42.28	27800	84560	2.00	3.04
Batishak	BARI-1	34.65	14250	51975	1.50	3.64
Brinjal	BARI-4	24.56	29120	85960	3.50	2.95
Cowpea	Local	1.08	5250	12960	12.00	2.47
Onion	Taherpuri	8.74	46022	113620	13.00	2.47
Garlic	Local	5.93	35622	109705	18.50	3.08
Chili	Local	2.0	35500	80000	40.00	2.25
Mustard	Improve tori-7	960 kg /ha.	10275	11520	12.00	1.12
Soybean	Local	2.14	13325	36380	17.00	2.73

Screening of Potato varieties for saline areas

Abstract

The experiment was conducted in the farmers' field at FSRD site, Atkapalia, Noakhali during the rabi reason of 2004-05 under rainfed condition. Seven different potato varieties were screened in saline area to find out the suitable saline tolerant variety. Among the varieties Diamont gave highest yield (30.73t/ha) which was followed by cardinal (28.83 t./ha)and Dheera (27.96 t/ha).

Introduction

Out of 2.88 million hectares in the 13 districts of Bangladesh, about 0.84 million hectares are affected by varying degrees of soil salinity (Karim and Iqbal, 2001). Bangladesh produced 15.58-lac ton potato in 1 lac 36 thousand ha land. In Noakhali the total potato cultivation land is 1,584 ha which is negligible (0.79%) in the context of total potato cultivation area in Bangladesh. High soil salinity and irrigation are the major problem to cultivate potato in this area. The present investigation was therefore, undertaken to identify the suitable potato varieties for saline area.

Materials and Methods

The experiment was conducted at farmers field under Farming System Research and Development (FSRD) site, Atkapalia, Noakhali, during the winter season of 2004-05.The soil was silt loam to clay under the Ramgati soil series of AEZ 18 (Young Meghna Estuarine Flood Plain). Seven varieties of potato (BARI TPS-1, Heera, Dheera, Benela, Cardinal, Fabula, Diamont) were tested. The experiment was conducted under randomized block design with three replications having unit plot size of 4.44m2. The crop was fertilized with N-P-K (100-24-100 kg/ha). All fertilizers were applied at the final land preparation as basal dose. The whole potato tubers were planted on 30.11.04 with 60cm x 25cm spacing. Mulches were applied immediately after planting to check the loss of soil moisture. Harvesting was done on first week of February 2005. The means were compared by Duncan's Multiple Range Test (DMRT). The salinity of the experimental area ranged from 1.2 to 4.5 ds/m.

Results and Discussion

The yield and yield contributing characters and days to emergence, days to maturity and grading were shown in table 1 and 2 respectively. Higher plant height was recorded in cardinal followed by BARI TPS-1, Benela and Diamont. The variety, BARI TPS-1, Heera and Cardinal were needed 12 days where rests were needed 10 days for 80% emergence. Maturity days were differed among the varieties. Dheera, Benela, cardinal, fibula and Diamont matured at 88 days while BARI TPS-1 and Heera needed 100 and 80 days, respectively. Tuber number per hill was highest in var. BARI TPS-1. Both Dheera and Diamont produced same numbers of tubers per hill. Higher yield was found in var. Diamont which was followed by Cardinal, Dheera, Fabula and Heera.

Conclusion: It could be concluded that Diamont showed slightly better performance than Cardinal and Dheera.

Reference

Karim,Z and Iqbal (ed.) 2001.Impact on land degradation in Bangladesh :Changing Scenario in Agricultural Land Use. Bangladesh Agricultural Council, Farmgate, Dhaka. p. 95

Table 1. Plant height, yield and yield attributes of different potato varieties

Varieties	Plant height (cm)	No. stem/hill	No. of tuber/hill	Tuber yield (t/ha)
BARI TPS-1	35.73a	3.27a	6.80a	24.23b
Heera	26.43c	1.60d	5.13cd	25.34ab
Dheera	29.93bc	2.67bc	5.60bc	27.96ab
Benela	34.37ab	2.43c	4.83d	24.45b
Cardinal	38.57a	3.20a	5.80b	28.83ab
Fabula	34.30ab	2.80bc	5.90b	25.56ab
Diamont	34.33ab	3.00ab	5.60bc	30.73a
CV(%)	8.67	7.33	5.30	10.88
LSD (0.05)	5.15	0.35	0.53	5.17

Screening of different rabi crops in saline area

Abstract

As attempt was taken to identify crops suitable to grow in the saline area of Patuakhali in rabi season of three years of 2001-05 at MLT site Kalapara under Patuakhali district. Among the crops grown e.g. Chilli, Mungbean, Sesame, Linseed, Cowpea, Sunflower, Safflower and Maize, some crops were possible to grow successfully. Considering cost and return Chilli, Mungbean Sunflower, Maize and Cowpea were found feasible and profitable. Salinity level in the area ranges between 6-14 ds/m during the dry period.

Introduction

At present total saline area of the country is estimated to be about 0.88 million ha (Annon,1985) of which more than 0.22 million ha is in Patuakhali region . These lands are affected by salinity of varying degrees from 5- 26 ds/m during dry period . Present land use in the coastal area is primarily limited within growing of t. aman rice crop in the wet season. During dry period (Nov.-March) a vast area of land remains fallow not only in the highly saline soils but also in the vary low to low saline soils due to ignorance about the crops those could be profitably grown.

Objective: To find out suitable crops those can be grown successfully in saline area of Patuakhali

Materials and Methods

The experiment was conducted at Multi Location Testing (MLT) site Kalapara Patuakhali during rabi 2001-2002 and repeated 2002-2003 and 2004-2005. The experiment was laid out in randomized complete block design with 4 replications. The unit plot size was 6m x 5m. Eight crops were selected viz., Chilli, Mungbean, Sesame, Linseed, Cowpea, Sunflower, Safflower and Maize. Crops were irrigated two times. Salinity was measured month wise. Management practices for different crops, salinity level of soil and irrigation water are given in Table 1 and 2. Average of salinity level of irrigation water in January, February and March were 0.53, 0.59 and 0.64 ds/m and average soil moisture (% by wt.) in January, February, March and April were 21.4, 16.4, 14.6 and 19.0, respectively.

Table 1. Management practices for the selected crops.

Crops	Variety	Spacing 'cm'	Fertilizer NPK kg/ha	Sowing time	Harvesting time
Chilli	Local	50 x 30	50-30-50	Dec.8-15	April,15-May 15
Mung	BARI mung-2	30 x 5	8-6-8	Dec.8-Jan.5	April, 15-30
Sunflower	Kironi	50 x 25	92-40-60	Dec.8-15	April 5-20
	ST-2250	50 x 25	92-40-60	Dec.8-15	April 5-20
	Contifler	50 x 25	92-40-60	Dec.8-15	April 5-20
Sesame	T-6	30 x 5	45-20-24	Dec.10-20	May 15-20
Safflower	Saff-1	40x15	92-40-60	Dec. 15-20	April 5-10
Linseed	Neela	30 x 10	45-20-24	Dec. 15-20	April 10-20
Cowpea	BARI Felon-1	40 x 15	8-14-18	Dec. 15-20	April 20-30
Maize	BARI maize-2	75 x 25	120-80-60	Dec.8-15	April 20-30
	BARI maize-2	75 x 25		Dec.8-15	April 20-30

Table 2. Average salinity level (ds/m) at different depth of soil at Kalapara, Patuakhali during rabi 2001-02, 2002-03 & 2004-05

Month	Top soil	10 cm	20 cm	30 cm
December	8.17	7.40	7.0	6.9
January	7.90	7.60	6.89	7.41
February	10.00	10.00	8.90	8.30
March	15.50	12.00	10.63	10.52
April	13.00	10.56	10.46	10.30

Results and Discussion

Among the crops, chilli was grown with local variety with an average yield of 761 kg/ha. Cowpea was grown as BARI Felon-1 with yield 1323 kg/ha. Mungbean did not perform well. Four oilseed crops were grown with reasonable yield but maize yield was not satisfactory. The highest gross return was obtained from chilli followed by maize but later crop involved the highest cost of cultivation. As a result, the highest gross margin and BCR was recorded from chilli. Mungbean yield was low but price is high so it showed second higher BCR.

Farmers reaction

Farmer choice is chilli and mungbean but other crops agronomically feasible but marketing problem.

Table 3. Average yield of different crops during 2001-02, 2002-03 & 2004-05

Crop	Variety	Yield (kg/ha)			
		2001-02	2002-03	2004-05	Mean
Chilli	Local	740	765	778	761
Cowpea	BARI Felon-1	1292	1300	1378	1323
Mung	Kanti	490	416	957	621
Sesame	T-6	1090	853	950	964
Sunflower	Kironi	1267	1260	1245	1320
	ST-2250	-	-	1500	
	Contifler	-	-	1330	
Safflower	Saff-1	1167	1050	1115	1110
Linseed	Neela	800	760	805	788
Maize	BARI maize-2	-	-	3565	3460
	BARI maize-7	-	-	3355	

Table 4. Average yield and economic performance of Mungbean, Chilli, Cowpea, Sunflower, Sesame, Safflower, Linseed and Maize (Kalapara, Rabi 2001-02, 2002-03 & 2004-05)

Crops	Yield (Kg/ha)	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk/ha)	BCR
Chilli	761	26635	12250	14385	2.17
Cowpea	1323	17199	10467	6732	1.64
Mung	621	15525	8029	7496	1.93
Sesame	964	11568	9220	2348	1.25
Sunflower	1320	15840	9250	6590	1.71
Safflower	1110	13320	9220	4100	1.44
Linseed	788	9456	7250	2206	1.30
Maize	3460	24220	14500	9720	1.67

Output price (Tk./kg): Chilli = 35, Sunflower = 12, Cowpea = 13, Linseed = 12, Mungbean = 25, Maize = 7, Safflower = 12 and Sesame = 12

Profitable crop screening after T.Aman rice harvest in Ganges Tidal Floodplain Zone (AEZ-13)

Abstract

As an attempt to identify crops profitable to grow in the Patuakhali area after T.aman harvest, the experiment as in the title above was initiated in the rabi season of 2001-2002 at FSRD site Lebukhali, Patuakhali. The experiment of rabi season of 2004-2005 were reported here. The experiment was initiated in tow phases of Medium high land viz. High (Ridge) phase and Low phase. In lower phase only local varieties of T.aman rice is grown which harvest late usually in last of December to mid January. Any rabi crops grown in the lower phase was not found more profitable in compare to mungbean. In the ridge almost all rabi crops of the experiment could be grown successfully and profitably. The experiment was conducted with 7 crops for ridge phase of medium high land where modern and local varieties of rice were harvested within 30 November. Among the crops grown Brinjal, Indian spinach, Bushbean, Lady's finger, Potato, and Chilli were found profitable. BCR from Brinjal was the highest (6.39).

Introduction

The entire district of Patuakhali and Barguna, and part of Barisal, Jhalkati and Pirojpur are within the Ganges Tidal Floodplain (AEZ-13) . Most of the land of this zone gets tidally flooded from end of March to end of November and in some fields beyond this limit if the link canals are not closed at the point they joined the rivers. More than 60% of all the cultivable land of this area remains fallow during winter. There are a lot of reasons like delayed harvested of T.aman rice late in attaining soil joe condition etc. for which only a limited number of crops like Khesari, Cowpea, Mungbean, Chilli, Sweet Potato G. Nut etc. are grown in about one third of the crop land . Though major part of the area is of medium high land type there are variations in the flooding depth of the crop land varies from 15cm to 80 cm. Depending upon flooding depth medium high land are divided into 3 phases namely ridge (6cm-30 cm) medium phase (30cm- 60cm) and lower phase(70 cm above).

Objective: To identify crops those could be grown profitability in medium high land both ridge and low phase.

Materials and Methods

The experiment was initiated at Farming Systems Research and Development (FSRD) site Lebukhali, Patuakhali during the year rabi 2001-2002 to find out the profitable crop production after t aman rice harvest. A number of crops were tested against Mungbean and Chilli as check crops in each year. Last year i.e. in rabi, 2004-2005, some vegetable and cash crops were selected as test crop and reported here. The study was made as in RCB design with 5 replications in medium high land. Each unit plot measured 5m x 4m. T.Aman was rice was harvested within November 30, 2004. Seven crops viz. Potato, Bushbean, Groundnut, Brinjal, Chilli, Indian spinach, Lady's finger for high phase and two crops viz. Sesame and Mungbean for low phase were grown in each unit plot as treatments. Management practices for selected crops are given in table-1. Other intercultural operations were done as per recommendation.

Table 1. Management practice of different crops grown for the experiment

Crops	Variety	Spacing cm x cm	Fertilizer kg/ha (Urea-TSP-MP)	Sowing time	Harvesting time
Medium High Land (High phase)					
Potato	Diamont	45 x 15	250-150-250	Dec.15-20, 2004	March 3,2005
Bushbean	BARI Bushbean-1	30 x 15	55-150-150	Dec.15-20, 2004	Feb.2-17, 2005
Groundnut	Dhaka-1	30 x 15	25-160-85	Dec.15-20, 2004	May 15, 2005
Brinjal	Kajla	70 x 50	375-150-250	Dec.15-20, 2004	March25- May 15, 05
Chilli	Local	40 x 30	180-250-150	Dec.15-20, 2004	April 20- May 15, 05
Indian spinach		50 x 40	280-125-125	Dec.15-20, 2004	March 20- May15, 05
Lady's finger	BARI Dherosh-1	50 x 40	150-125-125	Dec.15-20, 2004	March10- May 15, 05
Medium High Land (Low phase)					
Sesame	T-6	30 x 10	75-120-50	Feb.5-10, 2005	May 8, 2005
Mungbean	BARI mung -5	30 x 10	50-75-30	Feb.5-10, 2005	May 20, 2005

Result and Discussion

Out of Nine cultivars Brinjal, Indian spinach, Bushbean, Lady's finger, Potato, and Chilli were found profitable for ridge phase of medium high land and mungbean for low phase of that. Brinjal, Indian spinach, Bushbean, Lady's finger, Potato, Chilli, Groundnut Mungbean and Sesame yielded respectively 45.3 kg/ha, 35.87 kg/ha, 14.44 kg/ha, 15.18 kg/ha, 21.90 kg/ha, 1.23 kg/ha, 2.09kg/ha 1.20 kg/ha, and 1.14 kg/ha. BCR was highest in the Brinjal (6.39).

Table 2. Plants/m^2, yield, cost and return analysis of different crops after T.aman harvest in Patuakhali

Crops	Plant pop. /m^2	Yield (kg/ha)	Gross return (Tk/ha)	TVC (Tk./ha)	Gross margin (Tk/ha)	BCR
Medium High Land (High phase)						
Potato	12.33	21900	109500	43425	66075	2.52
Bushbean	20.66	14440	72200	22182	50018	3.25
Groundnut	18.33	2090	25080	22077	3003	1.14
Brinjal	2.66	45300	226500	35437	191063	6.39
Chilli	7.00	1230	49200	23725	25475	2.07
Indian spinach	4.66	35866	107598	23975	83623	4.49
Lady's finger	4.33	15176	60704	21500	39204	2.82
Medium High Land (Low phase)						
Sesame	29.66	1140	17100	16513	587	1.03
Mungbean	31.00	1220	30500	16270	14230	1.87

Output price (Tk./kg): Potato = 5.00, Bushbean = 5.00, Groundnut = 12.00, Brinjal = 5.00, Chilli = 40.00, Indian spinach = 3.00, Lady's finger = 4.00, Sesame = 15.00, Mungbean = 25.00

Screening of Potato varieties for saline area

Abstract

The experiment was conducted at Multilocation Testing (MLT) Site, Kalapara, Patuakhali during rabi seasons of 2002-03, 2003-04 and 2004-05. A good number of varieties and genotypes were planted to evaluate their performance in saline area. Dheera produced the highest tuber yield (19069 kg/ha) in three years. Heera gave 2nd highest yield (18927 kg/ha) followed by Cardinal (16981 kg/ha), Diamont (15312.8 kg/ha). In 2003-04, average yield of all varieties and genotypes were low due to late sowing. Rainfall in early December delayed sowing.

Introduction

Southern region of Bangladesh is mainly rice based. Cultivation of vegetables is very low. It is a vegetable deficit area. Potato is a promising crop for this area as vegetable. Though production is somewhat lower than North Bengal or Munshiganj area but price is higher than those areas. So farmers are highly interested to cultivate potato. Tuber Crop Research Center (TCRC) of Bangladesh Agricultural Research Institute has already developed some potato varieties and genotypes. These varieties and genotypes needs to be evaluated to find out suitable variety(s)/ genotype(s) for saline area.

Materials and Methods

The experiment was contucted Multilocation Testing (MLT) Site, Kalapara, Patuakhali during rabi seasons of 2002-03, 2003-04 and 2004-05. A good number of varieties and genotypes as shown in Table 2 were planted. The experiment was RCB with 3 replications. The crop was sown on 3 December 2002, 27 December 2003 and 7 December 2004. Seeds were sown with 60 cm x 30 cm spacing in unit plots of 5m x 3m. Irrigation was given thrice at 20 days interval of sowing. Crops were harvested on 3 Mach 2003 for the fist year, on 18 March for last two year. Soil samples were collected from experimental plot for determining salinity level.

Result and Discussion

Three year's experimental data were shown in Table 2. But variety and genotypes were changed due to availability of seeds. Among the variety, Diamont, Cardinal, Dheera and BARI TPS-1 was conducted for 3 years whereas Heera, Raja for two years and rest one year. Dheera produced the highest average tuber yield (19069 kg/ha) followed by Heera (18927 kg/ha), Cardinal(16981 kg/ha), Diamont (15312.8 kg/ha). New variety Billni and Fabula yielded 17345 and 15449 kg/ha, respectively in 2004-05. During 2003-04 season, average yield of all varieties and genotypes was low due to late sowing. Rainfall in early December caused delayed sowing.

Conclusion

Dheera or Heera variety could be grown in saline area Patuakhali for higher yield.

Table 1. Soil salinity of experimental plots at different dates

Salinity (0-15 cm depth of soil)					
Date of soil collection	ds/m	Date of soil collection	ds/m	Date of soil collection	ds/m
1-12-2002	3.95	20-11-2003	1.58	07-12-2004	4.25
15-12-2002	4.21	01-12-2003	2.01	22-12-2004	5.90
30-12-2002	5.60	30-12-2003	3.32	07-01-2005	6.50
15-1-2003	7.50	20-01-2004	4.55	22-01-2005	8.10
30-1-2003	8.75	30-01-2004	4.97	07-02-2005	9.80
15-2-2003	11.05	10-02-2004	6.43	22-02-2005	11.90
1-3-2003	12.91	01-03-2004	8.04	10-03-2005	13.80
16-3-2003	13.88	20-03-2004	8.91		
30-3-2003	15.27	30-03-2004	10.16		

Table 2. Yield of potato varieties/genotypes at Kalapara, Patuakhali

Varieties/ genotype	Tuber yield (kg/ha)			
	2002-03	2003-04	2004-05	Mean
Diamont	15740	12778b	17420c	15312
Cardinal	18333	12000b	20610a	16981
Heera	19074	-	18780b	18927
Dheera	22222	14463a	20522a	19069
BARI TPS-1	10370	8370d	15388d	11376
Raja	16481	9259c	-	12870
86.140	14629	9256c	-	11942
TPS-364167	9815	-	-	9815
Billni	-	-	17345c	17345
Fabula	-	-	15448d	15448
CV (%)		11.7	3.74	

MLT site, Cox's Bazar

The experiment was conducted in the farmers' field at MLT site, Cox's Bazar, Chittagong during the rabi reason of 2004-05 under rainfed condition. The soil was silt loam to clay under the Ramgati soil series of AEZ 23 (Chittagong coastal plain). Seven lines of Potato (38409.11, Asterix, V_{37}, V_{54}, Rodio, TPS/Tuberlet and V_{56}) were tested with local variety. The crop was fertilized with N-P-K (100-24-100 kg/ha). All fertilizers were applied at the final land preparation as basal dose. The whole potato tubers were planted on 09-12-04 with 60cm X 25cm spacing. Mulches were applied immediately after planting to check the loss of soil moisture. Harvesting was done on Last week of February 2005. Seven potato lines were tested to identify salt tolerant variety. The yield and yield contributing characters were significantly affected by different lines. Plant height was significantly the highest in V_{56} whereas number of stem/hill the highest in Asterix. But tuber number per hill was significantly the highest in local variety (11.43). Among the lines, V_{56} showed significantly the highest tuber yield.

Table 1. Yield performance of different potato lines at Cox's bazar MLT site during 2004-05

Lines	Plant height (cm)	No. Stem/hill	No. of Tuber/hill	Tuber yield (t/ha)
384091.11	53.37d	3.23c	9.96b	9.33c
Asterix	53.37d	4.33a	7.10bc	11.00b
V_{37}	54.47d	3.87b	9.30b	9.33c
V_{54}	58.67c	3.80b	5.93c	8.17d
Rodio	59.65bc	3.00c	5.93c	8.17d
TPS/Tuberlet	59.00bc	2.70d	9.23b	8.50cd
V_{56}	64.26a	3.13c	6.57c	12.16a
Local	60.78b	3.34c	11.43a	6.83d
CV (%)	6.67	7.21	8.23	10.23
LSD (0.05)	3.40	0.41	1.47	1.34

Performance of different Soybean varieties

Abstract

The study was conducted at FSRD site Atkapalia, Noakhali and MLT site Laxmipur during Rabi season of 2004-05. The variety, Sohag, Bangladesh soybean 4 and Bangladesh soybean 5 were evaluated against the BADC-1. Among the tested four varieties Bangladesh soybean –5 gave the highest yield (2.52 t/ha) and (2.58 t/ha) at Atkapalia and at Laxmipur respectively. The lowest yield (2.04 and 2.09 t/ha) were found in BADC-1 at both sites respectively.

Introduction

Soybean is a popular oil seed crop in Noakhali and Laxmipur districts. It is exclusively grown in Rabi season as a cash crop. But yield of soybean is low in comparison to that of other countries of the world. It has great potentiality to increase its hectare age as well as yield per unit area. In this context, Oilseed Research Centre of BARI undertaken varietal improvement program developed a good number of varieties. The present investigation was undertaken to evaluate performance of these varieties with some other varieties, which are available in BADC & farmers.

Materials and Methods

The study were conducted at FSRD site Atkapalia, Noakhali and MLT site Laxmipur during Rabi season of 2004-05. The experiment was laid out in RCB design with five dispersed replications at MLT site Laxmipur and at FSRD site Noakhali. The soil of the experimental area belongs to Young Meghna Estuarine Floodplain (AEZ 18f) and Meghna Estuarine Floodplain under (AEZ 18 respectively). Unit plot size was 6m x 5m. Fertilizer dose of 27-75-60 kg/ha of NPK, respectively were applied in the form of Urea, TSP and MP. All fertilizers were applied as basal dose during final land preparation. The variety, Sohag, Bangladesh soybean-4 and Bangladesh soybean 5 were evaluated against BADC-1 variety. Seeds were sown in lines maintaining 30 cm X6cm spacing. Seed were sown on last week of December 04 to 1st week of January 05 and harvesting was done in the 3rd week of May 05. During the experiment period the salinity range was 1.2 to 5.6 ds/m.. Data on yield and yield contributing characters were recorded and analyzed by computer program MSTAT-C.

Results and Discussions

Atkapalia FSRD site, Noakhali

Plant height, Stover yield and 1000-seed weight of Bangladesh soybean –5 was significantly varied with the all varieties (Table 1). Highest branch/plant, seed/pod and yield was recorded in Bangladesh soybean 5 which is statistically similar with the Bangladesh soybean –4, while the lowest branch/plant, seed/pod and yield was recorded in BADC-1 that is statistically similar with the Sohag. The variety revealed that highest pod/plant was recorded in Bangladesh soybean-5 that is statistically similar with Bangladesh soybean 4 and Sohag. While the lowest pod/plant was obtained in BADC-1.

MLT site, Laxmipur

Highest yield and stover yield was obtained in Bangladesh soybean 5 while the lowest yield was obtained in BADC-1. Similarly lower stover yield was recorded in BADC-1 which was statistically similar with Bangladesh soybean 4 and Sohag. The highest 100 seed weight was recorded in Bangladesh soybean-5 that is statistically similar with Sohag and the lowest 100 seed weight was found in Bangladesh soybean-4. Highest plant height, pod/plant and seed/pod were found in Bangladesh soybean-5 which was statistically similar with Bangladesh soybean 4. The lowest plant height, pod/plant and seed/pod were found in BADC-1 that is statistically similar with Sohag.

Farmers' reaction

Yield of both Bangladesh soybean-5 and Bangladesh soybean-4 are highly accepted by the farmers. If seeds are available in local market, it has an opportunity to increasing more area with Bangladesh soybean –5 due to its whitish seed colour, large seed size and good market price.

Conclusion

BARI Soybean –5 is highly accepted by the farmers because of its white colour seed and high yield in comparison with the other varieties.

Table 1. Performance of different soybean varieties at FSRD site, Atkapalia, Noakhali during 2004-05

Variety	Plant ht (cm)	Branch/ Plant	Pod/ Plant	Seed/ pod	100 seed wt (g)	Yield (t/ha)	Stover yield (t/ha)
BADC-1	58.52c	2.80b	37.60b	2.16b	133.60b	2.04b	3.09c
Bangladesh soybean 4	63.34b	3.76a	40.54ab	2.76a	63.80c	2.36a	3.37b
Bangladesh soybean 5	66.76a	3.86a	43.58a	2.94a	140.40a	2.52a	3.61a
Sohag	61.20bc	2.94b	40.92ab	2.22b	131.0b	2.14b	3.31b
LSD (0.05)	3.23	0.49	3.77	0.20	2.80	0.20	0.09

Table 2. Performance of different soybean varieties at MLT site, Laxmipur during 2004-05

Variety	Plant ht (cm)	Pod/ Plant	Seed/ Pod	1000-seed weight (g)	Yield (t/ha)	Stover yield (t/ha)
BADC-1	55.90c	39.20c	2.24b	12.40b	2.09d	3.24b
Bangladesh soybean 4	63.20ab	42.72ab	2.84a	6.40c	2.44b	3.36b
Bangladesh soybean 5	65.66a	43.96a	2.88a	13.20a	2.58a	3.75a
Sohag	61.00b	41.06bc	2.34b	13.00ab	2.17c	3.33b
LSD (0.05)	2.564	2.472	0.209	0.712	0.062	0.169

C. RAINFED AREA

Performance of five drought tolerant and wilt resistant Chickpea genotypes under high Barind conditions

Abstract

Five drought and wilt tolerant chickpea genotypes along with three other widely cultivated cultivars were tested at Chabbisnagar FSRD site, in the High Barind Tract, Rajshahi during 2003-04 and 2004-05. No symptom of wilt was observed on any cultivar. In both year, among the genotypes only ICCV 94924-3 had the high yield potential due to its higher number of pods per plat and heavier 100-seed weight. Considering yield and other parameters another line ICCV 94924-2 also performed better than check varieties during 2004-05.

Introduction

High Barind Tract (HBT) area is characterized by low and erratic rainfall having low soil moisture in post-rainy season along with highly compact soil (Ali, 2000). Thus the area needs deep rooting genotypes with high yield, i.e. cultivars with drought tolerant characteristics. Also often wilt is a constraint for chickpea production in the HBT. In the mean time the two deep rooting genotypes namely, ICC 4958 and Annigeri is already adapted to the HBT situations (Ali, 2000). Recently ICRISAT has developed drought tolerant and wilt resistant elite genotypes (personal communication, L. Krishnamurthy) through the crossing between ICC 4958 and Annigeri. Therefore, among the developed progenies five promising genotypes along with widely cultivated BARI released chickpea varieties and Annigeri were tested.

Materials and Methods

An experiment was conducted at Chabbisnagar FSRD site, HBT, Rajshahi during 2003-04 and 2004-05. The tested eight genotypes were; ICCV 94916-4, ICCV 94916-8, ICCV 94920-3, ICCV 94924-2, ICCV 94924-3, Annigeri, BARI chola 5 and BARI chola 2.The unit plot size was 2 m x 7 m. At the time of final land preparation different fertilizers were applied @ N_{20} P_{20} K_{20} S_{10} B_1 kg ha^{-1}. Seeds were shown on 12 November 2003 and 20 November 2004, maintaining a spacing of 40 cm x 10 cm. The chickpea fields were kept weed and pod borer free. All the genotypes were harvested on 14, March 2004 and 16, March 2005. Data on yield attributes were recorded from 10 randomly selected plant and yields were recorded from whole plot (as area was small).

Results and Discussion

2003-04: As the initial soil moisture was poor resulting in poor germination of two genotypes. Among the genotypes ICCV 94924-3 and Annigeri produced higher and promising seed yields (Table 1). Thus among the tested cultivars only ICCV 94924-3 showed promising yield potential due to its higher number of pods/plant and heavier seed weight. No symptom of wilt was observed on any cultivars.

2004-05: As the initial soil moisture was poor resulting in zero germination of two genotypes and poor germination in one genotype. Among the genotypes ICCV 94924-3 and ICCV 94924-2 produced higher and promising seed yields (Table-2). Thus among the tested cultivars only ICCV 94924-3 and ICCV 94924-2 showed promising yield potential due to its higher number of pods/plant and heavier seed weight. No symptom of wilt was observed on any cultivars.

Conclusion

Thus the genotypes would be tested over the years and locations (depend on seed quantity) to show its response to year and location variations. The experiment will be continued for the next year.

Table 1. Yield and yield attributes of eight different chickpea genotypes at High Barind Tract, Rajshahi, 2003-04

Genotype	Plant pop/m^{-2} (no.)	Plant height (cm)	Branches /plant (no)	Pods/ plant (no)	Grains/ pod (no)	100-seed wt (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
ICCV 94920-3	39.2	55.9	2.4	49.0	1.6	25.5	1221	1400
ICCV 94924-2	50.5	46.4	2.4	65.4	1.8	25.0	2126	2159
ICCV 94924-3	49.3	47.8	2.4	58.2	1.6	25.0	2641	2001
Annigeri	48.0	50.2	2.4	59.8	1.8	15.6	2640	2560
BARI chola 5	50.7	58.04	2.4	55.8	1.6	11.5	1246	2468
BARI chola 2	48.2	58.0	3.2	65.3	1.8	12.3	1823	2179

Table 2. Yield and yield attributes of eight different chickpea genotypes at High Barind Tract, Rajshahi, 2004-05

Genotype	Plant pop./m^{-2} (no.)	Plant height (cm)	Branches /plant (no)	Pods/ plant (no)	Grains/ pod (no)	100-seed wt (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
ICCV 94924-2	42.20	41.50	2.00	42.50	2.00	24.50	1120	2100
ICCV 94924-3	39.50	43.50	2.50	45.8	2.00	25.00	1225	2400
Annigeri	37.30	40.00	2.00	39.00	1.80	26.00	1085	1500
BARI chola 5	38.70	38.50	2.00	44.00	1.85	14.70	985	1800

Participatory variety selection of Chickpea

Abstract

A field experiment was conducted in the farmer's field of FSRD site, Chabbishnagar, Rajshahi during Rabi of 2004-05 to select the suitable variety (s) of chickpea for High Barind Tract (HBT). Six advanced lines of chickpea viz. ICCV-95138, ICCV-97004, BCX-910109-3, BCX-91010-1, ICCV-96020, ICCV-87322 and one check (BARI chola-5) were tested in the field. Among the entries tested ICCV-97004 gave the higher grain yield (1550 kg/ha) followed by BCX-91010-1 (1353 kg/ha). The entry BCX-910109-3 gave moderate yield (1273 kg/ha). The lowest yield (818 kg/ha) was obtained from the check BARI chola-5.

Introduction

Chickpea (*Cicer arietinum* L) is an important pulse crop in Bangladesh. It contributes about 20 percent of the total pulses. It is normally cultivated in the winter season on conserved soil moisture. Its average yield in Bangladesh is far below the yield level achieved by many other chickpea growing countries. The yield of chickpea is probably most unstable among pulses due to its more sensitivity to microenvironment conditions. On the other hand, it has got the highest yield potentiality under favourable environment. Such low yield might be attributed to the lack of higher yielding and disease resistance varieties, inadequate fertilizer use and inappropriate cultural practices. Chickpea is found to be a very suitable dry land rabi crop with residual soil moisture condition. Under barind stress situation it can be successfully grown after harvesting of short duration T.aman rice. So, the present experiment was undertaken to select the suitable line (s) of chickpea for high yield potential as well as resistant to major diseases.

Materials and Methods

The field trial was conducted at FRSD site, Chabbishnagar Rajshahi during rabi 2004-05. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 6 rows x 4 m. The seeds were sown in 40 cm row spacing with continuous sowing. Six advanced lines/varieties viz. ICCV-95138, ICCV-97004, BCX-910109-3, BCX-91010-1, ICCV-96020, ICCV-87322 and one check BARI Chola-5 were included in the study. Seeds were sown on 22

November, 2004. The seed rate was maintained 50 kg/ha. The land was fertilized at the rate of 20-40-20 N, P_2O_5, K_2O kg/ha in the form of urea, triple super phosphate and muriate of potash, respectively. All fertilizers were applied as basal during the final land preparation. The crops were harvested on 20 March, 2005. The seed yield and yield components were recorded and analyzed statistically.

Results and Discussion

Experimental results revealed that plant height, plants/m^2, yield components and yields were statistically significant except seeds/pod which was statistically at par (Table 1). The plants/m^2 varied widely where the highest plants/m2 was recorded from ICCV-96022. Pods/plant was similar to BCX-910193, BCX 910101, ICCV 96020 and ICCV 87320. Higher seed yield was recorded from line ICCV 97004 which was statistically identical to BCX 9101093. The existing high yielding variety BARI Chola 5 did not perform well and the lowest yield was obtained among the variety/lines.

Conclusion

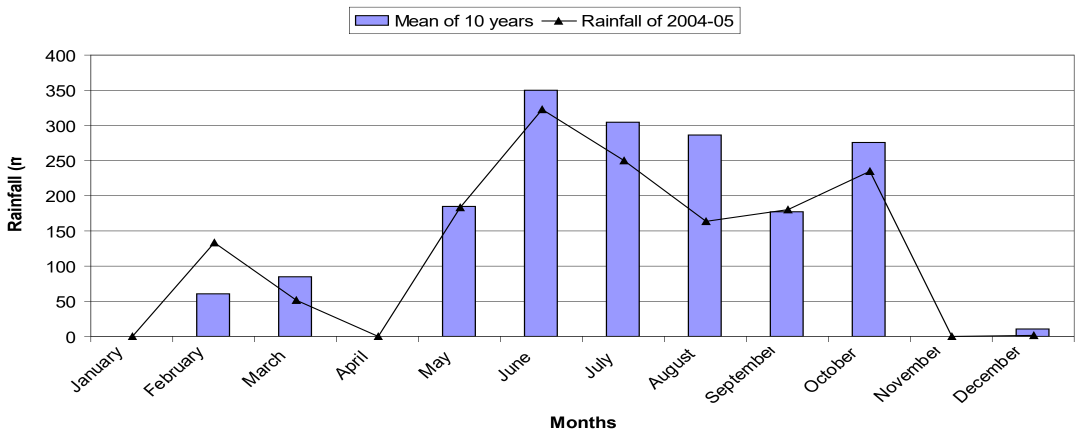
From this study it was observed that the chickpea line ICCV-97004 and BCX-91010-1 are found promising for Barind area. Therefore, it could be selected for further evaluation in the next year.

Farmers reaction

Farmers are very much interested to cultivate the chickpea lines ICCV-97004 and BCX-91010-1 due to its high yield potentiality.

Table 1. Yield components and yield of chickpea entries under participatory variety selection at HBT

Entries/lines	Plant pop./m^2	Plant height (cm)	Pods/ Plant	Branch/ plant	Seeds/ pod	Seed yield (kg/ha)
ICCV-95138	18.33	35.27	28.00	4.53	1.40	900
ICCV-97004	16.67	36.00	30.00	4.03	1.53	1550
BCX-910109-3	12.33	40.27	37.00	4.00	1.33	1273
BCX-91010-1	17.67	41.67	35.53	3.67	1.53	1353
ICCV-96020	27.67	33.00	36.00	3.47	1.53	880
ICCV-87322	23.67	48.20	36.33	3.07	1.67	978
BARI chola-5 (Check.)	17.00	30.87	31.00	3.50	1.53	818
CV (%)	7.14	2.78	4.10	6.66	12.92	13.37
LSD (0.01)	3.39	2.63	3.42	0.62	NS	369.3



Rainfall of FSRD site, Chabbishnagor, Rajshahi

Performance of different Chickpea varieties

Abstract

An experiment was carried out at MLT site Kushtia sadar to find out the yield and suitability of chickpea variety (s) after harvest of T.Aman rice. Six BARI developed chickpea varieties BARI chola 2, 3, 4, 5, 6 and 7 and one Local variety were evaluated. On an average, BARI chola 2 gave the highest yield which attributed by maximum pods/plants and relatively bigger seed size.

Introduction

Among the pulses growing area in Bangladesh chickpea ranked third in area and production but second in consumption priority. It covers an area of 16650 ha, producing 12225 tons of yield with a national average of 702 kg/ha (BBS-1999). About 85% of the total chickpea are grown in five greater districts namely Pabna, Rajshahi, Faridpur, Jessore and Kushtia in Aus/Jute-Fallow-Chickpea and Aman rice-chickpea cropping pattern. About 35-40% chickpea are planted in late December following Aman rice and suitable varieties for this situation are lacking. 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.

Materials and Methods

The experiment was conducted in rainfed condition at the MLT site Kushtia sadar during December, 2004 to March, 2005. There were seven chickpea varieties viz., BARI chola 2, 3, 4, 5, 6, 7 and local. The trial was laid out in RCB design with Four Replications. The plot size was 5m x 8m. Fertilizers were applied at the rate of 20-40-20 kg/ha of N-P-K respectively. The seeds were sown on 30.11.2004. Intercultural operation and plant protection measure were done as and when required. The crop was harvested at 27 March, 2005. Necessary data were collected and analyzed.

Results and Discussion

Plants/m^2, plant height, pods/plant, 100-seed wt, seed yield and straw yields were significantly affects by different varieties. Higher plants/m^2 was obtained from variety BARI Chola-5 which was statistically identical to BARI chola-4. The variety, BARI chola-4 & BARI chola-2 were statistically at par higher than other varieties. The variety BARI chola-7 & BARI chola-2 showed higher pods/plants among the varieties. Significantly highest 100 seed wt. was recorded from BARI chola-2 and other varieties showed much less seed weight. The variety BARI chola-2 gave significantly the highest seed yield which different from other variety. On an average seed yield was lower in all the varieties. Similar trend was followed in case of straw yield as in seed yield.

Conclusion

From the result it showed that among the varieties of BARI chola 2 & 4 performed better but yield should be more. This is first year trial and will be continue for the next year.

Table 1. Performance of different chickpea variety at Kushtia Sadar during Rabi, 2004-05

Variety	Plants/m^2	Plant height (cm)	Pods/ plant	100-seeds wt. (g)	Seed yield (t/ha)	Stover yield (t/ha)
BARI Chola-2	40.0bc	32.60c	25.5a	15.6a	1.35a	1.65a
BARI Chola -3	34.5c	40.11a	13.0d	14.5b	0.83c	1.6a
BARI Chola -4	42.5b	36.79b	21.0b	10.74d	1.01c	1.4b
BARI Chola -5	52.8a	31.29c	18.3c	10.18d	0.90 b	1.13d
BARI Chola -6	37.0bc	25.86c	12.8d	14.50b	0.81c	1.03d
BARI Chola -7	33.8c	39.36a	24.5ab	12.30c	0.84de	1.36d
Local	40.8bc	29.54d	12.0d	8.33c	0.90b	1.25c
CV (%)	18.4	3.1	8.9	4.0	4.6	5.3
LSD(0.05)	*	**	**	**	**	**

**.= Significant at 1% level, = Significant at 5% level.

Performance of seed priming on yield and yield contributing characters of Lentil

Abstract

An experiment was conducted in farmer's field at Kushtia during rabi season from November 2004 to March 05 to study the effect of seed priming on yield and yield contributing character's of lentil at Kushtia region. Four levels of priming (control, 4, 8 and 12 hours) were used. Sseed sowing at 8 hours of BARI Mashur-4 showed significantly higher yield than control (non priming). Beyond 8 hours sowing lentil seed resulted declined yield.

Introduction

Pulse play a vital role in Bangladesh diets and the present per capital consumption of pulse in about 12 g per day and if the rate is to be maintained by the year 2010 then the production has to be increased by 25.37% over the present production. Among the pulse crop, lentil in the most important pulse crop in Bangladesh which ranks second in position. It contains a good amount of palatable proteins (25%). Nearly 211987 hectare of land is under lentil with production 158981 tons. Kushtia is one of the major lentil growing areas of Bangladesh with 7090 ha land with average yield 910 kg/ha. There are many problems to associated lentil cultivation. Soil moisture is one of the important factor for crop germination and plant establishment. After harvesting of Aman crop it is difficult to crop establishment due to less moisture. But there is a positive effect of seed priming on germination and crop establishment of lentil with this view as experiment was undertaken to find out the effect of seed priming of lentil for better crop establishment.

Materials and Methods

The experiment was conducted at Kushtia during Rabi season of 2004-2005.The experiment was laid out in a RCB design with 3 (three) Replications. The size of each unit plot was 5 x 4 m^2, Nitrogen, phosphorous and potassium were applied as basal during final land preparation at the rate of 20-40-20 kg/ha. Seeds were sown in broadcast method on 2 November 2004. Seed rate was maintained 40 kg/ha. The crop was harvested in 20 February 2005 Weeding and plant protection measures were done as and when required. Data were collected on different yield and yield components.

Results and Discussion

Priming techniques had slightly affected on plant population where higher plant/m2 was recorded from treatment T_3. It was observed that plant population, plant height, pods/plant and grain yield were influenced by the priming techniques. Eight hours priming seed produced higher number of plant population /m^2 (139), pods/plants (54.0). Plant height was not influenced by different treatment. But pods/plant was higher in treatment T_3 followed by T_2.

Conclusion

It is very good positive and effective method in lentil production. The site farmers' are very happy about these system. It is first year trial and will be continue for the next year.

Table 1. Performance of different lentil variety on prime & non-prime system at farmers field in Kushtia region rabi 2004-05

Treatment	Plants/m^2	Plant height (cm)	Pods/plant (No)	1000 seed wt (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
T_1	118	30.0	46.0	14.0	1300.0c	800.0
T_2	129	32.6	50.6	15.6	1563.3ab	936.6
T_3	139	32.0	54.3	15.1	1600.0a	900.0
T_4	122	32.3	40.0	15.8	1523.3ab	833.0
CV (%)					6.4	
LSD		NS	NS	NS	**	NS

Performance of Mungbean varieties in Kharif-II season

Abstract

An experiment was conducted at MLT site, Gangni, Meharpur during Kharif-II season of 2004 to evaluate the performance of promising Mungbean varieties/lines. A total of eight (8) varieties/lines were tested. The results of the studies revealed that there was a significant variation in grain yield among the varieties/lines. Among the varieties/lines BMX-94010-10 gave the significant highest yield of 1.51t/ha. Similar trend was followed in stover yield.

Introduction

Mungbean (*Vigna radiata* L) is one of the most important pulse crops particularly in southern parts of Bangladesh where it is grown in T.Aman-Mungbean-T.Aus cropping pattern. It has good flavour, high protein content and easy digestibility. Although mungbean is an important pulse for the dietary situation of the country but its production per unit area of land has not increased. About 65-70% of the total mungbean area belongs to the southern region of Bangladesh. However the area of mungbean in Kushtia district has been increased in the recent past year. The farmer of this area is using BARI released varieties. Local cultivars of these areas are low yielding and highly susceptible to yellow mosaic virus (YMV), cercospara leaf Spot (CLS) and powdery mildew (PM) disease. The experiment was to identify the high yielding and short duration variety of mungbean for Kushtia area.

Materials and Methods

The experiment was conducted at MLT site Gangni during Kharif-II season of 2004 under rainfed condition. The experiment was laid out in RCB design with three dispersed replications. A total of Eight (8) varieties/lines were evaluated. The unit plot size was 6 rows x 4m with 40 cm x 10cm spacing. Seeds were sown by lines on 10 August 2004. Fertilizer was applied at the rate of 20-40-20 kg/ha NPK as basal dose. One weeding was done at 25 days after sowing. Plant protection measure was done accordingly. Data were collected on yield and yield components. The recorded data were analyzed statistically.

Results and Discussions

Plant height, plants/m2, Pods/plants, 1000-seed weight and seed yields were significantly affected by different varieties. Three variety/line BMX-99002-2, 97004-1 & BMX-94010-10, showed similar height & higher than other variety/line. Significantly highest pods/plant and seeds/pod were recorded from BMX-94010-10. The grain weight showed the highest in line BMX 97004-1 followed by BARO Mung 5. The highest seed yield was obtained from BMX-94010-10 which was significantly differing from other treatments. Other variety did not perform well. Similar trend was followed in case of stover yield.

Impact: Farmers were satisfied with the higher grain yield and higher number of pods in variety BMX-94010-10.

Conclusion: Out of eight varieties/lines BMX-94010-10 and new lines BMX-99002 performed well and had yield potentiality compared to other lines. The experiment needs to be continued for another year for confirmation.

Table 1. Yield and Yield attributes of mungbean as influenced by different lines/variety (MLT site Gangni, Meharpur Kharif-II at year of 2004)

Variety/line	Plant pop.(m^2)	Plant height (cm)	Pods/plant (no)	Seeds/ pod	1000-seeds wt.(g)	Seed yield (t/ha)	Stover yield (g/m^2)
BMX-99002-2	55.61ab	55.67ab	8.433b	8.50cd	38.50b	1.21b	2.55b
BMX-97004-1	54.55ab	55.33ab	6.61c	10.99b	39.50a	1.15bc	2.53b
BMX-94001-3	52.83ab	52.23c	8.40b	7.06 d	36.83d	1.00c	2.22c
BMX-94010-10	55.94a	56.55ab	10.44a	11.27a	37.17cd	1.51a	2.78a
BMX-95001-7	53.24ab	52.13c	7.80b	8.85cd	37.83	1.05cd	2.50b
BMX95006-18	55.67ab	54.86b	6.57c	6.66d	37.0c	0.86d	2.05c
BARI-Mung-2	52.67b	57.93a	8.50b	7.76d	36.83d	0.95de	2.10c
BARI-Mung-5	54.0ab	51.90c	7.67bc	9.08c	38.0ab	1.00c	2.42b
CV (%)	3.0	2.6	8.0	1.8	1.2	7.2%	4.3
LSD (0.05)	**	**	**	**	**	**	**

On-farm trial of wheat through power tiller operate wheat seeder

Abstract

The experiment was conducted at Radhanagar at Goyanghat Upazila under Sylhet district during rabi 2004-05 to popularize wheat cultivation and to demonstrate wheat power seeder. The higher grain yield (3.76 t/ha) was found from power driven wheat seeder, which was 13% higher than traditional broadcast method.

Introduction

Wheat is the second cereal crop of Bangladesh. It has to compete with other important winter crops like boro, maize, pulses, oilseeds and vegetables. After harvesting of T.Aman rice lands are remain fallow in Sylhet region. Limited area in this region is utilized in wheat cultivation and mainly in rainfed condition. Wheat is cultivated at Goyanghat and Jaintapur Upazila as a single crop in a year. Ploughing cost is the major production cost of wheat. CIMMYT and WRC developed power tiller operated seeder machine which is able to furrow, line sowing and leveling of soil at a time and also reduces production cost. Hence, to popularize wheat cultivation and to demonstrate wheat power seeder, OFRD, Sylhet took initiative with joint collaboration of CIMMYT and WRC.

Materials and Methods

A production program was conducted at Radhanagar at Goyanghat Upazila under Sylhet district during rabi 2004-2005. The program was conducted under rainfed condition and variety Satabdi was used. The area covered under production program was 2 hectares of land, out of which 1.5 hectares by power seeder and rest 0.5 hectare by conventional broadcast method. The seeds were sown on 28 November to 4 December 2004. The crop was fertilized @ 55-22-15-12 kg/ha of N, P, K and S respectively. Intercultural operations were done properly. Crop was harvested on 18-25 March 2005.

Results and Discussion

In this region wheat cultivation is delayed due to post monsoon rain which cause excess soil moisture exists in the field. Weed infestation is serious problem of the land. Farmers of the locality minimized the excess soil moisture and weed infestation, they open the land before 7-8 days of seeding. The higher grain yield (3.76 t/ha) was found from power driven wheat seeder, which was 13% higher than traditional broadcast method. From economic point of view, higher gross return, gross margin and benefit cost ratio were obtained from power tiller operated seeder machine.

Farmers reaction

Farmers showed positive response with new mechanical seeder. They opined that this power seeder machine reduces production cost as well as seed rate. Labour cost is minimized by using power seeder machine as the labour cost is very high and crisis in Sylhet region.

Table 1. Comparative performances of wheat in power seeder and traditional production method at Sylhet

Method	Farmers involved (no.)	Area covered (ha)	Grain yield (t/ha)	Gross return (Tk/ha	TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Seeding with power seeder	5	1.5	3.76	37600	8290	29310	4.54
Seeding with traditional broadcast method	2	0.5	3.33	33300	9490	23810	3.51

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Intercropping of hybrid maize with Bushbean at different fertilizer levels

Abstract

An experiment of inter-cropping hybrid maize (984) with bush bean (BARI Jharseem-1)at different fertilizer level was carried out at Bandarban sadar areas during rabi season 2004-05.It revealed that highest maize equivalent yield (12.12 t ha^{-1}) was obtained from T_3 (Maize normal planting + 2 rows of bush bean (30 cm x 10 cm) + 250-120-120-40 kg N, P_2O_5, K_2O and S/ha) followed by 10.55 t ha^{-1} for T_2 and 10.38 t ha^{-1} for T_5 and it was lowest 9.87 t ha^{-1} for T_4.The gross margin was found highest as Tk.71252 ha^{-1} for treatmentT_3 and it was lowest Tk35463 ha^{-1} for T_1 (sole maize) with (75 cm x 25 cm) + 250-120-120-40 kg N, P_2O_5, K_2O and S/ha (recommended dose).The gross margin increased by 45 percent due to inter-cropping system. The benefit cost ratio was highest 2.42 for T_3 and lowest 1.88 for T_1 (sole maize).

Introduction

Hybrid maize becomes importance in Bangladesh due to its higher yield potentiality and favorable agro-climate condition for its cultivation. It requires high amount of chemical fertilizers for exploiting its maximum yield potentiality. On the contrary, bush bean being a leguminous crop needs lower fertilizer dose for its cultivation. Maize-bush bean is a competent inter-cropping system because of their different photosynthetic pathway, growth duration, root systems and requirement of growth resources. Growing of bush bean in association with hybrid maize may reduce fertilizer requirement for the system as bush bean can fix atmospheric N_2 and subsequently release it to the soil. More over, after harvesting of green pods, incorporation of green biomass of bush bean may improve soil health in the long run. The nutrient management of intercropping is somewhat different from of the sole cropping and the success of intercropping depends on the proper nutrient management to obtain maximum productivity. In Bandarban district about 355 acres of land are covered by maize cultivation with very lower yield only 1.5 ton/ha (BBS, 1999). Now a days mini poultry industry has been developed in hilly areas. So, the demand of maize as poultry or dairy feed is increasing day by day. Due to the very low yield of existing local maize variety, farmers were deprived from higher benefit. Due to the limited area of land in hill district, an inter-cropping system might be more profitable than single cropping. So it is necessary to find out the optimum fertilizer dose for higher productivity for intercropping hybrid maize with Bushbean and to analyze the cost and return of hybrid maize-bush bean inter-cropping system at different fertilizer levels.

Materials and Methods

An experiment on inter-cropping of hybrid maize with bush bean at different fertilizer levels was conducted during rabi season 2004-05 at Bandarban sadar areas in hill district Bandarban. The soil was brown loam and slightly acidic to strongly acidic, soils pH ranges 4.5 -6.5. Land type was high land. Organic matter was low and N was very low, P- medium, K- medium, S- medium, Zn- very low and Boron was very low (SRDI Thana Nirdeshika, Bandarban). The site represents the area of AEZ-29. The treatments are, T_1 = Sole maize (75 cm x 25 cm) + 250-120-120-40 kg N, P_2O_5, K_2O and S/ha (recommended dose), T_2 = Maize normal planting (75 cm x 25 cm) + 2 rows of bush bean (30 cm x 10 cm) + 200-80-80-30 kg N, P_2O5, K_2O and S/ha, T_3 = Maize normal planting + 2 rows of bush bean (30 cm x 10 cm) + 250-120-120-40 kg N, P_2O_5, K_2O and S/ha, T_4 = Maize paired row (37.5 cm/150cm/37.5cm) + 4 rows of bush bean (30 cm x 10 cm) + 200-80-80-30 kg N, P_2O_5, K_2O and S/ha, T_5 = Maize paired row (37.5 cm/150cm/37.5cm) + 4 rows of bush bean (30 cm x 10 cm) +250-120-120-40 kg N, P_2O_5, K_2O and S/ha. The experiment was laid out RCB deign with 3 replications. The unit plot size was 4.0 x 4.5 m. The maize and bushbean variety was pacific 984 and BARI Jharseem 1. The experiment was sown on 21 November 2004. The bushbean was harvested 3 times on 10, 20 and 25 January 2005 and maize on 7-10 April 2005.

The yield contributing character data were recorded from ten randomly selected plants. Yield data was recorded per plot and convert per hectare yield. Data were analysis statistically and means were analysis by LSD test and cost return analysis was also done.

Results and Discussion

Yield and yield contributes of bushbean: Plants/m^2, pods/plants and weight of green pods were not significantly influenced by different treatment but green pod of yield was statistically different. Significantly highest yield was recorded from treatment T_3 (Maize normal planting + 2 rows of bush bean (30 cm x 10 cm) + 250-120-120-40 kg N, P_2O_5, K_2O and S/ha). Among the treatment lowest yield was obtained from treatment T_4 (Maize paired row (37.5 cm/150cm/37.5cm) + 4 rows of bush bean (30 cm x 10 cm) + 200-80-80-30 kg N, P_2O_5, K_2O and S/ha) due to lower dose of fertilizer and less number of green pods per plants (Table1).

Yield and yield contributes of maize: Number of cob/plants and length of cob was not significantly influenced by different treatment, but plant/m^2, length of cob, no. of grain/cob and wt. of 1000 grain weight was statistically different. Significantly highest grain yield was recorded from treatment T_3 (Maize normal planting + 2 rows of bush bean (30 cm x 10 cm) + 250-120-120-40 kg N, P_2O_5, K_2O and S/ha). Among the treatment lowest yield was obtained from treatment T_4 = Maize paired row (37.5 cm/150cm/37.5cm) + 4 rows of bush bean (30 cm x 10 cm) + 200-80-80-30 kg N, P_2O_5, K_2O and S/ha, due to less number of plants/m2 and lower dose of fertilizer than other treatment (Table 2).

Maize equivalent yield: Among the treatment highest MEY was recorded from treatment T_3 and other treatment also showed higher than sole maize crop.

Cost benefit analysis: The highest gross return (Tk. 121200 ha^{-1}) was obtained from treatment T_3 which was followed by treatment T_5 (Tk. 103800 ha^{-1}). All the treatments showed higher gross return than sole crop (Tk. 75400 ha^{-1}) (Table 3).The cost of cultivation was different among the crop. In case of bush bean, only seed, sowing and harvesting cost was considered due to intercropping with maize. But in case of maize, all cost had been considered except land rent. Among the treatment total cost of cultivation varied due to different fertilizer dose and it was Tk. 49948ha^{-1} for T_3 and T_5 while Tk.45133 ha^{-1} for T_2 and T_4. The highest gross margin (Tk. 101152 ha^{-1}) was obtained from treatment T_3 due to higher gross margin (Tk. 40852 ha^{-1}) from maize. Among the treatment the lowest gross margin (Tk.35463 ha^{-1}) was recorded from treatment T_1 (Sole maize). Considering economic analysis, highest BCR (2.42) was recorded from T_3 and lowest 1.88 for T_1 which was also lowest among the treatment.

It is evident from cost benefit analysis inter-cropping system was more profitable than sole crop. Per hectare gross margin increased by 50 percent than sole crop due to intercropping system. So, maize intercropped with 2 rows of bushbean could be grown instead of sole maize.

Field observation

- Some vertebrate birds severely disturbed at the time of flowering of bushbean.
- Some leaf bettle was attack in bushbean and control by Symbush spraying.
- The birds of Kakatoa sometimes disturbed on green cob at the maturity stage of maize.

Farmer's reactions

Farmer's preferred inter-cropping system than sole maize cultivation due to quick earn from vegetables (Jharseem) as well as getting more benefit.

Table 1. Yield and yield contributing character of BARI Jharsheem-1 in maize - bushbean intercropping system at hilly areas in Bandarban, 2004-05

Treatment	Plant/m^2	No. of pod /plant	Wt. of 50 green pods (gm)	Green pods yield (t/ha)
T_2	19	13	240	4.86b
T_3	18	14	245	6.08a
T_4	17	11	235	3.57c
T_5	18	13	250	4.58b
LSD (0.05)	NS	NS	NS	1.72

Table 2. Yield and yield contributing character of maize (pacific-984) in maize-bushbean inter-cropping system at hilly areas in Bandarban, 2004-05

Treatment	Plant/ m^2	No. of cob/plant	Length of cob (cm)	No. of grain/cob	Wt. of 1000 grain (g)	Grain yield (ton/ha)
T_1	4.2	1.00	21	522	338	7.54c
T_2	4.0	1.00	19	610	355	8.12b
T_3	4.7	1.00	20	538	339	**9.08a**
T_4	3.8	1.00	18	558	350	**7.18c**
T_5	4.3	1.01	21	578	322	8.09b
LSD (0.05)	**0.39**	**NS**	**NS**	**44.05**	**40.58**	**1.87**

Table 3. Per hectare costs and return of maize-bush bean intercropping system at different fertilizer level at hilly areas in Bandarban, 2004-05

Treatment	Maize equivalent yield (t ha^{-1})	Gross return (Tk/ha)	*Cost of cultivation (Tk/ha)	Gross margin (Tk/ha)	Benefit Cost Ratio (BCR)
T_1	7.54	75400	39937	**35463**	**1.88**
T_2	10.55	105500	45133	60367	2.33
T_3	**12.12**	121200	49948	**71252**	**2.42**
T_4	9.87	98700	45133	53567	2.18
T_5	10.38	103800	49948	53852	2.07

*Cost item was included in bush bean seed, sowing and harvesting cost only but in case of maize, land preparation, fertilizer, seed, sowing, weeding, irrigation, intercultural operation, insecticide and harvesting cost.

Note: Sales price of Bushbean @Tk. 5/kg and grain of maize @Tk. 10/kg in local market.

Intercropping Carrot with Hybrid Maize at different planting systems at hilly areas

Abstract

An experiment of inter-cropping carrot with hybrid maize at different planting system was carried out at Bandarban sadar areas during rabi season 2004-05 with view to identify the suitable planting system and find out the economic return from the system. It revealed that gross margin was found highest at Tk.49477 ha^{-1} for treatment T_3 (Maize paired row (37.5 cm/150cm/37.5cm) + 4 rows carrot (30cm x 10 cm) due to higher gross margin from maize and it was lowest Tk.38147 ha^{-1} for treatment T_2 (Maize normal row (75 cm x 25 cm) + 2 rows carrot (30 cm x 10 cm) due to negative gross margin from carrot. The benefit cost ratio was highest 2.18 for T_1 sole maize and it was lowest 1.71for T_2 followed by 1.71 for T_3 which was lower than sole maize might be obtained negative return from carrot. It proved that maize-carrot inter-cropping system would not be feasible in that area.

Introduction

Hybrid maize is newly introduced crop in Bangladesh. Due to the establishment of poultry industry its demand is increasing day by day. Maize is a long duration and wide spaced crop. In the inter-row space another short duration crop can be intercropped for better utilization of natural resources as well as maximizing total productivity of unit area. Carrot is a protein rich high value cash crop. It is a quick growing short stature crop; it may be intercropped with maize due to its different growth habit for getting maximum economic benefit. In Bandarban district about 355 acres of land are covered by maize cultivation with very lower yield only 1.5 t/ha (BBS, 1999). Now-a-days mini poultry industry has been developed in hilly areas. So, the demand of maize as poultry or dairy feed is increasing day by day. Due to the very lower yield of existing local maize variety, farmers are deprived from higher benefit. So, it is necessary to introduce hybrid maize for higher yield and high economic return as well as better utilization of land for maximum outlay. Farmers would be getting better economic return for maize-carrot intercropping system in hilly areas.

Objectives

- To find out the suitable planting system of carrot intercropped with maize;
- To estimate the cost and economic return of maize carrot intercropping system.

Materials and Methods

An experiment on inter-cropping carrot with maize at different planting systems was conducted during rabi season 2004-05 at Bandarban sadar areas in hill district Bandarban. The soil was brown loam and slightly acidic to strongly acidic, soils pH ranges 4.5-6.5. Land type was high land. Organic matter was low and N was very low, P- medium, K- medium, S- medium, Zn- very low and Boron was very low (SRDI Thana Nirdeshika, Bandarban). The site represents the area of AEZ- 29. The treatments are T_1 = Sole maize (75cm x 25cm), T_2 = Maize normal row (75 cm x 25 cm) + 2 rows carrot (30 cm x 10 cm) & T_3 = Maize paired row (37.5 cm/150cm/37.5cm) + 4 rows carrot (30 cm x 10 cm). The experiment was set up in RCB with 3 replications. The crop was sown on 01December 2004. The unit plot size was 4m x 4.5m. The variety of maize was pacific 984 and carrot was Yellow Rocket(F_1-hybrid).The fertilizer dose was 250-12-120-40 kg N-P_2O_5-K_2O-S/ha. The $^1/_3$ rd and other fertilizers were given as basal. The rest of N as top dressed on 30 and 60 DAS in maize row only. Three irrigation were given on 33, 64 and 86 DAS. The maize was harvested on 5-8 April 2005 and carrot on 08 March 2005.

Results and Discussion

Yield and yield contributes of carrot: Plants/m^2, root length, root diameter and weight of 10 roots were not significantly influenced by different treatment. Significantly highest yield was recorded from treatment T_3 (Maize paired row (37.5 cm/150cm/37.5cm) + 4 rows carrot (30cm x 10 cm). Between the two treatment lowest yield was obtained from treatment T_2 (Maize normal row (75 cm x 25 cm) + 2 rows carrot (30 cm x 10 cm) due to less number of plants/m^2 (Table 1).Slightly higher yield was recorded from treatment T_3 due to higher plants/m^2, root diameter and wt. of root.

Yield and yield contributes of maize: Plants/m^2, grain/cob, wt. of grain and grain yield were significantly influenced by different treatment. Among the treatment lowest yield was obtained from treatment T_2 (Maize normal row (75 cm x 25 cm) + 2 rows carrot (30 cm x 10 cm) due to obtained lower plants/m^2 (Table 2). Significantly highest grain yield was recorded from treatment T_3 whereas T_1 &T_2 treatments were statistically identical. The treatment T_3 showed higher grain yield due to higher plants/m2 and grain wt.

Cost benefit analysis: The highest total gross return (Tk.96596 ha^{-1}) was obtained from treatment T_3 was followed by treatment T_1 (Tk.82000 ha^{-1}). Among the treatment higher gross margin was obtained Tk.49477ha^{-1} for treatment T_3 and it was lowest Tk. 38147 for T_2. The cost of cultivation was different among the crop. In case of carrot, only seed, sowing and harvesting cost was considered due to inter-cropping with maize. But in case of maize, all cost had been considered except land rent. Among the treatment total cost of cultivation was estimated Tk.49193ha^{-1} for T_2 and T_3 while it was Tk.37537 ha^{-1} for T_1 sole maize. Considering the economic analysis the highest BCR was found 2.18 for T_1 sole maize than other treatment due to negative return of carrot (Table 3).

Field observation

- After sowing of carrot it was observed that the germination percentage was low
- Some diseases were observed at early stage of carrot plant
- No disease was found in hybrid maize.

Farmer's reaction

Farmers are interested to cultivate hybrid maize due to better yield and excellent big size of cob and its demand of local market is high, for example, one cob is sale 3-5 taka in local market. But carrot is not feasible due to lower yield.

Table 1. Plant height, yield and yield contributing character of carrot in maize-carrot intercropping system at hilly areas in Bandarban, 2004-05

Treatment	Plants/m^2	Root length (cm)	Root diameter (cm)	Wt. of 10- root (g)	Root yield (kg/ha)
T_2	7.9b	4.5	7.15	410	830
T_3	9.5a	4.22	8.35	450	887
LSD(0.05)	1.10	NS	NS	NS	NS

Table 2. Yield and yield contributing character of maize (Pacific-984) in maize-carrot inter-cropping system at hilly areas in Bandarban, 2004-05

Treatment	Plant/m^2	No. of cob/plant	Length of cob (cm)	No. of grain/cob	Wt. of 1000 grain (g)	Grain yield (ton/ha)
T_1	4.23b	1.00	18.15	502a	370a	8.20b
T_2	4.00b	1.00	17.80	494b	325b	8.07b
T_3	5.18a	1.01	19.40	505a	375a	8.95a
LSD(0.05)	0.20	NS	NS	0.31	0.25	0.30

Table 3. Per hectare costs and economic return of maize-carrot intercropping at different planting system at hilly areas in Bandarban, 2004-05

Treat ment	Gross return (Tk/ha)			* cost of cultivation (Tk/ha)			Gross margin (Tk/ha)			Benefit Cost Ratio (BCR)		
	carrot (a)	maize (b)	total (a+b)	carrot (a)	maize (b)	total (a+b)	carrot (a)	maize (b)	total (a+b)	carrot (a)	maize (b)	total (a+b)
T_1	-	82000	82000	-	37537	37537	-	44463	44463	-	2.18	2.18
T_2	6640	80700	87340	11656	37537	49193	-5016	43163	38147	-0.43	2.14	1.71
T_3	7096	89500	96596	11656	37537	49193	-4560	51963	49477	-0.39	2.38	1.99

Note: Farm gate price of carrot @Tk. 8.00/kg, Maize @Tk.10/kg

Intercropping of Maize with different short duration vegetable crops

Abstract

The experiment was conducted at farmer’s field in Bandarban sadar areas during rabi season, 2004-05 to observe the feasibility and profitability of growing short duration vegetables as intercrop with maize such as potato, lalshak, spinach, BARI Jharseem and radish. The maize equivalent yield showed that maize and spinach produced significantly higher yield, 17.83 tonha^{-1} followed by maize and lalshak, 15.77 tonha^{-1} while it was 14.89 tonha^{-1} for maize and potato. The yield of sole maize was 9.65 t ha^{-1}. Maize and lalshak accorded the highest gross margin Tk.81420ha^{-1} followed by maize and potato TK.80792 ha^{-1} and TK.76282ha^{-1} for maize and spinach, while maize and radish earned the lowest TK.22682ha^{-1}. The highest benefit-cost ratio was obtained from maize and lalshak (2.88) followed by maize and spinach (2.72) as well as maize and potato was 2.57. The lowest benefit-cost ratio was found 1.54 from maize and radish as intercrop. The study revealed that lalshak, spinach and potato were highly compatible and profitable crops in maize inter-cropping at hilly areas in Bandarban.

Introduction

Bandarban is an area that has an enormous potentiality for maize production. According to BBS, 1999 report, 355 acres land covered by maize cultivation. Now a days, the area are increasing due to local demand of maize. The tribal and non-tribal people usually grow maize as a monocrop or sometimes as intercrop with some local vegetable i.e. sweet potato, bottle gourd, sweet gourd and potato. Intercropping increases crop yield per unit area by intensifying the use of land. It does not only contribute to increase the productivity but also increases the farmer's income (Villarel, 1976). Traditionally, the farmer's of hilly regions cultivate different short duration vegetables as monocrops. Such vegetable crops might be a good intercrop with maize. Farmers are often demand for quick return from their crop. As maize is a long duration crops could helps the farmer to earn a quick return. However, for getting higher benefit, suitable intercrops, local food habit and market demands are important factors. The present experiment was, therefore, undertaken to examine the feasibility of growing different short duration rabi vegetable crops with hybrid maize.

Materials and Methods

The experiment was conducted at Bandarban sadar areas during rabi season, 2004-05.The soil of the experimental field was sandy loam having p^H 4.5-6.5. Land type was high land. Organic matter was low and N was very low, P-medium, K-medium, S-medium, Zn-very low and boron was very low (SRDI, Thana Nirdishika, Bandarban). The site represents the area of AEZ-29. The intercrops included in the treatments were: potato, lalshak, spinach, Jharseem and radish. The experiment was laid out in a randomized complete block design with three dispersed replications. The unit plot size was 9m x 5.5m. Potato seeds were planted in between two rows of maize at a signal line with seed to seed spacing 20cm. Jharseem and radish seed were planted at double line with maintaining the spacing 30cm x 10cm and other intercrops were planted at a broadcasting method.The sowing date was 26 November,2004 – 3 December,2005. Fertilizers were applied for maize @ N-256, P-55, K-138, S-3, B-1 kgha^{-1} and Cowdung-5 tonha^{-1}. One third N and all other fertilizer and cowdung were applied as basal and rest 2/3N; 1/3N were applied at 8-10 leaves stage and rest 1/3N at tasseling stage. All inter-crops harvested within 70 days after sowing. The yield data of intercrops was recorded by total harvested yield at a unit plot and than converted to per hectare yield. The maize was harvested 01-05 April 2005.The yield contributing character data of maize were recorded from ten randomly selected plants.

The yield data was calculated by using the following yield conversion formula for maize:

Adjusted Yield = CF x Plot yield, CF = M-03(N)/M – N, CF= Conversion factor, M = Optimum number of plants, N= Number of missing plants, 0.3 = Constant factor

Yield = Adjusted plot yield x 10000m^2/Area x 100- MC%/85 x 0.8, i.e. MC= 18%

Maize equivalent yield (MEY) was calculated by using the following formula:

$$\text{MEY} = \text{Maize grain yield (t ha-}^{1}\text{)} + \frac{\text{Yield of vegetables (t ha-}^{1}\text{) x market price of vegetables (TK.t-}^{1}\text{)}}{\text{Market price of maize (grain) (TK.t-}^{1}\text{)}}$$

Mean data were analyzed statistically by LSD test and Cost-benefit analysis was also done on a hectare basis as per present market value.

Results and Discussions

Plant height, number of plant /15m^2, number of cobs/15m^2, number of grains/cobs and 1000-grain wt. are presented in Table 1. It is seen from the table that highest plant height, number of grains and wt. of 1000 grain was recorded from sole maize and it was significantly different from rest of the treatments. Highest number of plants/15m^2 and number of cobs were accounted in maize and lalshak intercrop and it was significantly different from other treatments. The lowest number of grains/cobs and wt. of 1000 grain were recorded from maize and radish intercrop combination. The effect of radish on maize was resulted in less number of grains per cobs and less wt. of 1000 grain compare to rest of treatment.

The yield of maize was significantly influenced by different crop combinations (Table 2).Significantly highest grain yield was recorded from sole maize. The yield of maize was drastically reduced when radish, bushbean and spinach grown as intercrop. The lowest yield was received 5.17 ton ha^{-1} from maize and radish combination and it was might be happened less number of grain per cob and minimum wt. of 1000 grain. Behind this, yield of maize was also adversely affected by vigorous growth of radish because radish was competed with maize for moisture and nutrients that ultimately affected the yield of maize.

The yield of vegetables varied significantly. The highest yield 18.85 ton ha^{-1} was obtained from radish but market price was very low TK.0.50/kg. due to no demand of radish. The second highest yield was recorded from potato 7.13 ton ha^{-1} and it market price was also satisfactory level. The highest maize equivalent yield was accounted 17.83 ton ha^{-1} from maize with spinach. Inter-cropping with lalshak gave second highest 15.77 ton ha^{-1} maize equivalent yield and it was identical 14.89 ton ha^{-1} for maize and potato intercrop combinations (Table 2).

Cost and return analysis: Cost benefit analysis of intercropping is shown in Table 3. The highest gross return Tk. 1,32,117 ha^{-1} was received from maize and potato intercrop followed by TK. 1,24,655 ha^{-1} for maize and lalshak and TK.1,20,395 for maize and spinach. The lowest gross return was obtained Tk. 64,240 ha^{-1} from maize and radish intercrop due to very lower price received from radish. The cost of cultivation was accounted as all operational cost paid by cash by the farmer's. The highest cost of cultivation was found TK. 51325 ha^{-1} for maize and potato intercrop, the cost was higher due to higher amount and higher price for potato seed. The lowest cost was calculated as TK.39123 ha^{-1} for sole maize. The highest gross margin was obtained TK. 81420 ha^{-1} for maize and lalshak and it was identical as TK.80792 ha^{-1} for maize and potato and TK. 76282 ha^{-1} for maize and spinach intercropping. The lowest gross margin was obtained as TK. 22682 ha^{-1} from maize and radish intercrop due to lower amount received from radish. The highest benefit cost ratio 2.88 was found from maize and lalshak intercrop followed by 2.72 for maize and spinach and 2.57 for maize and potato. The lowest BCR was received 1.54 from maize and radish intercrop.

Field Observation

- No diseases were found in maize (Pacific-11);
- Some vertebrate birds disturbed bushbean at the flowering and in maize at the pre-matured stage of cobs.

Farmer's feedback

Farmers are agreed to cultivate maize-potato, maize-lalshak and maize-spinach inter cropping system in their field for quick and better economic return.

Conclusion

It can be concluded that intercropping lalshak, spinach and potato with maize was found more profitable compared to growing sole maize. Inter-cropping maize and radish would not be viable and economically profitable in this area.

Table 1. Effect of intercrop combination on yield components of maize

Treatments	Plant height (cm)	Plant/15m^2	Number of cobs/15 m^2	Number of grains/cobs	1000-grain wt. (gm)
Maize + potato	247	70	70	459	413
Maize + Lalshak	261	71	81	465	417
Maize + spinach	255	65	71	474	383
Maize + BARI Jharseem-2	240	66	77	432	383
Maize + Radish	260	65	79	369	330
Maize sole	265	63	77	542	400
CV (%)	9.73	9.93	9.72	10.76	8.85
LSD (0.05)	31.87	8.52	10.77	63.29	44.16

Table 2. Yield of maize and vegetables intercrops.

Treatment	Yield of maize (t/ha)		Intercrop (vegetable) yield (t/ha)	Maize equivalent yield (t/ha)
	Grain yield	Straw yield		
Maize + potato	8.74b	17.33	7.13	14.89
Maize + Lalshak	8.47b	17.98	5.54	15.77
Maize + spinach	6.87c	16.46	5.11	17.83
Maize + BARI Jharseem-2	6.82c	16.72	5.85	10.02
Maize + Radish	5.17d	16.12	18.85	7.53
Maize sole	9.65a	15.96	-	9.65
CV (%)	22.19	-	13.67	11.21
LSD (0.05)	2.17	NS	1.71	1.12

Table 3. Cost and return analysis of maize-vegetables inter-cropping system in Bandarban, 2004-05

Treatment (Crop combination)	Gross return (Tk./ha)	Cost of cultivation (Tk./ha)	Gross margin (Tk./ha)	BCR
Maize + potato	1,32,117	51325	80792	2.57
Maize + Lalshak	1,24,655	43235	81420	2.88
Maize + spinach	1,20,395	44113	76282	2.72
Maize + BARI Jharseem-2	95,990	42175	53815	2.27
Maize + Radish	64,240	41558	22682	1.54
Maize sole	81,190	40123	41067	2.02

Note: Market price of maize (dry grain)= TK.8/kg and Straw = Tk.250/t
Vegetable crops: Potato @ TK.8/kg, Lalshak @TK. 10/kg, spinach @TK.12/kg, Jharseem @TK.5/kg and Radish @TK.1.00/kg as farm gate price during harvest time.

On-farm verification of BARI Hybrid Maize 5 at hill valleys

Abstract

A verification trial of BARI hybrid maize-5 was conducted at hill valleys in Bandarban during rabi season, 2004-05 with view to evaluate the adaptability, yield potentiality of this variety. The trial revealed that the yield was obtained 7.056t ha^{-1} while gross margin received at TK. 35600 ha^{-1} and benefit cost ratio was found 1.93. The obtained yield accepted by the farmer's as a highest yield compared to local one and others high yielding variety of maize.

Introduction

BARI has developed some hybrid maize variety. Land is limited, so, it is essential to intensive use of land by introducing hybrid in order to obtain highest yield and income. Before mass recommendation of this developed variety, it needs on-farm evaluation across the country. Hence forth, Bandarban is an area that has an ample opportunity to produce maize as a great local demand of tribal people and the owner of mini poultry/dairy farm. With view this, a verification trial has been under taken at hill valleys in Bandarban.

Objectives:

i. To evaluate the adaptability, yield potentiality of BARI hybrid maize-5;
ii. To know the economic performance of BARI hybrid maize-5 cultivation;
iii. To monitor farmers reaction about of BARI hybrid maize-5.

Materials and Methods

The verification trial was conducted at Bandarban sadar areas at hill valleys during rabi season, 2004-05.The soil of the experimental field was sandy loam having p^H 4.5-6.5. Land type was high land. Organic matter was low and N was very low, P-medium, K-medium, S-medium, Zn-very low and boron was very low (SRDI, Thana Nirdishika, Bandarban). The site represents the area of AEZ-29. The variety was BARI hybrid maize-5 with non replicated. The unit plot size was 20m x 24m. with maintaining the spacing 75cm x 20cm.The sowing date was 06December,2005. Fertilizers were applied for maize @ N-256, P-55, K-138, S-3, B-1 $kgha^{-1}$ $tonha^{-1}$. One third N and all other fertilizer were applied as basal and rest 2/3N; 1/3N were applied at 8-10 leaves stage and rest 1/3N at tasseling stage.The maize was harvested 8-12 April, 2005.The yield contributing character data of maize were recorded from ten randomly selected plants. The yield data was calculated by using the following yield conversion formula for maize:

Adjusted Yield = CF x Plot yield, CF = M-03(N)/M – N, CF= Conversion factor, M = Optimum number of plants, N= Number of missing plants, 0.3 = Constant factor

Yield (ton/ha) = Adjusted plot yield x $10000m^2$/Area x 100- MC%/85 x 0.8, i.e. MC= 18%

Results and Discussions

Yield and yield components: Plant height, number of plant /$15m^2$, number of cobs/$15m^2$, number of grains/cobs and 1000-grain wt. and yield are presented in Table 1. It is seen from the table that more grain/cob was obtained but due to lower grain wt. yield was low. Grain yield was lower in comparing other available varieties but yield can be improved in future.

Cost and return analysis: The cost of cultivation of BARI hybrid maize-5 was shown in Table 2. The total cost of cultivation (excluded fixed cost) was estimated at TK.38285ha^{-1}. The cost item was estimated (TK./ha) as land preparation TK.2160, seed cost TK.2100, seed sowing cost cost TK. 2964, fertilizer cost at TK. 10,243, fertilizer application cost (3 times), TK.1482, weeding cost(3 times) TK.4446, irrigation cost TK. 1112, insecticide cost TK.440, harvesting cost TK. 5928 and processing/drying cost TK.7410.

The gross return was accounted as TK. 90625 multiplying by yield and market price. The gross margin was obtained as TK. 52340/ha while benefit cost ratio was 2.37.

Field observation

® At the middle stage goose neck diseases was observed but at the final stage it was automatically recovered
® At the early stage ear rot disease was prevalent at the inner side of ear.

Farmer's feedback

® Farmer's are interested to grow BARI hybrid maize-5 due to its higher yield than existing local one and instead of tobacco cultivation;
® It's acceptability was higher than local one in Bandarban.

Conclusion

Yield can be improved in future to maintaining proper management in farmer's field. This trial should be repeated in farmer's field for valid conformation.

Table 1.Yield and yield contributing character of BARI hybrid maize-5 cultivation in Bandarban

Variety	Plant height (cm)	No. of plant /15m^2	No. of cobs/ 15m^2	No. of grains/ cobs	1000-grain wt.	Grain yield (ton/ha)	Straw yield (ton/ha)	Days to maturity
BARI hybrid maize-5	279	65	78	600	280	**8.73**	13.30	130-140

Table 2. Economic performance of BARI hybrid maize-5 cultivation at hill valleys in Bandarban

Variety	Gross return (TK./ha)	Cost of cultivation (TK./ha)	Gross margin (TK./ha)	Benefit-cost ratio (BCR)
BARI hybrid maize-5	90625	38285	52340	2.37

Note: Market price of maize Tk.10/kg or Tk.3-4/cob at local market, Price of straw Tk.250/ton

An adaptive trial of different varieties of Potato cultivation at hilly valleys

Abstract

An adaptive trial of different 5 varieties of potato viz.: Diamant, Heera, Dheera, BARI TPS-1 and local one as Check was carried out at Bandarban Sadar areas during rabi season,2004-2005 with view to observe the yield performance of the variety for hilly areas. Among these variety Heera produced highest yield of 20.0 ton ha^{-1}, followed by Diamont 19.60 ton ha^{-1}, Dheera -13.5ton ha^{-1} and local one was 15.16 ton $ha^{-1.}$ On the other hand, the lowest yield was found 8.70 ton ha^{-1} from BARI TPS-1 due to lower weight of tuber. The yield of Heera was 22 percent higher than local one. The gross margin was found highest as Tk. 82390 per hectare for Heera and it was 42 percent higher than local one. Benefit Cost Ratio was highest 2.43 for Heera, followed by Diamant was 2.38. The trial revealed that among the four varieties, Heera was more profitable variety and Diamant was also the same. Unavailability of HYV potato seed in local market was the major problem and lack of technical know-how on improved management practiced of potato cultivation was the another production constraint.

Introduction

Potato is a cash crop at hilly areas in Bandarban which was widely cultivated throughout the year. But the area of this crop is limited due to abundant of hill. In Bandarban district about 2308 acres of land under potato cultivation with national average yield 13.8 t/ha (BBS, 1999). Maximum farmers are cultivated local variety called Dohajhari variety which occupied poor yield. So, It has an opportunity to increase per hectare yield of potato by introducing high yielding variety and applying scientific management to the farmer's level. So, an adaptive trial of different varieties of potato is undertaken with following objectives:

- To observe the yield performance of different varieties of potato at hilly areas in Bandarban district.
- To estimate cost and return of different varieties of potato cultivation at hilly areas in Bandarban.
- To popularize the HYV variety of potato at farmer’s level in hilly areas in Bandarban.

Materials and Method

An adaptive trial of different varieties of potato was carried out at hilly areas in Bandarban Sadar during 2004-2005.Five varieties of potato were evaluated at farmers field in Bandarban Sadar areas to study the yield performance of potato cultivation in Hilly region. TCRC of BARI supplied four varieties of potato (Diamant, Heera, Dheera and BARI TPS-1) and local one (Dohajari)as check. All varieties were planted on 4-8 December 2004 in 8m x 5m plot size maintaining 40cm x 25cm spacing. The design was RCBD with 3 replications (dispersed). Fertilizers were used at the rate of Urea- 250, TSP- 150, MP- 250 and Gypsum- 120kg/ha. Different intercultural operation i.e. irrigation, weeding, Top dressing and spraying etc. were done as and when necessary. The tuber was harvested on 14-17 February, 2005. The yield contributing characters data were recorded from ten randomly selected plants. Yield data was recorded per plot and to convert per hectare yield.

Results and Discussion

Yield and yield components: Plants/hill, tuber/hill, weight of tuber/hill and tuber yield were significantly affected by variety (Table 1). Significantly the highest plants/hill was recorded from local variety. Similar trend was followed in case of tuber/hill but weight of tubers/hill was similar among the three varieties except local one. Significantly highest yield was obtained from Heera due to highest weight of tuber. The lowest yield from BARI TPS-1 as because lowest weight of tuber and tuber was rotten might be causes excess water supplied by the farmer’s at the harvesting stage. The yield of Heera was 22 percent higher than local one.

Cost and return analysis: Highest gross return was recorded from variety Heera, followed by Diamont and lowest from BARI TPS-1. Higher gross margin was obtained from variety Heera which was closely followed by Diamont.The gross margin of Heera increased by 42 percent than local one.The variety Deera and BARI TPS-1 failed to show higher benefit cost than local one but Diamont and Heera showed higher BCR than other variety. So, both the variety showed better performance than other variety.

Field observation

- At the maturity stage, the *Agrotis ipsilon*(Hufnagel) locally called Khatui poka was attack which might be causes of yield loss.
- Just before harvesting farmer's supplied sufficient water in the experimental field resulting tuber was rotten, especially it was happened in the plot of BARI TPS-1 and Dheera, so, the yield was remarkably reduced.
- Yield could be increased if timely control insect, diseases and supplied irrigation water.

Farmer's Reaction

Farmers are very much interested to cultivate high yielding variety of potato due obtained higher yield and income than local one.

Conclusion

Potato could be cultivated within November than farmers will get additional benefit. Due to the higher local demand of HYV seed of potato, BADC and some relevant agencies should keep the seeds for farmers. Farmer's training program on modern potato cultivation practice should be organized with the emphasis of unskilled hilly people. The experiment should be repeated next year for confirmation and local demand.

Table 1. Yield and yield contributing character of potato varieties at farmer's field at Bandarban Sadar areas in Bandarban Hill district, 2004-05

Variety	Plant height (cm)	No. of plants/hill	No. of Tuber/hill	Weight of Tuber/hill (gm)	Tuber yield (t/ha)
Diamant	33.9	2.2c	4.1b	201b	**19.66a**
Heera	35.3	2.5b	5.0b	292a	**20.00a**
Dheera	31.2	1.7c	4.5b	188b	13.50b
BARI TPS-1	26.3	2.2c	6.1a	141c	8.70c
Local(Check)	45.3	4.5a	9.9a	165c	**15.16b**
CV (%)	13.11	15.47	19.53	19.97	18.79
LSD (0.05)	1.30	0.98	3.43	9.97	6.52

Table 2. Cost and return of potato cultivation at farmer's field in Bandarban Hill distric2004-05

Variety	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)	Benefit Cost Ratio
Diamant	137620	57610	80010	2.38
Heera	140000	57610	82390	2.43
Dheera	94500	57610	36890	1.64
BARI TPS-1	60900	57610	3290	1.06
Local(Check)	93960	55773	48187	1.68

Note: Seed cost of potato @Tk.20/kg for HYV and Tk.15/kg for local one, Sales price of potato Tk 7.00 /kg. for HYV & local one at Tk 6.00 per kg.

An adaptive trial of improved Sweet Potato varieties at hill valleys

Abstract

An adaptive trial of sweet potato varieties viz. BARI SP-4, BARI SP-5, BARI SP-6, BARI SP-7 and Local one (check) was carried out at hill valleys in Bandarban Sadar areas during rabi season 2004-2005 with view to yield performance and popularization of these variety. The experiment revealed that BARI SP-7 gave highest yield 29.23t ha^{-1} followed by BARI SP-4, 24.29t ha^{-1} while it was 20.64t ha^{-1} for BARI SP-6 and 19.03t $ha^{-1}$for BARI SP-5.The lowest yield was obtained 16.16t ha^{-1} from local one. Among the variety, considering the yield performance, farmer's preferred to BARI SP-7 while considering the sweetness they preferred BARI SP-5.

Introduction

BARI has recently developed some new variety of sweet potatoes. On-farm trial is essential for valid recommendation throughout the country. In Bandarban district, sweet potato grows well in hill valleys. About 385 acres area covered by sweet potato with average national yield 12.8 ton/ha in Bandarban district (BBS,1999). Farmers are grown local variety with receiving poor yield. It is necessary to identify the suitable variety for this area, an adaptive trial has been undertaken with following objectives:

- To compare the improve variety with local one and popularization in the farmer's field.

Materials and Methods

An adaptive trial of different varieties of sweet potato was carried out at hilly areas in Bandarban Sadar during 2004-2005.Five varieties i,e. BARI SP-4, BARI SP-5, BARI SP-6, BARI SP-7 and Local one (check) of sweet potato were evaluated at farmers field in Bandarban Sadar areas to study the yield performance of sweet potato cultivation in Hilly region. TCRC of BARI supplied the vine of four varieties.All varieties were planted on 1-3 December 2004 in 8m x 4.5m plot size maintaining 60cm x 30cm spacing. The design was RCBD with 2 replications (dispersed). Fertilizers were used at the rate of 74-57-111, N-P-K, respectively. Different intercultural operation i.e. irrigation, weeding, were done as and when necessary. The tuber was harvested on 19-21April, 2005. The yield contributing characters data were recorded from ten randomly selected plants. Yield data was recorded per plot and to convert per hectare yield.

Results and Discussion

Yield and yield components: Number of root/plant, root wt./plant, tuber yield and relevant information are presented in Table 1. The highest number of root per plant was found from BARI SP-4 and lowest for BARI SP-6. Maximum root wt./plant was obtained 614gm for BARI SP-7and it was lowest for local one 352 gm. Significantly highest tuber yield was found 29.23ton ha^{-1} from BARI SP-7 which might be due to maximum wt. of root per plant. Considering the time of boiling, lowest time 20min for BARI SP-7 and maximum time consumed 30min.of BARI SP-4 and local one. According to farmer's opined highest sweetness was BARI SP-5 and rest of all variety it was medium. No diseases were found in improved varieties except local one.

Cost and return of sweet potato cultivation: Cost and return analysis are shown in Table 2. Highest gross return was obtained from BARI SP-7 followed by Tk. 145740 for BARI SP-4. The lowest gross return was obtained Tk. 96960 ha^{-1} for local one. The highest gross margin was accounted at Tk. 70365 for BARI SP-7 and it was lowest at Tk. 43485ha^{-1} for local one. The benefit cost ratio (3.28) was found highest for BARI SP-7 but other variety also showed higher BCR than local one.

Field observation

No diseases were observed in HYV potato variety;
Rat attack was observed at the pre-matured stage of tuber in BARI SP-4 & BARI SP-5.

Farmer reaction

Farmers are agreed to grow new varieties (BARI SP-7 & BARI SP-4) of sweet potato due to higher yield, sweetness and income but vines were not available there.

Conclusion

Vine of sweet potato varieties should be ensured at farmer's level at reasonable time and scientific management should be provided to the farmers by arranging farmers training program. Farmer's should be practiced for keeping vines, which already was supplied by TCRC through OFRD.

Table 1. Yield performance and related parameter's of sweet potato varieties at hill valleys in Bandarban, 2004-05

Variety	No. of root/plant	Root wt/plant (gm)	Tuber yield (ton/ha)	Time of boiling (min.)	Sweetness	Diseases	Acceptability
BARI SP-4	4.65	528	24.29b	30	medium	none	moderate
BARI SP-5	4.20	414	19.03c	25	**high**	none	high
BARI SP-6	2.00	449	20.64c	22	medium	none	moderate
BARI SP-7	2.50	614	**29.23a**	20	medium	none	high
Local one (check)	3.50	352	**16.16d**	30	medium	yes	low

Table 2. Per hectare cost and return of sweet potato cultivation at hill valleys in Bandarban, 2004-05

Variety	Gross return (Tk./ha)	Cultivation cost (Tk./ha)	Gross margin (Tk./ha)	Benefit cost ratio (BCR)
BARI SP-4	145740	53475	92265	2.73
BARI SP-5	114180	53475	60705	2.14
BARI SP-6	123840	53475	70365	2.32
BARI SP-7	175380	53475	121905	3.28
Local one(check)	96960	53475	43485	1.81

Note: Local market price of sweet potato @TK.6.00/kg

Feasibility study of Pointed gourd at hilly areas

Abstract

A feasibility study of pointed gourd cultivation was carried out at hill valleys in Bandarban sadar areas during 2004-05 with justify to feasibility of pointed gourd cultivation at hilly areas and to estimate economic return of this new crop. The study revealed that highest yield was obtained 12.35ton/ha which received at Tk.149967 ha^{-1} as gross margin and benefit cost ratio was 3.07. No diseases were found in pointed gourd variety.

Introduction

Pointed gourd a high yielding vegetables are usually grown in north-western parts of Bangladesh. It can be grown in south-eastern parts of Bangladesh mainly on hill foot high lands where large amount of areas remains fallow. Moreover, there is a high demand of summer vegetables like pointed gourd in this region and vegetable deficit may be overdone by introducing it. In Bandarban district, pointed gourd is a new crop. It has high local demand. Unfortunately, pointed gourd was not cultivated in previous day in this region or no research work has been done. In order to fulfill the local demand, the crop should be introduced at farmer's level. In this context, an experiment has been under taken with the following

Objectives

- To observed the yield performance of pointed gourd
- To quantify the cost benefit analysis of pointed gourd cultivation at hilly areas in Bandarban;
- To know the farmers feed back of pointed gourd cultivation in their field.

Materials and Method

A feasibility study of pointed gourd was conducted at Bandarban Sadar areas during 2004-05 in farmer's field. The experiment was set up RCB with 2 dispersed replications. Two varieties, PG 025 and Rajbari are used with support system of Bamboo trellis. The bed size was 4.5m x 1.5m where pit to pit distance 1.5 m. No. of pot/bed was 3 and plant/pit was one. The ratio male and female was 1: 8. Fertilizer application per pit was used Cowdung - 5 kg during pit preparation (22 t/ha), TSP - 50 gm during pit preparation (222 kg/ha) and MP - 40 gm(20+10+10): 20 gm in pit preparation, 10 gm in after 15 days and 10 gm in after 30 days (178 kg/ha). Urea was applied as 70 gm (0+25+25+20): 25 gm after 15 days, 25 gm after 30 days and 20 gm after 45 days (311kg/ha). The crop was planted on 25October to 3 November 2004 and harvesting was started on 20 March 2005 and til now.Yield data was recorded from per plot and converted to per hectare. The yield was harvested in each 4-6 days interval and data was recorded by monitoring technique in each harvesting days. Irrigation, top dressing, weeding and spraying was done as and where necessary.

Results and Discussion

By this time 8 times of harvest was completed up to 30 May 2005 but fruit harvesting will be continued till October, 2005. Yield was obtained 12.35 ton/ha from the variety of PG025 with maintaining the support of bamboo trellis. The line PG025 showed higher yield due to higher individual wt., length and diameter of fruit. In case of variety Rajbari, fruit yield was found 10.65ton/ha comprising 39.60gm weight of individual fruit (Table 1). The age of crop is now 6 month and it would be continue till October 2005.

Cost benefit analysis: Cost item was included, number of vine per hectare 2430 and their cost, land preparation, weeding, fertilization, spraying, making bamboo trellis and harvesting cost. The higher gross return and gross margin was recorded from PG025 while BCR 3.07 (Table2).

Field observation

- No disease was found yet, but fruit fly was attack and poison trap(1.3ml Sabicron with 100g sweet gourd) was used for controlling it and it was effective.

Farmers' reaction

- Farmers are highly interested to grow pointed gourd as a new crop in Bandarban and its local demand and market price is always high
- Between the line of PG025 was attractive colour (dwarf) and big size of fruit. So, farmer's was highly accepted it.

Table 1. Yield and yield contributing character of pointed gourd cultivation at hilly areas in Bandarban, 2004-05

Variety	Support system (bamboo trellis)			
	Diameter of fruit (cm)	Length of fruit (cm)	Individual wt. of fruit (gm)	Fruit yield (ton/ha)
PG 025	12.10	9.70	87.50	12.35
Rajbari (local)	10.00	8.80	39.60	10.65

Table 2. Cost and return of pointed gourd cultivation at hilly areas in Bandarban, 2004-05

Variety	Gross return (Tk./ha)	Total cultivation cost (Tk/ha)	Gross margin (Tk/ha)	Benefit Cost Ratio (BCR)
PG 025	2,22,300	52,333	169967	4.27
Rajbari (local)	1,91,700	52,333	139367	3.66

Sales price of pointed gourd @ TK.18/kg in local market.

On-farm trial of BARI Chickpea varieties at hilly areas

Abstract

An on-farm trial of BARI Chickpea varieties i,e. BARI chola-2, BARI chola-3, anegri and local one (check) was carried out at Bandarban Sadar areas during rabi season 2004-05 with view to find out the yield performance of chickpea varieties at farmers field. The trial revealed that among the varieties, the highest seed yield was found 1.09 t ha^{-1} from Anegri followed by 1.00t ha^{-1} for BARI chola-3 and lowest yield was 0.61t ha^{-1} for local one. The highest gross margin was estimated as Tk 8671/ha for anegri followed by TK.6771/ha for BARI Chola-3 and it was lowest or negative return TK. 3004 from local one. Considering the profitability the highest Benefit Cost Ratio was found 1.47 for anegri followed by 1.36 for BARI Chola-3 and it was negative at 0.84 for local one. Attack of pod borer was the major production constraint in chickpea at hilly areas in Bandarban.

Introduction

Chickpea (*Cicer arietinum* L) is the third most important pulse crop in Bangladesh in respect of area and production with and average yield of 765 kg/ha. Chickpea yield is probably the most unstable among the pulse grown in Bangladesh due to the extreme sensitivity to micro-environment conditions (Musa and Kar,1995).It contributes about 20 percent of the total pulses (BBS,1992). The area and the productivity of chickpea are not encouraging due to lack of suitable varieties/cultivars. In Bandarban district, about 515 acres of land are covered by different pulse crop (BBS.1999). Chickpea is one of the new crops in Bandarban. The area of pulse crop is limited due to hill. In spite of this, it has an opportunity to grow chickpea at farmer's level in plain areas around the hills. In hilly areas, farmers are interested to grow new economic crops but they did not get suitable variety of those crops. In this regard, this type of trial has been undertaken with the specific objectives:

- to find out the yield performance of different varieties of chickpea and
- to estimate the cost and return of different varieties of chickpea at farmer's level of hilly areas.
- to popularize the chickpea cultivation for fulfill the deficit of pulse crop in hilly areas.

Materials and Method

An on-farm trial of different four varieties of chickpea i,e. BARI chola-2, BARI chola-3, Anegri and local one(check) was carried out at hilly areas in Bandarban Sadar during Rabi season, 2004-2005 with view to study the yield performance of chickpea cultivation in hill region. All variety was planted on 7-9 December 2004 in 4m x 2.5m plot size, maintaining 40cm x 10cm spacing. The design was RCBD with 3 replications (dispersed). Fertilizers (Urea- 43, TSP- 44, MP- 33, Gypsum-55 and Boric Acid 6 kg/ha) were used. Different intercultural operation i,e. irrigation, weeding and spraying etc. were done as and when necessary. The harvesting period was on 18-21 March,2005. The yield contributing characters data were recorded from ten randomly selected plants. Yield data was recorded per plot and to convert per hectare yield.

Results and Discussion

Pants/m^2 , plant height Pods/plant, seed weight and seed yield was significantly influenced by the variety (Table 1). Pods/plant was statistically identical in between variety Anegri and BARI Chola 3 and which was higher than rest of the variety. But weight of seeds was similar between Anegri and BARI Chola 3. Slightly higher seed yield was recorded from Annegri but statistically identical to other variety except local. Though higher seed wt. was recorded from local one but due to lower no. of pods/plant, seed yield was lower than other variety.

Cost benefit analysis

Highest gross return (Tk.27050 ha^{-1}) was obtained from Anegri due to higher yield followed by BARI Chola-3 (Tk.25150 ha^{-1}). The cost of cultivation was identical among the variety, which was Tk.18379/ha. Among the variety higher gross margin was obtained Tk.8671ha^{-1} for Anegri followed by Tk. 6771 for BARI Chola-3 and it was negative Tk.3004 for local one. Considering the Benefit cost ratio the highest was found 1.47 from Anegri followed by 1.36 for BARI Chola-3. Among the variety it was lowest negative0.84 for local variety indicating cultivation of local one was not economically viable (Table 2).

Field observation

- At the maturity stage, the *pod borer insect* was attack continuously;
- Symbose was sprayed for controlling the insect.

Farmer's reaction

- Farmers are interested to cultivate high yielding variety of chickpea in their fallow land due to better yield performance of chickpea in their field;
- Some farmer's are showed interest to grow chickpea in large portion of their land in next year.

Conclusion

Chickpea is one another new crop in hilly areas. Due to the limited land and fullfil the deficit of pulse crop in hilly areas, it might be possible to cultivate chickpea with improved management practices. The experiment should be continued in next year for confirmation.

Table 1. Yield and yield contributing character of different chickpea varieties at hilly areas in Bandarban, 2004-05

Treatment (variety)	Plant/m^2	Plant height (cm)	No. of pod/plant	Wt. of 1000 seed (gm)	Seed yield (ton/ha)	Days to flowering
BARI Chola-2	21.33	44.26	36.00	151	0.96a	60-70
BARI Chola-3	20.66	47.20	38.66	153	1.00a	60-70
Anegri	18.33	47.70	39.67	153	1.09a	60-70
Local (check)	18.00	68.66	20.76	197	0.61b	60-70
C.V. (%)	8.55	15.44	22.76	4.56	14.15	-
LSD (0.05)	2.89	13.87	13.30	12.93	0.225	-

Table 2. Cost and return of different chickpea varieties at hilly areas in Bandarban, 2004-05

Variety	Gross return (Tk/ha)	Total cost of cultivation (Tk/ha)	Gross margin (Tk/ha)	Benefit Cost Ratio
BARI Chola-2	24025	18379	5646	1.30
BARI Chola-3	25150	18379	6771	1.36
Anegri	27050	18379	8671	1.47
Local (check)	15375	18379	(-) 3004	(-)0.84

Seed cost @Tk.30/kg
The market price of chickpea was accounted as Tk 25 per kg.

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On-farm adaptive trial of advanced lines of turnip Rape (*Brassica campestris*)

Abstract

The experiment was conducted in medium high land at Tangail, Pabna, Comilla, Jamalpur, Jessore and Chittagong during rabi 2004-05 to evaluate the performance of advanced promising variety/lines of turnip rape mustard under farmer's field condition. Among the tested variety/lines OTBC1097 gave higher grain yield at Tangail, Comilla and Jamalpur whereas BCWY-03 showed higher yield at Jessore and OTBC-2193 at Chittagong.

Introduction

Bangladesh has to import huge amount of vegetable oil and oil seed every year to meet up the deficiency. Mustard is the major oil seed crop in Bangladesh. It covered about 70% of the total oil seed production of Bangladesh. The yield of this crop in Bangladesh is found much lower than the other countries due to yield potential of local varieties and its poor management practices. Oil Seed Research Center (ORC) of BARI has developed some advanced promising varieties/ lines of rape-mustard which possess the high yield and less diseases susceptible and high oil content (44%). Hence, the study was undertaken to evaluate the performance of advanced lines under farmer's field condition.

Materials and Methods

The trial was conducted at Tangail, Pabna, Comilla, Jamalpur, Jessore and Chittagong during rabi 2004-05 in farmer's field. The design of the experiment was RCBD with three replications. Tested variety/lines were BARI Sarisha-9, OTBC-2193 and OTBC-1097 (yellow) and BCWY-03. Plot size was 6m × 4m. The seed rate was 7 kg/ha. Seeds were sown on 1 November at Tangail, 24 November at Pabna, 22-24 November at Comilla, 6-22 November at Jamalpur, 28-30 November at Jessore 2004 and 4-17 December 2005 at Chittagong, respectively with a spacing of 30cm × 5cm. Fertilizer doses were 120-34-45-29-4-2 kg NPKSZnB/ha. All fertilizers were applied as basal except urea. Urea was applied as top dress on 20 and 45 days after sowing (DAS), respectively. One weeding cum thinning operation was done 18 DAS. The crops were harvested variety wise during 17-20 January at Tangail, 5-11 February at Comilla, 25 January to 13 February at Jamalpur and 22 February to 9 March at Chittagong 2005, respectively. The data on different plant characters and yield components were collected from 10 plants selected at random in each plot and yield was recorded plot wise. Data were analyzed statistically using MSTATC package.

Results and Discussions

Location: Tangail

Plant height, days to maturity, yield and yield attributes were significantly influenced by different lines/ variety (Table 1). The result showed that BARI Sarisha-9 and OTBC-1097 was 04 days earlier than that of other two lines. No significant variation was observed in plant population/m^2 except BARI-Sharisa-9. The lines showed insignificant number of branches/plant. The significant highest length of pod was obtained from the line OTBC1097. Higher number of pod/plant was recorded from the line OTBC2193 which was statistically identical to variety BARI Sarisha-9. The line OTBC -1097 showed the highest number of seeds/pod, which was significantly different from other variety/line. The existing variety BARI Sharisa-9 showed higher seed weight, but statistical identical to other lines except BCYO03. The line OTBC1097 produced significantly highest grain yield (2.1t/ha). The rest of the lines and variety (BARI Sharisa-9) contributed similar grain yield, which was much lower yield than OTBC1027.

Location: Comilla

Yield and other characters of Turnip rape are shown in Table 2. There were significance differences among the test lines and check variety were found only plant height and seed yield. The line OTBC-2193 gave the highest seed yield of 1.7 t/ha due to higher pods/plant and seeds/pod. The line OTBC-

1097 and BCWY-03 gave statistically similar yield of 1.35 and 1.29 t/ha respectively. The check variety BARI Sarisha –9 gave the lowest yield due lower pods/plant and seeds/pod.

Location: Jamalpur

Results obtained from the study indicated that all most all the yield contributing characters were influenced due to variety except plant/m2 and seed weight (Table 3). The longest plant recorded from OTBC-2193 which was similar to OTBC-1097 and differed from other varieties. The higher number of pods/plant was recorded from OTBC-2193 which was statistically at par to OTBC-1097 whereas BCEY-03 produced the lowest pods/plant. The seeds/pod was found highest in OTBC-1097 but at per to BCEY-03. However, higher seed yield was recorded from OTBC-1097 but statistically at par to OTBC-2193 & BARI Sarisha 9. The crop duration among the varieties is very close to each other.

Location: Pabna

The line OTBC-1097 took the shortest time in days to flowering (36) and days to maturity (79). The line BCWY-03 took the longest duration for flowering and BARI Sarisha-9 took the longest time to maturity (Table 4). Plant height was found significantly shorter in OTBC-1097 and the longest in OTBC-2193. Plant population was higher in BCWY-03 and lower in OTBC-2193. Number of pods per plant was found maximum in BARI Sarisha 9 which was followed by OTBC-2193. But number of seeds per pod was more in BCWY-03 and OTBC-1097. Thousand seeds weight was not influenced but higher weight from line OTBC-1097. Higher seed yield was obtained from BCWY-03 which was statistically identical with other line and variety. This yield was clearly influenced by the number of seeds per pod and plant population of BCWY-03. Cloudy weather and late sowing (due to delay in T. aman harvest) were hampered the seed and pod formation which resulted lower yield in all line/variety.

Location: Jessore

The performances of advanced lines of turnip rape have been presented in Table 5. Significant differences were observed in case of plant height, number of pods/plant, number of seeds/pod except plant population and 1000 seed weight among the genotype. The highest seed yield (567.00 kg/ha) was produced by BCWY-03 followed by BARI Sharisa-9 (513.25 kg/ha) and the lowest yield (329.00 kg/ha) was obtained from OTBC-1097. So in respect of yield performance the advance line BCWY-03 was found to be superior than that of check variety and others lines.

Locoation: Fatikchhari, Chittagong

Varieties/lines showed significant difference incase of plant population per m^2, number of pod per plant, number of seed per pod and seed yield. Plant population was significantly the highest in line OTBC-2193. Number of pod per plant was higher in OTBC-2193, which was statistically similar BARI Sharisha-9. Number of seed per pod was higher in OTBC-2193 which was statistically indentical to OTBC-1097. Significantly the highest seed yield was found OTBC-2193 due to higher number of plant population, number of pod per plant and number of seed per pod.

Disease and Insect pest: There was some leaf spot disease found on leaf and aphid infestation. All lines and varieties were more or less affected by thrips and pods and leaves were infected by fungi spot due to cloudy weather.

Farmers' reactions

Tangail : Farmers were interested to cultivate BARI Sarisha-9, its short duration and reasonable grain yield. They react positively to OTBC-1097due to higher yield

Comilla : The line OTBC- 2193 gave preference to the farmers for its higher yield.

Pabna : Farmers shown interest with new high yielding line BCWY-03. Farmers expressed their satisfaction with high yield and non lodging tendency against wind. They were satisfied with the uniform maturity of the line which they could harvest at a time.

Chittagong: Farmers satisfied with line OTBC-2193 and OTBC 1092 for higher yield and locally demand. More yield could be found if sowing was done earlier.

Conclusion

From one year result showed that the line OTBC 1097 gave higher seed yield at Tangail, Comilla and Jamalpur whereas BCWY-03 reveals higher yield at Jessore and OTBC 2193 at Chittagong. The experiment needs to be continued for another year for confirmation.

Table 1. Yield and yield contributing characters of rape mustard varieties/line at FSRD site, Palima, Tangail, 2004-05

Variety/line	Plant pop. /m^2	Crop duration (days)	No. of branches/ plant	No. of pods/ plant	Length of pod	Seeds /pod	1000 grain wt.(g)	Seed yield (t/ha)
OTBC1097	92.50a	76	3.80a	36.50bc	26.80a	3.40a	3.45ab	2.1a
OTBC2193	93.75a	80	4.15a	47.45a	12.85c	2.80c	3.52ab	1.4b
BCWY03	93.50a	80	3.50a	32.95c	20.25b	3.20b	3.36b	1.45b
BARI-Sarisha-9	86.75b	76	3.65a	46.65ab	13.90c	2.80c	3.76a	1.3b
CV %	3.20	--	14.37	15.63	11.65	0.0	6.03	7.09

Means followed by same letter is not significantly different at 5% level by DMRT

Table 2. Yield & Yield contributing characters of different lines and varieties of turnip rapes at Comilla site during rabi 2004-05

Variety/ Line	50% Flowering (days)	Maturity (days)	Plant population /m^2	Plant Height (cm)	Pod/ plant	Seeds/ pod	1000 Grain wt. (g)	Seed yield (t/ha)
BARI Sarisha- 9	26	90	59.5	77.40	59.65	14.03	3.06	0.99
OTBC-2193	28	90	57.5	88.25	66.55	17.25	3.24	1.70
OTBC- 1097	29	87	47.75	74.35	60.35	15.38	2.10	1.35
BCWY-03	30	88	53.75	85.85	60.60	16.38	2.56	1.29
LSD (5%)	-	-	NS	6.67	NS	2.48	NS	0.16
CV(%)	-	-	24.07	5.12	9.70	17.51	6.57	7.37

Table 3. Yield and yield contributing characters of different turnip rape mustard at Jamalpur, 2004-05

Variety/ line	Plant height (cm)	Plants/m^2 (no.)	Pods/plant (no.)	Seeds/pod (no.)	1000-seed wt (g)	Seed yield (kg/ha)	Maturity (days)
OTBC-1097	93.30b	65.85	79.85a	22.15a	2.90	1385a	90
OTBC- 2193	106.7a	71.15	81.15a	16.20b	2.80	1345a	91
BCEY- 03	104.4a	69.80	69.80b	20.57a	2.75	1253b	92
BARI Sarisha-9	95.32b	76.70	76.70ab	16.35b	2.60	1305a	91
F	**	NS	**	**	NS	**	NS
CV (%)	8.32	12.78	12.56	8.76	9.52	9.44	4.13

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

Table 4. Yield and yield contributing character of turnip rape seed at MLT site, Kashinathpur, Pabna during the rabi season 2004-05

Variety/line	50% flowering	80% maturity	Plant pop/ m^{-2}	Plant height (cm)	Pods $Plant^{-1}$ (no.)	Seeds Pod^{-1} (no.)	1000-seed wt. (g)	Seed Yield (t ha^{-1})
OTBC -1097	36.25c	79.0c	73.63a	95.7c	51.95b	16.68a	2.38a	0.69a
OTBC -2193	37.50b	83.3b	73.23a	112.0a	76.43a	12.08b	2.33a	0.71a
BCWY-03	40.25a	80.0c	82.58a	104.95b	54.65b	16.88a	2.20a	0.82a
BARI Sarisha-9	37.75b	88.0c	79.48a	110.2a	79.45a	12.18b	2.18a	0.79a
CV (%)	1.66	2.06	8.86	1.20	8.84	7.69	7.28	13.45
LSD (.05)	1.00	2.72	10.94	2.02	9.27	1.77	NS	**NS**

Table 5. Yield and yield contributing characters of turnip rape at FSR site, Bagherpara, Jessore during rabi 2004-05

Variety/line	Plant height (cm)	Plant Pop./m^2 (no.)	Pods/plant (no.)	Seeds/pod (no.)	1000- gr. wt. (g)	Seed yield (kg/ha)	Straw yield (t/ha)
BARI Sarisha-9	80.75b	72	61.93a	21.25b	2.23	513.25a	1.49b
BCWY-03	88.00a	82	39.08b	28.63ab	2.30	567.00a	2.47a
OTBC-1097	69.75c	81	19.65c	30.13a	2.35	329.00b	1.46b
OTBC-2193	87.25a	63	47.02b	24.78ab	2.15	358.00b	1.78b
CV (%)	4.77	16.43	17.63	18.05	8.37	14.61	13.13
LSD (.05)	6.22	NS	11.82	7.56	NS	103.3	0.37

Table 6. Yield and yield attributes of turnip rape lines and variety at Fatickchhari ML site in 2004-05

Variety	Plant population /m^2 (No.)	Pod/plant (No.)	Seed/pod (No.)	1000 seed Wt. (g.)	Seed yield (Kg/ha)
OTBC-1097	128.3b	63.25b	24.45a	2.91	1376b
OTBC-2193	143.0a	91.61a	23.80a	2.70	1445a
BARI Sharisha-9	124.5b	84.54 a	19.57b	2.73	1208c
CV (%)	6.53	7.93	8.31	4.31	9.03
LSD (0.05)	15.36	12.89	3.63	NS	168

On-farm adaptive trial of yellow seeded advanced lines of Mustard (*Brassica Juncea)*

Abstract

The experiment was conducted at Jessore, Barisal, Jamalpur, Pabna and Faridpur during 2004-05. The result revealed that higher seed yield was recorded from BJ536 at Chowgacha, BJ535 at Jamalpur and BARI Sarisha 11 at Barisal and Faridpur but yields were similar at Pabna.

Introduction

Rapeseed and mustard (*Brassica* Sps.) are commonly know as mustard in Bangladesh. It is the principal oilseed crop of Bangladesh and it covers about 60% of the oilseed crop area. The per hectare yield of rapeseed/mustard is only 740 kg/ha (BBS, 2000) in Bangladesh which is very low compared to other mustard growing countries of the world. Low yield of the crop in Bangladesh is due to low yielding varieties, poor management and insufficient precipitation (Miah et al., 1984). The country is running with acute shortage of edible oil. It can hardly meet up about one third of its total requirement. The remaining two third is imported (Mondal and Gaffer, 1983) with an expense of about one billion taka per annum (Hussain, 1985). Increasing production of the crop through horizontal expansion has limited scope in the country because of competition with other crops. An effort therefore, be made to increase production through vertical expansion which can be achieved greatly through improvement of varieties and management practices. Recently Oilseed Research Centre of BARI has developed some new varieties/lines of rapeseed and mustard. On-station performance of those varieties/lines was found promising. To observe the on-farm performance of these varieties/lines in the farmers field the present investigation was undertaken.

Materials and Methods

The study was carried out during rabi season of 2004-05 in farmers field at the MLT site Chowgacha, Jessore, Barisal, Jamalpur, Pabna and Faridpur to find out the superior line of mustard. The experiment was laid out in a RCBD with 4 replications. The unit plot was 10 rows x 5m long. Four advanced lines viz. BJ-11, BJ-66, BJ-535 and BJ-536 with check varieties (Daulat and BARI Sharisa-11) were used as the experimental material. Seeds were sown on 30 October to 3 November at Jessore, 25 November at Barisal, 6-22 November at Jamalpur, 14-16 November at Pabna and 7 November at Faridpur 2004, respectively maintaining the spacing of 30cm between rows, 5cm between plants and 1m between plots. Fertilizers were applied @ of 260-170-90-160-5 and 10 kg/ha in the form of urea TSP, MP, Gypsum, Zinc oxide and Boric acid respectively. Total amount of TSP, MP, Gypsum, Zinc oxide, Boric acid and half of urea were applied as basal during final land preparation and rest half of urea were applied as top dress in two equal splits following irrigation. The crops were irrigated twice at 22 and 55 DAS. Insecticides were applied two times for controlling aphids at the flowering and grain filling stage. The crops were harvested at 10-23 February at Jamalpur, 18 February at Barisal, 22-25 February at Pabna and 7 February at Faridpur 2005, respectively at maturity of the individual varieties. Data on yield and yield attributes were recorded and analyzed statistically. Means were separated by DMRT/LSD test.

Results and Discussion

Location: Chowgacha, Jessore

The seed yield and yield component of different varieties/lines of the experiment were presented in Table 1. Seed yield of different varieties/lines were found significantly different. The highest seed yield (1.51 t/ha) was recorded from BJ-536 followed by BJ-535 (1.47 t/ha) BARI Sarisha-11 (1.47 t/ha) and BJ-11(1.46t/ha). The lowest yield (1.43 t/ha) was obtained from BJ-66 and Daulat.

Location: Barisal

Recommended seed rates were maintained for all the treatments and at harvest plants populations were identical in all the varieties/lines except BJ-66 (Table 2). Maximum population was found in BARI Sarisa-11. Significant variation was found in plant height where the line BJ-11 produced significantly the tallest plant Flowering was earlier in BARI Sarisa-11 where line BJ-11 and Bj-66 took about 7 days more to complete 50% flowering than BARI Sarisa-11. Among the tested lines pod as well as seed bearing was higher in BJ-536 but it was statistically identical with BJ-535. Seeds of BJ-536 were bolder and significantly higher than other varieties/lines. Higher pod and seed bearing with bolder size grain were found in BJ536. The yield of BJ-535 (2.35 t/ha) and BJ-536 (2.41 t/ha) was statistically identical with BARI Sarisa-11 (2.62 t/ha) which produced higher yield.

Location: Jamalpur

Results obtained from the study indicated that all most all the yield contributing characters were significantly influenced due to variety (Table 3). The line BJ66 & BJ11 showed similar highest & higher than other line/variety. Plants/m2 was not significantly influenced by different line/variety. There was no significant difference in line BJ 535 & BJ11 is respect of pods/plant &higher than other line/variety. Higher seed weight was recorded from BJ535 which was closely followed by BARI Sarisha 11. All the lines showed higher yield than the existing variety. Among line/variety higher yield was recorded from line BJ535 with maturity days 91.

Location: Chatmohar, Pabna

The lines BJ-11 and BARI Sarisha-11 performed statistically similar in case of 1000 seed weight, number of seeds per pod and seed yield per hectare (Table 4). All lines and varieties showed non significant result among themselves incase of every parameter. Daulat took shortest days to 50% flowering and BJ-11 and BJ-535 took shortest days for 70% maturity. The 1000 seed weight was found maximum in BARI Sarisha-11, which was followed by BJ-11 (Y) while the minimum was recorded from Daulat. The seed yields were identical among varieties/lines. All the lines failed to show higher yield than BARI Sarisha 11.

Location: Faridpur

Plants/m^2, plant height, yield attributes & seed yield were significantly influenced variety/line (Table 5). Significantly highest plant height was recorded from BJ-11(y). No. of siliqua/plant was similar in BJ-66(y), BJ-11(y) and Daulat. But significantly highest seed/siliqua was obtained from BARI Sarisha 11. Higher seed yield was recorded from BARI Sarisha 11 but statistically at par to BJ-11(y) and BJ 66(y). Stover yield was highest from BARI Sarisha11.

Diseases and insect: Some leaf spots were found in BJ-11 (Y) in later stage. All lines/varieties were infected slightly by leaf blight.

Farmer's Reaction

Pabna : Initially the new lines looked promising but at later stage it does not attract the farmers due to smaller seed.

Faridpur : Farmers in this site already practicing BARI Sarisha-11. They are also preserving the seed**.**

Conclusion

From one year result showed that BARI Sarisha 11 performance better yield at Barind and Faridpur whereas the line BJ536 at Chowgacha, BJ535 at Jamalpur but yield were similar at Pabna. The experiment seed to be continued for another year for confirmation.

Table 1. Performance of yield and yield contributing characters of mustard varieties/lines at MLT site, Chowgacha, Jessore during rabi 2004-05

Variety/ line	Plant Pop./m^2 (no.)	Plant height (cm)	Branch/ plant (no.)	Pods/ plant (no)	Seeds/ pod (no)	1000- gr. wt. (g)	Seed yield (t/ha)	Straw yield (t/ha)
BJ-11	27a	167.53b	5.30ab	472.38bc	14.75	2.50c	1.46ab	4.47a
BJ-66	26ab	174.53a	5.50a	491.88ab	14.88	2.53c	1.43b	4.52a
BJ-535	25b	169.35b	5.38ab	489.85ab	14.90	3.10b	1.47ab	4.46a
BJ-536	26ab	156.60d	5.15b	447.05d	14.90	3.07b	1.51a	4.50a
Daulat	27ab	161.07c	5.40ab	455.07cd	15.13	2.58c	1.43b	4.36b
BARI Sarisha-11	25b	153.75d	5.50a	500.85a	14.43	3.35a	1.47ab	4.32b
LSD(.05)	1.40	3.40	0.24	22.3	0.76	0.12	0.04	0.08
CV (%)	6.58	7.38	8.94	9.11	8.42	7.02	4.57	5.15

Table 2. Yield and yield contributing characters of mustard varieties/lines at Barisal during 2004-05

Variety/line	Plants/m^2	Plant height (cm)	Days to 50% flowering	Pods /plant	Seed /pod	1000 seed wt. (gm)	Seed Yield (t/ha)
BJ-11	49ab	152.4a	55ab	112.9b	12.40b	2.12e	1.32c
BJ-66	46b	145.1b	56a	121.9ab	13.70ab	2.45d	1.36c
BJ-535	52ab	139.1c	54ab	130.3a	14.00a	2.65c	2.35a
BJ-536	53a	136.9c	54ab	132.8a	14.73a	3.16a	2.41a
BARI Sarisha-11	55a	125.6d	49b	114.4b	13.53ab	2.86b	2.62a
Daulat	51ab	109.8e	51ab	115.2b	12.63b	1.76f	1.85b
CV (%)	5.02	1.68	4.90	4.30	3.53	1.93	6.37

Table 4. Yield and yield contributing characters of different turnip rape mustard at Jamalpur during 2004-05

Variety/line	Plant height (cm)	Plants/m2 (no.)	Pods/plant (no.)	Seeds/pod (no.)	1000 seed wt (g)	Seed yield (kg/ha)	Maturity (days)
BJ 535	132.8c	55.9	136.5a	14.7a	3.40a	1321a	91a
BJ 536	137.5b	58.4	137.6a	11.2c	2.80bc	1275ab	91a
BJ 11	141.0a	60.8	117.7c	13.0a	2.55cd	1290a	91a
BJ 66	143.5a	58.6	126.9ab	12.3b	2.30d	1154abc	90a
BARI Sarisha-11	133.7c	55.2	134.5a	11.7bc	3.25ab	1116bc	92a
Daulat	124.7d	51.9	123.9b	12.7b	2.57cd	1093c	89b
CV (%)	5.96	9.97	12.92	5.74	8.17	.9.28	4.26

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

Table 4. Yield and yield contributing characters of yellow seeded mustard *Brassica juncea* at MLT site, Chatmohor, Pabna during 2004-05

Treatments	Days to flower	Days to maturity	Plant height (cm)	Plants pop./m^2	pods/ plant (no.)	No. of seeds/ pod	!000 seed wt. (gm)	Seed yield (t ha^{-1})
T_1= BJ-11 (Y)	43.8a	90.8a	173.8a	77.8a	105.3b	11.75a	2.95a	1.01a
T_2 = BJ-66(Y)	43.0ab	91.5a	172.3a	76.3ab	106.8b	11.25a	2.85a	0.95a
T_3 = BJ-535	43.0ab	90.8a	177.3a	76.8ab	106.5b	11.50a	2.85a	0.99a
T_4 = BJ536	42.3b	91.3a	174.5a	76.0ab	118.5ab	11.25a	2.90a	1.00a
T_5 = Daulat	41.8b	92.3a	168.0a	75.5b	122.8a	11.50a	2.60a	0.95a
T_6=BARI Sarisha-11	43.0ab	91.0a	168.5a	76.5ab	109.8ab	11.75a	3.00a	1.01a
CV (%)	2.21	1.36	6.33	1.93	8.5	8.79	7.18	5.08
LSD (.05)	1.42	NS	NS	2.23	14.26	NS	4.04	NS

Table 5. Yield and yield attributes of yellow seeded advanced lines of mustard (*Brassica juncia*) at Faridpur, 2004-05

Variety/ Lines	Days to maturity (80%)	No. of plants/ m^2	Plant height (cm)	No. of siliqua/ plant	No. of seeds/ siliqua	1000 seed wt. (gm)	Seed yield (kg/ha)	Stover yield (kg/ha)
BJ-11(y)	92	39c	172a	185a	16.75a	2.30c	1237ab	3123b
BJ-66(y)	91	41bc	148d	193a	14.75b	2.32c	1203ab	2500c
Daulat	89	41bc	147d	178a	14.25b	2.22c	990c	2438c
BJ-535	89	45abc	161b	152b	14.50b	2.85b	1078bc	2290cd
BJ-536	89	48a	154c	145b	13.00cd	2.75b	1118bc	3160b
BARI Sarisha-11	97	46ab	152c	154b	12.50d	3.22a	1355a	3320a
CV (%)	-	9.6	2.8	6.0	6.3	5.7	8.5	12.5

On-farm adaptive trial of advanced lines of Rapeseed (*Brassica Napus)*

Abstract

The experiment was conducted at Narikeli, Jamalpur, Chowgacha, Norail, Pabna and Fatikchhari, Chittagong during the rabi season of 2004-05 to evaluate the performance of rape seed varieties **(*Brassica napus)*** at farmers' field. Higher seed yield was recorded from Nap-2001 at Jamalpur and Pabna, Nap-118 at Chittagong whereas Nap 179 at Norail but no difference at Chowgacha.

Introduction

Mustard is the main oil crop in the country covering about 70% of the total area and production. An acute shortage of edible oil has been prevailing in our country. It produces only 33% of its requirement and the remaining 67% is met up by importing at the cost of huge amount of foreign currency. Farmers are cultivating mustard mostly the local Tori-7. A number of improved varieties has been developed by BARI and these are needed to be tested in the farmers field for familarize among the farmers and also to evaluate the performance as well. So, the experiment was undertaken at the Farming Systems Research and Development Site, Narikeli during the rabi season of 2004-05.

Materials and Methods

The experiment was conducted at Narikeli, Jamalpur, Chowgacha, Norail, Pabna and Fatikchhari, Chittagong during the rabi season of 2004-05 to evaluate the performance of rapeseed mustard among the farmers' field level. The treatment include in study were of three varieties viz. Nap-2001, Nap-179, Nap 118, BARI Sarisha 8 and BARI Sarisha 13. The experiment was laid out in a randomized complete block design with four dispersed replication. The unit plot size was 10 rows x 5m long plot.

The land was fertilized was 120-80-60-40-4 kg/ha of N-P_2O_5-K_2O-S-Zn, respectively. The entire amount of fertilizer was applied at the time of final land preparation. The seed were sown continuously with 30 cm apart line on 6-22, November at Jamalpur, 3 November at Chowgacha, 22 November at Narail, 20 November at Pabna, 2004 and 8-17 December 2005 at Chittagong, respectively and the crops were harvested depending on the maturity of the individual crop ranging from 29January to 13 February at Jamalpur and 22 February to 2 March 2005 at Chittagong. The data on the yield attributes were collected from 10 randomly selected plants collected prior to harvest from each plots. The grain yield was recorded plot wise. The collected data were averaged, analyzed and means were separated as per LSD test.

Results and Discussion

Location: Jamalpur

Results obtained from the study indicated that some of the yield contributing characters were found significant (Table 1). Significantly the highest number of pods/plant were noted from Nap-2001. The similar trend was found in number of seeds/pod. However, higher seed yield was recorded from Nap-2001 but statistically similar to Nap-179. The variety BARI Sarisha-13 produced the lower yield due to lower yield attribute.

Location: Jessore

Chowgacha: Plant/m^2, plant height, braches/plant grain and straw yield were not significantly influenced by different entry/variety (Table 2). There was no significant difference in pod/plant among Nap- 179 and BARI Sarisha-13. Significantly highest seed weight was recorded from Nap-179 but grain yield was almost same for the entry and variety.

Narail: Plant/m^2, branch/plant, seed/pods were not significantly affected by the treatment (Table 3). Significantly highest plant height was recorded from Nap-179 but BARI Sarisha 13 showed highest pods/plant. There was no difference between seed weight among Nap-179 and BARI Sarisha-9. Significantly highest seed yield was recorded from Nap-179 higher than BARI Sarisha 13.

Location: Pabna

The result revealed that days to 50% flowering, days to 80% maturity, plant height, number of pods per plant and number of seeds per pod were not statistically significant among varieties (Table 4). But plant population m^{-2}, 1000 seed weight and seed yields were found significantly different among the variety/lines. Higher seed yield was obtained from Nap-200 line and it was the cumulative effect of higher plant population, higher number of seeds per pod and higher 1000 seed weight. The line Nap-200 also showed statistically identical with BARI Sarisha-13 in case of seed yield. The lowest seed yield and yield contributing parameters were found in Nap-179.

Disease and insect pest reaction: After 100% flowering some plants leaves were affected by leaf blight but sprayed by Theovit twice to control the disease.

Fatikchhari, Chittagong

Significantly higher plant population was obtained from the line NAP-118. Similar trend was followed in case of pods/plant. The higher number of seed per pod was in NAP 118 but statistically identical to Nap 119. Significant variation was not found in seed weight. But significantly the highest seed yield was found in NAP-118 and the lowest yield was from the line NAP-119.

Farmer's reaction: Farmer's were interested with high yielding bold seeded line Nap 2001 compared to other local varieties.

Conclusion

From one year result showed that Nap 2001 gave higher yield at Jamalpur and Pabna but Nap 179 at Naroil whereas there was no difference at Chowgacha. Overall Nap 2001 showed better performance than BARI Sarisha 13.

The experiment need to be continued for another year trial for confirmation.

Table 1. Yield and yield contributing characters of different turnip rape mustard at Jamalpur

Variety/ line	Maturity (days)	Plant height (cm)	Plants/m^2 (no.)	Pods/plant (no.)	Seeds/pod (no.)	1000-seed wt (g)	Seed yield (kg/ha)
Nap-2001	89	93.7	80.7	80.3a	27.9a	3.15	1612a
Nap-179	89	95.5	80.8	67.9b	24.5b	3.35	1548a
BARI Sarisha-13	89	94.6	79.5	61.6b	23.7b	3.62	1427b
F	NS	NS	NS	**	**	NS	**
CV (%)	3.12	6.33	5.14	11.81	6.13	9.09	10.70

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

Table 2. Performance of yellow seeded advanced lines of rape seed (*Brassica napus*) at MLT site, Chowgacha during 2004-05

Variety/line	Plant Pop./m^2 (no.)	Plant height (cm)	Branch/ plant (no.)	Pods/pla nt (no)	Seeds/ pod (no)	1000- gr. wt. (g)	Seed yield (t/ha)	Straw yield (t/ha)
Nap-179	27	98.70	4.65	183.05a	27.95	3.88a	1.75	3.68a
Nap-2001	25	99.65	4.83	175.43b	28.58	3.58b	1.76	3.55b
BARI Sarisha-13	26	98.53	4.80	185.07a	28.40	3.48b	1.72	3.76a
CV (%)	5.78	7.12	4.64	7.96	8.99	9.30	5.77	8.14
LSD (.o5)	NS	NS	NS	6.13	NS	0.20	NS	0.13

Table 3. Performance of yellow seeded advanced lines of rape seed (*Brassica napus*) at MLT site, Narail during 2004-05

Variety/line	Plant Pop./m^2 (no.)	Plant height (cm)	Branch/ plant (no.)	Pods/ plant (no)	Seeds/po d (no)	1000- gr. wt. (g)	Seed yield (t/ha)	Straw yield (t/ha)
Nap-179	79	86.68a	4.78	78.50b	24.95	2.60ab	1.48a	2.79a
Nap-2001	80	83.60b	5.90	77.40b	26.25	2.52b	1.25c	2.35b
BARI Sarisha-13	75	81.67b	5.55	83.63a	26.75	2.84a	1.32b	2.97a
CV (%)	15.43	7.66	14.30	10.94	6.13	5.51	9.65	8.78
LSD (.05)	NS	2.42	NS	2.68	NS	0.25	0.61	0.17

Table 4. Yield and yield contributing characters of tested rapeseed lines/varieties at MLTsite Chatmohor, Pabna 2004-05

Treatment	Days to 50% Flowering	Days to 80% Maturity	Plant population m^{-2} (no.)	Plant height (cm)	Pods Plant^{-1} (no.)	Seeds Pod^{-1} (no.)	1000 Seed wt. (g)	Seed Yield (t ha^{-1})
Nap-179	38.25 a	80.00a	75.80b	93.00a	41.80a	20.40a	1.87b	1.24b
Nap-2001	39.25a	83.50a	79.80a	94.30a	43.30a	21.20a	2.06a	1.37a
BARI Sarisha 13	38.75a	81.00a	78.50a	96.50a	47.50a	19.90a	1.96ab	1.34a
CV (%)	1.92	2.24	1.33	4.26	12.1	4.15	3.41	1.61
LSD (.05)	NS	NS	1.80	NS	NS	NS	0.11	0.08

Table 5. Yield and yield attributes of rape seed lines and variety at Fatickchhari MLT site in 2004-05

Variety	Plant population /m^2 (no.)	Pod/plant (no.)	Seed/pod (No.)	1000-seed wt. (g.)	Seed yield (kg/ha)
NAP-119	147b	75.35c	24.91a	3.15	1332c
NAP-118	171a	109.30a	26.78a	3.31	1945a
BARI Sarisha-8	152b	87.81b	23.02b	3.08	1538b
CV (%)	6.32	9.10	6.71	4.82	7.56
LSD (0.05)	13.82	11.89	1.83	NS	205.0

On-farm adaptive trial of early advanced lines of Niger

Abstract

Performance of advanced lines of Niger were evaluated at the Farming Systems Research and Development Site, Narikeli, Jamalpur during the rabi season of 2004-05 at the farmer' field. Three advanced lines viz. Niger-106, Niger-107, Niger-1100 and one variety as check Shova were the planting materials. Results obtained from the study indicated that only the pod/plant and 1000-seed weight were significantly differed due to variety at Jamalpur and pod and seed/pod at Faridpur. The variety Shova gave higher yield at Jamalpur but there was no variation in yield among variety/line at Faridpur.

Introduction

Niger (*Guizotia abyssinica*) is a minor oilcrop in Bangladesh locally known as Garzan til or Guzitil. Oil quality of niger for edible purpose is very good. Niger oil contains 50% linoleic acid which is an essential fatty acid for human health. In Bangladesh, niger oil is not very popular as an edible oil. It contains 38-42% oil and 20-25% protein and can play an important role in increasing internal edible oil production. Very little research work has been done so far on niger. Local varieties are generally cultivated in Bangladesh which has very poor yield. BARI has developed some lines which has good yield potential. So, it is necessary to be put under trial for their adaptability and acceptability at farmer's level at Farming Systems Research and Development site, Narikeli, Jamalpur.

Materials and Methods

The trial was conducted at Farming Systems Research and Development Site, Narikeli, Jamalpur and Faridpur during rabi 2004-05. Three advanced lines viz.V_1) Niger-106 V_2) Niger-107, V_3) Niger-1100 and one variety as check V_4) Shova were broadcasted from 06-22 November, 2004 at different farmer's field at Jamalpur and 2 December, 2004 at Faridpur. The plot size was 4.0 x 5.0 m. The seeds were sown continuously in 40 cm apart rows. The trial was set up randomized complete block design with four dispersed replications. Fertilizer was used at the rate of 75, 120 and 50 kg/ha of Urea, TSP and MP, respectively. Half of urea and full of TSP and MP were applied at the time final land preparation. The rest urea was applied after 1st irrigation at 30 DAS. The crops were harvested depending on the maturity of the individual crop ranging from 6-12 March at Jamalpur and 24 February to 8 March at Faridpur 2005, respectively . The data on the yield attributes were collected from 10 randomly selected plants prior to harvest from each plot. The collected data were averaged, analyzed statistically and means were separated as per DMRT.

Result and Discussion

Location: Jamalpur

Results obtained from the study indicated that only the pod/plant and 1000 seed weight were significantly differed. However, higher seed yield was obtained from Niger 106 which was statistically similar to Shova. The other two lines produced identical seed yield and lower than previous one. The lines put under trial failed to show higher yield than shova.

Location: Faridpur

Number of pods/plant and no. of seed/pod was significantly influenced by different variety/line (Table 2). Other characters were not significantly influenced. Higher number of pod/plant was recorded from Nig. 106 followed by Nawalpur and Shova but higher seed/pod was recorded from Shava. Seed yield was not varied among the line and variety.

Farmers' reaction: Yield is satisfactory but farmers face problems in extracting oil from Niger. They do not know the use of the oil.

Conclusion

From one year result showed that the line Niger 106 and Shova gave similar yield but other two lines failed to show higher yield than Shova. The experiment need to be repeated for another year trial for confirmation.

Table 1.Yield and yield contributing character of Niger at FSRD, Narikeli, Jamalpur 2004-05.

Variety/line	Plant ht (cm)	Plants/m^2 (no.)	Pods/plant (no.)	Seeds/pod (no.)	1000 seed wt (g)	Seed yield (kg/ha)
Niger-106	132.3	41.0	55.1a	40.5	3.85a	1160a
Niger-107	127.9	42.7	42.2b	39.5	3.40b	1057b
Niger-1100	126.2	48.5	36.6c	35.0	3.80a	1007b
Shova	130.3	47.0	43.9b	39.8	3.80a	1150a
F	NS	NS	**	NS	**	**
CV(%)	8.54	15.65	10.82	13.10	7.69	10.35

Table 2. Yield and yield attributes of Niger at FSRD site Faridpur 2004-05.

Variety/line	Days to maturity	Plant pop. /m^2	Plant height (cm)	No. of pods/plant	No. Seeds/pod	1000 seed wt. (g)	Seed yield (kg/ha)
Nawalpur	105	56	91	60	35	3.55	1103
Nig-106	115	54	95	64	33	3.65	1114
Nig-107	114	57	95	55	31	3.28	1104
Nig-1100	113	59	97	55	32	3.28	1093
Shova	111	52	94	60	38	3.28	**1130**
LSD (0.05)	--	ns	ns	4.5	5.3	ns	**ns**

On-farm trial on intercropping Groundnut with garlic and onion

Abstract

An experiment was conducted at Katiadi MLT site of Kishoregonj during rabi season of 2003-2004 to verify the performance of onion and garlic as intercrop with groundnut. Two rows of onion in between 40 cm apart rows of groundnut produced the higher groundnut equivalent yield (6.64 t/ha) with higher gross return (Tk.132760/ha). But gross margin and BCR was much less than one row of onion in between 30 cm apart rows of groundnut due to 36 % higher cultivation cost was involved in T_3 than T_2. In case of garlic, one row of garlic in between 30 cm apart rows of groundnut produced higher groundnut equivalent yield (5.93 t/ha) with higher gross margin (Tk.85175/ha) and BCR (3.55). This treatment showed 28 % less cost than other treatment All the intercropped system earned higher return and equivalent yield than sole crop (groundnut).

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. Garlic and onion are two most popular and economic spices which need much shorter duration for their maturity. The inter row spaces of groundnut could be utilized for growing these crops as short duration crops. Oil crop Research Centre, BARI, has developed two intercropping technologies i.e. groundnut + garlic and groundnut + onion with suitable row arrangement. In these two intercropping technologies are found agronomically feasible and economically profitable at station trial. So, their performance in the farmers field need to be verified. Thus, an experiment was designed with the objectives to find out the performance of garlic and onion as intercrops with groundnut.

Materials and Methods

The experiment was conducted at MLT site Katiadi, Kishoregonj during rabi season of 2003-04. The experiment was laid out in RCB design with four replications. The unit plot size was 3.6 m x 4.0 m. There was five treatments viz. T_1 = Monoculture groundnut (324 plants groundnut), T_2= One row of onion in between 30 cm apart rows of groundnut (324 plants groundnut and 440 plants onion), T_3= Two rows of onion in between 40 cm apart rows of groundnut (360 plants groundnut and 640 plants onion), T_4= One row of garlic in between 30 cm apart rows of groundnut (324 plants groundnut and 440 plants garlic), and T_5= Two rows of garlic in between 40 cm apart rows of groundnut (360 plants Groundnut and 640 plants garlic). Spacing of groundnut was maintained at 30 cm x 15 cm in T_1, T_2 and T_4 whereas 40 cm x 10 cm in T_3 and T_5. Onion and garlic spacing was in single rows in T_2, T_4. Between two rows of groundnut two rows of onion and two rows of garlic were planted maintaining 40cm x 10 cm spacing in T_3 and T_5, respectively. The plot was fertilized with 30-44-83-30-4-1 kg of NPKSZnB/ha. Additional 60 kg N/ha was applied in intercropping plots (only in onion and garlic) as side dressing in 25 and 50 days after emergence (DAE) of groundnut. The variety of groundnut was BARI badam-6. Seeds of groundnut, garlic and seedlings of onion were sown/transplant on 9, 23 and 25 December 2003, respectively and harvested on 05 May, 27 March and 11 April 2004, respectively. Some onion seedlings were damaged and were transplanted on 10 January 2004. Plant characters were recorded and analyzed statistically.

Results and Discussion

Plants/m^2, maturity days were insignificant and other yield and yield contributing characters were statistically significant in different treatments (Table1). Significantly highest number of pods/plant was recorded from treatment T_1 but seeds/pod was statistically identical to treatment T_1, T_2 and T_4. Significantly highest seed weight was recorded from treatment T_1. The same treatment showed higher yield due to higher pods/plant and seed weight. There was decrease of yield with the introduce of intercropped (onion & garlic) but higher groundnut equivalent yield was recorded from treatment T_3 followed by T_2. Higher equivalent yield was recorded from all intercropped treatments. Though the treatment T_3 gave the lower yield of groundnut but two rows of onion in between 40 cm apart rows of groundnut (T_3) produced the higher groundnut equivalent yield (6.64 t/ha) with the higher gross return (Tk.132760/ha). But gross margin and BCR was less than one row of onion in between 30 cm apart rows of groundnut (T_2) due to 36 % higher cultivation cost involved in T_3 than T_2. This indicates that two rows of onion in between 40 cm apart rows of groundnut is better than one row of onion in between 30 cm apart rows of groundnut. In case of garlic, groundnut equivalent yield was higher in one row of garlic in between 30 cm apart rows of groundnut (T_4) than two rows of garlic in between 40 cm apart rows of groundnut (T_5) with higher gross margin (85175) and BCR (3.55) due to 28 % less cultivation cost involved in T_4 than T_5. This indicate that one row of garlic in between 30 cm apart rows of groundnut is better than two rows of garlic in between 40 cm apart rows of groundnut. Two rows of onion and one row of garlic gave the higher yield of onion and garlic than one row of onion and two rows of garlic, respectively. Yield of groundnut with one row of onion or garlic was higher than two rows of onion or garlic might be due to higher plant population of groundnut. Tow rows of onion and one row of garlic in between the two rows of groundnut are found more profitable. The experiment needs to be continuing for another year for confirmation.

Farmers reaction

Farmers opined that two rows of onion and one row of garlic in between two rows of groundnut was more suitable combination due to moderate yield of groundnut with additional higher yield of onion and garlic. They also opined that if they sow onion bulb directly instead off onion seedling then it might be more profitable.

Table 1. Yield and yield components of groundnut as affected by intercropping with garlic and onion at MLT site Katiadi during rabi 2003-04

Treatment	Pop. /m^2	Maturity (days)	Plant height (cm)	Pods/plant (No.)	Seed/pod (No.)	1000-kernal wt. (g)	Yield (t/ha)
T_1	20	160	41.36b	21.76a	1.70a	488a	4.27a
T_2	22	164	49.76ab	18.66b	1.70a	478c	3.69ab
T_3	20	166	51.16a	15.10d	1.60b	455e	3.32c
T_4	21	164	48.16ab	18.73b	1.70a	483b	3.68bc
T_5	20	164	50.60ab	16.76c	1.60b	461d	3.62bc
CV (%)	1.38	3.45	12.75	5.53	1.61	6.21	0.60
LSD (0.05)	ns	ns	9.47	1.55	0.042	0.36	4.38

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

Table 2. Yield of groundnut, onion, garlic and groundnut equivalent yield of groundnut intercropping with garlic and onion at MLT site Katiadi during rabi 2003-2004.

Treatment	Yield (t/ha)			G.nut equivalent yield (t/ha)
	Groundnut	Onion	Garlic	
T_1	4.27	-	-	4.27
T_2	3.69	4.09	-	6.14
T_3	3.32	5.53	-	6.64
T_4	3.68	-	1.50	5.93
T_5	3.62	-	1.38	5.69

Table 3. Cost and return analysis of groundnut intercropping with garlic and onion at MLT site Katiadi during rabi 2003-2004.

Treatment	Gross return (Tk/ha)	Cost of cultivation (Tk/ha)	Gross margin (Tk/ha)	BCR
T_1	85400	29525	55875	2.89
T_2	122880	36650	86230	3.35
T_3	132760	57339	75421	2.32
T_4	118600	33425	85175	3.55
T_5	113800	46625	67175	2.44

Input price (Tk./kg): Urea =6.00, TSP= 15.00, MP= 14.00, Gypsum =5.00, Zinc sulphate= 45.00, Alpha Boron = 100.00, Groundnut seed = 30.00 Onion seedling =25.00, Garlic= 35

Outpur price (Tk./kg): Groundnut = 20.00, Onion = 12.00, Garlic= 30.00

On-farm adaptive trial of improved varieties of Sweet Potato developed by BARI

Abstract

On-farm performance of sweet potato varieties viz. BARI SP-4, BARI SP-5, BARI SP-6 and BARI SP-7 were evaluated against the farmers' local variety at Katiadi, Kishoregonj, Jamalpur, Jessore, Kushtia, Mymensingh and Bogra during rabi season of 2004-05. The highest tuber yield was obtained from BARI SP-7 at Jamalpur, Kushtia and Mymensingh whereas BARI SP-6 at Narail and BARI SP-5 at Katiadi, Kishoreganj. Only cost and return analysis was done at Katiadi where the highest gross return (71760 Tkha^{-1}) and benefit cost ratio (4.51) was obtained from Local variety followed by BARI SP-5. The local variety gave the higher gross return due to higher market value than BARI developed varieties. But at Bogra, higher gross return (Tk. 147000/ha) and BCR (4.99) was obtained from Lalkuthi.

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. Farmers are using local variety, which is low yielded, 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 has high yield ability and also contain high amount of carotene. These varieties needs to be evaluated their performance at farmers level. Keeping the views, the experiment was under taken to evaluate their performance of recently developed sweet potato varieties by BARI and compared to local variety.

Materials and Methods

The experiment was conducted at MLT site, Katiadi, Kishoregonj, Jamalpur, Jessore, Kushtia, Mymensingh and Bogra during rabi season of 2004-05. Five varieties viz. BARI SP-4, BARI SP-5, BARI SP-6 and BARI SP-7 were evaluated against the farmers' local variety in the farmers' field. The BARI SP-2 and two lines (1870012 and 1870182) were included at Jamalpur. The experiment was set up in randomized complete block design with four replications. The unit plot size was 6×6 m^2. The vine was planted at the spacing 40 x 30 cm. The crop was fertilized with 70-16-75 kg ha^{-1} of NPK respectively. Half of urea and all others fertilizer were used at final land preparation. Remaining one half of N fertilizer was top dressed in two equal splits 15 & 30 DAT. The vines were planted on 6 November at Kishoreganj, 23 November at Jessore, 23-24 November at Jamalpur, 9 November at Kushtia, 21 November at Mymensingh and 4 December at Bogra 2004, respectively. One weeding and earthing up was done after 25 DAT. There was no incidence of disease and pest attack. The crop was harvested variety wise on 16 March at Kishoreganj, 9 April at Jessore, 6-9 April at Jamalpur, 16 April at Kushtia, 23 March at Mymensingh and 18-19 April at Bogra 2005, respectively. The 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 and means were separated by DMRT.

Result and Discussion

Location: Katiadi, Kishoreganj

The result showed that vine length/plant, weight of tuber/plant and tuber yields was significantly different in sweet potato varieties (Table1). The highest vine length/plant was recorded from variety BARI SP-6 which was statistically different from other varieties. Local variety and BARI SP-7 produced statistically similar vine length. Higher tuber wt./plant was recorded from variety BARI SP-5 followed by BARI SP-4. Significantly highest tuber yield (21.43 t ha^{-1}) was obtained from BARI SP-5. The farmers variety gave the lowest tuber yield (17.94 tha^{-1}) due to closer spacing (30x10m). As a result, population was more than double and yield was lower than other varieties. Among the BARI developed varieties BARI SP-5 gave the highest yield (21.43 t ha^{-1}) due to higher tuber/plant and tuber weight/plant. The highest gross return (Tk.71760 ha^{-1}) and benefit cost ratio (4.51) was calculated from local variety which was much higher than any other variety in the trial. The local variety gave the higher gross return due to higher market value of tuber than BARI developed varieties through yield was much lower.

Location: Melandah, Jamalpur

Yield and yield contributing characters of sweet potato varieties have been presented in Table 1. It was observed that all the yield contributing character viz. vine length, branches/plant, leaves/plant, vine weight/plant, tuber/plant, tuber weight/plant, tuber length, tuber breadth and tuber yield were influenced due to treatment variation. The results showed that BARI varieties were better than local variety. However, the highest tuber yield was obtained from BARI SP-7 (29.27 t/ha) and it was statistically similar to BARI SP-6, BARI SP-5 and BARI SP-2. Local variety gave the lowest tuber yield (11.28 t/ha).

Location: Narail and Magura, Jessore

The highest yield (23.8 t/ha) was obtained from BARI SP-6 followed by BARI SP-7 at Narail whereas at Magura highest yield (36.55 t/ha) was obtained from BARI SP-7. The lowest yield (13.5 t/ha) was obtained from BARI SP-5 at Narail and 13.25 t/ha from local at Magura. Highest yield was achieved due to higher number of tubers/plant and weight of tubers/plant.

Location: Kushtia

Number of tuber/m^2, tuber weight/plant and tuber weight (kg/m^2) were affected by the varieties. The highest tuber wt./plant was recorded from BARI SP-7 which resulted higher tuber yield from the same variety.

Location: Netrakona, Mymensingh

The results of the experiment have been presented in Table 1. All the yield contributing characters and yields of the sweet potato varieties differed significantly. Length of vine was higher in BARI SP-5 followed by BARI SP-6 and BARI SP-7. The variety BARI SP-4 had the lowest vine length but it was similar to the local. The variety BARI SP-7 had maximum number of branches/plant but it was statistically identical to all other varieties except BARI SP-5 which had lowest number of branches/plant. Similarly number of leaves/plant, weight of vine/plant, weight of tuber/plant and root yield was also lowest in BARI SP-5. But number of tubers/plants was lowest in the local variety. The variety BARI SP-7 had significantly highest weight of tubers/plant which resulted highest tuber yield. The variety BARI SP-5 gave the lowest root yield due to lower yield attributes. The local variety gave a comparable yield of 23.33 t/ha which was higher than BARI SP-5 and BARI SP-4. However, the root yields of BARI SP-7 and BARI SP-6 showed 63.44 and 12.18%, respectively higher than the local variety.

Location: Gabtali, Bogra

Yield performance as well as cost benefit analysis were presented in Table : 1. The highest vine length was found in BARI SP-4 which is identical to BARI SP-5, D-2144, Kamalasunduri, Lalkuthi and Kalomegh. The higher number of tuber/plant was found in Lalkuthi followed by Kamalasunduri, BARI SP-4 and BARI SP-5. Significantly the highest vine weight was produced by Lalkuthi and the lowest was found in Kalomegh. The highest tuber yield was produced by Lalkuthi due to higher vine weight and no. of tuber/plant. The lowest tuber yield was observed in local variety (16.7 t/ha). The highest gross return (Tk. 147000/ha) and BCR (4.99) was obtained from Lalkuthi followed by Kamalasunduri (4.50) and BARI SP-4 (4.44). The local variety gave the lowest gross return (Tk. 83500/ha) and BCR (2.84).In Kalomegh, longitudinal cracks were found on surface of about 70% tubers.

Farmer's reaction

Kishoreganj: The local farmers opined that due to bigger tuber size of BARI varieties they do not like as a result price was lower than local variety. Moreover, local variety had better keeping quality than the BARI released varieties when preserved under normal condition. Among BARI developed varieties they prefer BARI SP-5 due to its higher yield, yellow colour and taste. Farmer's of MLT site, Katiadi opined that there was no incidence of insect and diseases in the new varieties.

Jamalpur: Farmers expressed that after boiling SP-2 became very soft and gave the pungent odour like turmeric. The Line 1870012 and 1870182 gave poor yield compared to other varieties. On the other, 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 could be harvested a 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.

Jessore: BARI sweet potato varieties are less tasty and cheaper than local variety. So farmers are not interested to grow these varieties.

Kushtia: Among the four varieties, BARI Sweet potato-7 performed better yield and popular to the farmers for its attractive colour.

Netrakona: Out of the four tested varieties, the farmers preferred the variety BARI SP –7 for its bigger root size and higher yield.

Bogra: The Kamalasunduri and Lalkuthi are less sweet than local variety but more sweet than BARI SP-4 and BARI SP-5. The varieties Kamalasunduri and Lalkuthi were accepted by the farmers but the attitude of farmers about BARI SP-4 and BARI SP-5 was negative for less sweetness and high softness after boiling. Farmers do not want to cultivation the Kalomegh variety due to their longitudinally cracking characters.

Conclusion

Among the variety, BARI SP-7 showed better performance at Jamalpur, Kushtia and Mymensingh and BARI SP-6 at Narail and Bogra whereas BARI SP-5 at Katiadi, Kishoreganj.

Table 1. Performance of sweet potato varieties at MLT site, Katiadi during rabi 2004-05

Variety	Vine length/ plant (cm)	Tuber/plant (no.)	Tuber wt./ plant (g)	Tuber yield (tha^{-1})
BARI SP-4	90c	6.0	633.33ab	20.71b
BARI SP-5	127b	6.0	685.33a	21.43a
BARI SP-6	156a	5.0	578.66b	19.52b
BARI SP-7	66d	5.0	448.33c	19.13b
Local	72cd	5.0	303.33d	17.94c
LSD (0.05)	18.87	ns	57.68	2.34
CV (%)	9.77	15.62	5.78	1.50

Figures in a column having similar letter (s) do/does not differ significantly at 5% level of significance.

Table 2. Cost and return analysis of sweet potato varieties developed by BARI (MLT site, Katiadi during 2004-05)

Variety	Gross return ($Tkha^{-1}$)	Total Variable cost ($Tkha^{-1}$)	Gross margin ($Tkha^{-1}$)	BCR
BARI SP-4	62130	15890	46240	3.91
BARI SP-5	64290	15890	48400	4.04
BARI SP-6	58560	15890	42670	3.68
BARI SP-7	57390	15890	41500	3.61
Local	71760	15890	55870	4.51

Price of input (Tk./kg): Urea =6.00, TSP = 15.00, MP= 13.00, Labour = 70.00
Price of outputs (Tk./kg): Sweet potato (local) = 4.00, Sweet potato (BARI variety) = 3.00

Table 3. Effect of different varieties on yield and yield components of sweet potato at MLT site, Melandah, Jamalpur during rabi 2004-05

Treatment	Vine length (cm)	Branches/ plant (no.)	Leaves/ Plant (no.)	Vine.wt/ plant (g)	Tuber/ Plant (no.)	Wt.tuber/ plant (kg)	Tuber length (cm)	Breadth of tuber (cm)	Tuber yield (t/ha)
BARI SP-2	109.1a	8.3ab	120.7a	439.3a	6.2a	406a	12.43a	3.36ab	24.73a
BARI SP-4	114.5a	6.7b	90.2b	257.3b	2.5b	307ab	11.21ab	3.73ab	25.96b
BARI SP-5	101.6ab	9.8ab	124.1a	318.0b	4.0ab	356ab	12.30a	3.41ab	26.57a
BARI SP-6	110.1a	6.9ab	89.1b	296.6b	2.5b	374a	9.84ab	4.32a	27.63a
BARI SP-7	88.6abc	6.8b	108.8a	272.6b	3.3b	318ab	10.26ab	3.68ab	29.27a
Line 1870012	68.9cd	6.2b	82.6b	250.6b	4.7ab	238bc	7.48b	2.55bc	16.08c
Line1870182	74.2bcd	5.6b	71.0b	258.6b	4.8ab	132c	9.87ab	2.16c	15..89b
Local	56.1d	11.4a	80.2b	305.3b	4.2ab	246bc	11.99a	3.10bc	11.28d
F	**	**	**	**	**	**	**	**	**
CV (%)	12.62	10.29	7.56	9.95	12.05	9.55	8.19	10.65	7.47

Figure in a column having similar letters do not differ significantly

Table 4. Performance of sweet potato tested at MLT site, Narail during 2004-05

Variety	Tubers/plant (no.)	WT of Tuber/ plant (g)	Yield/plot (kg)	Yield (t/ha)
BARI SP-4	6.4	340	225	18.8
BARI SP-5	3.4	310	162	13.5
BARI SP-6	6.2	392	285	23.8
BARI SP-7	5.2	374	249	20.8
Local	6.8	350	220	18.4

Table 5. Performance of sweet potato tested at MLT site, Magura during 2004-05

Variety	Tubers/plant (no.)	WT of Tuber/ plant (g)	Yield/plot (kg)	Yield (t/ha)
BARI SP-4	3.8	750	388	32.33
BARI SP-5	4.3	710	358	29.86
BARI SP-6	4.6	800	375	31.23
BARI SP-7	5.2	850	439	36.55
Local	4.1	300	159	13.25

Table 6. Effect of different varieties on yield and yield components of sweet potato at Kushtia during 2004-05

Variety	Number of tubers/m^2	Tuber wt./plant (g)	Tuber wt. (kg/m^2)	Tuber yield (t/ha)
BARI SP-4	20	95	1.80	18.0
BARI SP-5	18	100	2.10	21.0
BARI SP-6	17	110	2.24	22.4
BARI SP-7	25	115	2.5	25.0

Table 7. Yield and yield contributing characters of sweet potato varieties (Netrakona, 2004-05)

Variety	Length of vine (cm)	Branches/ plant	Leaves / plant	Fresh wt. of vine /plant (g)	No. of tubers/plant	wt. of tubers / plant (kg)	Tuber yield (t/ha)
BARI SP-4	119.7c	8.60a	145.3ab	0.34b	5.25a	0.22bc	19.50cd
BARI SP-5	156.7ab	5.13b	120.3b	0.17c	3.59b	0.20c	18.43d
BARI SP-6	185.2a	8.44a	149.0ab	0.55a	4.42ab	0.29b	26.17b
BARI SP-7	161.4ab	10.35a	132.3b	0.46ab	4.00ab	0.44a	38.13a
Local	143.3bc	10.12a	180.3a	0.55a	2.23c	0.26bc	23.33bc
LSD (0.01)	30.82	2.59	38.92	0.16	1.30	0.086	4.58
CV (%)	7.34	11.09	9.76	14.43	12.15	8.41	6.65

Table 8. Yield, yield attributes and cost benefit analysis of different sweet potato varieties at MLT site Gabtali, Bogra during 2004-05

Variety	Length of vine (cm)	No. of tuber/plant	Wt. of vine (t/ha)	Tuber yield (t/ha)	GR (Tk./ha)	TVC (Tk./ha)	BCR
Local	91.32c	3.80d	53.47c	16.70c	83500	29445	2.84
BARI SP-4	122.3a	5.07ab	58.91b	32.65b	130600	29445	4.44
BARI SP-5	115.3ab	4.85abc	59.95b	22.40d	89600	29445	3.04
BARI SP-312	95.45bc	4.00cd	45.26e	29.55c	118200	29445	4.01
D-2144	122.1a	3.95cd	47.84d	28.92c	115680	29445	3.93
Kamalasunduri	115.1ab	5.35a	35.24f	33.13b	132520	29445	4.50
Lalkuthi (SP-6)	112.2abc	5.52a	82.00a	36.75a	147000	29445	4.99
Kalomegh (SP-7)	109.9abc	4.27bcd	33.98g	23.39d	93560	29445	3.18
LSD (0.05)	20.03	0.91	1.24	2.33			
CV (%)	12.33	9.94	1.19	4.18			

Figure(s) followed by different letters in same column are statically significant at 1% and 5% level of probability.

MLT site, Cox's bazar

The experiment was conducted at farmer's field at Cox's Bazar of Chittagong region during November 2004 to April 2005 to disseminate BARI released improved sweet potato varieties with farmer's own. The sweet potato varieties were planted at 21-11-2004 to 04-12-2005 and harvested at 21-23 April 2005.

The higher number of tuber per plant was found in BARI SP-6 followed by all variety except local one. Tuber weight per plant was also higher in BARI SP-6 but it was statistically similar to BARI SP-7 and BARI SP 4. Similar trend was followed in tuber yield where yield was found in BARI SP-6 which was statistically similar to BARI SP-7. Due to excess vegetative growth, the total tuber yield of sweet potato was comparatively low.

Table 9. Tuber yield and yield attributes of sweet potato varieties at Cox's Bazar in 2004-05

Variety	Tuber/Plant (No.)	Tuber wt/plant (g)	Tuber yield (t/ha)
BARI SP-4	3.25ab	1.10ab	22.68ab
BARI SP-5	3.50a	1.05b	20.55bc
BARI SP-6	3.65a	1.27a	24.64a
BARI SP-7	3.25ab	1.21a	22.94a
Local	2.27c	0.65c	17.85c
CV (%)	11.54	10.25	9.12
LSD (0.05)	1.06	0.18	2.55

Adaptive trial of improved stolon producing Panikachu varieties

Abstract

The advanced panikachu line PK-176 along with a check (local variety) was evaluated to their stolon and rhizome yielding ability at Bogra and Latiraj and local at Narail. At Joypurhat, higher yield of stolon was recorded from PK-176 but rhizom yield from local one whereas Latiraj showed higher yield at Narail.

Introduction

Panikachu is an important edible aroid in Bangladesh and one of the bulky vegetables available in summer season. It can be used as stolon and rhizome. BARI has already developed one variety Latiraj and another in pipe line. So, this variety/line could be compared with local one for yielding ability.

Materials and Methods

The study was conducted at the MLT site, Narail and Joypurhat, Bogra during 2004-05 to compare the improved variety of Panikachu with local one. The unit plot was 10m x 10m. The seedlings were planted on 30 January at Narail and 23-25 May at Gabtali 2004, respectively maintaining the spacing of 60cm x 45cm. Fertilizers were applied at the rate of 5 ton cowdung and urea, TSP, MP: 150-125-175 kg/ha respectively. All fertilizers were applied during final land preparation and urea was applied in two equal splits at 40 DAT and 90 DAT. Irrigation and weeding were done as and when necessary. Harvesting continued from 28 June, 2004 to 16 October at Narail and 4 July to 21 November at Gabtali 2004, respectively. Data on length of stolen, number of stolen/plant, weight of stolen/plant, stolen yield/plot and yield (t/ha) were collected.

Results and Discussion

Location: Narail

The variety Latiraj produced the highest yield (18 t/ha). Local variety produced the lower yield (15 t/ha) compared with Latiraj. Higher yield from Latiraj was due to higher yield contributing characters.

Location: Joypurhat, Bogra

The local variety was taller than that of Latiraj PK.-176. The highest number of stolon per plant was obtained from the tested variety PK-176 than that of local variety. The weight of stolon per plant was obtained from PK-176 higher than that of local variety). As a result the highest yield of stolon was obtained from the tested variety PK-176 (27.85 t/ha) and the local variety was produced (20.25 t/ha). But the rhizome length was obtained from local variety (37 cm) higher than that of PK.-176 (35 cm). Ultimately the total production of rhizome was obtained from local variety (20.83 t/ha) higher than that of PK-176 (18.75 t/ha).

Farmers' reaction

Narail: Farmers express their satisfaction with more yields of Latiraj and they are interested grow it for its high market price and demand.

Joypurhat: In respect of yield and taste, a few farmers showed their interest to grow the tested variety PK.-176. But the skin colour and size of local variety was attractive. The skin colour of tested variety PK 176 was light green and size was linear but the skin colour of local variety was deep green and size of stolon was shorter than that of the tested variety PK.-176. The market price of local variety (7.56 Tk./kg) was higher than that of tested variety PK.- 176 (6.04 Tk./kg). Another point of view the variety Pk.-176 was more susceptible to leaf blight disease than that of local variety. As a result most of the farmers were not interested to grow the tested variety Pk.-176.

Table 1. Performance of yield and yield contributing characters of Panikachu at MLT site, Narail during 2004-05

Variety	Length of stolen (cm)	Stolen/plant (no.)	Weight of stolen/plant (g)	Yield/plot (kg)	Yield (t/ha)
Latiraj	69.1	36	899	180	18
Local	60.9	32	700	157	15

Table 2. Yield and yield contributing characters of panikachu (Joypurhat, 2004-05)

Variety	Plant height (cm)	No. of stolon /plant	Weight of stolon /plant (kg)	Yield of stolon (t/ha)	Length of rhizome (cm)	Weight of rhizome (Kg/plant)	Yield of rhizome (t/ha)
PK-176	129	38.00	1.575	27.85	35	0.900	18.75
Local	176	20.61	1.145	20.25	37	1.00	20.83

Adaptive trial of improved variety of Mukhikachu

Abstract

The performance of mukhikachu varieties viz. Bilashi and local were evaluated in the farmers' field at Shepur and Majira, Bogra during the Kharif-I season of 2004 under AEZ 9. At Sherpur, the highest root yield was obtained from Bilashi (13.90 t/ha) which produced 37% higher yield than the local variety (10.18 t/ha). The performance of Bilashi appeared to be promising and preferred by the farmers because of higher yield, good shape and higher market price than the local variety. At Bogra, both the variety (Bilashi and Bordhaman) similar yield and farmers are interested to grow these varieties.

Introduction

Mukhikachu (*Colocasia 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 favourably in terms of nutritional value with other root crops, such as cassava, yam, sweet potato and other edible aroids. Monitoring of cultivation practices of mukhikachu revealed that all the farmers got very poor yield by using local varieties. Recently, Bangladesh Agricultural Research Institute (BARI) has developed modern variety of mukhikachu named Bilashi and therefore, it is necessary to evaluate the yield performance under farmers' condition at the Multilocation Test Site, Sherpur under AEZ 9.

Materials and Methods

The experiment was conducted in the farmers' field at the Multilocation Test Site, Sherpur and Bogra during Kharif 1, 2004 at four dispersed farmers' field. The unit plot site was 8 m x 6m with spacing 60cm x 40cm. The recommended fertilizer dose 60-40-80 kg/ha of NPK with 2 t/ha of cowdung. The full dose of cowdung, phosphorus and potash were applied at the time of final land preparation. The nitrogen was applied after 40 and 90 days after planting. The seeds were planted from April 26-28 at Sherpur and 22-26 March at Bogra 2004, respectively. The crop was harvested from October 19-23 at Sherpur and 9-10 October at Bogra, 2004. Data were collected on the plant height, number of plants/m^2, number of cormels/plant, weight of cormels/plant.

Results and Discussion

Location: Sherpur

The result showed that Bilashi produced the higher yield (13.90 t/ha) than the local (10.18 t/ha). The higher yield of Bilashi was the resultant of higher plants/m^2 and higher cormel weight/plant. It produced about 37% higher yield than local. The local variety although gave higher number of cormels/plant than Bilashi, yet it could not compensate the weight of cormels/plant by Bilashi. Gross return and net return was also higher in Bilashi variety when cost of cultivation was same for the variety. As a result higher benefit was recorded from Bilashi variety.

Location: Majira, Bogra

The results on the yield and yield contributing characters of Mukhikachu are presented in Table 1. The weight of primary corm was the highest in Bordhaman which was statistically identical to Bilashi. The lowest primary corm was produced from the local variety. The highest number of secondary corm was obtained from Bilashi which was identical to the variety Bordhaman. The lowest number of secondary corm was obtained from the local variety. The weight secondary corm per plant (481.0 g) was the highest in Bilashi which was significantly different from the two varieties. The variety Bilashi produced the highest yield (17.83 t/ha) which was closely followed by Bordhaman (17.29 t/ha) and the lowest yield (14.35 t/ha.) was recorded in the local variety.

Farmer's reaction

Sherpur: The performance of Bilashi appeared to be promising and preferred by the farmers because of higher yield, good shape, tolerant to water logged condition and higher market price than the local variety. They have already been preserved the seeds for next year cultivation. It could be expected to disseminate this variety among the farmers at Sherpur area under AEZ 9.

Bogra: In respect of yield and cooking quality most farmers showed their interest to grow the variety Bilashi and Bordhaman. The size of corm and skin colour of Bordhaman was attractive than that of Bilashi and local variety. The market price was higher of Bordhaman and Bilashi than that of local variety. Therefore, the most of the farmers are interested to grow the variety Bordhaman and Bilashi.

Table 1. Yield, yield contributing characters and cost and return analysis of Mukhikachu at Sherpur

Treatment	Plant height (cm.)	Plants/m^2 (no.)	Cormels/ plant (no.)	Cormel wt./plant (g)	Cormel yield (t/ha)	Gross return (Tk./ha)	TVC (Tk./ha)	Net return (Tk./ha)
Bilashi	1.14	5.19	13.1	265.8	13.90	139000	32445	106555
Local	1.11	4.96	13.8	202.6	10.18	91620	32445	59175

Price (Tk./kg): Bilashi= 10.00 and local = 9.00

Table 3. Yield and yield contributing characters of Mukhikachu at Majira, Bogra

Variety	Weight of primary corm/ plant (g)	No. of secondary corm/plant	Weight of secondary corm/plant (g)	Cormel yield (t/ha)
Local	83.00b	18.30b	405.0c	14.35b
Bilashi	87.50ab	19.00a	481.0a	17.83a
Bordhaman	89.50a	18.70ab	443.5b	17.29a
$LSD_{(P\geq0.01)}$	4.73	0.57	37.33	1.08
CV (%)	1.45	0.82	2.24	1.74

Bread wheat adaptive line trials at farmer's field condition

Abstract

The experiment was conducted in medium high land at FSRD site, Palima, Tangail, Mymensingh, Comilla, Jamalpur and Pabna during rabi 2004-05 to assess the yield performance of bread wheat lines in different agro-climatic zones under farmer's field condition. In the case of late sowing it was observed that the higher grain yield was obtained from line BAW1006 followed by BAW1008 and BAW1027. Kanchan gave the lowest grain yield among the varieties/lines.

Introduction

Wheat (*Triticum aestivum*) is the second most important cereal crop next to rice, cultivated during rabi season in Bangladesh. The area and production of wheat were markedly increased from 1975-1985 and after that area and production started declining. This declining was probably associated with yield, higher production cost, decreasing soil fertility, low market price during the harvest time. Wheat Research Center of BARI has developed a good number of wheat lines/varieties and also some technologies to eliminate those constrain. The Wheat Research Center (WRC) conducted several on station trials with newly released bread wheat lines, which need to be tested and compared with widely cultivated standard varieties at farmers' level. The experiment was undertaken to assess the yield performance of bread wheat lines and to compare with check variety in different region.

Materials and Methods

The experiment was undertaken in medium high land under irrigated condition at the farmer's field of FSRD site, Palima, Tangail, Mymensingh, Comilla, Jamalpur and Pabna during rabi 2004-05. Three advanced bread wheat lines BAW1006, BAW1008 and BAW1027 were compared with farmers' existing variety Kanchan. The experiment was laid out in a randomized block design with three replications. The unit plot size was 4m x 5m. The land was fertilized with 220 kg urea, 132 kg TSP, 68 kg MP, and 117 kg gypsum/ha. Two-third of urea and all amount of fertilizer were applied at final land preparation. Seeds were sown on 4 December at Tangail, 21 December at Mymensingh, 30 November at Comilla, 29 November at Jamalpur and 30 November at Puspapara, 2004 and 2 December at Kashinathpur, Pabna 2005, respectively as optimum sowing and another late sowing 21st December' 2004 in lines apart 20 cm with seed rate 120 kg /ha. Three irrigations were applied at 15, 45 and 75 days after sowing (DAS) followed by remaining urea as top dress. One hand weeding was done at 30 days after sowing. The crop was harvested on 10-20 March at Tangail, 19 March at Mymensingh, 15 March at Comilla, 21 March at Jamalpur and 23-25 March at Pabna 2005, respectively. All necessary data were collected and analyzed statistically.

Result and Discussion

Location: Tangail

Optimum sowing time: Yield and yield attributes were significantly influenced by different varieties/ lines (Table 1). Higher plant height was recorded from Kanchan which was statistically identical to BAW1006 and lowest was obtained from BAW 1027. The result showed that BAW1006 was matured 04 days earlier than kanchan. Number of tillers significantly influenced by different variety/lines, higher number of tillers/plant was obtained from line BAW 1006 which was statistically similar to kanchan. No variation was observed with spike length. The higher number of grain/spike was obtained from BAW 1008 which was statistically identical to Kanchan. BAW1027 gave the lowest number of grain/spike among the tested varieties/lines. Significantly highest grain weight was recorded in BAW1008 and the lowest in kanchan. Grain yield was statistically identical to among the lines/variety but line BAW1006 and BAW1027 produced higher grain yield than farmers' existing variety kanchan. Straw yield was not influenced by any lines/variety.

Late sowing: The results of wheat variety/lines (late sowing) was sown in table 2. No. of tiller, spike length, grain/spike and straw yields were not significantly influenced by line/variety. Under late sown condition all the yield attributes and grain yield were higher than optimum sowing. No. of spike/m^2

were statistically identical except line BAW1006 which showed lowest no. of spikes/m^2 Significantly highest 1000-grain weight was recorded from line BAW 1008 & lowest from Kanchan. Grain yields among three lines were statistically identical & higher than existing variety Kanchan.

Location: Mymensingh

The results of the experiment have been shown in Table1. The result reveals that plant characters like plant height, number of spike/m^2, length of spike, number of spikelet/spike and number of unfilled grains/spike were not statistically significant. However, number of filled grains/spike, 1000 grain weight and yields were statistically significant at 1% level. Number of filled grains/spike showed higher in BAW-1008 but statistically at par to Kanchan. Significantly the highest grain weight was recorded from BAW-1008 due to its bolder size. Grain and straw yields of BAW-1008 were 23.40 % and 19.49 %, respectively higher than the check variety Kanchan. The over all performance of the lines / variety was hampered due to heavy rain on 21 December, 04 (at seedling stage) and also at the maturity stage (on 11 March' 05). Besides, spikes of all the lines/variety were attacked by black point disease which might caused reduction in yield of the crop. But grain yield was satisfactory in BAW-1008 and BAW-1006 whereas lower yield in BAW-1027 then Kanchan variety. Straw yields were much higher in BAW-1008 but at par to BAW-1006 and Kanchan.

Location: Melandah, Comilla

A significant difference was found in plant/m2, length of spike, 1000-grain weight and grain yield. Yield and other characters of bread wheat lines are shown in Table 1. Out of 3 tested lines and check variety, BAW 1006 gave the higher grain yield of 3.83 t/ha but statistically identical to other lines except Kanchan. Two selected lines BAW 1006 and BAW 1008 were earlier by 4-6 days than the check variety. Among the lines the plant height of BAW 1008 is shorter than other tested materials, which indicates slightly is larger than other materials.

Location: Melandah, Jamalpur

Yield and yield contributing characters of bread wheat have been presented in Table 5. All most all the yield contributing characters were significantly differed due to variety. The plant height, length of spike and straw yield was found insignificant. The number of plants/m^2 was found higher in Kanchan but it was statistically identical to BAW-1027. The highest number of grains/spike was noted from BAW 1008 was statistically similar to BAW 1027 and Kanchan. BAW-1006 produced the lowest number of grains/spike. The weight of 1000-grain was found statistically similar to all lines and the lowest from variety Kanchan. There was no significant difference in grain yield among the lines but significantly the lowest yield was recorded from Kanchan.

Location: Pabna

Puspapara: From the current year's result of expanded FSRD site, Pushpapara, it was found that the line BAW-1006 took the lowest days to heading and maturity while line BAW-1027 took the highest days to heading and maturity. Higher plant population was attained by line BAW-1027 and lower by line BAW-1008. The highest grains spike^{-1} and 1000-grain weight was found in BAW-1008 and lowest in Kanchan. The highest grain yield was obtained from BAW-1006. Though the number of grains spike^{-1} and 1000-grain weight were higher in line BAW-1008 but yield was moderate and it might be due to thin plant population. Lowest yield was obtained from variety Kanchan (Table 6).

Kashinathpur: The line BAW-1006 took the minimum days to heading and maturity and line BAW-1008 required the maximum days to heading and maturity. Plant population was found higher in BAW-1027 and lowest in Kanchan. The highest grain yield was obtained from BAW-1027 and the lowest from Kanchan. Like FSRD site, though the number of grains spike^{-1} and 1000 grain weight were higher in BAW-1008 but the yield was second highest and it also might be due to lower plant population. Grain yield was higher in MLT site, Kashinathpur than FSRD site, which may be due to late sowing and less amount of moisture in the field of FSRD site (Table 7). This year wheat yield was lower than previous yield and it might be due to short winter.

Farmers' reactions

Tangail: Still Farmers were interested to cultivate the Kanchan because seeds are available in market. Positive reaction was also observed on the line BAW1008 and BAW1006 for its higher yield and shorter duration

Mymensingh: Farmers are interested to grow the high yielded new advanced lines BAW-1008 and BAW-1006 if the seeds are available to them.

Comilla: The lines BAW 1006, BAW 1027 and BAW 1008 are good because yields are higher and seeds are bold type than Kanchan. The lines BAW 1006 and BAW 1008 are also shorter than Kanchan.

Jamalpur: Farmers preferred the line BAW-1008 for its high yield potential, bold grain and attractive in colour. It is expected that higher yield could be obtained with this line at Jamalpur and Sherpur area under AEZ 9.

Pabna: Farmers of the locality accepted the line BAW 1008 for its good yield and bold size grain and BAW-1027 for its brightness. They want to grow more area in coming season. Some of them preserved seed of BAW 1008 and BAW-1027 for next seasons use.

Conclusion

The promising line BAW-1006 showed higher grain yield in all sites except Pabna where BAW-1027 showed higher yields at par to BAW-1008.

Table 1. Yield and yield contributing characters of newly released wheat lines/varieties at FSRD site, Palima, Tangail, 2004-2005 (Optimum sowing)

Treatment	Plant height (cm)	Nos. of tillers/m^2	No. Spike/m^2	Spike length (cm)	No. grain /spike	1000 grain wt.(g)	Grain yield (t/ha)	Straw yield (t/ha)
Kanchan	98.87a	3.47ab	298.3ab	10.57a	46.27a	32.90c	3.03a	4.67a
BAW1006	95.27a	3.73a	337.0a	10.17a	40.47b	41.20b	3.67a	4.50a
BAW1008	96.47a	3.07b	220.7c	10.57a	46.93a	45.73a	3.53a	4.17a
BAW1027	88.33b	3.40ab	270.7b	9.700a	39.40b	42.06b	3.67a	4.33a
CV %	2.70	8.22	7.10	4.25	5.73	2.78	10.97	8.44

Table 2. Yield and yield contributing characters of newly released wheat lines/varieties at FSRD site, Palima, Tangail, 2004-2005 (Late sowing)

Variety/ Lines	Plant height (cm)	No. of tiller/plant	Number of spike/m^2	Spike length (cm)	No. of grain/spike	1000-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
Kanchan	105.7a	3.733a	308.0ab	11.18a	45.47a	30.00c	2.40b	5..00a
BAW1006	102.9a	3.833a	270.7b	11.22a	38.87a	42.60b	4.17a	5..83a
BA1008	102.8a	3.600a	290.7ab	11.51a	47.57a	47.27a	3.77a	5..50a
BAW1027	96.47b	3.733a	325.0a	11.57a	35.47a	41.67b	3.70a	5..83a
CV %	1.63	5.08	7.47	4.22	15.07	4.50	8.64	15.04

Means followed by same letter is not significantly different at 5% level by DMRT.

Table 3. Yield and yield contributing characters of different bread wheat lines, Mymensingh, 2004-05

Variety/ Line	Plant height (cm)	No. of Spike /m^{-2}	Length of Spike (cm)	No. of spikelet / spike	No. of filled grain/ spike	No. of unfilled grain/ spike	1000 – grain weight (g)	Grain yield (t/ ha)	Straw yield (t/ ha)
Kanchan	94	283	8.47	15.40	33.0ab	5.9	32.5c	2.82b	5.13ab
BAW-1006	94	298	9.03	15.60	31.5 b	5.1	38.7b	3.40a	5.37ab
BAW-1008	95	276	9.63	15.67	34.0a	5.2	39.9a	3.48a	6.13a
BAW-1027	92	285	9.23	15.07	31.9b	5.3	31.9c	2.68b	4.37b
LSD (0.01)	NS	NS	NS	NS	1.71	NS	0.84	0.40	1.05
CV (%)	1.78	2.67	5.38	3.56	1.73	17.22	0.78	4.16	9.98

Table 4. Yield and yield attributes of bread wheat lines at Debidwar, Comilla during rabi 2003-04

Lines/ Variety	Plant height (cm)	Population/ m^2	Spike length (cm)	Grains/ spike	1000- seed wt. (g)	Maturity (Days)	Straw yield (t/ha)	Grain Yield (t/ha)
BAW 1006	96.8	385.3	10.47	33.67	34.60	98	5.33	3.83
BAW 1008	101.27	365.3	9.67	37.67	36.93	101	5.34	3.50
BAW 1027	95.07	303.0	10.37	32.8	36.67	103	5.11	3.00
Kanchan	102.07	329.7	12.53	41.6	34.80	102	5.89	2.83
LSD (0.05)	NS	39.44	0.79	4.143	3.25	-	NS	0.84
CV (%)	3.78	5.71	3.69	5.69	5.32	-	13.14	12.76

Table 5. Yield and yield contributing characters of bread wheat line at MLT Site, Melandah during 2004-05

Treat	Plant height (cm)	Plant/m^2 (no.)	Spike length (cm)	Spikelets / spike (no.)	Grains/ spike (no.)	1000 grain wt (g)	Grain yield (t/ha)	Straw yield (t/ha)
Kanchan	92.8	374a	10.04	19.4a	33.13ab	35.3b	3.13b	6.18
BAW-1006	93.4	311b	9.4	17.4ab	30.80b	42.0a	3.46ab	6.55
BAW-1008	93.2	277b	10.5	17.9ab	37.33a	45.3a	4.03a	5.86
BAW-1027	90.8	369a	10.46	15.4b	33.80ab	43.0a	3.55ab	6.03
F	NS	*	NS	*	**	**	**	NS
CV (%)	4.77	7.87	6.57	7.89	6.26	5.14	8.87	6.66

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

Table 6. Performance of advanced wheat lines/varieties at Expanded FSRD site of Goyeshpur, Pabna during 2004-05

Treatment	Days to heading	Days to maturity	Plant population m^2 (no.)	Grains $spike^{-1}$ (no.)	1000 Grain wt.(g)	Grain yield ($t\ ha^{-1}$)	Grain size & quality (visual)	Disease and insect
Kanchan	73.00	105.66	259.67	30.63 b	25.00b	1.30 c	Small & thin grain size	No disease or insect
BAW-1006	67.00	103.66	296.00	31.63 b	41.33a	2.75 a	Moderate grain size	do
BAW-1008	71.33	107.66	211.00	34.63 a	42.67a	2.33 b	Big and bold grain size	do
BAW- 1027	73.33	106.33	303.33	30.77 b	41.33a	2.37 b	Bright grain colour and bold size	do
CV %				3.25	2.16	7.30	-	
LSD				2.075	1.623	0.32		

Table 7. Performance of advanced lines/varieties at MLT site, Kashinathpur, Pabna during 2004-05

Treatment	Days to heading	Days to maturity	Plant population m^2 (no.)	Grains $spike^{-1}$ (no.)	1000 Grain wt.(g)	Grain yield ($t\ ha^{-1}$)	Grain size & quality (visual)	Disease and insect
Kanchan	68.006	108	291.50	39.47 b	33.07c	2.33 c	Small grain size	No disease or insect
BAW-1006	67.00bc	107	328.20	39.47 b	42.43b	3.26 b	Small grain size	do
BAW-1008	69.70 a	108	302.10	45.57 a	47.97a	3.45 ab	Bold grain size	do
BAW- 1027	67.30c	107	330.25	39.50 b	47.23a	3.52 a	Bright grain colour and bold size	do
CV %	0.55	0		2.5	1.60		-	-
LSD	0.744	-		2.047	1.356		-	-

On-farm verification trial of Hybrid Maize

Abstract

An On-farm trial was conducted at the farmer's field of MLT site Kushtia, Pabna, Tangail and Jessore during Rabi season, 2004-2005 to find out the yield performance of maize varieties. The result of the study revealed that there was a variation in grain yield among the variety. Four varieties were tested (BHM-3, 5, 2 and Pacific 11). Among the Four varieties BARI Hybrid Maize-5 performs well in all sites but BHM-3 showed slightly higher yield at Pabna of two locations.

Introduction

Maize ranks third globally among the cereal crops next to rice and wheat in terms of area and production. The yield potential of the existing varieties is lower in comparison to hybrid maize. In Bangladesh hybrid maize is being cultivated for the last few years. Farmer in this area mainly grows hybrid variety with imported seed in the country. To popularize the hybrid maize cultivation a adaptability trial of BARI Hybrid Maize-2, 3, 5 along with commercial hybrid maize pacific-11 was under taken by OFRD, BARI, at different locations.

Materials and Methods

The trial was initiated at Kushtia sadar, Pabna, Tangail and Jessore under irrigated condition during Rabi season 2004-05 with maize varieties namely BARI Hybrid Maize-2,3, 5 and Pacific-11. The experiment was setup in the farmers' field. The unit plot size was 15 Decimal. The seed was sown on 28 November at Kushtia, 5 December at Pabna, 4 January at Tangail, 21 November at Jhenaidah and 18 November at Chowgacha, 2004, respectively with a spacing of 75 x 25 cm. The trial was fertilized with 225-112-112-75-7 and 5 kg/acre of Urea, TSP, MP, Gypsum, Zinc and Boron and 2.5 t/cowdung/acre. One third Urea and all fertilizer were applied as basal and the rest Urea was applied in 2 (two) equal split. First top dress was done at 8-10 leaf stage and other at tasseling stage. Weeding was done after 3-5 leaf stage. Four irrigations was done at the time of 3-5 leaf stage, 8-10 leaf stage, tasseling and grain filling stage. Plant protection measure was taken. The crop was harvested 30 April at Kushtia, 28 April at Pabna, 11 April at Tangail, 10 April at Jhenaidah and 18 April at Chowgacha, 2005, respectively.

Results and discussions

Location: Kushtia

The variety Pacific 11 showed higher plant/plot and others variety reveals similar plant/plot. Similar trend was followed in case of cobs/plot. But 1000-grain weight gave higher from variety BHM-2 which was closely followed by Pacific 11. Higher grains/cob was recorded from variety BHM-3 and the lowest from variety BHM-2.

Location: Pabna

From the result it was found that days to emergence, flowering and maturity of all varieties were more or less same. Plant height was higher in BHM-3. Grain yield of all varieties except BHM-2 were statistically identical. However, BHM-5 gave higher yield, it might be due to higher plant population. BHM-2 variety gave lowest yield and it might be due to lowest plant population and lowest no. of grains cob^{-1}. Overall grain yield was poor due to lower plant population which was mainly due to less germination and damaged by cutworm. Seed was limited, so, it could not be re-sowing.

Location: Tangail

Plant characteristics and yield and other attributes were varied among the maize varieties. The variety BHM-2 showed higher ear height among the variety. But length of cobs was higher in BHM-3, which was statistically identical to BHM-2. Grains per cob showed similar in all the variety except BHM-2. Although higher 1000-grain weight was recorded in Pacific-11, but maximum grain yield was recorded from BHM-5, but statistically identical to other variety except BHM-2.

Location: Jessore

Chowgacha: Plant height, yield and yield attributes were significantly influenced by variety. Significantly the highest plant height was recorded from BHM-3. There was no significant difference in grains/cob except BHM-2 which showed the lowest grains/cob. Significantly the highest grain weight was recorded from BHM-3 but grain yield was similar in BHM-3 and Pacific-11 and the lowest from BHM-2. Stover yield was the highest from BHM-3.

Jhenaidah: Yield, yield attributes and plant height was significantly affected by variety (Table 2). There was no difference in highest among BHM-2 and 3. But significantly the highest grains/cob was recorded from BHM-5 whereas grain weight was recorded the highest from BHM-2. Significantly the highest grain yield was obtained from BHM-5 and the lowest from Pacific 11.

The experiment needs to be repeated for another year for confirmation.

Farmer reaction

Kushtia: The new variety was highly accepted by the farmers due to its higher production.

Pabna: Farmers of that location liked BHM-5 variety due to its higher yield, good quality and after all it is our own variety.

Conclusion

From above result showed that BARI Hybrid Maize 5 showed higher yield at Kushtia, Pabna and Tangail but BHM-3 at Pabna of both sites. The current variety Pacific 11 performs well but it could not out yielded the BARI hybrid variety.

Table 1. Yield and yield performance of different variety of Hybrid Maize at Kushtia Sadar during Rabi 2004-05

Variety	Plants/plot	Cobs/plot	100-grain weight (g)	Grains/cob	Grain yield (t/ha)	MC (%)
BHM-3	30	30	36.1	502.0	6.53	16.0
BHM-5	33	33	35.2	448.9	7.73	15.8
BHM-2	32	33	41.2	414.8	6.53	17.0
Pacific-11	40	42	40.8	450.8	6.67	16.0

Table 2. Performance of different maize variety at FSRD site Goyeshpur, Pabna, during 2004-05

Treatments	Days to maturity	Plant pop./ plot	Plant height (cm)	Ear height (cm)	Lodging (%)	Poor husk cover (%)	Grain/ cob (no.)	100 grain weight (g)	Grain yield ha^{-1} (t)
BHM-2	144	105.50b	209.60a	100.63a	16.67a	3.31c	428.37c	34.67a	6.55b
Pacific-11	142	110.5ab	194.62b	79.55ab	1.67b	19.98a	463.97b	34.17a	7.82a
BHM-5	144	121.0a	188.03b	91.65b	5.00b	12.09b	485.98ab	31.08b	7.97a
BHM-3	144	120.5a	210.55a	96.93ab	16.67a	7.02bc	492.88a	31.92b	6.81ab
CV (%)	-	7.82	3.53	5.40	41.83	47.04	4.61	3.32	12.59
LSD	-	11.01	8.71	6.436	5.15	6.14	26.54	1.35	1.13

Table 3. Yield and yield contributing characters of hybrid maize, Palima, Tangail (Rabi, 2004-05)

Name of variety/line	Ear height (cm)	Cob length (cm)	Grains/cob	Weight of 1000-grains (g)	Grain yield (t/ha)
BHM-2	133.30	17.47ab	339.0b	379.7	8.49a
BHM-3	119.60	18.72a	489.7a	366.3	10.34ab
BHM-5	104.20	16.47b	450.7ab	383.3	11.25a
Pacific-11	108.30	16.43b	473.4a	394.3	10.63ab
CV (%)	9.47	8.71	6.50	6.28	12.53

Table 4. Yield and yield attributes of maize varieties at MLT site, Chowgacha during 2004-05

Variety	Crop duration (days)	Plant height (cm.)	Plant/plot (no.)	Grains/ cob (no.)	100 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
BHM-2	139	214.93b	112ab	422b	36.33b	6.79c	10.88b
BHM-3	140	233.17a	110b	511a	37.27a	7.72a	11.15a
BHM-5	137	209.15d	114a	502a	32.67c	7.09b	10.09c
Pacific-11	136	218.03c	112ab	511a	36.15b	7.75a	10.87b
CV (%)	5.12	6.18	8.93	5.18	7.26	7.11	8.36
LSD(0.05)	NS	3.21	2.66	13.0	0.55	0.10	0.17

Table 5. Yield and yield attributes of maize varieties at MLT site, Jhenaidah during 2004-05

Variety	Crop duration (days)	Plant height (cm.)	Plant/ plot (no.)	Grains/ cob (no.)	100 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
BHM-2	138	234.00a	118	440d	42.37a	8.12b	7.63b
BHM-3	141	231.33a	117	525b	39.57b	7.38d	10.44a
BHM-5	142	198.00b	119	541a	36.07d	8.37a	7.02b
Pacific-11	137	202.13b	119	487c	38.67c	7.53c	7.28b
CV (%)	5.89	6.52	8.18	7.19	8.04	9.80	10.22
LSD (0.05)	-	10.91	-	11.89	0.831	0.126	1.926

On-farm adaptive trial of Barley

Abstract

The experiment was conducted at the farmer's field of MLT site, Narail during rabi season, 2004-05 with six advance lines (BHL-04, BHL-05, BHL-07 BHL-08, BHL-10 and BHL-11 with BARI Barley-3 & 4). The result showed that the line BHL-08 gave higher yield among the variety/line.

Introduction

Barley (*Hordeum vulgare* L.) is the world's fourth important cereal after wheat, maize and rice. It is cultivated successfully in a wider range of climate than any other cereal. Hence barley has an importance to cultivate in marginal land where other cereals can not grown successfully. So, the present study was undertaken to evaluate the advanced lines in the farmer's field in order to release a new variety.

Materials and Methods

The experiment was conducted with six advance lines viz. BHL-04, BHL-05, BHL-07 BHL-08, BHL-10 and BHL-11 with BARI Barley-3 & 4 as local check variety at MLT site Narail during rabi 2004-05 following randomized complete block design with three replications. Seeds of different entries were sown on 25 November, 2004. The unit plot size was 4m x 3m maintaining a spacing of 25cm between rows. Fertilizers were applied @ of 100-60-40 kg/ha N, P and K in the form of urea, triple super phosphate and muriate of potash respectively. Total amount of TSP, MP and half of urea was used as basal dose and rest half of urea in two equal splits after 1st and 2nd irrigation, respectively. Thinning was done at 30 DAS. Other inter cultural operations were done as and when necessary. Data on days to 50% heading and maturity, plant height, plant population, spike length, number of grains per spike, 1000-grain weight, grain yield/plant, grain yield t/ha were recorded and analyzed statistically. Means separated by DMRT.

Results and Discussion

Performances of different barley varieties/lines are shown in Table 1. Significant differences were observed among the entries in respect of grain yield, plant population, plant height, 1000-grain weight and straw. Higher grain yield (3.63 t/ha) was produced by BHL-08 followed by BB-3 (3.39 t/ha), BHL-07 (3.36 t/ha), BHL-10 (3.30 t/ha), BHL-11 (3.16 t/ha). The lowest grain yield (2.52 t/ha) was produced by BB-4.

Conclusion

From one year result showed that the line BHL-08 gave higher yield followed by BHL-07, BHL-11, BHL-10 and BB-3. The experiment need to be continued for another year.

Table 1. Yield and yield contributing characters of barley genotype under on-farm adaptive trial at MLT site, Narail during rabi 2004-05

Entries	Plant Pop./m^2	Plant height (cm)	Length of spike (cm)	Grains/ spike	1000- gr. wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
BHL-04	230	90.77bc	8.33	48.27b	30.90b	2.62cd	3.48c
BHL-05	278	100.00ab	9.07	54.50a	22.00d	2.77bcd	3.69c
BHL-07	324	82.33c	8.27	49.43ab	36.01a	3.36abc	4.56b
BHL-08	329	87.63bc	8.77	51.87ab	36.39a	3.63a	4.87ab
BHL-10	334	86.33bc	8.33	50.27ab	29.58bc	3.30abc	4.36b
BHL-11	302	97.57abc	9.57	51.57ab	29.25bc	3.16a-d	4.60b
BB-3	319	85.37bc	8.13	50.90ab	27.79c	3.39ab	4.92ab
BB-4	306	109.17a	7.77	40.47c	28.96bc	2.52d	5.30a
CV (%)	19.84	8.79	8.02	5.54	4.23	12.63	6.65
F-test	NS	*	NS	**	**	*	**

On-farm evaluation of Turmeric varieties under two different fertilizer levels

Abstract

An experiment was conducted at Bakta, Fulbaria, Mymensingh during Kharif season of 2004 to know the performance of three turmeric varieties viz, Dimla, Shinduri, and BARI turmeric-3 along with the local check under two different fertilizer doses viz, High Yield Goal (HYG) and Medium Yield Goal (MYG) level of fertilizer doses. The effects of variety and fertilizer doses on turmeric yield and yield contributing characters were statistically significant but the inter action effect was not significant. The tested varieties gave identical but higher fresh weight/plant (0.29-0.33 kg/plant), fresh yield (22.50-25.25 t/ha) and dry turmeric yield (4.73-5.43 t/ha) compared to local. The variety BARI turmeric-3 gave highest fresh yield (29.00 t/ha), gross return (Tk. 290,000/ha), gross margin (Tk. 283,072/ha) and benefit cost ratio (41.86) under High Yield Goal (HYG) fertilizer level.

Introduction

Turmeric is an important spice crop in Bangladesh. The Fulbaria Upazila of Mymensingh is a potential place for turmeric production. The soil and environment of Fulbaria is very much suitable for the crop. But the farmers of this area are growing low yielding local varieties. Spices Research Center of BARI has already released some high yielding varieties of turmeric which needs to be verified at farmers field for fine tuning. So, the experiment has been under taken to identify a suitable package of fertilizer and a suitable variety in the location.

Materials and Methods

The experiment was conducted at Bakta of Fulbaria upazila under Mymensingh district during Kharif season of 2004. The soils of the experimental field belongs to the high land of Old Brahmaputra Flood plain soil (AEZ-9). The design of the experiment was randomized complete block with three replications. The treatments of the experiment were four varieties viz., Dimla, Shinduri, BARI Turmeric-3 and Fulbaria local and two levels of fertilizers viz., HYG (100-40-85-20-1.3 kg NPKSZn/ha) and MYG (80-30-65-15-1.0 kg NPKSZn/ha). Unit plot size was 4 m×3m. The seeds (corm) were planted on 18 May 2004 at spacing 45×25 cm. Fertilizers were applied as per treatment. Full amount of TSP, Gypsum and Zinc and half of MP were applied as basal. Half of urea was applied as topdress at 50 DAP. Rest half urea and MP were also applied as top dress in two equal splits at 80 and 110 DAP. Intercultural operations were done as and when necessary. The crop was harvested on 23 March 2005. Data on yield and yield contributing Characters were recorded and analyzed statistically. Mean differences were adjudged by LSD.

Economic analysis was done on the basis of prevailing market price of input and output.

Results and Discussion

Effect of variety: All the plant characters and yields of the varieties varied significantly at 1% level. The variety Shinduri and Dimla gave similar but higher plant height (133.70-139.87 cm) than the local variety. All the varieties gave similar number of finger/plant except local one. Diameter of finger and diameter of corm were also higher in the tested varieties compared to local variety. Diameter of finger and diameter of corm in the tested varieties varied from 4.83 cm-5.85cm and 12.20 cm-13.08cm, respectively. In the local variety they were only 3.80 cm for finger and 7.26 cm for corm. Fresh weight/plant, fresh yield and dry yield were also significantly higher in the tested varieties compared to local. Fresh weight in the tested varieties varied from 0.29-.33 kg/ plant, fresh yield 22.50-25.25 t/ha. The dry turmeric yield varied from 4.73-5.43 t/ha but higher yield was recorded from BARI turmeric-3. This variety showed higher diameter of finger, fresh weight/plant and fresh yield. Other two varieties also gave higher yield than the local one. The local variety showed lower yield due to lower yield attributes.

Effect of fertilizer: Except diameter of corm, other plant characters and yields varied significantly at 1% level (Table2). The plant height, number of finger/ plant, diameter of finger, fresh weight / plant, fresh yield, dry yield in the HYG were 126.42 cm, 29.44, 5.27 cm, 0.28kg, 24.20 t/ ha and 5.15 t/ha, respectively which were significantly higher than MYG. The fertilizer levels in HYG showed significantly higher dry yield i.e., 31% than MYG.

Effect of variety × fertilizer: Only fresh weight / plant was significant at 5% level. Other plant characters and yields were not significantly influenced by variety and fertilizer level (Table1).

Economic performance of fertilizer doses: Table 2 shows that the variety BARI turmeric-3 gave the highest gross return (Tk. 290,000/ha), gross margin (Tk. 283072/ha) and benefit cost ratio (41.86) followed by the variety Dimla under high yield goal (HYG) fertilizer level. The variety BARI turmeric-3 also gave highest return under MYG fertilizer level. But under this fertilizer level, BARI turmeric-3 was followed by the variety shinduri with BCR 40.58 and 37.13, respectively. This was due to higher yield (21.50 t/ha)in shinduri than Dimla (19.50 t/ha) under MYG fertilizer level.

Table 1. Yield and yield parameters of turmeric varieties as influenced by various doses of fertilizers at Fulbaria upazila (2004-05)

Treatment	Plant height (cm)	No. of finger/ plant	Diameter of finger (cm)	Diameter of corm (cm)	Fresh weight / plant (kg)	Fresh Yield (t/ha)	Dry yield (t/ha)
Variety							
Dimla	133.70ab	28.49a	5.48a	12.30a	0.30a	22.95a	4.88a
Shinduri	139.87a	30.25a	4.83b	13.08a	0.29a	22.50a	4.73a
BARI Turmeric-3	118.60b	29.34a	5.85a	12.20a	0.33a	25.25a	5.43a
Local	88.33c	20.76b	3.80c	7.26b	0.09b	14.28b	3.10b
LSD (0.01)	16.24	5.99	0.50	4.38	0.11	4.85	1.06
Fertilizer doses (kg/ha)							
HYG	126.42a	29.24a	5.27a	11.61	0.28a	24.20a	5.15a
MYG	113.83b	25.18b	4.72b	10.81	0.23b	18.29b	3.93b
LSD (0.01)	8.04	2.96	0.24	NS	0.02	2.40	0.52
Fertilizer doses × variety							
$F_1 \times V_1$	139.67	31.32	5.60	12.77	0.33 a	26.40	5.60
$F_1 \times V_2$	144.73	31.53	5.17	13.77	0.33 a	25.33	5.37
$F_1 \times V_3$	126.33	30.69	6.27	12.40	0.38 a	29.00	6.23
$F_1 \times V_4$	94.93	23.43	4.03	7.51	0.09 b	16.07	3.40
$F_2 \times V_1$	127.73	25.67	5.37	11.83	0.27 a	19.50	4.17
$F_2 \times V_2$	135.00	28.98	4.50	12.40	0.26 a	19.67	4.10
$F_2 \times V_3$	110.87	27.97	5.43	12.00	0.29 a	21.50	4.63
$F_2 \times V_4$	81.73	18.09	3.57	7.00	0.09 b	12.50	2.80
CV (%)	7.87	12.81	5.76	15.74	8.76	13.27	13.64
LSD (0.05)	NS	NS	NS	NS	0.16	NS	NS

Table 2. Economic Performance of fertilizer doses and turmeric varieties

Treatments	Fresh yield (t/ha)	Gross return (Tk./ha)	*Variable cost (Tk./ha)	Gross margin (Tk./ha)	B/C ratio
$F_1 \times V_1$	26.40	264000	6928	257072	38.11
$F_1 \times V_2$	25.33	253300	6928	246372	36.56
$F_1 \times V_3$	29.00	290000	6928	283072	41.86
$F_1 \times V_4$	16.07	160700	6928	153772	23.20
$F_2 \times V_1$	19.50	195000	5298	189702	36.81
$F_2 \times V_2$	19.67	196700	5298	191402	37.13
$F_2 \times V_3$	21.50	215000	5298	209702	40.58
$F_2 \times V_4$	12.50	125000	5298	119702	23.59

* Variable cost includes fertilizer cost only.

Price: Fresh turmeric Tk.10 /kg, N= Tk.13.32 /kg, P = 70.00 /kg, K= 26.00 /kg, S= 22.00 /kg, Zn = 112.00/kg

Effect of rovral and micronutrient on the disease free quality seed production of onion

Abstract

The experiment was conducted at FSRD, Ishan Gopalpur, Faridpur during 2004-05 to produce disease free healthy seed in farmers' field and to disseminate the technology to the farmers level. Application of both rovral @ 2 g/lit water and micronutrients (Zn_4 and B_2) at 10 days intervals gave shigher seed yield (246.8 kg/ha) of onion which was followed by application of only micronutrients (234.2 kg/ha).

Introduction

Although onion is an important spice crop, its production is not enough to meet the country's need. Every year huge amount of onion is to be imported by spending hard earned foreign currency. Alternaria leaf blotch caused by *Alternaria porii* is responsible for the low per acre production of onion. It can be efficiently managed by the application of specific fungicides with recommended doses and times. The seed production can be tremendously increased by the application of micronutrients like Zn/B where these are in deficient. However, the technology is still not widely adopted by the farmers. So, large scale demonstration/experiment on farmer's field will help to disseminate the technology to the farmer's level.

Materials and Methods

The experiment was conducted at FSRD, Ishan Gopalpur, Faridpur during 2004-05 to produce disease free healthy seed in farmers' field and to disseminate the technology to the farmers level. The Onion variety was Taherpuri/local and treatments were i) Rovral applied @ 2g/lit. water at 10 days intervals up to maturity of seeds, ii) Micronutrients alone (Zn & B), iii) Both Rovral and Micronutients, and iv) Control. The unit plot size was 4m x 3m. The experiment was laid out at RCB design with four replications. The seedlings were planted at 26 November 2004 and fertilized with 120-40-75-20-5-1 kg urea, TSP, MP, Gypsum, Zinc and boric acid per hectare. Two irrigations were given at 12 December 2004 and 15 January 2005. The crops were harvested at 27 March 2005.

Results and Discussion

Application of both rovral @ 2 g/lit water and micronutrients (Zn and B) at 10 days intervals gave significantly highest seed yield (246.8 kg/ha) of onion which was followed by application of only micronutrients (234.2 kg/ha). The lowest seed yield (185.5 kg/ha) was produced from no spray. Application of rovral and micronutrients also gave highest plant height and 1000-seed weight (3.05g). The disease incidence in this treatment was also low.

Farmers' reaction: Farmers are happy having higher yields by applying rovral and micronutrients

Table 1. Effect of fungicides on onion seed production at Faridpur during 2004-05

Treatment	Plants/m^2 (no.)	Plant height (cm)	1000 seed wt. (g)	Seed yield (kg/ha)	Disease rating (1-10)
Rovral applied @ 2 g/lit water at 10 days interval upto maturity of seeds	60.4	67.2	2.53	223.4	3
Micronutrients alone (Zn_4 & B_2)	58.3	64.4	2.94	234.2	4
Both rovral and micronutrients	59.8	68.8	3.05	246.8	1
No spray	55.6	63.2	2.46	185.5	5
LSD (0.05)	ns	--	0.36	24.3	--

Disease free quality seed production of Radish

Abstract

The experiment was conducted at Rangpur during rabi 2004-05 to control the disease and as well as production of quality seed. The combination of Rovral spraying at 10 days interval with B (1.5 kg/ha) and $ZnSO_4$ (10 kg/ha) could be recommend to Alternaria leaf spot disease control for producing higher quantity of quality seed yield of radish.

Introduction

Alternaria leaf spot of radish caused by Alternaria brassiceae is an important disease of radish. The yield and quality is reduced due to its attack. Disease free healthy seeds can reduce the risk of this problem. So, disease free seed production is important for the commercial production of radish. Thats why, the study was undertaken to control the disease and as well as production of quality seed.

Materials and Methods

The experiment was conducted at Rangpur during rabi 2004-05. The design was Randomized Complete Block Design with three replications. The unit plot size was 3m x 3m. The variety was Tasakisun with spacing 50cm x 30cm. The crop was sown on 16 November, 2004 at seed bed and 24 December in main field. There were fungicides treatments: i) No Rovral 50 WP + B_0 Zn_0, ii) No Rovral 50 WP + $B_{1.5}(ZnSO_4)_{10}$, iii) Rovral 50 WP (spraying at15 days interval) + B_0 Zn_0, iv) Rovral 50 WP (spraying at15 days interval) + $B_{1.5}(ZnSO_4)_{10}$, v) Rovral 50 WP (spraying at10 days interval) + B_0 Zn_0 and vi) Rovral 50 WP (spraying at10 days interval) + $B_{1.5}(ZnSO_4)_{10}$.

Results and Discussion

Effect of B & Zn: There was no effect of B and Zn in controlling Alternaria leaf spot of Radish but 1000 seed Weight and seed yield was positively influenced by boron and zinc.

Effect of Rovral 50 WP: Rovral 50 WP effectively controlled the Alternaria leaf spot disease as a result the life span of crop become longer which increased the 1000 seed weight as well as yield. Rovral 50 WP at 10 days interval spraying performed better compared to 15 days interval spraying.

Effect of Rovral 50 WP + B Zn: Combination of Rovral 50 WP + B Zn effectively controlled the disease. It increased significantly the life span of crop, 1000 seed wt. and seed yield. The spraying of Rovral 50 WP at 10 days interval with B and Zn showed the highest performance in controlling disease and production of quality seed.

Conclusion

The combination of Rovral spraying at 10 days interval with B (1.5 kg/ha) and $ZnSO_4$ (10 kg/ha) could be recommend to Alternaria leaf spot disease control for producing higher quantity of quality seed yield.

Table 1. Effect of different combinations (Rovral 50 WP + B Zn) for Alternaria disease free radish seed production

Treatment	% Leaf area Infection	% Siliqua surface area infection	Days to maturity	1000-seed wt. (g)	Seed yield (kg/ha)
No Rovral 50 WP + B_0 Zn_0	83.00a	79.00a	117d	8.90e	549.00f
No Rovral 50 WP + $B_{1.5}(ZnSO_4)_{10}$	81.00a	76.00a	124d	10.88d	693.00e
Rovral 50 WP (spraying at15 days interval) + B_0 Zn_0	5.35b	4.25b	137c	11.90c	869.67d
Rovral 50 WP (spraying at15 days interval) + $B_{1.5}(ZnSO_4)_{10}$	4.72bc	4.22b	147b	14.68b	1411.67b
Rovral 50 WP (spraying at10 days interval) + B_0 Zn_0	0.98c	0.97b	149ab	12.49c	989.00c
Rovral 50 WP (spraying at10 days interval) + $B_{1.5}(ZnSO_4)_{10}$	0.83c	0.78b	158a	15.62a	1579.67a
CV (%)	7.41	9.21	3.74	3.41	2.11
LSD (0.05)	3.95	4.62	9.00	0.77	38.98

Means common letter are not significantly different at 5% level by DMRT

Efficacy of new fungicides in controlling late Blight of potato

Introduction

Late blight caused by *Phytophthora infestans* is the most serious disease of potato in the world and in Bangladesh. Till to date, there is no resistant variety and suitable agro-technique to control this deadly disease. Therefore, it is the last option to use the fungicides in managing the disease. Besides, new fungicides are coming almost in every year in the country, the efficacy of which need to be tested. Therefore, this experiment was conducted at OFRD, Rangpur to select the effective fungicide(s) in controlling late blight of potato.

Materials and Methods

The experiment was conducted at Rangpur during rabi 2004-05. The design was Randomized Complete Block Design with three replications. The unit plot size was 6m x 6m. The crop was sown on 20 November, 2004 with Diamont variety. There were 13 fungicides treatments i.e. i) Oxycob 85 WP (3.5 gm/lit), ii) Acmecop 50 WP (3.5 gm/lit), iii) Dolphin 77 WP (2.0 gm/lit), iv) Baimyl (2.0 gm/lit), v) Pestcojeb (2.0 gm/lit), vi) Evamil 72 WP (2.5 gm/lit), vii) Pipertox 50 WP (3.5 gm/lit), viii) Hydrocob (2.0 gm/lit), ix) Dentol (2.0 gm/lit), x) Metaplus (2.0 gm/lit), xi) Edmita (2.0 gm/lit), xii) Orion (2.0 gm/lit) and xiii) Control (plain water)

Results and Discussion

Foliage Infection: All the fungicides significantly reduced the late blight severity over control. The lowest foliage infection (5%) was found in Evamil 72 WP sprayed plot followed by Pestcojeb (10% foliage infection), Baimyl (11.33% foliage infection), Pipertox 50 WP (13.67% foliage infection) and so on.

Tuber yield: Evamil 72 WP gave the highest tuber yield (30.30 ton/ha) which was significantly different from all other treatments whereas 18.16 ton/ha tuber yield recorded from control plot. The second highest tuber yield (28.20 ton/ha) was recorded from Pestcojeb used plot which was identical with Baymil (27.21 ton/ha) and Pipertox 50 WP (26.22 ton/ha) used plot.

Conclusion

Evamil 72 WP (2.5 gm/lit water) could be recommended for late blight control of potato if it performed well in other locations (Debiganj, Bogra and Jamalpur) where it was tested this year.

Table 1. Effect of fungicides in controlling late blight incidence and yield of potato

Fungicide		Dose	% Foliage Infection	Tuber yield (t/ha)
01.	Oxycob 85 WP	3.5 gm/lit	69.67c	20.28de
02.	Acmecop 50 WP	3.5 gm/lit	80.00b	19.19de
03.	Dolphin 77 WP	2.0 gm/lit	80.33b	19.03de
04.	Baimyl	2.0 gm/lit	11.33e	27.21b
05.	Pestcojeb	2.0 gm/lit	10.00e	28.20b
06.	Evamil 72 WP	2.5 gm/lit	5.00f	30.30a
07.	Pipertox 50 WP	3.5 gm/lit	13.67e	26.22b
08.	Hydrocob	2.0 gm/lit	81.33b	19.03de
09.	Dentol	2.0 gm/lit	69.00c	20.41d
10.	Metaplus	2.0 gm/lit	70.00c	20.21de
11.	Edmita	2.0 gm/lit	27.33d	24.25c
12.	Orion	2.0 gm/lit	28.00d	24.15c
13.	Control	Plain water	92.33a	18.16e
CV (%)			5.01	1.29
LSD (0.05)			4.14	1.91

Means common letters are not significantly different at 5% level by DMRT

Field performance evaluation of Bed former-Cum-Seeder

Abstract

The experiment was conducted at the FSRD site, Narikeli, Jamalpur and Faridpur, during the rabi season of 2004-05 with objective was to test the field performance of the bed former-cum-seeder and also to compare the performance with traditional method. Two seeding method viz. bed-cum-seeder and farmers practice were evaluated on wheat variety, Shatabdi. The result showed that all the yield and yield contributing characters were higher in bed-cum-seeder treatment than the farmers practice. The causes might be for the well conservation of the soil moisture, better aeration and less attack by rats. However, the yield recorded by bed former-cum-seeder was 4.03 t/ha which was 7.5% higher than the farmers' practice (3.75 t/ha) in Jamalpur whereas 30% grain yield increase in line sowing by bed former at Faridpur.

Introduction

Bed cultivation is a new concept of resource conservation technology. Wheat, maize, mungbean, sesame, vegetables even rice can be grown on beds with less management cost and better crop yield. Water management in bed system is better than flat land. A well designed bed former can save 96% labour requirement and 73% cost. Now power tillers are available in the country. This tiller can be used as a source of power for operating bed former. Considering all of these, a power tiller operated bed former-cum-seeder has already been developed in FMPE Division of BARI. The preliminary test results of the machine are satisfactory. Now, the machine needs to be tested at different research station and farmers field. With a view to test the field performance of the bed former-cum-seeder and also to compare the performance with traditional method, the experiment was conducted at the Farming Systems Research and Development Site, Narikeli.

Materials and Methods

The experiment was conducted at the Farming Systems Research and Development Site, Narikeli , Jamalpur and Faridpur during the rabi season of 2004-05. Two seeding method viz. bed former-cum-seeder and farmers practice at Jamalpur and four treatments such as i) Line sowing by bed former, ii) Line sowing by seeder, iii) Line sowing by seeder in stripe and iv) Line sowing in conventional method at Faridpur were evaluated on wheat variety, Shatabdi. The experiment was conducted in three farmers field. The unit plot size was about 500 m^2. The land was fertilized with 100 kg N, 60 kg P_20_5, 40 kg K_20 and 20 kg S through Urea, Triple Super Phosphate (TSP), Muriate of Potash (MP) and Gypsum, respectively. Two-third of urea and entire amount of all other fertilizers were applied at the time of final land preparation. Seeds were planted by bed seeder maintaining 20 cm apart line and in farmers practice seeds were broadcasted with seed rate 120 kg/ha on December 21, 2004 at Jamalpur and 2 December at Faridpur. One hand weeding was provided before crown root (CRI) initiation stage with the top dressing of the rest quantity of Urea followed by irrigation. Irrigation was applied at primordia (60 DAS) stage of the crop. The crops were harvested following sequences of sowing and depending on the maturity on March 21, 2005 at Jamalpur and 26 March at Faridpur.

Ten plants were collected prior to harvest from each replication after attaining maturity to collect data on yield attributes. Data on grain yield was recorded from 30 m^2 area. The collected data were averaged and presented in the table.

Results and Discussion

Location: Jamalpur

The result showed that all the yield and yield contributing characters were higher in bed former-cum-seeder treatment than the farmers practice. The causes might be for the well conservation of the soil moisture, better aeration and less attack by rats. However, the yield recorded by bed seeder was 4.03 t/ha which was 7.5% higher than the farmers' practice (3.75 t/ha).

Location: Faridpur

The result showed that higher no. of spike/m^2 and grains/spike were obtained from line sowing by bed former but seed weight was slightly higher line sowing by seeder. Overall higher grain yield was obtained line sowing by bed former although grain yield was very low. Similar trend was obtained in straw yield.

Farmers' reaction

Jamalpur: Farmers will be convinced in this method provided they should be ensured of this bed planter.

Conclusion

From one year result showed that grain yield by bed former-cum-seeder was 4.03 t/ha which was 7.5% higher than the farmers' practice (3.75 t/ha) in Jamalpur whereas 30% grain yield increase in line sowing by bed former at Faridpur. The experiment needs to be continued next year.

Table 1. Yield and yield contributing characters of wheat under bed-cum-seeder experiment at FSRD site, Narikeli during 2004-05

Treat	Plant height (cm)	Spike/ m^2 (no.)	Spike length (cm)	Spikelets /spike (no.)	Grains/spike (no.)	TGW (g)	Grain yield (t/ha)	Straw yield (t/ha)
Bed seeder	95.8	372	10.2	18.2	32.4	45.3	4.03	5.98
Farmers' practice	91.6	329	9.7	17.9	30.5	42.8	3.75	5.68

Table 2. Field performance evaluation of wheat by Bed former cum seeder at Faridpur

Treatment	Plant height (cm)	Spike/ m^2 (no)	Grain/ spike (no.)	1000 seed wt. (gm)	Grain yield (t/ha)	Straw yield (t/ha)	% Yield increased over conventional method
Line sowing by bed former	95.96	156	31.41	42.48	**1.78**	2.48	30
Line sowing by seeder	94.52	152	29.79	43.20	1.55	2.45	13
Line sowing by seeder in stripe	92.68	135	29.35	41.70	1.43	2.38	4
Line sowing in conventional method	93.20	128	29.57	41.33	1.37	2.14	-

Adaptation of High Speed Rotary Tiller for dry land cultivation

Abstract

An adaptive trial was conducted at MLT site, Kashinathpur, Pabna during 2004-2005 to observe the performance of high speed rotary titter for dry land cultivation for onion production compared to traditional method. Rotary tilth plot gave higher yield in every cases than traditional tilth plot and yield increased in average 21.73%.

Introduction

Onion is one of the most important spices crop in Bangladesh, Pabna district is famous for onion production .But successful onion production mainly depend upon fine tilth of land. For this purpose farmer of this area used power tiller driven by sifang engine,7-8 times tillering for fine tilth. It is very costly and time consuming. Wheat Research Centre and CIMMYT Bangladesh have a good program to introduce Chinese made power tiller operated minimum tillage seeder for sowing wheat earlier. They have already distributed about 100 units of seeder among the farmers of wheat growing areas. Due to its high speed rotary action of soil surface, tilth quality is very fine in sandy to clay loam soil for dry land crop cultivation, use of this high speed rotary tiller can be a good option for land preparation. Considering the benefit of new tiller, an observation trial was conducted in farmer's field under Rajbari district. The tiller was used for plowing onion and garlic field. One plowing operation was enough for planting crop and farmers liked it very much for dry land cultivation. The study was conducted for the following objectives

Objectives

1. To modify the CHT seeder as high speed rotary tiller.
2. To test the high speed rotary tiller for ploughing dry land of this area.
3. To compare the machine performances with traditional practice on cultivation of dry land crop (onion and garlic).

Materials and Methods

The adaptive trial was conducted at MLT site, Kashinathpur, Pabna during 2004-05. The experiment was laid out in RCB design with two same fertilized and same variety replications and three different farmers practiced replication were chosed to compare. In same replication plot, fertilizer nutrients were used @ 57.03 kg, 51.68 kg and 64.45 kg of N, P and K ha^{-1} respectively. Generally S fertilizer is not used at this location. Traditionally sifang power tiller is used for land preparation and needed 7-8 times cross ploughing but high speed Rotary tiller driven by Dongfang was needed only one time for ploughing and its tillage condition is better than normal power tiller. Two treatments were maintained i.e. T_1= Land prepared by normal power tiller (Traditional method) and T_2= Land prepared by high speed rotary tiller (Rotary tiller). Onion seedlings (var. Taherpuri) were planted on December 29-30, 2004 maintaining the spacing 14 cm × 6 cm. Intercultural operation and plant protection measures were taken as and when required. Bulb of onion was harvested few days early due to unexpected rainfall and it is March 28-29, 2005. Data on yield and different operations were recorded and mean data were presented in Table-1.

Results and Discussion

Higher bulb yield was obtained in every cases from high speed rotary tiller prepared land. The average bulb yield 15.75 t ha^{-1} was obtained from high speed rotary tiller prepared land and 13.00 t ha^{-1} was obtained from traditional power tiller prepared land. Average yield increased by high speed rotary tiller was 21.73% and it might be due to well prepared, fine and leveled soil. Fuel cost decreased 87.5% due to use of high speed rotary tiller. It is mainly due to one time use of rotary tiller and 7-8 times use of traditional power tiller for same land cultivation.

Farmer’s reaction

Farmers of that location were very happy and high speed rotary tiller is very suitable for their onion land preparation. Because it needs less time, less labour, less fuel but land preparation quality is better than traditional power tiller. They also opined that it should be available for their land preparation and the device should also be suitable for use with sifang power tiller.

Conclusion

Land prepared by high speed rotary tiller is very good and it leads the onion yield higher. Land can be prepared by rotary tiller shortly, timely, finely and economically. But, at this location, farmer’s have no Dongfang engine, so, it should be modified to fit with sifang engine for the popularization of rotary tiller.

Table 1. Performance of onion production by high speed rotary tiller in comparison to traditional method during 2004-2005 at MLT site Kashinathpur, Pabna

Name of the farmers	Variety	Spacing	Date of transplanting	Fertilizer use (kg/ha)				Irri-gation	Use of insecticides	Date of harvest	Yield of bulb(t ha^{-1})			
				N	P	K	S				Traditional practice	Rotary tiller	Yield Increase (%)	Fuel cost decease then traditional method (%)
Abdus Salam	Taherpuri	14cm× 6cm	30/12/2004	57.03	51.68	64.45	--	Twice	Fedi & Theovit	28/3/05	14.0	16.0	14.28	87.5
Sorman Ali	Taherpuri	14cm× 6cm	29/12/2004	57.03	51.68	64.45	--	Twice	Fedi & Theovit	29/3/05	12.0	15.5	29.17	
Average											13.00	15.75	21.73	
Ziaur Rahman	Faridpuri	12cm× 5cm	31/12/2004	86.41	39.15	50.78	20.45	Once	Ridomil & Theovit	30/3/05	8.0	10.0	25.00	
Ablul Hakim	Faridpuri	13cm× 7cm	29/12/2004	34.56	39.15	39.06	--	Once	Ridomil & Theovit	28/3/05	7.5	9.0	20.00	87.5
Ramzan Ali	Faridpuri	14cm× 7cm	30/12/2004	34.56	31.32	39.06	--	Nil	Tilt & Theovit	30/3/05	6.5	8.5	30.70	

Field performance evaluation of power tiller operated inclined plate planter

Abstract

A field experiment was carried out at Regional Agricultural Research station, BARI, Rahmatpur, Barisal during rabi 2004-05 to find out the field performance of power tiller operated inclined plate planter. Wheat sown by power tiller operated inclined plate planter gave higher yield (3.16 t/ha) than sown by traditional method (1.7 t/ha).

Introduction

Agricultural Machinery play an important role to reduce drudgery of farm works as well as minimizes operational time and production cost. Land preparation and sowing are expensive and time-consuming operations for wheat cultivation. Proper placement and distribution of seeds and fertilizers into the soil is necessary for good germination and plant establishment for better yield (Ganesh sah, 1999). Line sowing of wheat contributes to higher yield and involves less cost. Still the farmers of Bangladesh are practicing traditional broadcast method of sowing for wheat. Considering all these, BARI have developed a power tiller operated inclined plate multi crop planter. An upland weeder has also developed by BARI, which can easily operate within lines. The performance of the planter is satisfactory for planting wheat at BARI experimental plot, Joydebpur, Gazipur. So the study was undertaken with the following objectives-

(a) To evaluate the field performance of power tiller operated inclined plate planter for planting wheat in different soil type and field condition.
(b) To compare the machine performance with traditional method and
(c) Cost of cultivation by different methods.

Materials and method

A field experiment was carried out at the research field of Regional Agricultural Research Station (RARS), BARI, Rahmatpur, Barisal during 2004-05. One unit power tiller operated inclined plate planter was used for line sown in conventional tillage. Wheat seeds were sown on 06 December 2005. Weeding was done by upland weeder in the field sowed by power tiller operated inclined plate planter and by Khurpi in traditional method. The treatments of the experiment were T_1= Wheat sown by power tiller operated inclined plate planter in conventional tillage and T_2= Wheat sown by traditional method. Fertilizer and other cultural practices were done as and when necessary. The crop was harvested 20 March 2005. Yield and agronomic parameters were recorded.

Result and discussion

Performance of power tiller operated inclined plate planter and conventional broadcast method is shown in the table-1. It was found that wheat seed sown in line by Power tiller operated inclined plate planter contributes 85.88% higher yield over conventional method and involves less cost (Tk. 450/ha). Depth of seed placement was found uniform (2-3 cm) in sowing by power tiller operated inclined plate planter. Optimum spacing (20 cm) was also controlled in this treatment. Seed rate was lower in case of planter (80kg/ha) than the conventional broadcasting method (130-135 kg/ha). Line sowing by inclined plate planter reduced 49% planting cost and 71.79% weeding cost compared to conventional broadcasting method. The Agronomic performances of inclined plate planter and conventional method are shown in table-2. Line sowing insured healthy and taller plant (66.6 cm). Plant population ($48/m^2$), no. of filled grains/spike (31.5) and grain size (41.67g) was higher in inclined plate planter method which resulted higher yield (3.16 t/ha).

Conclusion

The result implies that seed sown by inclined plate planter ensure sufficient moisture for germination and good vegetative growth, which leads higher plant populations, grain production and finally higher yield.

Table 1. Performance of power tiller operated inclined plate planter and traditional (broadcast) method in wheat at Barisal during 2004-05

Parameter	PTOIPP	Traditional method
Depth of seed placement (cm)	2-3	Broadcasted
Spacing (cm)	20	Broadcasted
Seed rate (kg/ha)	80	130-135
Field capacity (ha/h)	0.1215	-
Planting cost (Tk/ha)	450	886
Weeding cost (Tk/ha)	1250	4432

Table 2. The Agronomic performances of inclined plate planter and traditional (broadcast) method in wheat at Barisal during 2004-05

Parameter	PTOIPP	Traditional method
No. of tiller/hill	4.43	3.67
No. of filled grain /spike	31.5	28.6
No. of unfilled grain/ spike	4.53	4.53
1000-grain weight (g)	41.67	40.33
Plant height (cm)	66.6	62.6
Plants/m^2	48.0	34.67
Grain yield (t/ha)	3.16	1.7

Efficacy of different fungicides in controlling Die back/Anthracnose of Chili

Abstract

The trail was carried out at OFRD, BARI, Rangpur during 2004-05 with a view to find out the effective fungicides in controlling anthracnose, die-back and ripe fruit rot of Chili caused by *Colletotrichum capsici*. Eleven fungicides in this trail were included such as Fild (@ 0.5 ml/lit), Indofil-78 (@ 2 gm/lit), Propicon 250 EC (@ 0.5 ml/lit), Cupper (@ 2 gm/lit), Sunoxamil 72 WP (@ 2 gm/lit), Seadazim 50 WP (@ 1 gm/lit), Gimgurd 50 WP (@ 1 gm/lit), Winner (@ 0.5 ml/lit), Fuji-one 40 EC (@ 1 ml/lit), Insuf 80 WP (@ 3 gm/lit) and Controll @ 0.5 ml/lit). Of them Fild ranked best in reducing disease incidence and increasing yield but it was statically identical with Indofil-78. Fild also statically identical with Propicon 250 EC in all aspect except in reducing die back incidence. Cupper also gave effective control of the disease.

Introduction

Anthracnose, die back and ripe fruit rot of Chili caused by *Colletotrichum capsici* in the most important fungal disease of the crop. In suitable weather, it may cause 12 to 25% loss in the crop (Singh 1987). Ripe fruit rot is more conspicuous as it causes severe damage to mature fruits in the field as well as, sometimes in transit and storage, if favorable conditions are present (Singh 1990). But spraying of effective fungicides can control the disease effectively and minimize the yield loss. This experiment has designed to find out new effective fungicides in controlling the disease of chilli.

Materials and Methods

The experiment was conducted during 2004-05 crop season at OFRD, BARI, Rangpur. The design of the experiment was RCBD with three replications and twelve treatments of which eleven fungicides and control (Plain water). The fungicides were Fild (@ 0.5 ml/lit), Indofil-78 (@ 2 gm/lit), Propicon 250 EC (@ 0.5 ml/lit), Cupper (@ 2 gm/lit), Sunoxamil 72 WP (@ 2 gm/lit), Seadazim 50 WP (@ 1 gm/lit), Gimgurd 50 WP (@ 1 gm/lit), Winner (@ 0.5 ml/lit), Fuji-one 40 EC (@ 1 ml/lit), Insuf 80 WP (@ 3 gm/lit) and Controll (@ 0.5 ml/lit). The variety was BARI Lanka-1. The seedlings of 35 days old were transplanted on January 03.2005 having spacing 0.40 m × 0.40 m. The unit plot size was 2.0 m × 2.0 m. Fertilizer dose was 210-300-200-110-10-10-10,000 kg Urea-TSP-MP-Gypsum-Zinc Sulfate-Boric Acid-Cowdung /ha. One half MP and along with other fertilizers & Manures except Urea were applied during final land preparation. Urea and rest MP splitted into equally three and applied as side application at 25 days after transplanting (DAT), 50 DAT & 70 DAT. The fungicides were sprayed following proper concentration as per design with the initiation of the disease and the subsequent two sprays were applied at an interval of 10 days. Data on disease incidence were recorded started from 10 days of final spray. Data were collected from five randomly selected plants from each plot avoiding border effects. Yield data was also recorded.

Results and Discussion

All the fungicides significantly reduced Leaf infection, LAD (Leaf Area Diameter) infection, die back incidence, fruit infection and Lesion area of infected fruit over control except controll fungicide. Controll fungicide failed to reduce percentage of Leaf infection and LAD infection only.

Leaf Infection (%): The lowest leaf infection 5.51 was found in Fild sprayed plot which was statically identical with Propicon 250 EC (7.79 %) and Indofil–78 (6.65 %). The highest leaf infection (38.57%) was recorded from control plot which was statically similar with controll fungicide treated plot (36.64 %).

LAD infection (%): The lowest LAD infection (0.90) was recorded from Fild treated plot which was also identical with Propicon 250 EC (1.31 %), Cupper (1.53 %) and Indolif – 78 (1.28 %). The highest % LAD infection was recorded from control plot (19.98 %) which was identical with controll fungicide sprayed plot (18.65 %).

Die back (%): Fild gave the lowest die back incidence (5.63 %) which was only identical with Indofil-78 (6.89 %) when 8.34 % and 8.87 % die back incidence was found from Propicon 250 EC and Cupper respectively. The significantly highest die back incidence 33.49 % was recorded from control plot.

Fruit Infection (%): All the fungicides significantly reduced the % fruit infection over control. The lowest % fruit infection 2.68 was recorded from Fild which was statistically identical with Propicon 250 EC (3.25%), Cupper (3.76%) and Indofil –78 (2.92%) when 29.48 % infection was recorded from control plot.

Lesion area of Infected fruit (%): The lowest 2.97 % Lesion area of infected fruit was recorded from Fild sprayed plot it was statistically identical with Propicon 250 EC (3.66 %), Cupper (3.96%) and Identical –78 (3.19%). The highest 40.55% Lesion area of infected fruit was found from control plot which was significantly differed from all fungicides sprayed plot.

Ripe fruit yield (t/ha): Fild sprayed plot gave the highest fruit yield (8.33 t/ha) which was identical with Indofil–78 (8.07 t/ha) and Propicon 250EC (7.85 t/ha). The lowest fruit yield (4.84 t/ha) was produced from control plot and it was statistically identical with controll (4.92 t/ha), Insuf 80 WP (5.01 t/ha), Fuji-one 40 EC (5.19 t/ha) and Winner (5.35 t/ha).

Results of present investigation show that Fild (0.5 ml/lit), Indofil-78 (2 gm/lit), Propicon 250 EC (0.5 ml/lit) and Cupper (2 gm/lit) may be recommended for controlling of anthracnose, die back and ripe fruit rot were of Chili in chilli growing areas of Bangladesh.

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Table 1. Efficacy of Fungicides in controlling anthracnose, die back and ripe fruit rot of Chili

Treatment	Leaf Infection (%)	LAD infection of Infected leaf (%)	Die back (Stem affected) (%)	Fruit Infection (%)	Lesion area of Infected fruit (%)	Yield* (t/ha)
01. Fild (0.5 ml/lit)	5.51i	0.90h	5.63i	2.68h	2.97i	8.333a
02. Propicon 250 EC (0.5 ml/lit)	7.79hi	1.31h	8.34h	3.25h	3.66i	7.850a
03. Cupper (2 gm/lit)	8.36h	1.53h	8.87h	3.76h	3.96i	6.937b
04. Indofil-78 (2 gm/lit)	6.65hi	1.28h	6.89hi	2.92h	3.19i	8.067a
05. Sunoxamil 72 WP (2 gm/lit)	13.66g	4.58g	14.09g	7.58g	6.22h	6.173c
06. Seadazim 50 WP (1gm/lit)	17.38f	6.33f	15.14g	10.59f	8.29g	5.943cd
07. Gimgurd 50 WP (1 gm/lit)	23.26e	10.45e	18.14f	15.23e	12.36f	5.533de
08. Winner (0.5 ml/lit)	28.17d	12.09d	20.86e	17.71d	17.77e	5.350ef
09. Fuji-One 40 EC (1 ml/lit)	30.97c	14.91d	23.34d	22.34c	22.22d	5.187ef
10. Insuf 80 WP(3 gm/lit)	36.04b	17.53b	28.56c	25.40b	36.17c	5.013ef
11. Controll (0.5 ml/lit)	36.64ab	18.65ab	30.86b	25.56b	38.63b	4.920f
12. Control (plain water)	38.57a	19.98a	33.49a	29.48a	40.55a	4.837f
CV (%)	6.51	9.57	7.05	7.23	6.10	4.60
LSD (0.05)	2.32	1.48	2.13	1.70	1.69	0.48

Means not sharing common letters are significantly different at 5% level by DMRT. *Ripe fruit, not dried

Performance of BARI released promising Tomato varieties in Chittagong region

Abstract

The experiment was conducted at Patiya and Satkaniya MLT sites of Chittagong during November 2004 to March 2005 to study the performance of BARI released tomato varieties (BARI Tomato-2, BARI Tomato-8 and BARI Tomato-9 with local one) and also to disseminate variety to farmer's level. The result showed that the variety BARI Tomato-8 performed better in terms of fruit yield and also highly accepted by the farmers in the both sites.

Introduction

Farmers of Chittagong region usually grow tomato in a large number of area. Although they do not fulfill their local demand because of low yield of their existing local varieties. Moreover, the storage quality of those local varieties was very low. For this region a huge quantity of tomato was lost before reaching to the consumer. BARI has developed a number of tomato varieties including processing tomato variety. Those varieties need to be tested with local existing one. Hence the study was designed to study the performance and suitability of BARI released tomato varieties in Chittagong region.

Materials and Methods

The experiment was conducted at Patiya and Satkaniya MLT sites of Chittagong during November 2004 to March 2005. The land was medium high land. The experiment was laid out in a randomized complete block design with four dispersed replications. The variety BARI Tomato-2, BARI Tomato-8 and BARI Tomato-9 were tested with a local variety as check. Fertilizer dose was 253-89-125 kg/ha NPK along with 10 t/ha well rotten cowdung. Half of the cowdung was applied during land preparation. The remaining half of the cowdung, the entire amount of TSP and 1/3rd each of urea and MP were applied during pit preparation. The rest of urea and MP were applied in two equal splits at 21 and 35 days after transplanting. Unit plot size was 4.8 m x 6.0 m. Bed size was 4.8 m x 1.0 m. Two rows tomato lines were planted in each bed with 60 cm x 40 cm row to row and plant to plant spacing. Tomato seedlings were planted in the main field on the 2nd of December 2004 and edible fruits were harvested during last week of January to 2nd week of March 2005 by hand picking. Irrigation, weeding, staking, desuckering and other intercultural operations and plant protection measures were done as and when necessary. Data on yield and yield contributing characters were recorded and analyzed statistically. Yield data were recorded by whole plot basis and yield contributing characters were recorded at randomly selected 10 plants.

Results and Discussion

Fatikchhari site: Tomato varieties showed significance difference in number of fruits per plant, fruit weight per plant and fruit yield (Table-1). Significantly the highest fruits/plant was obtained from BARI Tomato-9 and the lowest from local variety. The higher fruit weight per plant was found in BARI Tomato-8 which was statistically similar with BARI Tomato-9. The lowest was found in BARI Tomato-2 which was statistically same with local variety. The higher fruit yield (70.20 t/ha) was obtained in BARI Tomato-8 which was statistically similar to BARI Tomato-9 (63.45 t/ha). The lowest fruit yield was found in BARI Tomato-2 which was statistically identical similar to local variety.

Satkaniya site: Tomato varieties showed significance difference in case of number of fruits per plant, fruit weight per plant and also fruit yield (Table 2). Similar trend was followed in case of all the characters as in Fatikchhari site.

Farmers' reaction: The farmers in both MLT sites of Fatikchari and Satkaniya were much impressed to see the performance of variety BARI Tomato-8, not only for its higher fruit yielding capacity but also its high storability in normal condition.

Table 1. Yield and yield contributing characters of tomato varieties conducted at Fatikchari site in 2004-05

Treatment	Fruit/plant (no.)	Fruit weight/plant (Kg)	Fruit yield (t/ha)
BARI Tomato-2	28.46c	2.81b	48.83c
BARI Tomato-8	31.18b	3.72a	70.20a
BARI Tomato-9	42.89a	3.41a	63.45ab
Local	21.61d	2.86b	53.48bc
CV (%)	7.68	6.84	8.12
LSD (0.05)	6.45	0.51	9.48

Table 2. Yield and yield contributing characters of tomato varieties conducted at Satkaniya site in 2004-05

Treatment	Fruit/plant (no.)	Fruit weight/plant (Kg)	Fruit yield (t/ha)
BARI Tomato-2	31.08b	3.14c	63.14b
BARI Tomato-8	30.45b	4.32a	71.92a
BARI Tomato-9	40.81a	3.56b	67.12ab
Local	22.30c	2.61d	53.66c
CV (%)	7.43	6.31	7.33
LSD (0.05)	8.75	0.50	8.41

On-farm adaptive trial of Sesame varieties

Abstract

The experiment was conducted at Sherpur MLT site, Bogra during kharif, 2005 to evaluate new high yielding varieties of sesame in farmers' field. The experiment was laid out following RCBD with 4 dispersed replications. The variety BARI Til-2 and BARI Til-3 produced similar and higher grain yield 1290 kg/ha and 1227 kg/ha respectively. The lowest grain yield (995 kg/ha) was observed in T_6. Highest gross return (26737 Tk/ha), gross margin (12082 Tk/ha) and BCR (1.82) was also obtained from BARI Til-2 which was followed by BARI Til-3.

Introduction

Bangladesh imports huge amount of oilseed every year to meet up the deficiency. Sesame (*Sesamum indicum*) is the second edible oilseed crop in Bangladesh. It occupies 80000 hectares of land and produces 49000 tons of sesame. The yield of this crop in Bangladesh is found much lower than the other countries due to yield potential of local varieties and its poor management practices. Recently Oilseed Research centre (ORC) of BARI has developed two varieties of sesame which possess high yield and less disease susceptible. So, the study was undertaken to evaluate the performance of new varieties of sesame at Sherpur, Bogra.

Materials and Methods

The experiment was conducted at MLT site, Sherpur, Bogra during kharif I season of 2005. There were three varieties such as BARI Til-2, BARI Til-3 and T_6. The experiment was laid out following RCBD with four dispersed replications. The unit plot size was 4m×10m and the spacing was line to line 30cm and plant to plant 5cm .The seeds were sown on 16, March 2005 and the crop was harvested on 7 June,2005. Manures and fertilizers were applied @ 5 tons of cowdung, 120 kg of Urea, 140 kg of TSP, 45 kg of MP, 105 kg of Gypsum, 5 kg of Zinc sulphate and 10 kg of Boric acid per hectare. Half of urea and full dose of other fertilizers were applied at the time of final land preparation. Rest half of urea was applied as a top dress during 25-30 days after sowing i.e. before flowering. During top dressing adequate soil moisture was present. Excess seedlings were thinned out keeping 5 cm distance of 15 DAG. Weedings were done at 15 DAE and another at 35 DAS. Irrigation was not required. When seedlings age was 25 days, infestation of hairy caterpillar was noticed and ripcord was sprayed in the field. Data on yield and yield contributing characters were recorded and statistically analyzed following DMRT.

Results and Discussion

The plant population, plant height,1000-grain weight and straw yields of different sesame varieties were non significant. The number of capsule/plant was significantly different where higher number of capsule/plant was observed in BARI Til-2 which was statistically identical to BARI Til-3. Higher number of seeds/capsule was found in BARI Til-2 which was statistically similar to BARI Til-3. The lowest number of seeds/capsule was observed in T_6. The higher seed yield was found in BARI Til-2 but it was statistically identical to BARI Til-3. The lowest grain yield was found in T_6.

The highest gross return, gross margin and BCR were obtained from BARI Til-2 which was followed by BARI Til-3. The lowest gross return (20857 Tk/ha) and BCR (1.38) was obtained from T_6.

Farmers' reaction

Farmers did not know about variety of BARI Til-2 and BARI Til-3. Besides, radish colour of BARI Til 3 is not acceptable. They thought black colour sesame seeds are better, but when they got similar yield from BARI Til-2 and BARI Til-3. They showed their interest for BARI Til-3. So the farmers are very much impressed with considerable yield from new varieties of sesame.

Conclusion

BARI Til-2 and BARI Til-3 produced higher yield than the variety T_6. So, farmers are interested to grow these varieties in AEZ-25 of sherpur, Bogra region.

Table 1. Yield and yield attributes of different sesame varieties at MLT site, Sherpur, Bogra during Kharif 2005

Variety	Plant population (m^2)	Plant height (cm)	No. of Capsule /plant	No. of seeds/ capsule	1000-seed weight (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
BARI Til-2	16	93.68	74.08a	64.85a	2.60	1290a	1873
BARI Til-3	20	98.45	72.50a	61.83a	2.52	1227a	2123
T_6	17	95.23	65.03b	53.45b	2.60	995b	1913
CV (%)	13.87	5.96	4.48	2.77	7.63	7.10	23.92

Figure(s) followed by different letters in same column are statistically significant at 1% and 5% level of probability.

Table 2. Cost and return analysis of different sesame varieties at MLT site, Sherpur, Bogra during kharif, 2005

Treatments	Gross Return (Tk/ha)	Total variable cost (Tk/ha)	Gross Margin (Tk/ha)	BCR
BARI Til-2	26737	14655	12082	1.82
BARI Til-3	25602	14655	10947	1.75
T_6	20857	14655	6202	1.42

COLLABORATIVE RESEARCH PROGRAM CIMMYT-BARI

Intercropping Maize with different vegetable

Abstract

Field experiment was conducted during rabi season of 2004-05 to observe the productivity and economic feasibility of Maize + Vegetable intercropping systems. The intercropping systems were Maize + Potato, Maize + Radish, Maize + Coriander, Maize + Bushbean, Maize + Spinach, Maize + Lalshak and Maize sole. The result indicated that grain yield of maize was reduced due to intercropping systems. The highest grain yield of maize was found from sole maize and lowest when it was grown with potato in all sites. The highest maize equivalent yield was obtained from maize+ bush bean intercropping systems at Jamalpur, maize + potato at Pabna, Maize + Coriander at Kushtia, Maize + spinach at Jessore, Maize + radish and Maize + Potato (Heera) at Mymensingh, maize + Lalshak at Manikganj.

Introduction

Cereal-legume intercropping is one of the most popular in the tropical and subtropical regions of the world. Among the cereals, maize is considered as one of important and high yield potential crops which need to be popularized in Bangladesh to increase production and income of the poor farmers. As maize competes for land with a number of rabi crops during winter season, intercropping with its contemporary vegetable may be an alternative way of its accommodation in the existing cropping system.

Intercropping system, however, becomes more productive and economical when component crops differ with genetic make up, photosynthetic pathway, growth habit, growth duration and demand of different growth resources. It also depends on the light availability within the canopy of components crops. The productivity of undestroyed vegetable, however, varied with variation of species itself. Furthermore, scenario of total intercrop productivity and economic viability may be changed due to growing of maize in association with different vegetables. The present study, therefore, is aimed to determine the most productive and economically feasible maize + vegetable intercropping system at the Multilocation Test Site, Sherpur, Pabna, Kushtia, Kishoregonj, Mymensingh, Rangpur and Manikganj during the rabi season 2004-05.

Materials and Methods

The experiment was conducted at the Multilocation Test Site, Sherpur, Pabna, Kushtia, Kishoregonj, Mymensingh, Rangpur and Manikganj during the rabi season 2004-05. The experiment consisted of seven treatments, viz. i) Maize+Potato, ii) Maize+Radish, iii) Maize+Coriander, iv) Maize+Bushbean, v) Maize+Spinach, vi) Maize+Lalshak and vii) Maize sole. Maize seeds were sown in a planting configuration of 75 x 20 cm spacing and fertilized at the rate of 256-55-138-3-1 kg/ha of NPKSB and cow dung at the rate of 5 t/ha. Full amount of PKSB and 1/3rd of N along with full amount of cow dung were applied at the time of final and preparation. The rest N was applied into two equal splits at 8-10 leaves stage and at tasselling stage. Seeds of maize and all other vegetables were sown on November 28 at Sherpur, Jessore & Jamalpur, 27 November at Pabna, 23-30 October at Kushtia, 9 December at Kishoreganj, 4 December at Mymensingh, 20 November at Rangpur and 10 November at Manikganj 2004, respectively. Intercropped vegetables were harvested depending on the maturity of the individual crops ranging from December 28, 2004 to February 6, 2005. Finally maize was harvested on April 19, 2005 at Sherpur, 15 April at Jessore, 30 April at Kishoreganj, 23 April at Mymensingh and 19 April at Manikganj 2005, respectively. Intercultural operation was done as and when necessary. For determination of yield components of maize, ten plant were randomly selected from each plot and plant height, number of cobs/plant, seeds/cob and 1000 kernel weight were recorded. Grain yield of maize was determined by harvesting an area of 7.5 m^2 and converted into t/ha at 14% moisture content. Different vegetable was harvested at different times and their yield

Equivalent yield of component corps crops were determined following the method of Anjaneyulu *et al*. (1982). For example

$$\text{Maize Equivalent Yield (MEY)} = Y_m + \frac{\text{Yi} \times \text{P}_\text{i}}{P_m}$$

Where,

Y_m = Yield of maize (t/ha)
Y_i = Yield of intercrop vegetable (t/ha)
P_i = Price of intercrop vegetables (Tk/ha)
P_m = Price of maize (Tk/ha)

Data recorded on the different parameters were analyzed and means were separated as per LSD/DMRT test

Location: MLT site, Sherpur, Jamalpur

The result indicated that most of the yield attributes were not influenced due to maize vegetable intercropping. The higher plant height was recorded from maize sole treatment but it was statistically identical to all other treatments except maize+radish treatment (Table 1). The other yield contributing characters were found insignificant. The higher grain yield was recorded from sole maize treatment which were statistically identical to all other treatments except maize+potato treatment which gave the lowest grain yield (9.70 t/ha). The highest MYE was recorded from maize+bushbean intercropped combination & other treatment were very close to each other. Similar trend was followed in case of gross return but higher cost of was involved in maize+potato treatment. But over all, higher benefit cost ratio was recorded from maize+bushbean combination & only this treatment showed higher benefit than sole maize. Other treatment failed to show higher benefit than sole maize (Table 2).

Location: Pabna

Maize: Grain/cob, 100-seed weight and grain yields were significantly affected by the treatments. Higher grain/cob and 100-seed weight was recorded from sole maize which reflected grain yield. Sole maize gave significantly the highest grain yield and it might be due to non disturbance of vegetable crops (Table 3). Maize with french been gave the lowest yield. Maize with any of the vegetable crops gave lower yield than sole maize and it is mainly due to competition of nutrient among the crops.

Vegetables: From the result, it was found that Radish gave higher yield which followed by spinach but potato also showed moderate yield with higher market value. Lower yield was obtained from coriander+maize combination (Table 4).

Cost and return analysis: The highest gross return and net return was calculated from maize with potato followed maize+spinahc. Most of the vegetable crops with maize gave higher economic return than sole maize but maize with bushbean and maize+red amaranth is not profitable. Higher BCR was obtained potato+maize followed spinach+maize. Higher benefit was not possible than sole maize in case of red amaranth and French bean.

Location: Kushtia

Plant/m^2 varied treatment to treatment where higher plants were obtained from sole maize, maize + coriander & maize+bushbean but plant/m^2 was drastically reduced in potato combination. Grain weight did not vary among the treatment. Sole maize crop showed higher grains/cob but reduced in bushbean, spinach and coriander combination. Highest grain yield was obtained from maize+coriander followed by sole maize. The yield was drastically reduced in radish and spinach combination. MEY was highest from maize+coriander combination due to higher yield of maize among the treatment. The potato also showed reasonable equivalent yield. All the intercropped combinations gave higher MEY than sole maize except maize+spinach combination (Table 5).

Location: Jessore

Grain yield of maize, intercrops, yield and MEY were shown in table 6. Grain yield of maize showed identical in sole maize followed by maize+coriander, maize+bushbean & maize+lalshak. Among the intercrops, spinach produced highest yield. Grain yield of maize reduced in radish and spinach combination. But due to higher yield of spinach, maize equivalent highest in this treatment.

Location: Mymensingh

Table 7 shows the results of yield and yield contributing characters of maize. The plant height, grain and straw yields of maize were statistically significant at 1% level. However, number of cobs/plant, number of grains/cob and 1000- seed weight were not varied significantly. Significantly highest plant height (238.7 cm) was obtained from the combination of Maize + garden pea. The plant height was lower (215.1cm) in maize + potato (var. Heera) which was statistically identical with the treatments of sole maize and maize + red amaranth. Though grains/cob was statistically identical but higher grains/cob obtained from sole maize. Similarly 1000-seed weight was recorded higher from sole maize but statistically at par to other treatments except maize + bean and maize + red amaranth. Higher grain yield was recorded from sole maize which was statistically identical to maize + radish combination. The potato variety Heera affected the grain yield of maize substantially but radish did not affect the yield. Though sole maize stover showed higher yield but it was statistically at par to the treatments of maize intercropped with radish, potato and bean.

Maize equivalent yield and economic analysis of different treatments have been shown in Table 8. The maize equivalent yield varied significantly at 1% level. Higher maize equivalent yields were obtained from the treatment maize + radish (11.07 t/ha) followed by maize + potato (Heera) with yield of 11.05 t/ha. Other treatments showed much lower equivalent yield than these two treatments. The lowest maize equivalent yield (7.90 t / ha) was obtained from the combination maize + red amaranth. The highest gross return was recorded from the treatment combination of maize + potato (Heera) followed by maize + radish combination. All the treatment showed higher net return than sole maize except maize + red amaranth where grain yield of maize drastically reduced. Though higher gross return to maize + potato and maize + radish was similar but due to higher seed cost of potato resulted lower BCR in maize + potato than the maize + radish. Similarly lower BCR in both maize + potato combination failed to give higher BCR than sole maize. So, only maize + radish combination gave higher economic return than sole maize and other combinations failed to show higher return.

Location: Rangpur

The result showed those days to maturity, plant height and grain yield of maize were significantly influenced by different combinations (Table 9). Sole maize showed higher plant height but statistically at par to other treatment except maize+radish combination. Maize+potato combination took longest time and shortest from sole maize. Higher grain yield of maize was obtained from sole maize which was statistically identical to maize+Napasak, Maize+frenchbean though french been have no fruits. Among the intercrops, potato showed higher yield but grain yield of maize drastically reduced. On an average maize+lalsak showed reasonable good yield without sacrificing yield of maize.

Location: Manikganj

Higher grain yield of maize was obtained from maize + coriander combination which was higher yield than sole maize. Potato combination affected maize grain yield substantially. Radish and garden pea also affected grain yield of maize. Among the intercrops highest yield was recorded from radish but maize yield was drastically reduced. The combination of maize+lalsak gave higher equivalent yield followed by maize+potato. Highest gross return was obtained from maize + potato followed maize+coriander (Shak). Almost all the intercropped showed higher gross return than Lalshak & Gardenpea due less population. Maize + Potato reveal lower BCR due to higher cost of cultivation and maize+lalsak showed higher BCR than all combination. The combination of Maize + Lalshak and maize + coriander reveals higher BCR than sole maize (Table 10 and 11).

Farmers' reaction

Farmers are very much impressed to see the performance of intercropped and they will get extra benefit from the intercropped combination than sole crop.

Conclusion

From one year result showed that maize+bushbean, maize+potato, maize+coriander, maize+spinach, maize+radish/potato (var. Heera) and maize+lalsak could be grown at Jamalpur, Tangail, Kushtia, Jessore, Mymensingh and Manikganj as intercrop instead of sole maize. But this experiment need to be continued for another year for confirmation.

Table 1. Yield attributes and grain yield of maize in different maize +vegetable intercropping systems at Jamalpur during 2004-05

Treatment	Plant height (cm)	Plants/m^2 (no.)	Cobs/m^2 (no.)	Cobs/ plant (no.)	Grain/ cob (no.)	1000-grain wt (g)	Yield (t/ha)		Stover yield (t/ha)
							Maize	Intercrop	
Maize+Potato	229.6ab	6.42	7.04	1.10	415.3	320.33	9.70b	10.08	5.50ab
Maize+Radish	228.0b	6.42	6.82	1.06	427.9	320.00	9.92ab	8.12	4.87b
Maize+Coriander	230.4ab	6.49	6.91	1.06	450.4	320.33	10.54ab	0.64	5.62ab
Maize+Bushbean	229.6ab	6.51	6.93	1.06	439.3	320.67	10.57ab	6.27	5.73ab
Maize+Spinach	237.9a	6.40	7.09	1.11	434.7	320.00	10.50ab	5.08	5.54ab
Maize+Lalshak	231.7ab	6.33	7.16	1.30	453.2	320.33	10.69ab	3.31	6.03a
Maize sole	237.4 a	6.49	7.04	1.08	432.3	330.00	10.90a	-	6.37a
CV(%)	1.33	1.70	3.05	3.67	5.99	1.43	5.39	-	8.96

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

Table 2. Agronomic productivity and cost return analysis economics of maize-vegetables intercropping systems at Jamalpur, 2004-05

Treatment	Maize equivalent yield (t/ha)	Gross return (Tk/ha)	Total cost (Tk/ha)	Benefit cost ratio
Maize+Potato	10.16	76200	42523	1.79
Maize+Radish	10.81	81075	29373	2.76
Maize+Coriander	10.66	79950	31073	2.57
Maize+Bushbean	14.04	105300	29773	3.54
Maize+Spinach	11.32	84900	31173	2.72
Maize+Lalshak	11.06	82950	28973	2.86
Sole maize	10.90	81750	27723	2.95

Seed price (Tk./kg): Potato= 15, Radish= 200, Bushbean = 50, Lalshak = 500, Spinach = 30, Coriander = 40, Maize = 106

Sell price (Tk./kg): Potato= 4, Radish= 1, Bushbean= 7, Lalshak= 3, Spinach= 2.50, Coriander= 15, Maize= 7.50

Table 3. Performance of Maize as affected by intercropping with short duration Vegetables at expanded FSRD site Modhupur, Pabna during 2004- 05

Treatments	No. of plants m^{-2}	Cobs m^{-2} (no)	Grains cob^{-1} (no)	100-seed weight (g)	Grain yield (t/ha)	Straw yield (t/ ha)
Maize +Potato	4		366	35.83	9.33	9.66
Maize+ Red amaranth	4		350	31.75	9.08	9.61
Maize +Spinach	4		339	33.71	8.86	9.69
Maize+ Radish	4		350	34.59	8.67	8.91
Maize+ Coriander	4		393	35.02	9.77	9.55
Maize+ Fresh bean	4		369	33.34	8.55	9.69
Sole maize	4		416	34.30	11.33	10.22
CV (%)	-		4.75	2.91	2.77	4.93
LSD (.05)	NS	NS	31.20	1.763	0.46	NS

Table 4. Cost and return analysis intercropping maize with short duration Vegetable crops of 2004- 05 at FSRD site Pabna

Treatments	Yield		MEY	Cultivation cost (Tk)	Gross return (Tk)	Net return (Tk)	BCR
	Maize	Vegetable					
Maize +Potato	9.33bc	11.47	16.50	30039	136820	106781	4.55
Maize+ Red amaranth	9.08cd	3.01	10.60	28489	89485	60996	3.14
Maize +Spinach	8.86cde	18.04	15.62	28789	129845	101056	4.50
Maize+ Radish	8.67de	20.43	13.78	29039	114670	85631	3.95
Maize+ Coriander	9.77b	0.86	11.12	28839	100135	71296	3.47
Maize+ Fresh bean	8.55e	3.59	11.24	29114	94780	65666	3.25
Sole maize	11.33a	-	11.33	28239	95750	67511	3.39

Price (Tk/kg): Potato=5, Red amaranth=4, Spinach=3, Radish=2, Coriander=20, Fresh bean=6

Table 5. Performance of different vegetables and spices as Intercropped with maize at MLT site Bheramara, Kushtia during 2004-05

Treatment	Plant/m^2	Grain cob (No)	100 grain wt.(g)	Grain yield (t/ha)	Intercrop yield (t/ha)	MEY (t/ha)
Maize +Potato	3	450	40.3	8.24	2.62	9.10
Maize+ Lalshak	5	400	40.0	8.40	0.75	8.90
Maize +Radish	7	440	39.33	6.90	5.39	8.51
Maize+ Coriander	7	435	40.0	9.23	0.20	10.00
Maize+ Fresh bean	7	405	39.33	8.47	0.44	8.69
Maize+Spinach	5	423	39.33	7.13	2.18	7.94
Sole maize	5	461	40.0	8.53	-	8.53
LSD (.05)	1.8	18.0	NS	2.02	-	-

MEY= Maize Equivalent Yield

Prices (Tk./kg): Maize= 8 , Potato= 4, Lalshak= 5, Coriander= 40, Radish = 4 Bushbean = 4, Spinach= 3.

Table 6. Performance of different vegetables intercropped with maize at MLT site, Chowgacha, Jessore during 2004-05

Treatment	Maize yield (t/ha)	Intercrop yield (t/ha)	Maize equivalent yield (t/ha)
Maize+Spinach	7.39b	15.17a	11.18
Maize+Coriander	7.46ab	1.54d	10.05
Maize+Lal shak	7.49a	1.42d	7.84
Maize+Radish	7.28c	5.58b	8.33
Maize+Potato	7.41ab	1.83cd	8.55
Maize+ Bushbean	7.49a	2.71c	8.51
Sole maize	7.50a	-	7.50
CV (%)	0.08	1.36	-

Products price (Tk,/kg) = Maize = 8 ,Spinach = 2, Coriander = 15, Lalshak = 2, Radish = 1.5, Potato = 5 & Bushbean = 3

Table 7. Yield and yield contributing characters maize in different intercropped maize + vegetable combination at Mymensingh 2004-05

Treatment	Plant height (cm)	No. of cobs / plant	No. of grains / cob	1000-grain weight (g)	Grain yield (t/ha)	Stover yield (t/ha)
Maize+ Red Amarnath	220.7cd	1.13	418	308.8bc	7.57bc	11.67bc
Maize + Radish	231.1b	1.07	428	325.9ab	8.90a	12.63abc
Maize+B.bean	225.9bc	1.03	422	303.3c	7.93b	12.00bc
Maize+G.pea	238.7a	1.07	427	323.7ab	8.10b	11.17c
Maize+Potato (Var.Heera)	215.1d	1.00	399	315.0abc	7.13c	13.07ab
Maize+Potato (Var.Challisha)	223.3c	1.03	401	324.7ab	8.13b	13.03ab
Sole Maize	221.3cd	1.13	443	334.0a	9.07a	13.70a
LSD (0.01)	6.82	NS	NS	19.74	0.62	1.57
CV (%)	1.21	5.15	5.43	2.48	3.03	7.82

Table 8. Maize equivalent yield and economic analysis of maize + vegetable inter cropping at Mymensingh

Crop combinations	Grain yield of maize (t/ha)	Yield of inter crop (t/ha)	Maize equivalent yield (t/ha)	Gross return (Tk./ha)	Total cost (Tk./ha)	Net return (Tk./ha)	BCR
Maize+ Red Amarnath	7.57bc	1.10	7.90d	84835	22094	62741	3.83
Maize + Radish	8.90a	15.5	11.07a	117015	22269	94746	5.25
Maize+B.bean	7.93b	8.5	9.63bc	102300	23169	79131	4.41
Maize+G.pea	8.10b	3.8	9.24c	97985	22969	75016	4.26
Maize+Potato (Heera)	7.13c	9.8	11.05a	117035	39969	77066	2.93
Maize+Potato (challisha)	8.13b	4.3	10.28b	109315	31969	77346	3.42
Sole Maize	9.07a	-	9.07c	97550	21969	75581	4.44
LSD (0.01)	0.62	-	0.69	-	-	-	-
CV (%)	3.03	-	2.69	-	-	-	-

Price (Tk/kg): Maize (seed) =50.00, Maize (non seed) =10.00 , Maize (stover)= 0.50, Red amaranth=3.00, Radish=1.40,Bush bean=2.00, Garden pea= 3.00, Potato (Heera)= 4.00, Potato (Challisha)=5.00

Table 9. Performance of different intercrops with maize at Rangpur during 2004-05

Treatment	Days to maturity (days)	Plant height (cm)	Grain yield (t/ha)	Intercrops yield (T/ha)	MEY
Maize + Potato	153a	197.30c	6.557c	11.60	
Maize + Lalshak	146b	216.80ab	8.433a	8.10	
Maize + Radish	148ab	212.40b	7.633b	20.14 + 2.10 (shak)	
Maize+Coriander shak	146b	216.50ab	7.987ab	6.25	
Maize + Fr. bean	146b	220.60ab	8.130ab	No fruits	
Maize + Napa shak	144b	219.50ab	8.270ab	4.35	
Sole Maize	143b	221.50a	8.497a	-	
CV (%)	2.0	2.02	4.36	-	
LSD (0.05)	6.0	7.73	0.61	-	

Price : (Tk/ha)

Table 10. Plant height, yield and yield attributes of maize as influenced by different intercropping combinations, Manikgonj, 2004-05

Treatment	Plant pop. /m^2	Plant height (m)	Cobs/m^2	Grain/ cob	1000-seed weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
Maize+Potato	6.53	1.93	7.06	431	24	7.32a	11.72a
Maize+Lalshak	6.66	2.00	7.53	450	25	8.48a	12.0a
Maize+Palon shak	6.86	2.02	7.73	460	24	8.73a	12.16a
Maize+Radish as shak	7.00	1.87	7.66	421	24	7.76a	12.60a
Maize+Coriander as shak	7.06	2.03	8.13	475	25	9.44a	12.35a
Maize+Garden Pea	6.40	2.01	7.20	456	24	7.87a	11.56a
Sole maize	6.73	1.99	7.47	475	25	8.77a	12.12a
LSD (.05)	NS	NS	1.09	NS	NS	NS	NS
CV(%)	5.58	4.78	6.57	9.26	4.44	15.47	6.15

Table 11. Grain yield, equivalent yield and economic analysis of maize in different intercropping combinations Manikganj, 2004-05

Treatment	Yield (t/ha)			Maize equivalent yield (t/ha)	Gross return (Tk/ha)	Total cost (Tk/ha)	Net return (Tk/ha)	BCR
	Maize		Vegetables					
	Grain	Straw						
Maize+Potato	7.32	11.72	3.25	10.57	115140	67012	48128	1.72
Maize+Lalshak	8.48	12.00	5.00	10.98	118167	44272	73895	2.67
Maize+Palon shak	8.73	12.16	0.46	9.01	96249	44172	52077	2.18
Maize+Radish as shak	7.76	12.60	11.87	8.95	95808	45712	50096	2.10
Maize+Coriander(Shak)	9.44	12.35	0.50	9.84	104740	43452	61288	2.41
Maize + Garden Pea	7.87	11.56	9.83	9.37	90378	43272	47106	2.10
Sole maize	8.77	12.12	-	8.77	93793	42273	51520	2.23

Price (Tk/ha): Potato=10, Lalshak= 5, Palonshak= 6, Radish=1, Coriander=8, Gardenpea =6, Maize(grain)=10, Straw=0.50

Synchronization of N application with growth stages of maize

Abstract

An experiment was under taken to verify the effect of N application at different growth stages of maize at FSRD site Goyeshpur, Pabna, Kushtia, Comilla, Kishoreganj, Jessore and Rangpur during 2004-05. The present recommendation of N application as top dress at 8 leaves stage and at tasseling gave identical yield with the application of N as top dress at only 8 leaves stage at all sites except Comilla where FP showed higher yield due to higher no. of irrigation accompanied with N fertilizer dose.

Introduction

Maize, a multipurpose cereal crop is very popular to people now a days. In the present recommendation urea-N is applied as top-dress at 8 leaves stage and at tasseling. However, at tasseling most of the maize farmers do not apply urea, as at that time it is difficult to enter maize field because by leaves injury of skin occurred. Thus the recommendation needs verification to find out alternative package of urea application at different growth stages.

Materials and Methods

The experiment was conducted at FSRD site Goyeshpur, Pabna, Kushtia, Comilla, Kishoregonj, Jessore and Rangpur during 2004-05. A new N fertilizer application method and farmer's method were tested against the present recommendation method. Treatment T_1 was the present recommendation of urea N application method where N applied as basal and two topdress at 8 leaves stage and at tasseling. Treatment T_2 was the new one where N were applied as basal and one topdress at 8 leaves stage. Treatment T_3 was the farmers' practice where N were applied as basal and three topdress at 3-5 leaves stage, at 8 leaves stage and at tasseling stage. The experiment was designed in RCB (Dispersed) design with 4 replications. Seeds of maize (var. pacific-11) was sown at December 6 at Pabna, 28 November to 2 December at Kushtia, 14-19 December at Comilla, 20 December at Kishoreganj, 29 November at Jessore and 25 November at Rangpur 2004, respectively maintaining the spacing 75cm x 20 cm. Fertilizer nutrients were used @ 255, 56, 144, 34, 13.5, 1.3 kg N, P, K, S, Zn, B and 6 ton cowdung ha^{-1}. Irrigations were given when necessary. Other intercultural operation was done when necessary. But about 20% of maize plant was lodged after a storm at April 3, 2005. The crop was harvested at 27 April at Pabna, last week of May at Kushtia, 19-25 May at Comilla, 5 May at Kishoreganj and 16-21 May at Jessore 2005, respectively. Data on different parameter were collected and analyzed statistically.

Result and Discussion

Location: Pabna

From the result it was found that grain yield did not differ significantly due to different treatment. However, higher grain yield, 100 seeds weight, grains per cob, plant height were observed in T_1 treatment but these were statistically identical with other treatments. So, it was reveled that single top dress of N at 8 leaves stage and two topdress at 8 leaves stage and tasseling stage had no significant difference. So, single top dress is economically viable due to less labour cost.

Location: Kushtia

Performance of different yield of different treatment are present in table 3. Higher no. of grain/cob was obtained from treatment T_2 followed by T_3 and T_1 but grain weight was higher in treatment T_1. There was no significant difference is grain yield was recorded in treatment T_2 and T_3 but difference from T_3 which showed lowest yield. So, result showed that half of urea as basal followed by half at 8-10 leaf stage gave higher yield. In this context one split of urea is sufficient than two splits.

Location: Chandina, MLT site, Comilla

Yield and yield contributing data were presented in table 4. Yield and yield contributing characters were not statistically significant. But higher grain yield was recorded from treatment T_3 due to higher plant/m2 and 100-grain weight. Farmer practice showed higher yield could be due to more number of irrigations though urea fertilizer rate was lower than T_1 & T_2 treatment..

Location: Kishoregonj

The result showed that plant height, grains/cob and grain yield were statistically significant in different treatments (Table 5). The higher plant height was recorded from T_2 which was statistically similar to T_1 treatment. T_3 treatment produced lower plant height. Statistically significant grains/cob produced by different treatments Higher number of grains/cob was recorded from T_2 followed by T_1 treatment. Significantly higher grain yield was obtained from T_2 which was gave about 8% higher yield over T_3 treatment. The treatment T_3 (farmer's practice) gave the lowest grain yield due to use of less amount of fertilizers. The highest gross return (Tk.117050 ha^{-1}) was calculated from T_2 treatment which was about 8% higher than T_3 (farmer's practice). But benefit cost ratio was higher in T_3 due to lower cultivation cost.

Location: Jessore

Plants/m^2, yield attributes, grain and straw yield were significantly influenced by time of N application at different growth stage but plant height was insignificant (Table 7). Significantly highest plant was recorded from T_2 treatment. Similar trend was followed in case of grain/cob. There was no significant difference between treatment T_1 & T_2. Significantly highest grain yield was recorded from treatment T_2 where Urea was applied at basal & leaf stage. All the yield attributes and plant/m^2 revealed higher yield in treatment T_2.

Location: Syedpur, Rangpur

Plant height, 100-grain weight and grain yield were significantly influenced by different N application (Table 8). Though maturity days was statistically identical but 7 days less in farmer practice. There was no significant difference in treatment T_1 & T_2 in grain weight but lower weight from FP. Though higher grain yield was recorded from T_2 treatment but statistically at par to treatment T_1 and significantly lowest from T_3 treatment (FP). So, two times of application of N at basal & rest at 8 leaf stage could be feasible for maize production.

Farmers' reaction

Pabna: Farmers are pleased on this theme of N-fertilizer application.

Conclusion

Single time of N fertilizer application at 8 leaf stage of maize is cost effective but this trial should continue to the next year for a solid conclusion.

Table 1. Effect of different methods of N fertilizer application on maize at FSRD site Goyeshpur Pabna during 2004-05

Treatments	No. of plants m^{-2}	plant height (cm)	Ear height (cm)	No. of cobs 15 m^{-2}	No. of grains cob^{-1}	100 seeds weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_1	667	215.23	114.90	103.18ab	473.40	33.38a	8.14a	6.10a
T_2	667	213.40	113.00	107.46a	440.95	32.13b	8.02a	6.26a
T_3	667	214.80	112.75	101.06b	436.35	33.50a	8.00a	5.43b
CV%	-	5.80	7.15	2.71	5.05	2.04	6.12	5.48
LSD (.05)	-	NS	NS	4.86	NS	1.16	NS	0.56

Table 2. Economic analysis of different N application at FSRD site, Pabna during 2004-05

Treatment	Cultivation cost (Tk)	Gross Return (Tk)	Net return (Tk)	BCR
T_1	28230	68170	39940	2.41
T_2	28010	67290	39280	2.40
T_3	28440	66715	38275	2.35

Table 3. Yield and Yield attributes of Maize as affected by different level of N- application at Kushtia during Rabi 2004-05

Treatment	Plant/ m^2	Grain/cob (No)	100-grain wt. (g)	Grain yield (t/ha)
T_1	6	385	36.37	8.22a
T_2	6	398	34.89	8.8a
T_3	6	390	33.15	7.73b
LSD (5%)	NS	NS	NS	0.38

Table 4. Yield and yield contributing characters of maize during rabi 2003-04, Comilla

Treatment	Plant height (cm)	Plant population /m^2	No. of cobs/ m^2	No. of grains/cob	100 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	253.4	82.5	7.11	396	33.15	10.97	12.90
T_2	253.5	82.0	7.71	400	32.56	10.79	12.30
T_3 (F P)	259.2	84.0	7.75	361	33.22	11.42	13.16
LSD (5%)	NS	NS	NS	NS	NS	NS	NS
CV (%)	3.05	3.04	8.95	6.57	4.03	5.63	7.14

Table 5. Yield and yield contributing characters of Maize at Sadar MLT site, Kishoregonj, during rabi 2004-05

Treatment	plant height (cm)	Cobs/plant (no.)	Grains/ cob (no.)	100-grains wt. (g)	Grain yield (t/ha)	Stover yield (t/ha)
T_1	242.3a	1.30	518a	30.7	9.08b	13.50
T_2	243.5a	1.27	528a	31.4	9.43a	13.87
T_3	229.0b	1.20	501b	30.9	8.75b	12.80
LSD (0.05)	11.0	NS	9.73	NS	0.33	NS
CV (%)	2.66	6.35	10.95	6.78	2.09	7.28

Figures in a column having similar letter (s) do/does not differ significantly at 5% level of significance.

Table 6. Cost and return analysis of Maize at Sadar MLT site, Kishoregonj, during rabi 2004-05

Variety	Gross return (Tk/ha)	Total Variable cost ($Tkha^{-1}$)	Gross margin ($Tkha^{-1}$)	BCR
T_1	79390	29423	49967	2.70
T_2	82375	28723	53652	2.87
T_3	76400	21608	54792	3.54

Price Tk/kg : Maize grain 8/-, Stover 0.50.

Table 7. Yield and yield attributes of hybrid maize affected by N application (FSR site, Bagherpara during 2004-05)

Treatments	Plant height (cm.)	Plant pop/m^2	Cobs/m^2 (no)	Grains/ cob (no)	100 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	207	5.66	5.73	433b	30.10ab	9.13b	10.71a
T_2	217	5.93	5.93	459a	31.58a	9.68a	11.59a
T_3	200	5.53	5.60	411c	29.10b	8.83b	8.58b
CV (%)	4.80	5.73	6.24	8.24	9.55	8.72	5.13
LSD (.05)	NS	0.03	NS	16.8	1.86	0.43	0.91

Table 8. Effect of different type of Urea– N application on maize yield and yield contributing characters, Rangpur 2004-05

Treatment	Days to maturity	Plant height (cm)	100 Seed wt. (gm)	Grain yield (ton/ha)
T_1	161	243.73a	37.03a	8.813a
T_2	155	236.90ab	37.13a	9.023a
T_3	154	228.10b	34.10b	8.153b
CV (%)	2.16	2.43	3.32	3.04
LSD(.05)	NS	13	2.72	0.48

Relaying of Hybrid Maize with Potato across environments

Abstract

An experiment was undertaken to observe the relay intercropping potato in maize at different dates of maize sowing. The result showed that one row of potato sown in between maize rows gave higher MEY at Comilla and Rangpur, but cost and return analysis should that sole maize gave higher return in sole maize at Comilla and Pabna.

Introduction

Maize is the third important cereal crop in our country. Now a day's maize produces many places of our country. Maize mainly used as fodder crop and fuel. 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 and plant population should be optimized. Therefore, an experiment was undertaken to observe the intercropping and relay time of maize along with potato plant population.

Materials and methods

The experiment was conducted at Chandina MLT site of Comilla, Pirganj, Rangpur and Goyeshpur, Pabna during rabi, 2004-2005 medium high land. The experiment had three replications with RCB design. The treatments were T_1= 0 day before maize sowing + One row of potato, T_2= 0 day before maize sowing+ Two row of potato, T_3= 10 day before maize sowing+ One row of potato, T_4= 10 day before maize sowing + Two rows of potato, T_5= 20 day before maize sowing + One row of potato, T_6= 20 day before maize sowing + Two rows of potato and T_7= Sole maize. The unit plot size was 10m × 8m. The maize variety was Pacific 11. The land was well prepared and diamond potato seeds were sown on 10.11.2004 at Comilla, 22-11-04 at Rangpur and 25-11-04 at Pabna. Single row potato seeds were sown in between two maize rows having 20 cm spacing within the line. But in case of double row sowing in between two maize rows the spacing for potato was 30cm × 20cm. Maize seeds were sown on three dates as per treatment schedule i.e., 10, 20 and 30 November at Comilla, 25 November, 5 and 15 December at Rangpur and 25 November at Pabna 2004, respectively. Maize seeds were sown maintaining spacing 75 cm x 20 cm. The fertilizer doses were 550-280-280-187-17-12 kg Urea- TSP-MP-Gypsum-$ZnSO_4$-Boric acid per ha. Two third of Urea and all other fertilizer were applied at final land preparation and rest amount of Urea was applied as top-dress at 20 DAS. The experimental plot was irrigated twice. Other cultural practices were done as and when required. Potato was harvested on 25 January at Comilla and 19 January at Rangpur, 2005 and maize was harvested during 28 March to 11 April 2005 at Comilla. Bacterial wilt and virus diseases were observed in potato plants. All data were recorded properly.

Location: Comilla

Maize: Grain yield & yield attributes significantly affected by different treatment except 100-seed weight (Table 1). Grain yield of maize differ mainly plant/m^2 where T_5 and T_6 showed significantly lower plant/m^2. The higher grain yield was found in treatment T_1 which was statistically identical with treatment T_2 and T_7. The lowest grain yield was found from the treatment T_5 and T_6 where maize seeds were sown 20 days after potato sowing when potato plants were in vegetative stage, which may subside the growth of maize plants due to nutrient competition.

From the economic point of view highest gross margin was recorded in T_1 where single row of potato was sown in between two maize rows in the same date but when cost was calculated then sole maize was found profitable than relay crop of potato. The result should that highest BCR was recorded from sole maize (Table 3).

Potato: There was a significant variation in yield and yield attributes among the treatments (Table 2). The highest tuber yield was recorded in treatment T_4 (Double rows potato in between two rows of maize relay sowing after 10 days) which is statistically identical with the treatment T_6, and T_1.

Location: Rangpur

Plant eight, days to maturity, 100-seed weight and grain yield of maize were significantly affected by the treatment (Table 4). Significantly highest plant height and 100-seed weight was obtained from sole maize also took less time as compare to relay crop of potato. Tuber yield of potato was significantly highest from treatment T_5 where one row of potato relayed 20 days before maize sowing. Relayed two rows of potato gave lower yield of both the crops due to crop competition. Higher MEY was recorded from treatment T_5 followed by T_3.

Location: Pabna

Potato: Higher potato yield was obtained from T_4 treatment at FSRD site but at ARS it was found higher in T_6 treatment. Potato yield was lower in T_1 treatment at both locations. It was also observed that all treatments with two rows of potato gave higher potato yield (Table 5).

Maize: At FSRD site, highest grain yield was obtained from sole maize plot and yield contributing character also supported this results. The lowest grain yield was obtained from T_2 treatment. At ARS, Pabna, the highest grain yield was found in T_3 treatment where lowest was found in T_6 treatment. It was found that intercropping of potato had a little negative effect on maize production especially incase of two rows of potato (Table 6 and 7).

Cost and return analysis: The highest gross return & net return was obtained from T_4 treatment. From the economical point of view, it was observed that relaying of potato with maize was profitable than sole maize production. But when cost was calculated than relaying of potato was not profitable than sole maize.

Farmer's reaction

Farmers were very much interested with the potato cultivation with maize. They could get earlier some extra income from potato. But due to high seed cost of potato, relaying is not profitable than sole maize.

Conclusion

Maize production with potato is a promising technology. One row of potato sowing at 10 days before maize sowing is more profitable though two rows of potato at same treatment gave higher net return. But when total cost was calculated and seed price of potato is included than relaying could not be profitable than sole maize.

Table 1. Yield and yield contributing characters of maize as affected by relay crop with potato during rabi 2004-05 Comilla

Treatment	Plant height (cm)	Plant population/ plot (m^2)	No. of cobs/m^2	100 seed wt. (g)	No. of grains/ cob	Straw yield (t/ha)	Grain yield (t/ha)
T_1= 0 DBMP* +1row	228.73	5.19	109.67	32.47	429	11.22	10.81
T_2= 0 DBMP +2 row	213.93	5.13	103.00	33.09	436	10.95	10.53
T_3= 10 DBMP +1 row	228.60	4.53	84.33	31.01	405	9.43	9.10
T_4= 10 DBMP +2 row	212.43	4.05	76.67	31.01	371	9.08	8.24
T_5= 20 DBMP +1 row	223.23	1.80	35.00	33.29	353	4.73	7.26
T_6= 20 DBMP +2 row	216.10	1.80	33.00	33.76	342	4.79	7.26
T_7= Sole maize	220.17	3.03	128.00	37.54	427	11.49	10.74
LSD (5%)	NS	192	51.70	NS	52.31	6.56	1.26
CV (%)	10.42	33.97	35.71	10.05	7.44	29.75	7.11

Table 2. Yield and yield contributing characters of potato in maize during rabi 2004-05 Comilla.

Treatment	Plant height (cm)	No. of tuber/hill	No. of shoot/hill	Haulm wt. (t/ha)	Tuber yield (t/ha)
T_1= 0 DBMP + 1 row	64.60	3.7	1.5	7.27	9.15
T_2= 0 DBMP + 2 row	60.13	4.4	2.0	9.18	7.07
T_3= 10 DBMP + 1 row	60.70	5.1	1.9	6.02	10.15
T_4= 10 DBMP + 2 row	63.67	5.1	2.2	11.65	14.12
T_5= 20 DBMP + 1 row	57.23	4.7	1.5	7.98	8.65
T_6= 20 DBMP + 2 row	64.07	4.7	2.0	10.03	12.22
LSD (5%)	NS	1.24	0.373	5.71	6.4
CV (%)	6.42	14.66	10.89	41.73	34.29

Table 3. Grain yield, cost & return analysis of relaying of potato with hybrid maize at Chandina, Comilla 2004-05

Treatment	Grain yield of maize (t/ha)	Tuber yield (t/ha)	MEY	Gross return (Tk/ha)	Total cost of cultivation (Tk/ha)	Net return (Tk/ha)	BCR
T_1= 0 DBMP + 1 row	10.81	9.15	15.36	115080	65000	50080	2.30
T_2= 0 DBMP + 2 row	10.53	9.07	14.06	102520	81000	31520	1.26
T_3= 10 DBMP + 1 row	9.10	10.05	14.18	113400	65000	48400	1.74
T_4= 10 DBMP + 2 row	8.24	14.12	15.30	122400	81000	41400	1.51
T_5= 20 DBMP + 1 row	7.26	8.65	11.57	92680	65000	27680	1.42
T_6= 20 DBMP + 2 row	7.26	12.22	13.37	106960	81000	25960	1.32
T_7= Sole maize	10.74	-	10.74	85920	21000	64920	4.09

Price : Tk/kg= Maize 8/-, Maize (Straw) 0.50/-, Potato 4/-

Table 4. Yield and yield attributes of maize & yield of intercrops, 2004-05, Rangpur

Treatment	Plant height (cm)	Days to maturity	100-seed weight (g)	Grain yield of maize (t/ha)	Tuber yield (t/ha)	MEY
T_1= 0 DBMP +1row	195.70e	155c	34.15b	6.60b	10.13c	12.16
T_2= 0 DBMP +2 row	176.30f	162a	30.66d	4.53d	17.75f	8.40
T_3= 10 DBMP +1 row	204.60cd	154c	34.60b	6.99b	13.06b	13.52
T_4= 10 DBMP +2 row	198.0de	158b	32.31c	5.47c	9.04e	9.99
T_5= 20 DBMP +1 row	216.10b	152c	35.10b	7.22b	15.03a	14.74
T_6= 20 DBMP +2 row	206.30c	154c	32.70c	5.71c	10.11d	10.76
T_7= Sole maize	230.40a	146d	36.90a	8.52a	-	8.52
LSD(.05)	7.67	3.00	1.20	0.66	0.55	-

Table 5. Performance of Potato as affected by relaying with maize at expanded FSRD site Modhupur, Pabna during 2004- 05

Treatments	Tubers plant^{-1}	Tubers weight plant^{-1} (g)	Tuber yield ha^{-1} (t)
T_1= 0 DBMP* +1row	5.60a	39.29ab	8.92c
T_2= 0 DBMP +2 row	5.85a	29.37c	15.03b
T_3= 10 DBMP +1 row	5.53a	42.45a	10.90c
T_4= 10 DBMP +2 row	6.40a	32.77bc	18.68a
T_5= 20 DBMP +1 row	5.63a	41.34ab	10.88c
T_6= 20 DBMP +2 row	5.08a	36.98abc	17.41a
T_7= Sole maize	-	-	-
CV (%)	20.77	16.55	11.28
LSD (.05)	NS	9.24	2.32

* DBMP=Day before maize planting

Market price of Potato = 5 Tk kg$^{-1,}$ Market price of Maize = 8 Tk kg^{-1}

Table 6. Performance of Maize as affected by relaying of Potato at expanded FSRD site Modhupur, Pabna during 2004- 05

Treatments	No. of plants m^{-2}	Plant height (cm)	No. of cobs 15 m^{-2}	Grains cob^{-1} (no)	100-seed weight (g)	Grain yield (t ha^{-1})	Straw Yield (t ha^{-1})
T_1= 0 DBMP +1row	6.17	166.80a	104.37a	401.50a	34.78ab	9.31b	9.79a
T_2= 0 DBMP +2 row	6.17	150.17b	105.01a	391.01a	33.86b	8.13c	8.63b
T_3= 10 DBMP +1 row	6.17	176.98a	103.76a	401.00b	34.01b	9.18b	9.63a
T_4= 10 DBMP +2 row	6.17	170.80a	105.60a	394.50a	34.09b	8.25b	8.83b
T_5= 20 DBMP +1 row	6.17	180.60a	104.36a	391.25a	32.87b	9.17b	9.83a
T_6= 20 DBMP +2 row	6.17	178.20a	103.76a	381.00b	32.36b	8.67b	9.60a
T_7= Sole maize	6.17	172.90a	107.49a	408.75a	37.42a	11.46a	10.81a
CV (%)	-	5.37	3.26	3.14	5.45	5.8	11.91
LSD (.05)	-	13.64	5.127	18.47	2.767	0.791	1.116

Table 7. Performance of maize- potato combination as affected by relaying of potato ARS, Pabna during 2004-05

Treatments	No. of plants m^{-2}	Plant height (cm)	No. of cobs 15^{m-2}	Grains cob^{-1}	100 seed weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Potato yield (t/ha)
T_1= 0 DBMP +1row	6.17	2.8.93ab	110.00a	403.73b	34.76	8.15ab	8.97ab	7.03
T_2= 0 DBMP +2 row	6.17	201.73b	106.00a	401.73b	32.93	7.83ab	8.39bc	10.67
T_3= 10 DBMP +1 row	6.17	214.93a	105.33a	469.53a	33.20	8.82a	8.04c	7.22
T_4= 10 DBMP +2 row	6.17	211.13ab	105.33a	483.80a	33.57	8.44ab	7.93c	11.18
T_5= 20 DBMP +1 row	6.17	214.06a	108.33a	403.33b	34.13	7.97ab	8.22c	7.63
T_6= 20 DBMP +2 row	6.17	218.00a	102.67a	399.93b	33.77	7.38b	7.15d	13.37
T_7= Sole maize	6.17	211.80a	109.33a	391.80b	32.23	7.90ab	9.29a	-
CV (%)	-	2.43	3.98	6.20	5.83	7.38	4.74	-
LSD (.05)	-	9.129	7.561	46.58	3.467	1.061	0.603	-

Table 8. Economic analysis of Relaying of Potato with hybrid Maize during 2004-05 at FSRD site, Pabna

Treatments	Cultivation cost (Tk)	Gross Return (Tk)	Net return (Tk)	BCR
T_1= 0 DBMP +1row	43305	123975	80670	2.86
T_2= 0 DBMP +2 row	56805	144505	87700	2.59
T_3= 10 DBMP +1 row	43305	132755	89450	3.06
T_4= 10 DBMP +2 row	56805	163565	106760	2.88
T_5= 20 DBMP +1 row	43305	132670	89365	3.06
T_6= 20 DBMP +2 row	56805	161210	104405	2.84
T_7= Sole maize	28230	97085	68855	3.44

On-farm evaluation of different types of hybrid maize at two dates of seeding

Abstract

An On-Farm experiment was conducted at Mithapukur, Rangpur during November 2004 to April 2005 to evaluate the performance of different hybrid maize varieties (Pacific 11, Pacific 60, BARI hybrid maize 3, Pacific 983 and Pacific 984) at early (20 Nov.) and late (20 Dec.) sowing dates. Results revealed that single cross hybrid Pacific 984 and Pacific 983 gave higher yields at early sowing while double cross hybrid Pacific 11 yielded higher at late seeding. For late sowing highest yield reduction was in Pacific 983 whereas lowest in Pacific 11. BARI hybrid maize 3 also produced reasonable yield at both dates of seeding.

Introduction

There are different types of imported hybrid maize in the market such as single cross, double cross and three way cross. Some performs better at early date of seeding but some are well adapted to wide range of seeding time in rabi season. To get optimum yield at farmers level those different types of hybrids are be tested in various dates of seeding for suggesting recommendation. Therefore, three types of hybrid crosses are to be evaluated at early and late times of seeding.

Materials and Methods

The experiment was conducted at Serudangha, Mitapurkur of Rangpur during rabi 2004-05. There were two sowing date (20 November & 20 December) and five varieties (Pacific 11, Pacific 60, BHM-3 Pacific 983 and Pacific 984). The experiment was sown in factorial RBD with four dispersed replications. The unit plot size 2 Decimal. The spacing was 75cm x 25cm with recommended fertilizer dose intercultural operation were dose as and when necessary.

Result and Discussion

All the yield attributes and yield were higher in early sowing (20 November) than late sowing (20 December). Among the variety higher grain yield was recorded from Pacific 984 followed by pacific 983 when sown on 20 November. The BARI variety (BHM-3) also showed good and reasonable grain yield but slightly lower than imported variety except Pacific 60. Due to late sowing (15 Dec.) highest yield reduction (2.01 t/ha) was for Pacific 983 followed by Pacific 984 (1.92 t/ha) and then for BHM-3 (1.58 t/ha). The lowest yield reduction was in Pacific 11 (.106 t/ha). However, yield was reasonable for all the varieties in case of late seeding. The results indicate that for late seeding the double cross hybrid Pacific 11 would be the best. Almost similar trend was followed in case of straw yield.

Conclusion

Results revealed that single cross hybrid Pacific 984 and Pacific 983 gave higher yields at early sowing while double cross hybrid Pacific 11 yielded higher at late seeding. For late sowing highest yield reduction was in Pacific 983 whereas lowest in Pacific 11. BARI hybrid maize 3 also produced reasonable yield at both dates of seeding.

Table 1. Yield & yield attributes of different hybrid maize at two date of sowing Rangpur 2004-05

Treatment		Plant height (cm)	Plant/ m^2	Cobs/ m^2	Grain/ cob	100-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
D_1	V_1	230.85	6.13	6.20	461	34.32	8.93	7.98
	V_2	228.50	6.17	6.17	467	33.19	8.50	7.37
	V_3	268.15	6.25	6.13	488	33.53	8.86	8.17
	V_4	217.00	6.20	6.20	517	32.38	9.12	8.49
	V_5	230.40	6.17	6.17	505	32.97	9.40	8.61
D_2	V_1	198.65	5.82	5.87	443	31.04	7.87	7.09
	V_2	208.80	5.82	5.98	453	30.17	7.28	6.39
	V_3	242.90	5.88	5.88	477	30.78	7.28	7.28
	V_4	196.50	5.87	5.87	488	29.52	7.11	6.65
	V_5	208.20	5.87	5.87	483	29.84	7.48	6.76
LSD(.05)		6.34	NS	NS	8.17	0.58	0.41	0.53

D_1= 20 November, D_2 = 20 December, 2004

V_1= Pacific 11, V_2=Pacific 60, V_3= BHM=3, V_4=Pacific-983, V_5=Pacific 984

On-farm verification of BARI Hybrid Maize-3

Abstract

An on-farm trial was conducted at FSRD site Goyeshpur, Pabna, Kushtia, Faridpur, Kishoregonj, Mymensingh and Patuakhali during 2004-05 to evaluate the adaptability and potentiality of BARI hybrid maize-3. BARI hybrid maize-3 gave slightly higher yield than Pacific-11 at Pabna, Patuakhali and Mymensingh but Pacific 11 at Kushtia, Faridpur and Kishoregonj.

Introduction

In the present situation, maize is a very common, popular and multiuse cereal crop. Every year a huge amount of maize grain is required for poultry sector and most of them are fulfilled by imported from other countries. So, it needs to develop high yielding hybrid maize variety. From this view, BARI already developed BARI hybrid maize-3 variety. From on-station data it was observed that BARI hybrid maize-3 had comparable/higher yield potential than Pacific 11 or other hybrid maize cultivars. However, before mass recommendation it needs on-farm evaluation across the country. So BARI hybrid maize-3 will be evaluated across different environments of the country.

Objectives

i) To evaluate the adaptability, yield potentiality of BARI hybrid maize-3
ii) To monitor farmers reaction about BARI hybrid maize-3

Materials and Methods

The trial was conducted at FSRD site, Goyeshpur, Pabna, Faridpur, Kishoregonj, Mymensingh and Patuakhali during 2004-05. BARI hybrid maize-3 was tested against Pacific-11. The experiment was non- replicated and plot size was 33 decimal. Seeds at maize were sown December 5, 2004 at Pabna, December 3, 2004 at Faridpur, 20 December, 2004 at Kishoregonj, December 04, 2004 at Mymensingh and December 20, 2004 at Patuakhali maintaining spacing 75 cm X 20cm. The crop was fertilized @ 255, 56, 144, 34, 13.5, 1.3 kg N, P, K, S, Zn, B. An unexpected storm was occur at April 3, 2005 which caused lodging of some maize plants at Pabna. Intercultural operations were done as and when necessary. The crop was harvested at April 27, 2005 at Pabna, May 2, 2005 at Faridpur, April 28, 2005 at Kishoregonj, 23 April, 2005 at Mymensingh and April 20-24, 2005 at Patuakhali. Data on different parameter were collected and mean data are presented in the table.

Results and Discussion

Location: Pabna

From the results it was revealed that BARI hybrid maize -3 gave slightly higher yield than Pacific-11 (Table 1). Though its 100 seed weight is lower than Pacific-11 but higher no. of grains cob^{-1} leads its higher yield. Plant height of BARI hybrid maize-3 is longer than Pacific-11. Maize cob was full filled with grain up to top in BARI hybrid maize-3 where Pacific-11 cob top was unfilled which might be reduced no. of grain cob^{-1} in Pacific-11.

Location: Kushtia

On an average plant population/m^2, varied for two varieties where higher plants/m^2 from Pacific-11. But cob/m^2 was same. The hybrid Variety BMH-3 showed higher grains/cob but grain weight almost same in both the variety. Ultimately there is no difference in yield but yield was low due lower plant/m^2 (Tabel 2).

Location: Faridpur

In BARI hybrid maize-3 the number of grains per cob was higher (523) than Pacific-11 (474). But number of cobs per sq. meter and 100 grain weight was higher in Pacific-11. The variety Pacific-11 showed higher grain yield than BARI hybrid maize 3 due higher plant/m^2, cobs/m^2 and grain weight (Tabel 3).

Location: Kishoregonj

The performance of BARI hybrid maize-3 and pacific-11 on yield and yield attributes have been presented in Table 4. The result revealed that yield contributing characters like, cobs/m^2, cobs/plant, seed/cob, 100-seed weight more or less similar. The grain yield of BARI hybrid maize-3 was 8.03 t/ha which was about 4 % less than Pacific-11. This might be due to less no. of cobs/m^2, no. of grain/cob and 100-seed weight than in Pacific-11.

Location: Mymensingh

The performance of BARI hybrid maize-3 and Pacific-11 on yield and yield attributes have been presented in Table 5. The results revealed that yield contributing characters like, cobs/m^2, cobs/plant, grains/cob were higher in BARI hybrid maize-3 compared to Pacific-11. The grain yield of BARI hybrid maize-3 was 9.0 t/ha which was 9.45% higher than Pacific-11. This might be due to higher number of cobs/unit area and number of grains/cob than in Pacific-11. The stover yield was also higher in BARI hybrid maize –3 than the Pacific 11.

Location: Patuakhali

Between two cultivars BARI Hybrid maize-3 yielded slightly higher than Pacific-11. Number of grain per cob was higher in BARI hybrid maize-3 but 100 grain weight was higher in Pacific 11 due to larger grain size. Slightly higher grain was obtained from BARI hybrid maize-3 but higher stover yield from Pacific 11. Highest gross return, gross margin and BCR was obtained from BARI hybrid maize-3.

Farmer's reaction

Pabna: Farmers of that location were happy about BHM-3. They opined that it is high yielder but it has lodging tendency due to more tall plant. They desired that seeds of this variety should be available as early as possible.

Kushtia: The BHM-3 variety 3 is highly accepted by the farmers due to its higher yield.

Faridpur: Farmers are interested to grow both variety in next year due to higher benefit and yield.

Mymensingh: Farmers are very much interested to grow BARI hybrid maize-3 for its higher yield but seed should be supplied timely with adequate amount.

Patuakhali: Yield was satisfactory so farmers were interested to grow BARI Hybrid maize-3 but there is no marketing facility in this region.

Conclusion

BARI hybrid maize-3 is a high yielder variety compared to Pacific-11 except Faridpur, Kushtia and Kishoregonj area. But its quality of seed should maintain properly for proper germination. Plant height is longer than other variety which may cause lodging during the storm.

Table 1. Yield and yield contributing characters of BARI hybrid maize-3 and Pacific-11 at Goyeshpur, Pabna during 2004-05

Treatments	Plant height (cm)	Ear height (cm)	Plant pop./m^2	No. of cobs/m^2	No. of grains/cob	100-grain weight (g)	Grain yield (t/ha)
BARI Hybrid maize-3	232.3	107.0	5.66	5.66	490.4	30.00	8.20
Pacific - 11	215.23	114.90	84	5.65	6.68	33.38	8.14

Price : Maize grain Tk. 8/kg

Table 2. Yield and yield contributing characters of BARI hybrid maize-3 and Pacific-11 at Kushtia during 2004-05

Variety	Plants/m^2	Cob/m^2	Grains/Cob	100 grain wt.(g)	Grain yield (t/ha)
BHM-3	3.0	3.0	568	40.0	6.62
Pacific-11	4.0	3.0	450	40.8	6.67

Table 3. Yield and yield contributing characters of BARI hybrid maize-3 and Pacific-11 at Ishan Gopalpur, Faridpur during 2004-05

Variety	Plants/m^2	Cob/m^2	Grains/Cob	100-grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)
BHM-3	4.20	4.20	523	31.80	7.23	8.03
Pacific-11	4.60	4.75	474	33.40	7.71	8.95

Table 4. Yield and yield contributing characters of BARI hybrid maize-3 and Pacific-11 at Kishoregonj Sadar during 2004-05

Variety	Plant height (cm)	Population /m^2 (no.)	Cobs/ m^2 (no.)	Cobs/ plant (no.)	Grains/ cob (no.)	100-grain weight (g)	Grain yield (t/ha)	Stover yield (t/ha)
BHM -3	235	5.33	5.55	1.10	487	29.2	8.13	11.20
Pacific-11	217	5.33	5.56	1.11	512	31.2	8.52	11.54

Table 5. Plant height, yield and yield contributing characters of hybrid maize-3 Mymensingh Sadar, 2004-05

Variety	Plant height (cm)	Plant population /m^2	Cobs/ m^2	No. of cobs/ plant	No. of grains/ cob	Grain yield (t/ha)	Stover yield (t/ha)
BHM -3	262.41	5.33	6.03	1.15	530	9.00	14.7
Pacific -11	221.25	5.33	5.82	1.11	442	8.22	11.2

Table 6. Yield and yield contributing characters and cost & return analysis of BARI Hybrid maize-3 at Patuakhali, 2004-05

Variety	Plants /m^2	No of cob/m^2	No of grains/ cob	100-grain weight (g)	Grain Yield (t/ha)	Straw yield (t/ha)	Gross return (Tk/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
BHM-3	6.6	8.0	588	32.0	10.35	11.05	82436	39060	43376	2.11
Pacific11	6.6	7.03	578	34.0	10.08	11.15	80811	39060	41750	2.07

Output price : Grain Tk. 7.00/kg & Stover Tk. 0.50/kg

On-farm verification trial of BARI Hybrid Maize-5

Abstract

On-Farm performance of BARI Hybrid Maize-5 was evaluated at Multilocation Test Site, Sherpur, Jhenaidah, Kushtia, Manikganj and Rangpur during the rabi season of 2004-05. The objective was to observe the performance of BARI maize hybrids-5 in farmers' field. The results showed that BARI Hybrid Maize-5 gave yield of 9.47 at Sherpur, 7.55 t/ha at Kushtia 8.20 t/ha at Jhenaidah, 6.49 t/ha at Manikganj and 8.55 t/ha at Rangpur.

Introduction

Maize ranks third globally among the cereal crops next to rice and wheat in terms of area and production. The yield potential of the existing varieties is lower in comparison to hybrid maize. In Bangladesh hybrid maize is being cultivated for the last few years. Farmers in this area mainly grow hybrid variety imported from abroad BARI already developed BARI hybrid maize-5 which need to be popularize. In this context a trial was undertaken by OFRD, BARI at different location of Bangladesh to evaluate its potential yield at farmers' field.

Materials and Methods

The on-farm verification of BARI Hybrid Maize 5 was tested at the farmers' fields of MLT site, Sherpur, Jhenaidah, Kushtia, Manikganj and Rangpur during rabi season of 2004-05. A discussion meeting was arranged with co-operator farmers for implementation of the program. Farmer were motivated and agreed to co-operate with the site team. The site team supplied good quality seeds of BARI Hybrid Maize-5 to the farmers. The trial was set in four dispersed replications. The seeds were planted at the spacing was 75x20cm. The area was about 400m2 (10 decimal). The crop was fertilized with 256-55-138-3-1 kg/ha N-P-K-S-Zn, respectively. One third of urea and all others fertilizer were used at final land preparation. Remaining part of urea was top dressed in two equal splits at 45 and 85 DAS. The seeds were sown on November 11, 2004 at Sherpur, 21 November, 2004 at Jhenaidah, 25 November, 2004 at Kushtia, 15 November, 2004 at Manikganj and 25 November, 2004 at Rangpur. The crop was harvested on April 23, 2005 at Sherpur, April 10, 2005 at Jhenaidah, April 12, 2005 at Kushtia, March 28, 2005 at Manikganj and March 30, 2005 at Rangpur. The average yield was shown in the table 1.

Result and Discussion

The result showed that reasonable good yield was obtained from BARI Hybrid Maize-5 at Sherpur, Rangpur and Jhenaidah whereas lower grain yield was recorded from Kushtia and Manikganj due to lower no. of plants/m^2 and no. of grain/cob.

Table 1. Yield and yield attributes of BARI Hybrid Maize-5 at MLT site, Jhenaidah, Kushtia, Sherpur, Rangpur and Manikganj during 2004-05

Location	Plant height (cm)	Plant pop-/m^2 (no)	Cobs/ m^2 (no)	Grain/cob (no.)	100-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
Jhenaidah	217.5	5.33	5.33	544	34.5	8.20	7.80
Kushtia	216.0	3.33	3.33	344	33.9	7.55	-
Sherpur	221.6	6.4	6.47	494	37.0	9.47	9.76
Rangpur	221.4	-	-	531	36.0	8.95	-
Manikganj	227.0	6.33	6.87	378	25.0	6.49	10.80

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Adaptive trial of Hybrid Maize in saline area

Abstract

Performance of four Maize varieties namely Pacific 11, BARI hybrid Maize 2, BARI hybrid Maize 3 and BARI hybrid Maize 5 were evaluated at Banerpota farm, Satkhira during the rabi season 2004-05. The variety BHM-5 and Pacific-11 showed similar grain yield but reasonable yield could not achieved.

Introduction

A vast coastal and offshore area (2.85 m ha) in the southern part of Bangladesh exhibit soil salinity of various magnitudes due to onrush of salt water form the Bay. However, during the dry season (November through March) surface layer of the soil dries up due to evaporation and the saline water form the underground moves up by capillary forces. Thus a considerable amount of salt from the subsoil is carries to the surface and accumulates as salt crust. So, cultivation of winter crops is very limited due to absence of irrigation water. As a result, most of the areas remain fallow during dry months. Recently BARI released some hybrid maize varieties. But at present there is no known salt tolerant maize hybrid for the vast saline area of the country. So, the present study was undertaken to find out the performance of hybrid varieties in saline area.

Materials and Methods

The trial was conducted at Banerpota farm, Satkhira during Rabi season, 2004-2005 with four varieties namely Pacific 11, BARI hybrid Maize 2, BARI hybrid Maize-3 and BARI hybrid Maize-5 following RCB design with four replications. The unit plot size was 5m 54m. The crop was sown on 13 December, 2004 as line sowing. Line to line spacing was 75cm. Fertilizer were applied at the rate of 250, 120, 120, 40 and 5 kg/ha of N, P_2O_5, K_2O, S and Zn respectively. All Urea, TSP, MP, gypsum and zinc sulphate were applied as basal. One irrigation was given at initial growth stage. All the intercultural operations were done as and when necessary. Data on yield and yield attributes were collected and analyzed statistically. The soil salinity level during 06 Dec'04, 21 Dec.'04, 05 Jan '05, 20 Jan '05, 04 Feb'05, 19 Feb '05, 06 Mar '05, 21 Mar '05, 04 Apr '05, 19 Apr '05 and 03 May '05 were 3.00, 4.05, 6.10, 7.85, 9.10, 10.40, 10.75, 9.95, 8.50, 8.15 and 6.75mmhos/cm respectively.

Results and Discussion

Plant population/m^2, plant height, grains/cob, 100-grain weight and grain yield were significantly influenced by varieties. Performance of Maize varieties has been presented in Table 1. Pacific 11 took less time than BARI Hybrid Maize variety but grain yield was almost same for the two hybrids. Number of grains/cob and grain weight was less in hybrid maize which resulted overall lower yield.

Conclusion

From the study it was observed that BARI hybrid maize could not perform well in saline area. For more confirmation the experiment should be repeated in next year.

Table 1. Yield and yield attributes of Maize as affected by varieties at Banerpota farm, Satkhira during 2004-05

Variety	Days to maturity	Plant population/m2	Plant height (cm)	Cob/plant (No.)	Grain/cob (No.)	100-grain weight (g)	Grain yield (t/ha)
Pacific-11	134	3.07	166	1.87	242	34.75	4.12
BHM-2	140	2.35	177	1.62	377	27.25	3.15
BHM-3	140	2.38	163	1.72	323	25.25	3.31
BHM-5	140	3.32	131	1.87	387	30.00	4.16
LSD (0.05)	-	0.29	1.38	NS	18.52	3.80	0.08
CV (%)	-	6.59	1.00	9.30	3.48	8.13	1.43

Adaptive yield trial of Barley for saline area

Abstract

On-Farm performance of eight Barley lines/varieties namely BHL-04, BHL-05, BHL-07, BHL-08, BHL-10, BHL-11, BB-3 and BB-4 were evaluated at Banerpota farm, Satkhira during the rabi season 2004-05. BB-4 produced the significantly highest grain yield (1207kg/ha). BHL-08 produced the lowest yield (508 kg/ha). Further investigation in relation to screening and management practices need to be done.

Introduction

Barley is one of the important cereals of the world. In Bangladesh barley is cultivated as minor cereal. It can be grown in less fertile soil with minimum inputs. Barley is grown as food for poor people. In foreign country barley is used in a beverage industry for processing alcohol and wine. It is known that barley is a salt tolerant crop. In coastal area, vast lands remain fallow due to salinity in rabi and early kharif season. Barley may be cultivated in saline area. BARI has recently developed some high yielding barley lines. The performance of these lines needs to be evaluated in saline area. Keeping this in mind the trial was undertaken.

Materials and Methods

The trial was conducted at Banerpota farm, Satkhira during Rabi season, 2004-2005 with eight Barley lines/varieties namely BHL-04, BHL–05, BHL –07, BHL –08, BHL –10, BHL –11, BB-3 and BB-4 following RCB design with three replications. The unit plot size was 3m 52m. The crop was sown on 07 December 2004 as line sowing. Line to line spacing was 30cm. Fertilizer were applied at the rate of 100-60-40 kg/ha of N, P_2O_5, and K_2O respectively. All Urea, TSP and MP were applied as basal. To ensure germination, single irrigation was given at initial stage. All the intercultural operations were done as and when necessary. Data on yield and yield attributes were collected and analyzed statistically. The soil salinity level at the site during 06Dec'04, 21Dec.'04, 05Jan'05, 20Jan'05, 04Feb'05, 19Feb'05, 06Mar'05, 21Mar'05 and 04Apr'05 were 3.00, 4.05, 6.10, 7.85, 9.10, 10.40, 10.75, 9.95 and 8.50 mmhos/cm respectively.

Results and Discussion

Plant height, spike/m^2 spike length, grain/spike, 1000 grain weight and grain yield were significantly influenced by varieties/lines. Performance of Barley lines/varieties have been presented in table–1. The results revealed that the significantly highest grain yield (1207 kg/ha) was obtained from BB-4 Significantly lowest yield (508kg/ha) was obtained from BHL-08. The highest yield produced by BB-4 could be due to tallest plant, maximum spike/m^2, longest spike and maximum grain/spike. The lowest yield produced by BHL-08 could be due to shortest plant and minimum spike/m^2 and minimum grain/spike.

Conclusion

From the study it was observed that the variety BB-4 performed better in saline area in 2004-'05. Barley can be grown in Fallow-T.Aman-Fallow cropping pattern. For more confirmation the experiment should be repeated in next year.

Table 1. Yield and yield attributes of barley as affected by different lines/variety at Banerpota farm, Satkhira during rabi season 2004-05

Line/ Variety	Days to maturity	Plant height (cm.)	Spike/m^2 (no.)	Spike length (cm)	Grains/ spike (no.)	1000 seed wt. (g)	Grain yield (kg/ha)
BHL-04	100	61.67	113	5.60	26	30.33	623
BHL-05	100	66.67	105	5.70	30	29.33	522
BHL-07	100	63.00	103	6.20	29	30.67	558
BHL-08	100	60.67	95	5.93	27	29.33	508
BHL-10	103	68.00	111	5.70	31	30.67	673
BHL-11	103	62.33	118	5.53	31	31.67	733
BB-3	103	65.67	185	7.03	33	29.00	1053
BB-4	103	68.67	204	7.37	34	29.33	1207
LSD (0.05)	--	5.22	8.12	0.25	2.21	2.09	68.22
CV (%)	--	4.62	3.59	2.35	4.16	3.99	5.30

Adaptive yield trial of hull-less barley for coastal area

Abstract

The adaptive yield trial of hull less barley was conducted with barley lines viz. BHL-06, BHL-12, BHL-13, BHL-15, BHL-18, BHL-19, BB-3 and BB-4 at farmers' field of FSRD site, Atkapalia, Noakhali during the rabi season of 2004-05 to evaluate yield performance and suitability in the saline area. Among the different lines BHL-15 gave maximum yield (1.83 t/ha).

Introduction

Southern parts of the country covers an area of 25-30% of the total area of the country in saline zone (Quazi *et al.*, 1996) and remains fallow mostly during the rabi season. Barley is one of the crops which can tolerate salinity as well as drought. Plant Breeding Division of Bangladesh Agricultural Research Institute (BARI) recently developed some barley lines. These lines need to be verified at the farmers field to select suitable varieties for the saline area of Noakhali

Materials and methods

The experiment was conducted under rainfed condition at the farmers' field of FSRD site, Atkapalia, Noakhali during the rabi season of 2004-05. Six lines of barley viz. BHL-06, BHL-12, BHL-13, BHL-15, BHL-18, BHL-19 were compared with BB-3 and BB-4. All the lines were hull less. The experiment was laid out in a RCB design with three replications. The plot size was 3mx2 m. Fertilizer @ 100-60-40 kg of NPK/ha was applied as basal during the final land preparation. The seed rate was 100kg/ha. The seeds were sown in line with 30 cm spacing on last week of November. Diazon (2ml/L) was sprayed twice at 10 days intervals to control wireworm. Two times weeding were done. The crops were harvested on first week of March. During the experimental period salinity ranged from 1.6 to 7.5 ds/m. The data on yield and yield attributes were statistically analyzed and means were separated by DMRT.

Results and discussion

Eight different barley lines were tested to identity the salinity tolerance as well as highest yield performance. The result of yield and yield contributing characters were shown in Table1. The yield number of effective tiller and number of grains/spike was found higher in line BHL-15.Grain yield was maximum in line BHL-13 but statistically identical to all the lines except BHL-06 and BHL-12. Straw yield was not significantly influenced.

Conclusion

From the above result it was observed that BHL-15 gave higher yield and can be suitable for saline area.

Reference

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Table 1. Yield and yield attributes of Barley at the FSRD site, Atkapalia, Noakhali

Name of the variety	Plant height (cm)	No. of effective tillers/hill	Spike length (cm)	No. of grain/spike	Grain yield (t/ha.)	Straw yield (t/ha.)
BHL-06	83.59b	4.53ab	7.27bcd	47.12b	1.20c	1.70
BHL-12	81.83b	4.20ab	7.98a	49.47ab	1.35bc	1.73
BHL-13	82.63b	3.67b	7.03cd	48.60ab	1.48abc	1.97
BHL-15	78.17bc	4.80a	7.29bcd	55.60a	1.83a	2.37
BHL-18	81.73b	4.33ab	7.67ab	47.85b	1.62abc	2.10
BHL-19	76.57bc	4.20ab	7.60abc	54.03ab	1.53abc	1.90
BB-3	73.33c	4.70ab	6.93d	47.67b	1.69ab	1.98
BB-4	98.47a	4.20ab	7.67ab	46.47b	1.69ab	1.99
CV (%)	5.04	12.67	4.290	7.90	25.42	18.42
LSD (0.05)	4.437	0.588	0.342	4.204	0.422	0.389

Adaptive trial of improved varieties of Sweet Potato

Abstract

The experiment was conducted in the farmers' field of FSRD site, Atkapalia, Noakhali and at MLT site, Feni under rain fed condition during the Rabi season of 2004-05. Among the tested varieties BARI sweet potato varieties vary significantly with the local variety in respect of root yield and yield attributing characters. All the BARI varieties performed better than local variety in both the sites with more than double yield.

Introduction

Sweet potato grows well in char area of Noakhali and at Feni district. Farmers of coastal areas are growing only local sweet potato variety, which are low yielder. Recently BARI has developed some new varieties of sweet potato. So, these varieties need to be identifying for this area.

Materials and Methods

The experiment was conducted at Atkapalia, FSRD site of Noakhali and MLT site of Feni under rain fed condition during the Rabi season of 2004-05 in the farmers' field. The experiment was laid out in RCB design with three dispersed replications. BARI has already developed sweet potato varieties viz. BARI sweet potato-4, BARI sweet potato-5, BARI sweet potato-6, BARI sweet potato-7 and Kamalasunduri. The later variety was included at MLT site, Feni. The unit plot size was 6m x 5m. Fertilizers were applied at the rate of 114-92-57.5 (N-P-K kg/ha) during final land preparation. Vines were planted in line with 60cm x 30cm spacing in the 3rd week of December 2004. Two weedings were done during the crop growth period. Earthing up was done at optimum time. Harvesting was done in the 1st week of May 2005. Data on yield and yield contributing characters were recorded and means were separated with Duncan's Multiple Range Test (DMRT).

Results and Discussion

FSRD Site, Atkapalia

Yield and yield performance of sweet potato varieties are presented in Table 1. Higher number of root per plant was found in BARI sweet potato-7 that was statistically similar to BARI sweet potato-4 while the lowest number of root per plant was recorded in local variety. Higher root weight per plant was found in BARI sweet potato-7 which was statistically similar to all varieties of BARI. The lowest root weight per plant was observed in local variety.

MLT Site, Feni

Yield and yield performance of sweet potato varieties are presented in Table 2. Higher number of root per plant was found in BARI sweet potato-5 that was statistically similar to BARI sweet potato-6, BARI sweet potato-7 and Kamalasunduri. The lowest number of root per plant was recorded in BARI sweet potato-4. Highest root weight per plant was found in BARI sweet potato-6 that was statistically similar to BARI sweet potato-7 and BARI sweet potato-5. The lowest root weight per plant was observed in Kamalasunduri. Similar trend was followed in case of root yield.

Farmers' Reaction

FSRD Site, Atkapalia: Yield and yield contributing characters of all BARI sweet potato varieties are better but these are not acceptable to the farmers due to their over size, taste, colour and lower market price. So, they are not interested in BARI varieties over local variety.

MLT Site, Feni: Yield and yield contributing characters are better of all BARI sweet potato varieties except Kamalasunduri but taste, market price are good of BARI sweet potato-6. So they are interested in this variety.

Table 1. Yield and yield attributes of Sweet Potato as influenced by different varieties at Atkapalia FSRD site of Noakhali during 2004-05

Variety	No. of root/plant	Root weight/plant (g)	Root yield (t/ha)
BARI sweet potato-4	2.87ab	1021.0a	23.64ab
BARI sweet potato-5	2.57bc	998.3a	21.36abc
BARI sweet potato-6	2.47bc	973.7a	19.06bc
BARI sweet potato-7	3.53a	1023.0a	27.23a
Local variety	1.70c	699.0b	15.21c
LSD (0.05)	0.86	58.45	6.17

Table 2. Yield and yield attributes of Sweet Potato as influenced by different varieties at Feni MLT site of during 2004-05

Variety	No. of root/plant	Root weight/plant (g)	Root yield (t/ha)
Kamalasunduri	5.43ab	780.0c	17.00c
BARI sweet potato-4	4.23c	846.7b	19.92b
BARI sweet potato-5	5.70a	1002.0a	22.79a
BARI sweet potato-6	5.53ab	1052.0a	23.49a
BARI sweet potato-7	5.43ab	1033.0a	22.15a
Local variety	4.93b	797.3bc	11.95d
LSD (0.05)	0.68	58.40	2.08

On-farm adaptive trial of advanced lines of Groundnut

Abstract

An adaptive trial was conducted in the farmers' field of MLT site, Laxmipur during the Rabi season of 2004-05 to evaluate the performance of some groundnut varieties in char area. BARI Chinabadam-6 along with advanced lines (ICGV 94322) performed better yield. The highest nut yield (3.12 t/ha) was recorded in ICGV 94322 that was statistically identical with BARI Chinabadam-6 (3.09 t/ha) while the lowest nut yield was found in Maijchar Bad am (2.54 t/ha).

Introduction

Most of the farmers of the coastal area of Laxmipur cultivate local variety of groundnut with traditional management practices resulting very low yield compared to HYV. Oilseed Research Center of BARI selected some advanced lines of groundnut on the basis of their performance in the regional yield trials. The yield performances of the selected materials need to be tested in the farmer's field before recommendation as variety for cultivation. So, the present study was undertaken to evaluate the performance of some advanced lines along with BARI released variety of groundnut under farmers' field condition.

Materials and Methods

The study was conducted at MLT site Laxmipur during Rabi season of 2003-04. Five groundnut varieties/lines namely; JX 87015 SLI, ICGV 94322, Zhingabadam, Maijchar Badam (DA-1) and BARI Chinabadam-6 were included in the study. The experiment was laid out in RCB design with three replications. The soil of the experimental site belongs to Ramgoti soil series and Meghna Estuarine Food Plain under AEZ 18. Unit plot size was 4m x 2m. Nutrient dose of 10-70-50 kg/ha of NPK, respectively were applied in the form of Urea, TSP and MP. All fertilizers were applied as basal dose during final land preparation. Seeds were sown in lines maintaining 30 cm x 10 cm spacing. Seed sowing was done from last week of December 2004 to first week of January 2005 and harvesting was done in the first week of May 2005. During the experiment period salinity range was 1.2 to 5.5 ds/m.

Results and Discussion

Yield and yield attributes are presented in Table 1. Significant the highest number of branch/plant was recorded in BARI Chinabadam-6 and the lowest number of branch/plant (5.93) was found in Maijchar Badam. The maximum pod per plant was recorded in ICGV 94322 that was followed by other varieties except Maijchar Badam. Seeds/pod was similar in both the lines and higher than other variety. But in case of the weight of 100-kernels was obtained from BARI Chinabadam-6 followed by ICGV 94322. The higher nut yield was recorded in ICGV 94322 that was statistically identical with BARI Chinabadam-6 while the lowest nut yield was found in Maijchar Badam.

From one year result showed that BARI chinabadam 6 and advanced two lines performed better at Laxmipur site.

Farmer's reaction: Farmers of the experimental site preferred ICGV 94322 line for smooth & bigger nut/kernels along with higher nut yield. They also preferred BARI Chinabadam-6 due to its better germination and good market price. But they disliked Maijchar badam due to its smaller nut, low nut yield and low market price.

Table 1. Performance of advanced groundnut varieties/lines in the coastal area of MLT site, Laxmipur during 2004-05

Variety	Plant ht (cm)	Branch/ Plant	No. of pod/plant	No. of seed/pod	100 kernel wt (g)	Yield (t/ha)
JX87015 SLI	54.63a	5.89c	24.47a	3.13a	47.00b	3.02bc
ICGV94322	45.33c	7.90b	26.03a	3.60a	53.33a	3.12a
Ghina badam	54.78a	6.19c	23.98ab	2.97b	44.67c	2.96c
BARI chinabadam-6	47.81bc	8.53a	25.45a	3.02b	54.67a	3.09ab
Maijchar badam	51.73ab	5.93c	22.20b	2.67c	39.33d	2.54d
LSD (0.05 %)	5.04	0.40	1.83	0.32	2.09	0.08

On-Farm adaptive trial of advanced lines of groundnut

Abstract

The experiment was conducted at farmer's field at Cox's Bazar during December 2004 to April 2005 to evaluate to the performance of developed and advanced lines of groundnut (JX87015-SL1, ICGV 94322 and Dhaka-1, BARI Badam-6 with local one). The line JX87015-SL1 showed the best performance with higher yield but BARI badam 6 also showed reasonable yield.

Introduction

BARI has released a number of groundnut varieties and some advanced lines were found suitable. These developed and advance lines need to disseminate among the farmers at different locations. Hence the proposed study was taken in hand to compare these with local one at Cox's Bazar in Chittagong region.

Materials and Methods

The experiment was conducted at farmers field at Cox's Bazar of Chittagong region during December 2004 to April 2005 to evaluate the performance of some varieties of groundnut under farmers condition JX87015-SL1, ICGV 94322, BARI Badam-6, Dhaka-1 and local were tested. The experiment was conducted in RCB design with four dispersed replications. The land comprised of revering silted soil. The groundnut varieties were sown at 18-19 December 2004 and harvested 15-23 April 2005. The unit plot was 50 m^2 with spaced 30 cm × 15cm. Fertilizer was applied at the rate of 12:31:43:30 kg/ha NPKS in the form of Urea, TSP, MP and Gypsum , respectively. Intercultural operations were done as and when necessary. Data on number of nut per plant, weight of nut per plant at randomly selected 10 plants and nut yield on 10 m^2 area basis and analysed statistically. Farmers comments were also recorded.

Results and Discussion

The higher number of nut per plant was found in Dhaka-1 followed by BARI Badam 6 and the lowest in local one. The higher weight of nut was found in JX87015-SL1 followed by BARI Badam-6. But significantly the highest nut yield was found in JX87015-SL1.

Farmers' reaction

The line JX87015-SL1 and BARI Badam-6 may be disseminated in large scale at Cox's Bazar as those lines/ varieties are high yielder than local one.

Table 1. Nut yield and yield contributing characters of groundnut conducted at Cox's Bazar MLT Site in 2004-05

Variety	Nut/Plant (No.)	Nut wt/plant (g)	Nut yield (t/ha)
Dhaka-1	43.57a	81.38c	1.80d
BARI badam-6	40.67ab	96.24a	3.02b
ICGV 94322	33.90c	90.33 b	2.42c
JX87015-SLI	38.67bc	97.83a	3.69a
Local	34.40c	70.67d	1.58d
CV (%)	6.77	6.84	9.24
LSD (0.05)	4.65	5.91	0.60

Adaptive trial of Linseed, Niger and Safflower

Abstract

Five varieties of three minor oil seed crops viz. Safflower (Saf-1), linseed (Neela) and Niger (Shova, Nig-107 and Nig-1100) were studied at the FSRD site, Atkapalia, Nokhali during the rabi season 2004-05. Among the varieties of Niger, Nig-1100 performed the best yield (1.36 t/ha) followed by shova (1.07 t/ha). Variety Saff-1 and Neela produced 1.1 and 1.14 t/ha seed yield, respectively.

Introduction

Safflower (*Carthamus tinctorius* L), Niger (*Guizotia abyssinica* Coss) and Linseed (*Linum usitatissimum* L) are a new oil seed crop in Bangladesh. The climatic condition of Bangladesh favours its growth and its cultivation in winter season. Bangladesh Agricultural Research Institute has developed one variety and two lines of niger viz. Shova, Nig-107 and Nig-1100 respectively. Oil and fibre can be extracted from seeds and stem of linseed respectively. Bangladesh has been facing acute shortage of edible oil for the last decades. The shortage of edible oil has been a chronic problem for nation as the population increases. The aforesaid minor oil crop can play an important role in reducing the chronic shortage of edible oil in the country. Considering the above information, an on-farm adaptive trial of linseed, niger and safflower were undertaken at FSRD site, Atkapalia, Noakhali with objective to evaluate the performance of this minor oil crop in coastal area.

Materials and Methods

The experiment was conducted under rainfed condition at FSRD site, Atkapalia, Noakhali during the rabi season 2004-05. The design of the experiment was RCB with three replications. The unit plot size was 2m x 1m. The varieties of minor oil seed crops eg. Safflower (var. Saff-1) Linseed (var. Neela) and niger (Shova, Nig-107 and Nig-1100) were selected as treatment. Field was fertilized with 75, 120 and 50 kg/ha of area, TSP and MP respectively. All fertilizers were applied as basal dose during the final land preparation. During the experimental period salinity ranged from 1.2 to 4.1 ds/m. The collected data were analyzed and means were separated with DMRT.

Results and Discussion

Niger: Five oil seed varieties belong to three oil seed crops were studied. The yield and yield attributes of these varieties were presented in Table 1 and 2. All the parameters related to yield was found significantly the highest in Nig-11000. Plant population/plot between Nig-107 and Nig-11000 were statistically similar. Head/plant was significantly higher in Nig-11000 but seeds/head was similar in Shova and Nig-11000. Significantly the highest seed weight was recorded from Nig-11000. The highest seed yield was recorded from Nig-11000 due to higher yield attributes.

Safflower: Both the crop showed similar yield but yield higher in plants/m^2 and head/plant was recorded from Neela. In contrast, higher seeds/head and 1000-seed weight was obtained from Saf-1.
From one year result showed that Niger variety Nig-11000, Safflower (var. Saf-1) and Linseed (var. Neela) performed better and reasonable yield for Noakhali area.

Table 1. Yield and yield contributing characters of different varieties of Niger at the FSRD site, Atkapalia, Noakhali

Variety	Plant pop^n/plot	Plant height (cm)	Head/ plant	Seeds/ head	1000seed wt. (g)	Seed yield (t/ha)
Shova	112.0b	49.83	20.57b	19.27ab	3.50b	1.07b
Nig-107	203.0a	46.63	22.50b	17.13b	2.83c	0.98b
Nig-11000	207.7a	46.67	26.17a	24.03a	4.17a	1.36a
CV (%)	2.68	5.98	14.23	14.16	8.18	9.88
LSD (0.05)	10.58	NS	3.24	6.554	0.4646	0.23

Table 2. Yield and yield contributing character of safflower and Linseed

Variety	Plant pop^n/pot	Plant height (cm)	Head/ plant	Seeds/ head	1000-seed wt. (g)	Yield (ton/ha.)
Saff-1	257.33	55.73	11.00	14.73	19.16	1.1
Neela	670.66	56.20	29.33	8.40	4.00	1.14

Adaptive trial of improved varieties of Sweet Potato

Abstract

The experiment was conducted at FSRD site, Lebukhali, Patuakhali during 2004-05 with eight sweet potato varieties viz. Daulatpuri, Kamalasunduri, Kalomegh, Lalkuti, Tripti, BARI SP-4 and BARI SP-5, and local one to find out improved varieties for Barisal -Patuakhali region. Kamalasunduri variety yielded highest (42.9 ton/ha) followed by Lalkuti, BARI sweet potato-4 and BARI Sweet potato-5 and Kalomegh. Among these varieties local variety produced the lowest yield (16.7 t/ha). Among BARI varieties, Daulatpuri was preferred most by the farmers.

Introduction

Sweet potato is one of the major rabi crops grown in Barisal-Patuakhli region. In this region farmers usually grow local variety of low yield potential (8-10ton/ha). Recently BARI has improved some sweet potato varieties like Tripti, Kamala sundari, BARI SP-4 and BARI SP-5. These improved varieties need to disseminate among the farmers. The experiment was laid down with this view to compare the improved varieties with the farmers' used variety.

Materials and Methods

The experiment was conducted in RCBD with 4 replications at FSRD site, Lebukhali, Patuakhali during 2004-2005 with eight sweet potato varieties viz. Daulatpuri, Kamalasunduri, Tripti, BARI SP-4 and BARI SP-5, Kalomegh, Lalkuti and local one. Unit plot size was 6m x 3m and spacing was 60cm x 30cm. The crop was planted 3 December 2004 and was harvested on 30 April 2005. The fertilizer doses were as per TCRC recommendation (50-24-50 kg/ha N-P-K). Total amount of TSP and MP and one fourth of urea were applied during final land preparation. The rest of urea was top dressed followed by earthing up after 60 days of planting. Others intercultural operations were done as per required.

Results and Discussion

The mean data reveals that the highest tuber yield was obtained from Kmalasunduri (42.9 ton/ha) followed by Lalkuti, BARI sweet potato-4, Tripti, BARI Sweet potato-5, Kalomegh, Daulatpuri whereas local variety produced the lowest yield (16.7 t/ha). There was no disease development and pest infestation in this season. Yield of BARI varieties is much higher than that of local variety althogh these are not preferred by farmers.

Table 1. Yield & yield contributing characters of some sweet potato varieties

Varieties	No of tuber/plant	Individual tuber weight (g)	Tuber weight /plant (g)	Yield (t/ha)
Lalkutir	6.4	120	768.0	37.6
BARI-5	5.6	110	616.0	33.5
BARI-4	7.0	106	742.0	37.2
Kamlasundri	5.7	145	826.5	42.9
Kalomegh	6.7	95	636.5	33.4
Tripti	5.0	125	625.0	33.7
Daulatpuri	6.0	95	570.0	30.6
Local	4.3	74	318.2	16.7
CV (%)	8.9	6.4	5.5	7.3
LSD (0.05)	1.3	15.5	115.4	3.2

Farmers' reaction

1. BARI SP-4 & 5 do not taste sweet like local and Daulatpuri
2. BARI SP-4 gets cracked on boiling whereas local and Daulatpuri do not crack
3. BARI varieties can not be stored as long as local variety
4. Among BARI varieties, farmers preferred Daulatpuri as its taste and sweetness similar to local variety.

On-farm adaptive trial of Linseed, Niger and Safflower

Abstract

The experiment was conducted at Multilocation Testing (MLT) site at Kalapara, Patuakhali during rabi season of 2004-2005 to determine salt tolerant oilseed genotypes in this locality. Five genotypes viz., Neela for Linseed; Shova, Nig-107, Nig-11000 for Niger and Saff-1 for Safflower were evaluated in RCBD with three replications under rainfed condition. Among three crops, Safflower (var. Saff-1) yielded higher whereas Nig variety of niger showed slightly higher yield in niger. Linseed did not perform well.

Introduction

Linseed, Niger and Safflower are small holder crops which have been growing in the fallow char and marginal land under rainfed condition. Oil and fibre both are yielded from Linseed and it has a good utilization as industrial oil. Niger and Safflower are also promising oilseed crops in the country. An attempt was taken to find out the yield potential of minor oilseed crops in Barisal-Patuakhali region.

Materials and Methods

The experiment was conducted at Multilocation Testing (MLT) site at Kalapara, Patuakhali during rabi season of 2004-2005 under rainfed condition to determine salt tolerant oilseed genotypes in this locality. Total five genotypes viz. Neela for Linseed; Shova, Nig-107, Nig-11000 for Niger and Saff-1 for Safflower were sown on December 28, 2004 and harvested during April 3-7, 2005. The experiment was laid out in RCBD with three replications. The unit plot size was 3m x 1m and plot fertilized with Urea, TSP and MP @ 75, 120 and 50 kg/ha respectively.

Results and Discussion

Among the crops, Safflower (var. Saf-1) showed reasonable good yield (1368 kg/ha) whereas linseed did not perform well. Three niger varieties yield was within 588-750 kg/ha where higher yield was recorded from Nig-107.

Farmers' reaction

1. Cost of production including labour cost is lower than other rabi crops though yield is also lower.
2. Lack of marketing facilities could be major problem for adoption of these crops in this area.

Table 1. Yield & yield contributing characters of Linseed, Niger and Safflower

Crop	Variety	Plant height (cm)	Plant pop. / m^2	Heads/ Plant	Seed/ Head	1000 seed wt (g)	Seed yield (kg/ha)
Linseed	Neela	52	60	22	11.5	3.4	516
Niger	Shova	60	62	23	12.7	3.25	588
	Nig-107	54	60	22	17.5	3.25	750
	Nig-11000	60	68	25	11.5	3.20	625
Safflower	Saff-1	65	25	13	14.6	28.40	1368

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SUBPROJECT: CROPPING PATTERN BASED FERTILIZER MANAGEMENT

Development of fertilizer recommendation for different cropping patterns and environments

Abstract

The experiment was conducted at 28 different locations across the country during 2001-02 to 2003-04 to develop a cropping pattern based fertilizer recommendation with emphasis on IPNS for dominant cropping patterns under different AEZ. A total of 15 (fifteen) dominant cropping patterns all over the country were tested against six different nutrient management packages (soil test based fertilizer dose for MYG & HYG, IPNS for HYG, FRG '97, farmers practice and absolute control). In general, higher yield as well as gross margin was recorded from STB fertilizer dose for HYG (T_2) and IPNS (T_3) treatment irrespective of locations. But marginal benefit cost ratio (MBCR) over control was higher in AEZ based fertilizer recommendation (FRG '97) and as well in STB fertilizer dose for MYG & HYG. In IPNS treatment due to cost of organic manure MBCR was less compared with other treatments. In some locations the experiment was completed for three cycles. Based on three years results and considering yield, economic return as well as soil fertility concern the recommendation were proposed for different cropping patterns at different locations.

Introduction

Soil fertility is a dynamic property which varies with crops, cropping intensity and input use. More than 50% of our cultivated soil contain organic matter below the critical level (1.5%). 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 cultivated land which is in most cases deficient in essential nutrients such as nitrogen, phosphorus, potassium and sulphur. 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 fertilizers. Scarcity of fuel led them to use cowdung and crop residues as domestic fuel. To maintain and improve soil fertility and organic matter content of the soil it felt necessary to use organic manures 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. BARC developed a national fertilizer recommendation guide '97 that needs to be further updated and verified for different dominant cropping patterns at different environments. Therefore, it is very important to develop a cropping pattern based fertilizer recommendation under different agro-ecological conditions considering the above mentioned issues.

Objectives

- To verify different nutrient management approaches
- To find out a cropping pattern based fertilizer recommendation for dominant cropping patterns in different AEZ
- To determine the economic dose of fertilizer for pre-dominant cropping patterns

Materials and Methods

The experiment was conducted at 28 different locations across the country during 2001-02 to 2003-04. A total of 15 dominant cropping patterns were tested under different AEZs. The experiment was laid out in RCB design with six dispersed replications. The following six fertilizer management packages were tested-

T_1 (ED1) = Estimated inorganic fertilizer dose for moderate yield goal
T_2 (ED2) = Estimated inorganic fertilizer dose for high yield goal
T_3 (IPNS) = Integrated Nutrient Management for HYG
T_4 (FRG '97) = Fertilizer dose from BARC Fertilizer Recommendation Guide'97
T_5 (FP) = Farmers' practice
T_6 (Control) = Absolute control

The treatment concept was to compare the soil test based (STB) inorganic fertilizer dose for High Yield Goal (HYG), Moderate Yield Goal (MYG), the high yield goal integrated with organic manure with current BARC's Fertilizer Recommendation Guide '97 as well as the farmers prevailing practices. Details of the site characteristics and crop management are given in appendix table 1 & 2. The different cropping patterns studied at different locations are as follows-

Different cropping patterns tested in different locations

Sl #	Cropping pattern	Location
1.	Mustard-Boro-T.Aman	Netrakona, Phulpur, Nandigram and Gabtali
2.	Wheat-Jute-T.Aman	Sherpur, Palima, Ishan Gopalpur and Lakmonirhat
3.	Boro-T.Aman	Feni
4.	Potato-Jute-T.Aman	Melandah
5.	Groundnut-T.Aman	Atkapalia, Laxmipur and Natore
6.	Potato-T.Aman	Barind, Paba
7.	Potato-Boro-T.Aman	Syedpur
8.	Potato-T.Aus-T.Aman	Katiadi and Kishoreganj
9.	Boro-T.Aus-T.Aman	Chandina
10.	Mustard-Boro	Mymensingh, B. Baria and Manikganj
11.	Chilli - T.Aman	Lebukhali and Hathazari
12.	Maize - T.Aman	Goyeshpur
13.	Wheat-T.Aman	Boda
14.	Sesame-T.Aman	Dumuria
15.	Wheat-Mungbean-T.Aman	Jhenaidah

Fertilizer dose (kg/ha) of different cropping patterns tested in different locations

Netrakona

Treatment	Mustard (N-P-K-S-Zn-B-CD)	Boro rice (N-P-K-S)	T.Aman rice (N-P-K-S)
T_1	68-24-38-26	98-23-67-17	68-17-49-10
T_2	95-31-55-32	168-33-94-23	92-21-62-13
T_3	65-21-25-32-10 t/ha CD	168-33-94-23	92-21-62-13
T_4	70-15-25-15	120-18-20-5	60-8-30-4
T_5	48-13-13-0	133-12-15-11	85-0-0-0
T_6	0-0-0-0-0-0-0	0-0-0-0	0-0-0-0-0

Phulpur, Mymensingh

Treatment	Mustard (N-P-K-S-Zn-B)	Boro rice (N-P-K-S)	T.Aman rice (N-P-K-S)
T_1	84-25-39-26	90-15-68-17	66-11-48-11
T_2	118-31-56-32	126-22-95-24	84-13-61-14
T_3	88-21-26-32	126-22-95-24	84-13-61-14
T_4	70-15-25-15	100-12-40-7	60-8-30-4
T_5	55-20-20-0	113-18-31-0	82-0-0-0
T_6	0-0-0-0-0-0-0	0-0-0-0	0-0-0-0

Mymensingh sadar

Treatment	Mustard (N-P-K-S-Zn-B-CD)	Boro (N-P-K-S-Zn-CD)
T_1	86-26-44-26-0.5	93-13-33-7
T_2	120-34-64-32-1	130-19-45-9
T_3	90-24-34-32-1-1o t/ha CD	130-19-45-9
T_4	70-15-25-15	100-12-50-7
T_5	54-60-15-0	115-8-14-4
T_6	0-0-0-0	0-0-0-0

Nandigram, Bogra

Treatment	Mustard (N-P-K-S-Zn-B-Oilcake)	Boro rice (N-P-K-S-Zn-B)	T.Aman rice (N-P-K-S-Zn-B)
T_1	60-19-45-19-opt.-1	87-17-79-13- opt.	60-12-55-8- opt.
T_2	84-25-66-24- opt.-1.5	122-25-111-19- opt.	82-15-70-11- opt.
T_3	69-20-61-24- opt.-1.5 (+5 t CD/ha)	107-20-96-19- opt. (+ 5 t CD/ha)	67-10-55-11- opt. (+ 5 t CD/ha)
T_4	70-20-35-20- 1-0.5	100-15-60-8-0	75-12-40-5-0
T_5	69-15-38-14-0-0	90-25-40-15-1	51-15-34-10-0.5
T_6	0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0-0

Gabtali, Bogra

Treatment	Mustard (N-P-K-S-Zn-B-Oilcake)	Boro rice (N-P-K-S-Zn-B-Oilcake)	T.Aman rice (N-P-K-S-Zn-B-Oilcake)
T_1	65-28-29-14-1-0.5-0	94-20-47-11-1.3-0	65-15-33-7-1-0
T_2	88-37-42-17-1.5-0.5-0	132-29-66-16-2-0	88-17-42-9-1.5-0
T_3	68-30-37-17-1.5-0.5-400	112-22-61-16-2-0-400	68-10-37-9-1.5-0-400
T_4	65-15-30-15-1-1-0	100-15-40-10-1-0	65-5-30-3-0
T_5	52-15-27-14--0-0	69-12-26-7-0-0	52-10-26-0-0
T_6	0-0-0-0-0-0-0	0-0-0-0-0-0-0	0-0-0-0-0-0-0

Sherpur

Treatment	Wheat (N-P-K-S-Zn-MOC)	Jute (N-P-K-S)	T.Aman (N-P-K-S)
T_1	100-20-50-17-1-0	80-15-50-10	70-10-40-7
T_2	125-30-75-27-1.5-0	120-20-80-20	100-15-50-10
T_3	75-10-50-27-1.5-500	90-10-70-20	75-7-44-10
T_4	80-17-40-12-1.0-0	30-4-15-20	70-8-25-4
T_5	30-22-28-0-0-0	30-25-31-12	58-3-31-0
T_6	0-0-0-0-0-0	0-0-0-0	0-0-0-0

Melandah, Jamalpur

Treatment	Potato (N-P-K-S-Zn-B-CD)	Jute (N-P-K-S)	T.Aman (N-P-K-S)
T_1	90-20-70-7-1-0	70-8-40-5	65-8-30-3
T_2	130-30-100-11-1.5-0	100-10-50-7	90-10-35-4
T_3	100-20-70-11-1.5-10 t/ha CD	100-10-50-7	90-10-35-4
T_4	90-15-50-10-1-0	40-7-20-3	60-8-30-4
T_5	95-40-65-15-2.5-6 t/ha CD	45-2-0-0	90-7-10-0
T_6	0-0-0-0-0	0-0-0-0-0	0-0-0-0-0

Palima, Tangail

Treatments	Wheat (N-P-K-S-Zn-CD)	Jute (N-P-K-S)	T.Aman (N-P-K-S)
T_1	109-30-73-18-0.2	81-10-42-8	71-19-39-9
T_2	125-41-75-36-0.5	113-13-60-11	97-12-40-6
T_3	110-21-50-36-0.5-5t/ha CD	113-13-60-11	97-12-40-6
T_4	60-15-25-8-1	55-7-25-5-1	40-6-15-2
T_5	55-12-15-0-0	58-21-31-0	58-3-31-0
T_6	0-0-0-0	0-0-0-0	0-0-0-0

Ishan Gopalpur, Faridpur

Treatments	Wheat (N-P-K-S-Zn-CD)	Jute (N-P-K-S)	T.Aman (N-P-K-S)
T_1	73-25-35-7-2	65-9-35-3	57-8-25-1.5
T_2	100-35-50-10-2	85-12-50-5	78-10-33-2
T_3	70-25-20-10-2+10 ton/ha	85-12-50-5	78-10-33-2
T_4	75-20-25-10-2	65-7-20-3	60-6-16-4
T_5	105-21-26-14	31-11-44-0	90-20-25-15
T_6	0-0-0-0	0-0-0-0	0-0-0-0

Jhenaidah

Treatments	Wheat (N-P-K-S-Zn-CD)	Mungbean (N-P-K-S)	T.Aman (N-P-K-S)
T_1	77-25-38-3-2	16-6-8-1-0	60-7-18-2-0
T_2	110-34-54-5-3	22-9-11-2-0	82-9-23-2-0
T_3	95-29-39-5-3+ CD 5 t/ha	22-9-11-2-0	82-9-23-2-0
T_4	90-20-35-10-2	20-10-10-6-0	70-6-20-4-0
T_5	74-21-26-19-2	20-5-8-0-0	87-21-26-14-4
T_6	0-0-0-0-0	0-0-0-0-0	0-0-0-0-0

Feni

Treatment	Boro (N-P-K-S-Zn-B-CD)	T.Aman
T_1	130-33-86-20-1.5-0	90-12-60-12-1
T_2	183-47-120-28-2-0	122-14-77-16-1.5
T_3	168-42-105-28-2-0 + CD 5t/ha	122-14-77-16-1.5
T_4	95-20-40-10-1	65-7-25-4-0
T_5	85-20-60-0	76-16-30-0
T_6	0-0-0-0-0-0	0-0-0-0-0

Atkapalia, Noakhali

Treatment	Groundnut (N-P-K-S)	T.Aman (N-P-K-S)
T_1	21-33-24-0-0	66-12-22-0-1
T_2	30-43-34-0-0	90-14-29-0-1.5
T_3	15-38-19-0-0 + CD 5 t/ha	90-14-29-0-1.5
T_4	20-20-25-12-1	65-7-25-4-0
T_5	6-24-0-0-0	38-16-0-0 + CD 1.25 t/ha
T_6	0-0-0-0-0	0-0-0-0

Laxmipur

Treatment	Groundnut (N-P-K-S)	T.Aman (N-P-K-S)
T_1	20-30-10-0	60-12-14
T_2	30-40-15-0	80-15-23
T_3	18-35-10-0+ CD 5 t/ha	80-15-16
T_4	20-20-25-12	65-7-25-4
T_5	6-24-0-0	36-6-0-0
T_6	0-0-0-0	0-0-0-0

Barind, Rajshahi

Treatments	Potato (N-P-K-S-Zn-B)	T.Aman (N-P-K-S)
T_1	106-22-37-8-2.5-0.8	74-9-16-6
T_2	147-32-54-18-4-1.0	100-11-20-8
T_3	138-27-48-18-4-1.0 + Cd 10 t/ha	100-11-20-8
T_4	161-30-132-18-2.5-1.0	75-12-40-5
T_5	207-70-210-18-2-1.0	62-13-16-8
T_6	0-0-0-0-0-0	0-0-0-0

Lalmonirhat

Treatments	Wheat (N-P-K-S-Zn-CD)	Jute (N-P-K-S)	T.Aman (N-P-K-S)
T_1	90-14-58-20-10-3-0-0	80-7-43-8	70-3-30-5
T_2	130-20-80-30-15-4-0-0	112-9-60-12	100-4-38-7
T_3	108-13-58-30-15- 4-0-5000	112-9-60-12	100-4-38-7
T_4	85-20-30-12-0-1.5-1-0	70-7-20-5	65-7-20-3
T_5	70-23-32-12-0-0-0-7000	48-0-0-0	78-19-28-11
T_6	0-0-0-0-0-0-0-0	0-0-0-0	0-0-0-0

Syedpur

Treatment	Potato (N-P-K-S-Mg-Zn-B-CD)	Boro (N-P-K-S)	T.Aman (N-P-K-S)
T_1	95-17-98-12-10-2-1-0	95-7-51-8	65-5-36-5
T_2	135-25-140-17-15-3-1.5-0	135-10-71-11	90-7-46-7
T_3	105-15-110-17-15-3-1.5-10000	135-10-71-11	90-7-46-7
T_4	100-20-50-8-0-1-0-0	100-10-20-5	65-7-20-3
T_5	110-48-160-20-0-4-1-7500	69-0-0-0	97-18-28-0
T_6	0-0-0-0-0-0-0-0	0-0-0-0	0-0-0-0

Katiadi, Kishoreganj

Treatment	Potato (N-P-K-S-Zn-B-CD)	T.Aus (N-P-K-S)	T.Aman (N-P-K-S)
T_1	96-23-66-12-0	66-8-21-05	66-8-21-5
T_2	135-32-107-17-0	90-9-29-6	90-9-29-6
T_3	120-27-92-17-5000	90-9-29-6	90-9-29-6
T_4	90-15-50-10 -0	60- 08-30-04	60-08-30-4
T_5	124-51-150- 0-10000	50-10-17-0	52-14-25-2
T_6	0-0-0-0-0	0-0-0-0-0	0-0-0-0-0

Kishoreganj sadar

Treatment	Potato (N-P-K-S-Zn-B-CD)	T.Aus (N-P-K-S)	T.Aman (N-P-K-S)
T_1	90-20-69-11-0	61-7-24-5	61-7-24-05
T_2	120-29-98-16- 0	84-8-31-6	84-8-31-6
T_3	111-24-83-16-5000	84-8-31-6	84-8-31-6
T_4	90-15-50-10-0	60-8-30-4	60-8-30-04
T_5	152-45-75-0-11000	50-0-0-0	96-16-24-0
T_6	0-0-0-0-0	0-0-0-0-0	0-0-0-0-0

Chandina, Comilla

Treatment	Boro (N-P-K-S-Zn)	T.Aus (N-P-K-S)	T.Aman (N-P-K-S)
T_1	83-13-48-12	57-5-33-4	57-5-33-4
T_2	117-18-67-16	78-6-43-5	78-6-43-5
T_3	102-13-52-16-5t/ha CD)	78-6-43-5	78-6-43-5
T_4	95-20-40-10	65-7-25-4	65-7-25-4
T_5	120-60-100	110-25-44	110-25-44
T_6	0-0-0-0	0-0-0-0	0-0-0-0

Brahman Baria

Treatment	Mustard (N-P-K-S-Zn-B-CD)	Boro (N-P-K-S-Zn-CD)
T_1	83-13-48-12	83-13-48-12
T_2	117-18-67-16	117-18-67-16
T_3	102-13-52-16 + (CD 5t/ha)	102-13-52-16+ (CD 5t/ha)
T_4	95-20-40-10	95-20-40-10
T_5	120-60-100	120-60-100
T_6	0-0-0-0	0-0-0-0

Lebukhali, Patuakhali

Treatment	Chilli (N-P-K-S)	T.Aman (N-P-K)
T_1	95-81-76	46-15-25
T_2	123-105-98	65-19-35
T_3	93-95-68 + CD 10 t/ha	65-19-35
T_4	65-40-50	30-3-15
T_5	60-25-0	60-0-0
T_6	0-0-0	0-0-0

Hathazari, Chittagong

Treatment	Chilli (N-P-K-S-B)	T.Aman (N-P-K)
T_1	106-17-106-18-1	71-5-32-5
T_2	138-22-138-23-1	97-5-41-6
T_3	108-3-117-23-1-3 t/ha PM	97-5-41-6
T_4	100-40-70-15	45-4-20-3
T_5	93-57-82-0	43-23-0-0
T_6	0-0-0	0-0-0

Goyeshpur, Pabna

Treatments	Maize (N-P-K-S-Zn-B)	T.Aman (N-P-K-S-Zn)
T_1	139-45-58-24-5.5-0.6	61-11-18-4
T_2	181-59-76-31-5.5-0.7	84-13-23-6
T_3	115-41-53-18-5.5-0.7-5 t/ha PM	84-13-23-6
T_4	260-55-114-34-5.5-0.8	70-6-20-4
T_5	173-38-94-27-5	75-16-29-4
T_6	0-0-0-0-0	0-0-0-0-0

Boda, Panchaghar

Treatment	Wheat (N-P-K-S)	T.Aman (N-P-K-S)
T_1	84-14-53-20-1-0.6	67-4-37-8-1-0
T_2	120-20-75-30-1.4-0.8	90-5-47-10-1.5-0
T_3	105-15-60-30-1.4-0.8	90-5-47-10-1.5-0
T_4	90-20-45-15-1.5-0.5	75-10-35-4-0
T_5	86-24-40-13-0-0-0	75-15-22-6-3-0
T_6	0-0-0-0-0	0-0-0-0

Dumuria, Khulna

Treatment	Sesame (N-P-K-S)	T.Aman (N-P-K-S)
T_1	44-12-0-0-1.6	51-5-0-0
T_2	61-15-0-0-2.5	70-5-0-0
T_3	46-10-0-0 + CD @ 5 t/ha	70-5-0-0
T_4	50-20-14-15-1	35-4-15-2
T_5	0-0-0-0-0	0-0-0-0

Manikganj

Treatment	Mustard (N-P-K-S-B-CD)	Boro (N-P-K-S-Zn-CD)
T_1	66-25-21-18-1	96-15-30-6-2
T_2	93-32-31-23-1	135-21-41-8-3
T_3	78-27-16-23-1 + CD 5 t/ha	135-21-41-8-3
T_4	60-15-10-10-0-0	100-15-35-6-1
T_5	105-24-45-5-0-0	104-27-28-25-0
T_6	0-0-0-0-0-0	0-0-0-0-0-0

Natore

Treatment	Groundnut (N-P-K-S-Zn-B)	T.Aman (N-P-K-S)
T_1	21-24-20-8-1.5	62-7-16-3
T_2	30-30-29-10-2.5	85-9-20-4
T_3	15-25-14-10-2.5+5 ton/ha CD	85-9-20-4
T_4	21-24-20-8-1.5	70-6-20-4
T_5	6-17-21-2-0	97-47-32-0
T_6	0-0-0-0-0	0-0-0-0-0

Paba

Treatment	Potato (kg/ha) (N-P-K-S-Zn-B)	T.Aman (kg/ha) (N-P-K-S)
T_1	88-34-48-0-0-0	62-0-10-0
T_2	124-45-66-0-0-0	85-0-15-0
T_3	94-22-30 + 10 t/ha CD	85-0-15-0
T_4	100-48-48-8	70-6-20-4
T_5	172-119-186-22	62-25-15-8
T_6	0-0-0-0-0	0-0-0-0-0

Results and Discussion

Location : Netrakona, Mymensingh (AEZ 9)
CP : Mustard-Boro-T.Aman
Year : 2003-04

Higher seed yield of Mustard was obtained with STB fertilizer dose for HYG (T_3) followed by IPNS (T_2) based fertilized plot. The next higher yield was recorded from STB fertilizer dose for MYG (T_1) but it was identical to FRG'97 (T_4). Farmers' dose (T_5) also gave similar yield with T_4. Stover yield of Mustard did not vary appreciably among the treatments except with no fertilizer and farmers' dose. In Boro rice higher yield was recorded from T_3 followed by T_2. Similar yield was also recorded from STB fertilizer dose for MYG (T_1) and FRG'97 (T_4) along with Farmers' practice (T_5). In T.Aman rice grain yield was not significantly different among T_2, T_3 and T_4 treatments but higher than T_5 and T_6 treatments. Farmers' yield was significantly lower than other fertilizer packages. Regarding straw the highest yield was found with T_2 followed by T_3. Similarly, in T.Aman rice higher yield was obtained with T_2 and T_3.

From the cost and return analysis it was found that the highest gross return as well as gross margin was obtained from T_3. The 2nd highest gross margin was found with FRG'97 (T_4). Farmers' usually use fewer amounts of fertilizers; therefore, fertilization cost was lowest in Farmers' practice. Due to lowest fertilization cost MBCR was the highest in Farmers' practice. The next higher value was found with T_4. However, gross return as well as gross margin was higher in T_3 but due to higher fertilization cost MBCR was less in that treatment.

Table 1. Yield, cost and return analysis of Mustard -Boro-T.Aman cropping pattern as influenced by different fertilizer packages at Netrakona, Mymensingh during 2003-04

Treat	Grain yield (t/ha)			Stover/ straw yield (t/ha)			GR	TVC	GM	MBCR
	Mustard	Boro	T.Aman	Mustard	Boro	T.Aman				
T_1	1.025b	4.71bc	3.48b	2.067ab	5.55c	4.59cd	92124	12593	79531	3.32
T_2	1.158a	4.99ab	3.72a	1.992ab	6.08b	5.02a	99386	17410	81976	2.82
T_3	1.167a	5.32a	3.69a	2.133a	7.39a	4.88ab	102622	18391	84231	2.84
T_4	0.992bc	4.58c	3.54ab	2.042ab	5.58c	4.70bc	90961	8548	82413	4.76
T_5	0.908c	4.44c	3.23c	1.817b	5.04d	4.35d	85129	6196	78933	5.62
T_6	0.250d	2.49d	2.73d	0.467c	2.96e	3.68e	50314	0	50314	--

Location : Phulpur, Mymensingh (AEZ 9)
CP : Mustard-Boro-T.Aman
Year : 2003-04

Seed yield of Mustard was very low this year due to heavy shower in November. Higher yield obtained with STB for HYG and IPNS treatment is less than present national average. Higher yield was recorded from STB for HYG (T_2) followed by IPNS (T_3) treatment. Fertilizer dose for MYG (STB and FRG'97) gave identical yield with Farmers' practice (T_5). Significantly the highest grain yield in Boro rice was recorded from STB fertilizer dose for HYG (T_2). Statistically similar yield was obtained with fertilizer doses for MYG (T_1 and T_4) and Farmers' dose. T.Aman rice the highest yield was recorded from T_2 followed by T_3. Yield did not vary appreciably with other fertilizer packages except with no fertilizer treatment (T_6). In case of stover and straw yield of Mustard and Boro rice almost similar trend was found. But in T.Aman rice straw yield did not vary significantly among the fertilizer packages except with T_1 and T_6.

From the cost and return analysis it was found that the highest gross return as well as gross margin obtained from T_2 followed by T_3. Satisfactory gross margin was also obtained with fertilizer dose based on FRG'97 (T_4). Marginal benefit cost ratio (MBCR) over no fertilizer was the highest in T_4 due to less fertilization cost.

Table 2. Yield, cost and return analysis of Mustard -Boro-T.Aman cropping pattern as influenced by different fertilizer packages at Phulpur, Mymensingh during 2003-04

Treat	Grain yield (t/ha)			Stover/ straw yield (t/ha)			GR	TVC	GM	MBCR
	Mustard	Boro	T.Aman	Mustard	Boro	T.Aman				
T_1	0.558b	5.25c	2.60b	1.300b	6.43c	3.73b	79680	12095	67584	1.92
T_2	0.692a	5.99a	2.73a	1.433a	7.07a	4.33a	90017	16367	73649	2.05
T_3	0.675a	5.74b	2.68ab	1.458a	6.78b	4.37a	87164	14297	72866	2.15
T_4	0.550b	5.28c	2.60b	1.275b	6.50c	4.10ab	79978	7497	72480	3.14
T_5	0.550b	5.13c	2.60b	1.308b	6.43c	4.07ab	78744	8433	70311	2.41
T_6	0.258c	3.63d	2.23c	0.658c	5.00d	3.21c	56474	0	56474	--

Location : Mymensingh (AEZ 9)
CP : Mustard-Boro
Year : 2002-03 to 2004-05

Average of three years data revealed that seed yield of Mustard increased substantially with IPNS based fertilizer application. On an average about 90 kg/ha of yield increased with IPNS (T_3) over STB inorganic fertilizer (T_2). The 2[nd] highest yield was obtained with T_2 followed by FRG'97 (T_4) and Farmers' practice (T_5). Almost similar trend was observed over the years. However, higher and identical yield was recorded from T_2 and T_3 during 2002-03 and 2004-05 but in 2003-04 significantly higher yield was obtained with T_3. Similarly, in Boro rice higher grain yield was found in T_3 followed by T_2. More or less similar yield was obtained with FRG'97 and Farmers' practice. Regarding stover and straw yield of crops, similar trend was found as observed in grain yield. A considerable response of crops to organic manure was observed in Mustard-Boro rice cropping pattern.

Cost and return analysis showed that the highest gross return as well as gross margin was obtained from IPNS based fertilizer dose (T_3) followed by STB inorganic fertilize (T_2). Fertilizer dose from FRG'97 (T_4) also gave satisfactory economic return. Marginal benefit cost ratio is the highest in FRG'97 (T_4). In spite of highest fertilization cost IPNS (T_3) also gave 2[nd] highest value with farmers' practice (T_5). Based on three years of experimentation the IPNS based fertilizer dose for HYG (T_3) was found superior in respect of yield and profit and it could be recommended for sustainable productivity as well as soil fertility concern.

Table 3. Yield of crops as influenced by different fertilizer packages in Mustard-Boro rice cropping pattern at Mymensingh during 2002-03 to 2004-05

Treat	Seed (kg/ha) and grain yield (t/ha)							
	2002-03		2003-04		2004-05		Mean	
	Mustard	Boro	Mustard	Boro	Mustard	Boro	Mustard	Boro
T_1	725b	4.75c	842c	4.47c	580c	5.13d	715	4.78
T_2	813a	5.83a	1008b	5.50ab	840ab	5.89ab	887	5.74
T_3	838a	5.93a	1163a	5.86a	930a	5.92a	977	5.90
T_4	713bc	5.30b	1006b	4.84c	770b	5.63c	829	5.26
T_5	663c	4.51d	1043b	5.27b	810b	5.77bc	838	5.18
T_6	425d	3.05e	408d	4.06d	450d	3.94e	427	3.68

Table 26. Contd.

Treat	Stover (kg/ha) and Straw yield (t/ha)							
	2002-03		2003-04		2004-05		Mean	
	Mustard	Boro	Mustard	Boro	Mustard	Boro	Mustard	Boro
T_1	1600b	5.98ab	2122c	4.47c	1450c	6.72d	1724	5.72
T_2	1900a	4.10c	2534b	5.92a	1900ab	8.40a	2111	6.14
T_3	2050a	7.39a	2905a	5.94a	2020a	8.60a	2325	7.31
T_4	1500b	4.83b	2545b	5.64b	1670bc	7.28c	1905	5.92
T_5	1463b	5.63ab	2600b	5.80a	1820ab	7.76b	1961	6.40
T_6	775c	4.20c	962d	4.38d	1000d	5.80e	912	4.79

Table 4. Cost and return of Mustard -Boro rice cropping pattern as influenced by different fertilizer packages at Mymensingh during 2002-03 to 2004-05 (Average)

Treatment	GR	VC	GM	MBCR
T_1	54862	8012	46850	1.95
T_2	66124	11185	54939	2.40
T_3	69392	11795	57597	2.55
T_4	60437	6468	53969	3.27
T_5	59206	7818	51388	2.55
T_6	39228	0	39228	-

Location : Gabtali, Bogra (AEZ 4)
CP : Mustard-Boro-T.Aman
Year : 2001-02 to 2003-04

Average of three years data revealed that higher grain yield of Mustard was obtained from STB fertilizer dose for HYG (T_2) followed by IPNS based fertilizer dose (T_3). More or less similar trend was found over the years. However, during 2003-04 yield was very low in T_4, T_5 and T_6 compared with other years result. Similarly, in Boro rice grain yield was higher in T_2 and closely followed by T_3. The yield was almost same with T_1 and T_4. In T.Aman rice almost similar trend was observed. The highest yield was obtained with T_2 followed by T_3. Regarding stover and straw yield of crops, more or less the trend was same as observed in grain yield. In IPNS treatment mustard oil cake was applied @ 400 kg/ha in each crop. But yield of crops did not increase over inorganic fertilizers.

Cost and return analysis showed that the highest gross margin was obtained from STB fertilizer dose for HYG (T_2) treatment. In IPNS treatment application of MOC increased fertilization cost (Tk. 9000/ha) as compared to treatment T_2. Marginal benefit cost ratio is almost same with all fertilizer packages except IPNS (T_3) treatment. The value is more than 3 in all the fertilizer packages, where as it was 2.13 in T_3. Based on three years of experimentation the STB fertilizer dose for HYG (T_2) was found superior in respect of yield and profit. But application of organic manure @ 2-5 t/ha once in a year could be recommended for sustainable productivity as well as soil fertility concern.

Table 5. Yield of Mustard, Boro and T.Aman as affected by fertilizer levels in the cropping pattern Mustard-Boro-T.Aman at Gabtali, Bogra during 2001-02 to 2003-04

Treat	Seed/grain yield (t/ha)			Seed/grain yield (t/ha)			Seed/grain yield (t/ha)		
	2001-02			2002-03			2003-04		
	Mustard	Boro	T. Aman	Mustard	Boro	T. Aman	Mustard	Boro	T.Aman
T_1	0.96	4.94	3.11	0.61	5.03	1.84	0.651	4.63	3.61
T_2	1.09	5.93	3.96	1.01	5.66	2.31	1.23	5.18	3.90
T_3	1.02	5.27	3.75	1.00	5.53	2.01	1.05	4.87	3.66
T_4	0.90	4.76	3.09	0.595	4.95	1.70	0.275	4.59	3.50
T_5	0.8	3.90	2.72	0.540	4.25	1.52	0.083	4.27	3.10
T_6	0.36	1.83	1.72	0.24	2.23	1.31	0.037	2.14	2.05

Table 5. Contd.

Treat	Stover/ Straw yield (t/ha)			Stover/ Straw yield (t/ha)			Stover/ Straw yield (t/ha)		
	2001-02			2000-03			2003-04		
	Mustard	Boro	T. Aman	Mustard	Boro	T. Aman	Mustard	Boro	T.Aman
T_1	3.04	6.53	6.09	2.55	5.65	2.76	1.85	5.85	4.34
T_2	2.65	7.05	6.51	2.91	5.94	3.29	2.03	6.33	4.68
T_3	3.06	7.14	6.36	2.88	5.82	3.20	1.86	6.08	4.39
T_4	2.73	6.90	6.05	2.50	5.31	2.94	1.79	5.88	4.17
T_5	2.51	6.20	5.91	2.39	5.10	2.81	0.928	5.44	4.18
T_6	0.62	3.18	2.96	1.30	2.67	2.42	0.364	2.97	2.89

Table 6. Yield, cost and return analysis of Mustard -Boro-T.Aman cropping pattern as affected by fertilizer levels at Gabtali, Bogra during 2001-02 to 2003-04

Treat	Grain yield (t/ha)			Stover/ straw yield (t/ha)			GR	TVC	GM	MBCR
	Mustard	Boro	T.Aman	Mustard	Boro	T.Aman				
T_1	0.74	4.87	2.85	2.48	6.01	4.40	79145	12389	66756	3.51
T_2	1.11	5.59	3.39	2.53	6.44	4.83	96450	16727	79723	3.63
T_3	1.02	5.22	3.14	2.60	6.35	4.65	89900	25461	64439	2.13
T_4	0.59	4.77	2.76	2.34	6.03	4.39	74655	10117	64538	3.85
T_5	0.47	4.14	2.45	1.94	5.58	4.30	64815	7656	57159	3.80
T_6	0.21	2.07	1.69	0.761	2.94	2.76	35671	0	35671	-

Location : Nandigram, Bogra (AEZ 25)
CP : Mustard-Boro-T.Aman
Year : 2003-04

Significantly highest seed yield of Mustard was recorded from STB fertilizer dose for HYG (T_2). Fertilizer dose for MYG both STB and FRG '97 (T_1 and T_4) gave similar yield. Yield advantage of IPNS against inorganic fertilizer was not observed in Mustard. Almost similar trend was observed in stover yield. In Boro rice higher and identical yield was obtained with T_2, T_3 and T_4. But in T.Aman rice grain yield did not vary significantly among the fertilizer packages except with no fertilizer and Farmers' practice. Regarding straw yield did not vary significantly among the fertilizer packages except with Farmers' dose. But in T.Aman rice the highest yield was obtained with T_2 followed by T_3, T_1 and T_4. Significantly the highest stover yield of mustard was recorded from T_3 but in T.Aman rice treatment T_2.

Cost and return analysis showed that highest gross return as well as gross margin was obtained from T_2 followed by T_3 and T_4. MBCR was the highest with FRG'97 (T_4) due to less fertilization cost. Almost similar and the values are more than 5 in all the treatments except with T_3. Due to higher fertilization cost the value was lowest in T_3.

Table 7. Yield, cost and return analysis of Mustard-Boro-T.Aman cropping pattern as affected by fertilizer levels at Nandigram, Bogra during 2003-04

Treat.	Grain yield (t/ha)			Stover/ straw yield (t/ha)			GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Mustard	Boro	T.Aman	Mustard	Boro	T.Aman				
T_1	0.5717cd	7.07b	6.02ab	2.76c	7.52ab	6.34bc	132975	11534	121441	5.82
T_2	0.7817a	7.79a	6.68a	3.02b	7.85a	6.88a	149740	16068	133672	5.23
T_3	0.7090b	7.30ab	6.17ab	3.20a	7.58ab	6.52b	139250	16116	123134	4.56
T_4	0.5908c	7.27ab	5.95ab	2.7c	7.54ab	6.12c	134025	10732	123293	6.36
T_5	0.5117d	6.77b	5.62b	2.59c	6.75b	5.75d	124760	10669	114091	5.53
T_6	0.2882e	3.19c	3.16c	1.52d	3.88c	3.51e	65760	0	65760	-

Price (Tk./kg): Urea = 5.5, TSP= 14.5, MP= 9.5, Gypsum= 3 & Zinc Sulphate= 50
Output Cost: Mustard = 20, Boro Rice = 6.5 & Straw = 0.5, T.Aman Rice = 6.5 & Straw = 0.5.

Location : Sherpur, Jamalpur (AEZ 9)
CP : Wheat-Jute-T.Aman
Year : 2001-02 to 2003-04

Average of three years data revealed that higher grain yield of Wheat was obtained from IPNS (T_3) followed by STB fertilizer dose for HYG (T_2). STB fertilizer dose for MYG (T_1) also gave higher yield than FRG'97 (T_4), however, both of them are MYG level fertilizer dose. Farmers' practice (T_5) gave higher yield than T_4. Results over the years showed that Grain yield did not vary significantly among the treatment except with T4 and no fertilizer (T_6) treatment in 2001-02. But during 2002-03 and 2003-04 higher and identical yield was obtained with T_1, T_2 and T_3. In Jute, the higher yield was recorded from T_2 followed by T_3. Almost similar yield was found in T_1 and T_4 and it was higher than Farmers' practice (T_5). In T.Aman rice the higher yield was obtained with T_2 followed by T_3 and T_1.

Yield did not vary appreciably among the treatments. Higher and identical yield was found in T_1, T_2 and T_3 in all the years. Almost similar trend was observed in straw and stick yield of crops. Mustard oil cake @ 500 kg/ha was applied in Wheat in IPNS treatment and a substantial amount of NPK was reduced in succeeding crops. Therefore, yield was lower with T_3 in Jute and T.Aman rice.

Cost and return analysis showed that the higher gross return as well as gross margin was obtained from STB fertilizer dose for HYG (T_2) and IPNS (T_3) treatment. Marginal benefit cost ratio was higher with FRG'97 (T_4) and Farmers' practice (T_5) due to lower fertilization cost. A satisfactory gross margin and MBCR was found in STB fertilizer dose for MYG (T_1) also. Based on three years of experimentation the STB fertilizer dose for HYG (T_2) was found superior in respect of yield. But application of organic manure @ 2-5 t/ha as IPNS once in a year could be recommended for sustainable productivity as well as soil fertility concern.

Table 8. Yield of crops as influenced by different fertilizer packages in Wheat-Jute-T.Aman rice cropping pattern at Sherpur during 2001-02 to 2003-04

Treat	Grain/fiber yield (t/ha)								
	2001-02			2000-03			2003-04		
	Wheat	Jute	T. Aman	Wheat	Jute	T. Aman	Wheat	Jute	T.Aman
T_1	2.37ab	1.79ab	4.39ab	3.14a	2.69a	4.64a	3.41ab	2.73b	4.71a
T_2	2.39ab	1.98a	4.47a	3.18a	3.08a	4.78a	3.80a	3.30a	4.89a
T_3	2.53a	2.01a	4.31ab	3.41a	2.91a	4.61a	3.91a	3.07b	4.81a
T_4	2.05b	1.67b	4.05c	2.70b	2.88a	4.31b	2.85b	2.91b	3.97b
T_5	2.43a	1.75b	4.16bc	2.83b	2.04b	4.16b	2.74b	2.24c	3.76b
T_6	0.83c	1.01c	1.81d	0.68c	1.01c	1.31c	0.74c	1.12d	1.43c

Table 8. Contd.

Treat	Straw/stick yield (t/ha)								
	2001-02			2002-03			2003-04		
	Wheat	Jute	T. Aman	Wheat	Jute	T. Aman	Wheat	Jute	T.Aman
T_1	3.87ab	4.42a	5.28a	4.34ab	3.59b	5.15a	3.96ab	3.64b	5.15a
T_2	3.89ab	4.60a	5.53a	4.21b	4.28a	5.47a	4.16b	4.43a	5.47a
T_3	4.21a	4.67a	5.39a	4.60a	3.78b	5.39a	4.85a	3.84b	5.39a
T_4	3.61b	4.47a	4.87b	3.59c	3.82b	4.87b	3.65c	3.72b	4.87b
T_5	3.88ab	4.37a	4.96b	3.69c	3.13c	4.46b	3.17c	3.23c	4.46b
T_6	1.63c	1.67b	2.91c	1.06d	1.41d	2.61c	1.24d	1.54d	2.61c

Table 9. Mean yield, cost and return analysis of Wheat-Jute-T.Aman rice cropping pattern as influenced by different fertilizer packages at Sherpur during 2001-02 to 2003-04

Treat	Grain yield (t/ha)			Stover/ straw yield (t/ha)			GR	VC	GM	MBCR
	Wheat	Jute	T.Aman	Wheat	Jute	T.Aman				
T_1	2.97	2.40	4.58	4.05	3.88	5.21	103650	12609	91041	5.38
T_2	3.12	2.79	4.71	4.09	4.44	5.50	111595	18189	93406	4.16
T_3	3.28	2.66	4.58	4.55	4.10	5.39	110430	17970	92460	4.15
T_4	2.53	2.49	4.11	3.62	4.00	4.87	96305	8824	87481	6.85
T_5	2.67	2.01	4.03	3.58	3.58	4.71	90785	9079	81706	6.05
T_6	0.75	1.05	1.52	1.31	1.54	2.76	35835	0	35835	-

Location : Melandah, Jamalpur (AEZ 9)
CP : Potato-Jute-T.Aman
Year : 2001-02 to 2003-04

Tuber yield of Potato influenced significantly due to different fertilizer packages. Significantly the highest yield was obtained with IPNS (T_3) based fertilizer dose. Effect of cowdung applied in T_3 was observed on the yield of Potato. The 2nd highest yield was recorded from STB fertilizer dose for HYG (T_2) and FRG'97 (T_4). STB fertilizer dose for MYG (T_1) produced similar yield with Farmers' practice (T_5). In Jute higher and identical fibre yield was recorded from T_2 and T_3. Similar yield was also found in T_1 and T_4 along with T_5. Almost similar trend was found in stick yield of Jute. In T.Aman rice significantly the highest grain yield was recorded from STB fertilizer dose for HYG (T_2). Again T_1 and T_4 gave similar yield along with Farmers' practice (T_5). In straw yield significantly higher and identical yield was obtained with T_2 and T_3. Other treatments also gave similar yield except with no fertilizer (T_6) treatment.

From the cost and return analysis it was found that higher gross margin was obtained from T_2 followed by T_3 treatment. Treatment FRG'97 (T_4) also gave satisfactory gross margin. Marginal benefit cost ratio (MBCR) over control was higher in T_4 due to lower fertilization cost. The 2nd highest value was found in STB fertilizer dose for HYG (T_2). In IPNS treatment the MBCR was less due to the additional cost of organic manure applied in Potato. Considering yield as well as economic return STB fertilizer dose for HYG (T_2) was found superior over other fertilizer packages. But application of organic manure @ 2-5 t/ha as IPNS once in a year could be recommended for sustainable productivity as well as soil fertility concern.

Table 10. Yield, cost and return analysis of Potato-Jute-T.Aman cropping pattern as influenced by different fertilizer packages at Melandah, Jamalpur during 2003-04

Treat.	Tuber/fibre/grain yield (t/ha)			Stick/straw yield (t/ha)		GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Potato	Jute	T.Aman	Jute	T.Aman				
T_1	30.63c	2.83b	4.03c	4.74c	5.68b	194722	10002	184720	13.8
T_2	34.95b	3.75a	5.08a	6.98a	6.61a	270675	13615	257060	15.7
T_3	36.96a	3.43a	4.73b	6.39a	6.12a	273250	18113	255137	12.0
T_4	33.87b	2.72b	4.34c	5.69b	5.58b	245190	11253	233937	16.8
T_5	25.36c	2.65b	3.87c	4.84c	5.01b	196905	12485	184420	11.3
T_6	5.98d	1.23c	1.01d	2.55d	1.73c	56155	0	56155	-

Output (Tk/kg): Potato= 4.00, T.Aman rice = 7.00, Jute (fibre)= 8.00, Jute stick = 1.00, Rice straw = 0.50
Inputs (Tk/kg):Urea= 6, TSP= 14, MP= 10, Gypsum= 3, Zinc sulphate= 25, Mustard oil cake=10

Location : Palima, Tangail (AEZ 8)
CP : Wheat-Jute-T.Aman
Year : 2003-04

Grain yield of Wheat influenced significantly due to different fertilizer packages. Significantly the highest grain yield of Wheat was obtained from T_3 (IPNS). Similar trend was observed in straw yield. In Jute, fiber yield did not vary significantly among the fertilizer packages except with no fertilizer treatment. However, higher yield was recorded from T_3. In T.Aman rice, higher yield was obtained with T_3 which was identical with T_2 and T_1. Fertilizer dose from FRG'97 (T_4) produced identical yield with Farmers' practice. More or less similar trend was found in straw and stick yield of crops.

From Cost and return analysis it was found that the highest gross return as well as gross margin was calculated from IPNS based fertilizer dose (T_3) followed by T_2 and T_4. Regarding MBCR the highest value was obtained from T_4 (FRG '97) due to less fertilization cost followed by FP (T_5). Fertilization cost was higher in T3 due to additional cost of cowdung.

Table 11. Yield, cost and return analysis of Wheat-Jute-T.Aman cropping pattern as influenced by different fertilizer packages at Palima, Tangail during 2003-04

Treat.	Grain yield (t/ha)			Stover/stick/ straw yield(t/ha)			GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Wheat	Jute	T.Aman	Wheat	Jute	T.Aman				
T_1	1.67c	2.37a	4.64ab	3.325c	3.50c	4.83ab	107040	11263	95777	5.50
T_2	2.34b	2.60a	4.81ab	4.113b	3.63bc	5.13ab	115550	14785	100765	4.77
T_3	2.62a	2.90a	4.92a	4.363a	4.62a	5.67a	124380	15124	109256	5.25
T_4	1.40d	2.80a	4.17c	2.713d	4.46a	4.38b	106280	6179	100101	9.92
T_5	1.11e	2.68a	4.47bc	2.225e	3.95b	4.83ab	98650	6634	92016	8.09
T_6	0.63f	1.23b	2.70d	1.112f	2.03d	3.27c	45000	0	45000	---

Price of inputs (Tk./ka): Urea = 6, TSP= 12, MP = 10, Gypsum= 5, Zinc sulphate= 35 and Cow dung = 0.50
Price of output (Tk./ha): Grain (wheat) = 7.50, grain (rice) =7, Fibre =.9, Straw= 0.05 and stick = 3

Location : Ishan Gopalpur, Faridpur (AEZ 12)
CP : Wheat-Jute-T.Aman
Year : 2003-04

Grain yield of Wheat influenced significantly due to different fertilizer packages. Higher grain yield of Wheat was obtained with IPNS (T_3) followed by STB fertilizer dose for HYG (T_2). STB fertilizer dose for MYG (T_1) gave identical yield with FRG'97 (T_4) and Farmers' practice (T_5). Regarding straw significantly the highest yield was recorded from T_3. Similar yield was found in other fertilizer packages except in no fertilizer treatment (T_6). In Jute, significantly the highest fiber yield was also obtained with T_2. Similar yield was obtained with T_3, T_4 and T_5. More or less similar trend was found in stick yield. In T.Aman rice the highest yield was obtained with T_2 which differ than other treatments. Similar yield was also found in T_3, T_4 and T_5. However, nutrient dose are same in T_2 and T_3 but yield was significantly lower in T_3 in Jute and T.Aman rice. Regarding straw, higher yield was found in T_5 which was similar with other fertilizer packages except with T_3 and T_6.

From Cost and return analysis it was found that the highest gross return as well as gross margin was calculated from T_2. MBCR was the highest in the same treatment followed by T_1 and T_4.

Table 12. Yield, cost and return analysis of Wheat-Jute-T.Aman cropping pattern as influenced by different fertilizer packages at Ishan Gopalpur, Faridpur during 2003-04

Treat.	Grain yield (t/ha)			Stover/stick/ straw yield(t/ha)			GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Wheat	Jute	T.Aman	Wheat	Jute	T.Aman				
T_1	2.56b	2.36b	2.99ab	4.69b	3.98b	4.09ab	101805	8007	93798	4.82
T_2	2.97a	2.80a	3.30a	5.37a	4.62a	4.05ab	116840	10838	106002	4.95
T_3	2.53a	2.28bc	2.84b	4.62b	3.81b	3.68b	98265	13155	85110	2.67
T_4	2.44b	2.04c	2.67b	4.29b	3.82b	4.31ab	91745	6925	84820	4.12
T_5	2.51b	2.18bc	2.89b	4.44b	3.70b	4.53a	97492	9162	88330	3.74
T_6	1.58c	1.58d	1.67c	2.82c	2.72c	2.23c	63182	0	63182	-

Location : Jhenaidah, Jessore (AEZ 11)
CP : Wheat-Mungbean-T.Aman
Year : 2003-04

Grain yield of Wheat influenced significantly due to different fertilizer packages. Higher grain yield of Wheat was obtained with IPNS (T_3) followed by STB fertilizer dose for HYG (T_2) and STB fertilizer dose for MYG (T_1). Fertilizer dose from FRG'97 (T4) gave similar yield with Farmers' practice (T_5). In Mungbean significantly the highest seed yield was found in T_2. Yield did not differ significantly with other fertilizer packages except with no fertilizer (T_6). Similar trend was followed in T.Aman rice where the highest yield was obtained in T_2. The next higher yield was obtained from Farmers' practice (T_5). However, nutrient dose are same in T_2 and T_3 but yield was significantly lower in T_3 in Mungbean and T.Aman rice. Regarding stover and straw almost similar trend was observed.

From Cost and return analysis it was found that the highest gross return as well as gross margin was calculated from T_2. MBCR was the highest in T_1 followed by T_2 and T_4.

Table 13. Yield, cost and return analysis of Wheat-Mungbean-T.Aman cropping pattern as influenced by different fertilizer packages at Jhenaidah, Jessore during 2003-04

Treat.	Grain yield (t/ha)			Stover/ straw yield(t/ha)			GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Wheat	M.bean	T.Aman	Wheat	M.bean	T.Aman				
T_1	2.85a	1558b	4.11c	5.94a		5.97abc	118739	6725	112014	7.89
T_2	2.96a	1705a	4.73a	6.08a		6.45a	130648	9328	121320	6.97
T_3	3.07a	1582b	4.09c	6.13a		5.59c	121229	10902	110327	5.10
T_4	2.55b	1555b	4.10c	5.36ab		5.87bc	115204	7191	108013	6.89
T_5	2.52b	1511b	4.47b	5.27ab		6.17ab	117994	8740	109254	5.99
T_6	1.22c	965c	2.33d	2.51c		4.61d	65622	0	65622	-

Location : Feni, Noakhali
CP : Boro-T.Aman
Year : 2001-02 to 2003-04.

Grain yield of Boro rice influenced significantly among the different nutrient management packages. Statistically highest grain yield was recorded from IPNS (T_3) treatment in 2001-02 and 2002-03 but statistically similar with STB fertilizer doses for HYG (T_2) in 2003-04. Effect of Cowdung on the yield of Boro rice was evident. STB fertilizer dose for MYG (T_1) and HYG (T_2) gave similar result in 2001-02 and fertilizer doses for MYG both STB and FRG '97 gave similar yield in 2003-04. In case of T.Aman, higher yield was obtained in T_3 in three years. Higher yield from IPNS (T_3) was statistically similar with $T_1$and T_2 in 2002-03 and T_1, T_2 and T_4 in case of 2003-04. On an average of three years, T_1, T_2 and T_3 showed more or less similar yield than other treatments. Farmers' do not apply sulphur fertilizer in rice crops. But the soil is deficit in S and therefore, yield is less in farmers' practice. On an average of three years, almost similar result was found in case of straw yield of Boro and T.Aman rice, respectively.

Cost of return analysis showed that the highest gross margin was recorded from T_3 followed by T_2 and T_1. The highest MBCR was also observed in FRG'97 (T_4) due to less fertilization cost. Based on three years of experimentation STB fertilizer dose for MYG was found superior in respect of yield and profit. Incorporation of Boro rice straw @ 2-3 t/ha in soil could be recommended for sustainable productivity as well as soil fertility concern.

Table 14. Yield of crops as affected by different fertilizer packages in Boro-T.Aman cropping pattern at Feni, during 2001-02 to 2003-04

Treatment	2001-02		2002-03		2003-04		Mean	
	Boro	T.aman	Boro	T.aman	Boro	T.aman	Boro	T.aman
Grain yield (t/ha)								
T_1	4.81b	4.32ab	5.30c	4.52ab	4.93b	4.64a	5.01	4.49
T_2	4.94b	4.65a	5.68b	4.77ab	5.12ab	4.81a	5.25	4.69
T_3	5.46a	4.94a	5.86a	5.03a	5.29a	4.96a	5.54	4.98
T_4	4.37c	3.62bc	4.63d	4.27bc	5.05b	4.73a	4.68	4.21
T_5	3.52d	3.23c	3.95e	3.83c	4.69c	3.75b	4.05	3.60
T_6	2.74e	2.16d	2.60f	2.20d	2.16d	2.01c	2.50	2.12
Straw yield (t/ha)								
T_1	5.84a	5.14b	5.10c	4.96c	5.12b	5.53b	5.35	5.21
T_2	5.22b	5.51a	5.47b	5.25b	5.38a	5.70ab	5.36	5.49
T_3	5.42b	5.73a	5.65a	5.55a	5.49a	5.87a	5.52	5.72
T_4	4.69c	4.33c	4.43d	4.68d	4.95b	5.50b	4.69	4.84
T_5	3.87d	3.89d	3.75e	3.95e	3.89c	4.03c	3.84	3.96
T_6	3.04e	2.66e	2.40f	2.55f	2.35d	2.50d	2.60	2.57

Table 15. Cost and return analysis of Boro-T.Aman cropping pattern as influenced by different fertilizer packages at Feni, during 2001-02 to 2003-04

Treatment	Gross return (Tk/ha)	Variable cost* (Tk/ha)	Gross margin (Tk/ha	MBCR (Over control)
T_1	87090	10381	76709	4.30
T_2	90825	14172	76653	3.42
T_3	95760	15796	79964	3.38
T_4	80970	5947	75023	6.48
T_5	69075	6639	62436	4.02
T_6	42405	0	42405	-

*Variable cost = Fertilizer cost only.

Price (Tk/kg): Urea =6.00, TSP=15.00, MP=10.00, Gypsum =5.00, $ZnSO_4$=40.00, Grain= 7.50 and Straw =1.50

Location : Atkapalia, Noakhali
CP : Groundnut-T.Aman
Year : 2001-02 to 2003-04.

Nut yield of Groundnut did not vary markedly among the different nutrient management packages except with Farmers' practice (T_5) and no fertilizer treatment (T_6) in three consecutive years. Average of three years data showed that higher yield of groundnut was recorded from STB for HYG (T_2) and IPNS (T_3). Similar trend was found in T. Aman rice also. Higher grain yield was obtained from T_3 which was also more or less similar to other fertilizer packages except with Farmers' dose and no fertilizer treatment. Generally, farmers' of Noakhali apply a very few amount of fertilizer in the crop. Almost same trend was observed in straw yield of T.Aman rice.

Cost and return analysis showed that higher gross return was obtained from T_3 followed by T_2. But gross margin was similar in T_3 and T_4. The highest MBCR was obtained from T_4 due to less fertilization cost. Although highest MBCR was found from BARC cropping pattern based fertilizer recommendation on AEZ basis (T_4) but its gross return was lower than IPNS (T_3). The MBCR of T_1, T_2, and T_3 are more or less same. Based on three years of experimentation present recommendation based on FRG' 97 was found superior in respect of yield and profit.

Table 16. Yield of crops as affected by different fertilizer packages in Groundnut-T.Aman cropping pattern at FSRD site, Atkapalia, Noakhali, during 2001-02 to 2003-04

Treatment	2001-02		2002-03		2003-04		Mean	
	Groundnut	T.Aman	Groundnut	T.Aman	Groundnut	T.Aman	Groundnut	T.Aman
Nut/Grain yield (t/ha)								
T_1	2.53a	3.57bc	2.15bc	3.83b	2.17ab	3.77ab	2.28	3.72
T_2	2.70a	3.64b	2.42ab	4.02ab	2.45a	3.72ab	2.52	3.79
T_3	2.43a	4.33a	2.49a	4.44a	2.48a	4.20a	2.47	4.32
T_4	2.40a	4.41a	2.28ab	3.97ab	2.28ab	3.92a	2.32	4.10
T_5	2.25ab	3.31bc	1.95cd	3.59bc	2.09bc	3.12b	2.10	3.34
T_6	1.81b	3.20c	1.72d	3.17c	1.88c	2.40c	1.80	2.92
Straw yield of T.Aman (t/ha)								
T_1	-	3.80b	-	4.98bc	-	4.92a	-	4.57
T_2	-	3.99b	-	5.22b	-	4.85a	-	4.69
T_3	-	4.76a	-	5.76a	-	5.10a	-	5.21
T_4	-	4.43a	-	5.16b	-	4.82a	-	4.80
T_5	-	4.00b	-	4.67c	-	4.06b	-	4.24
T_6	-	3.70b	-	4.17d	-	3.12c	-	3.66

Table 17. Cost and return analysis of Groundnut-T.Aman cropping pattern as influenced by different fertilizer packages at FSRD site, Atkapalia, Noakhali during 2001-02 to 2003-04

Treatment	Gross return (Tk/ha)	Variable cost* (Tk/ha)	Gross margin (Tk/ha	MBCR (Over control)
T_1	68955	5403	63552	2.70
T_2	73260	7083	66177	2.66
T_3	77265	8732	68533	2.62
T_4	72750	4621	68129	3.97
T_5	62910	4043	58867	2.11
T_6	54390	-	54390	

*Variable cost = Fertilizer cost only.

Price (Tk/kg): Urea =6.00, TSP=15.00, MP=10.00, Gypsum =5.00, $ZnSO_4$=40.00, Groundnut = 15.00, Grain= 7.50 and Straw =1.50

Location : Laxmipur, Noakhali (AEZ 18)
CP : Groundnut-T.Aman
Year : 2001-02 to 2003-04.

Average yield of three years data showed that yield of Groundnut influenced appreciably due to different fertilizer packages except control treatment. The highest nut yield of Groundnut was obtained with IPNS (T_3) based fertilizer dose followed by STB fertilizer dose for HYG (T_2). However, groundnut is a leguminous crop but effect of cowdung was observed to some extent. STB fertilizer dose for MYG (T_1) gave higher yield over FRG'97 (T_4). Yield obtained with Farmers' practice (T_5) was lower than other fertilizer packages. In T.Aman rice higher yield was obtained with IPNS (T_3) and STB fertilizer dose for HYG (T_2). Almost similar yied was obtained with T1 and T4 which was higher than Farmers' practice (T_5). Usually farmers' apply less amount of N and do not use K fertilizer in Groundnut and T.Aman rice. Therefore, yield was much lower than other fertilizer management packages. More or less similar trend was observed in stover and straw yield of Groundnut and T.Aman rice, respectively.

Cost and return analysis showed that the highest gross return as well as gross margin was found with T_3 followed by T_2. The highest MBCR was obtained from T_1 closely followed by T_2. Based on three years of experimentation STB fertilizer dose for HYG as well as IPNS was found superior in respect of yield and profit.

Table 18. Effect of different nutrient packages on agro-economics performance of Groundnut-T.Aman cropping pattern at Laxmipur, Noakhali during 2001-02 to 2003-04

Treatment	Average Yield (t/ha)				Variable cost (Tk/ha)	Gross return (Tk/ha)	Gross margin (Tk/ha)	MBCR over control
	Nut/Grain		Stover/Straw					
	Groundnut	T.Aman	Groundnut	T.Aman				
T_1	2.47	4.53	2.65	5.54	4767	77447	72680	7.0
T_2	2.67	4.97	3.20	6.30	6387	85599	79212	6.56
T_3	2.83	5.11	3.26	6.41	8049	89080	81031	5.64
T_4	2.21	4.39	2.94	5.05	4739	72924	68185	6.17
T_5	1.81	3.70	2.36	4.32	2514	52342	54856	4.44
T_6	1.25	2.76	1.44	3.11	-	43681	43681	-

Input price (Tk./kg): Urea = 6.50, TSP= 14.00, MP= 10.00, Gypsum= 5.00, Zinc sulphate = 60.00
Output price (Tk./kg): Groundnut = 14.00, Stover= 0.25, Grain = 8.00, Straw= 1.00

Location : Barind, Rajshahi (AEZ 26)
CP : Potato-T.Aman
Year : 200-01 to 2003-04

Average of three years data revealed that tuber yield of Potato influenced substantially with different fertilizer packages. The highest tuber yield was obtained with Farmers' practice (T_5). The next higher yield was found in FRG'97 (T_4). STB fertilizer doses failed to increase yield over existing fertilizer recommendation. Similar yield was obtained with STB fertilizer dose for HYG and MYG (T_2 and T_1). Yield over the years showed that higher yield was obtained with Farmers practice in 2001-02 but it was statistically similar with other fertilizer packages except T1 and no fertilizer treatment (T6) during 2002-03 and 2003-04. But in T.Aman rice higher grain yield was obtained with T_2 and T_3 followed by T_4. Almost similar yield was obtained with T_1 and Farmers' practice (T_5). More or less same trend was observed over the years. Regarding stover and straw yield of crops, similar trend was found.

Cost and return analysis showed that the highest gross margin was obtained from FRG'97 (T_4) followed by IPNS based fertilizer dose (T_3) and Farmers' practice (T_5). Farmers' usually apply higher dose of fertilizers in Potato, therefore fertilization cost was the highest in Farmers' practice (T_5). MBCR over control did not vary appreciably among the fertilizer packages. The highest value was found in T_4 followed by T_3. Based on three years of experimentation FRG'97 based fertilizer dose was found superior in respect of yield and profit at Barind. However application of organic manure @ 2-5 t/ha once in a year could be recommended for sustainable productivity as well as soil fertility concern.

Table 19. Yield of crops as influenced by different fertilizer packages in Potato-T.Aman rice cropping pattern at Barind, Rajshahi during 2001-02 to 2003-04

Treat	Tuber/ grain yield (t/ha)							
	2001-02		2002-03		2003-04		Mean	
	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman
T_1	13.75d	3.82b	14.80b	3.07b	19.18b	3.01ab	15.91	3.30
T_2	18.31c	4.60a	20.21a	3.46a	24.88ab	3.33ab	21.13	3.80
T_3	19.12c	4.49a	19.21ab	3.26ab	26.37a	3.59a	21.57	3.78
T_4	20.69b	3.98b	22.07a	3.11b	25.50a	2.87b	22.75	3.65
T_5	23.09a	3.81b	23.67a	3.12b	26.75a	2.78b	24.50	3.24
T_6	9.71e	2.72c	8.18c	2.31c	12.13c	2.07c	10.00	2.37

Table 19. Contd.

Treat	Stover /Straw yield (t/ha)							
	2001-02		2002-03		2003-04		Mean	
	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman
T_1	2.96d	4.20b	3.44c	4.67abc	3.82b	3.65bc	3.41	4.17
T_2	3.50c	5.37a	4.87b	5.47a	5.00b	4.63ab	4.46	5.16
T_3	3.83b	5.24a	7.57a	5.25ab	6.59a	5.50a	5.97	5.33
T_4	4.03ab	4.04b	6.42a	5.23ab	6.96a	4.87a	5.71	4.71
T_5	4.25a	3.92b	7.24a	4.39bc	6.63a	5.08a	6.04	4.46
T_6	1.69e	3.05c	3.17c	4.03c	3.57b	2.88c	2.81	3.32

Table 20. Cost and return of Potato-T.Aman rice cropping pattern as influenced by different fertilizer packages at Barind, Rajshahi during 2001-02 to 2003-04 (Average)

Treat	GR	VC	GM	MBCR
T_1	94210	11620	82590	2.74
T_2	119280	15526	103754	3.67
T_3	121850	14491	106359	3.84
T_4	124910	15981	108929	3.91
T_5	128380	21390	106990	3.09
T_6	62280	0	62280	-

Location : Syedpur, Rangpur (AEZ 3)
CP : Potato-Boro-T.Aman rice
Year : 2001-02 to 2003-04

Average of three years data revealed that the highest tuber yield of Potato was obtained with Farmers' practice (T_5) followed by IPNS (T_3) treatment. STB fertilizer dose for HYG (T_2) gave lower yield than T_3. But fertilizer doses for MYG both STB and FRG'97 (T_1 and T_4) gave similar yield. Almost similar result was observed over the years. Significantly higher yield was obtained with T_5 in 2001-02 but during 2002-03 and 2003-04 the yield was statistically similar. Identical yield was found in T_3 and T_2 in all the years. Treatment T_1 and T_4 gave similar yield over the years. In Boro rice higher yield was recorded from T_2 and T_3. Almost similar yield was found in T_1 and T_4 and it was higher than Farmers' practice (T_5). But over the year result showed that identical yield was obtained with T_1 and T_4 along with Farmers' practice. Almost similar result was found in T.Aman rice and higher yield was obtained with T_3 followed by T_2. Similar yield was observed in T_1, T_4 and T_5. More or less similar trend was observed in straw yield of crops.

Cost and return analysis showed that the higher gross return as well as gross margin was obtained from IPNS (T_3) treatment. The 2nd highest gross margin was found in Farmers practice (T_5). Marginal benefit cost ratio was higher in all the fertilizer packages and it was more than 5. However, the highest MBCR was found in Farmers' practice (T_5) followed by T_1. Based on three years of experimentation IPNS based fertilizer dose for HYG (T_3) was found superior in respect of yield and profit. Application of organic manure @ 2-5 t/ha as IPNS once in a year could be recommended for sustainable productivity as well as soil fertility concern.

Table 21. Yield of crops as influenced by different fertilizer packages in Potato-Boro-T.Aman rice cropping pattern at Syedpur, Rangpur during 2001-02 to 2003-04

Treat	Grain/fiber yield (t/ha)								
	2001-02			2000-03			2003-04		
	Potato	Boro	T. Aman	Potato	Boro	T. Aman	Potato	Boro	T.Aman
T_1	22.84c	4.36b	4.21b	23.15c	4.23b	4.32b	22.13c	3.82c	3.19b
T_2	25.63b	4.88a	4.95a	26.07b	4.62a	4.87a	25.04b	4.25ab	4.06a
T_3	26.08b	4.91a	5.07a	27.46ab	4.86a	5.18a	26.46ab	4.53a	4.26a
T_4	22.33c	4.19b	4.11b	22.81c	4.22b	4.21b	21.75c	3.89bc	3.34b
T_5	28.67a	4.10b	4.18b	29.12a	4.01b	4.27b	27.59a	3.71c	3.42b
T_6	10.72d	2.09c	2.25c	10.42d	1.93c	2.18c	9.48d	1.70d	1.77c

Table 21. Contd.

Treat	Straw yield (t/ha)								
	2001-02			2002-03			2003-04		
	Potato	Boro	T. Aman	Potato	Boro	T. Aman	Potato	Boro	T.Aman
T_1	-	5.90ab	5.78ab	-	5.56abc	5.81ab	-	5.24b	5.67ab
T_2	-	6.22a	6.31a	-	6.09a	6.17a	-	5.92a	5.81ab
T_3	-	6.12ab	6.20a	-	5.82ab	6.41a	-	5.44ab	6.11a
T_4	-	5.33b	5.42b	-	5.12c	5.32b	-	4.97b	5.31b
T_5	-	5.75ab	5.55b	-	5.31bc	5.44b	-	5.30b	5.33b
T_6	-	3.48c	3.08c	-	3.13d	2.97c	-	3.01c	2.84c

Table 22. Mean yield, cost and return analysis of Potato-Boro-T.Aman rice cropping pattern as influenced by different fertilizer packages at Syedpur, Rangpur during 2001-02 to 2003-04

Treat	Grain yield (t/ha)			Stover/ straw yield (t/ha)			GR	VC	GM	MBCR
	Potato	Boro	T. Aman	Potato	Boro	T. Aman				
T_1	22.70	4.13	3.90		5.56	5.75	160597	13633	146964	6.26
T_2	25.58	4.58	4.62		6.07	6.09	181890	18383	163507	5.80
T_3	26.66	4.76	4.83		5.79	6.24	189637	19444	170193	5.88
T_4	22.30	4.10	3.88		5.14	5.35	158132	13539	144593	6.12
T_5	28.46	3.94	3.95		5.45	5.44	182100	14275	167825	7.48
T_6	10.62	1.91	2.06		3.20	2.96	75285	0	75285	-

Location : Lalmonirhat, Rangpur (AEZ 3)
CP : Wheat-Jute-T.Aman rice
Year : 2003-04

Grain yield of Wheat influenced significantly due to different fertilizer packages. Higher grain yield of Wheat was obtained from T_3 (IPNS) followed by STB fertilizer dose for HYG (T_2). STB fertilizer dose for MYG (T_1) gave higher yield than FRG'97 (T_4). Almost similar trend was observed in straw yield. In Jute, higher fiber yield was obtained with IPNS (T_3) followed by STB fertilizer dose for HYG (T_2). Similar yield was also obtained with T_1 and T_4 which was higher than farmers' practice (T_5). Regarding stick yield higher and identical yield was recorded from T_2 and T_3. In T.Aman rice higher and identical yield was obtained with T_2 and T_3. Yield did not vary significantly among other fertilizer packages except with no fertilizer (T_6) treatment. More or less similar trend was found in straw yield of rice.

From Cost and return analysis it was found that the highest gross return as well as gross margin was calculated from IPNS based fertilizer dose (T_3) followed by T_2. Regarding MBCR the value was almost same among the treatments. However, the highest value was obtained from T_4 (FRG '97) due to less fertilization cost followed by FP (T_5).

Table 23. Yield, cost and return analysis of Wheat-Jute-T.Aman cropping pattern as influenced by different fertilizer packages at Lalmonirhat, Rangpur during 2003-04

Treat.	Grain yield (t/ha)			Stover/stick/straw yield(t/ha)			GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Wheat	Jute	T.Aman	Wheat	Jute	T.Aman				
T_1	3.01bc	2.08c	2.94b	3.76b	4.01b	4.51b	74855	11869	62986	3.13
T_2	3.27ab	2.40b	3.41a	4.50a	4.74a	5.08a	84975	16042	68933	2.95
T_3	3.58a	2.72a	3.48a	4.63a	4.91a	5.18a	90940	16119	74821	3.31
T_4	2.75cd	1.96cd	3.07b	3.81b	3.79bc	4.71ab	72580	9369	63211	3.73
T_5	2.59d	1.78d	2.89b	3.55b	3.59c	4.50b	67895	10509	57385	2.88
T_6	1.26e	1.28e	1.39c	1.58c	2.60d	3.06c	37650	0	37650	-

Location : Katiadi, Kishoreganj (AEZ 9)
CP : Potato-T.Aus-T.Aman
Year : 2003-04

Tuber yield of Potato influenced significantly by different fertilizer packages. Higher and identical yield was recorded from IPNS (T_3) and Farmers' practice (T_5). Generally, farmers' apply higher amount of P and K along with cowdung. A positive effect of organic manure was observed. However, same amount of nutrients were applied in T_2 and T_3 but yield was differed significantly. Higher yield obtained in T_3 might be due to the effect of cowdung. Fertilizer doses for MYG both STB and FRG '97 (T_1 and T_4) produced similar yield.

In T.Aus rice, significantly the highest yield was obtained from IPNS (T_3). Similar yield was obtained with T_1 and T_4 along with Farmers' practice (T_5). But straw yield of T.Aus rice did not differ significantly among the fertilizer packages except with T_6. In T.Aman rice, higher and identical grain yield was recorded from T_3 and T_2. Yield did not differ significantly with T_1, T_4 and T_5. Straw yield did not differ significantly among the fertilizer packages except with T_6.

From cost and return analysis it was found that the highest gross return as well as gross margin was calculated from IPNS treatment (T_3) followed by Farmers' practice (T_5). Similarly, MBCR was the highest in T_3 in spite of the higher fertilization cost. However, fertilization cost is slightly higher in Farmers' practice as they apply a very high dose of inorganic fertilizer along with cowdung. Considering yield and economic return IPNS based fertilizer dose was found superior for this cropping pattern.

Table 24. Yield, cost and return analysis of Potato-T.Aus-T.Aman cropping pattern as affected by different fertilizer packages at Katiadi during 2003-04

Treat.	Tuber/grain yield (t/ha)			Straw yield (t/ha)		GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Potato	T.Aus	T.Aman	T.Aus	T.Aman				
T_1	15.51c	2.97c	3.41b	3.67a	4.36a	141075	10115	130960	7.13
T_2	22.13b	3.19b	3.66a	3.86a	4.39a	178139	13747	164392	7.94
T_3	25.42a	3.49a	3.73a	3.87a	4.57a	197760	15309	182451	8.42
T_4	15.90c	2.79c	3.29b	3.60a	4.32a	140520	11087	129433	6.46
T_5	26.20a	2.82c	3.26b	3.40a	4.14a	191393	15976	175417	7.67
T_6	6.41d	1.82d	2.11c	2.70b	2.89b	68930	0	68930	-

Location : Kishoreganj sadar (AEZ 9)
CP : Potato-T.Aus-T.Aman
Year : 2003-04

Higher tuber yield of Potato was obtained with Farmers practice (T_5) but it was statistically similar with IPNS (T_3) and STB fertilizer dose for HYG (T_2). Generally, farmers' apply higher amount of P and K along with cowdung. A positive effect of organic fertilizer was observed. STB fertilizer dose for MYG (T_1) and FRG'97 (T_4) produced identical yield and it was significantly higher than no fertilizer treatment (T_6).

In T.Aus rice, significantly the highest grain yield was found with T_3. However, nutrient dose was same in T_2 and T_3 but yield differed significantly might be due to residual effect of cowdung. Fertilizer dose for MYG both STB as well as FRG'97 (T_1 and T_4) gave identical yield and it was significantly higher than Farmers' practice (T_5). Higher and identical straw yield of T.Aus rice was obtained from T_1, T_2 and T_3. In T.Aman rice, higher grain yield was recorded from T_3 and T_2. Fertilizer dose from FRG'97 (T_4) gave similar yield with Farmers' practice (T_5). Almost similar trend was found in straw yield.

From cost and return analysis it was found that the highest gross return as well as gross margin was calculated from IPNS treatment (T_3). MBCR was also higher in T_3 followed by T_1. Fertilization cost is the highest in Farmers' practice as they apply a very high dose of inorganic fertilizer along with cowdung in Potato. Considering yield and economic return IPNS based fertilizer dose was found superior for this cropping pattern.

Table 25. Yield, cost and return analysis of Potato-T.Aus-T.Aman cropping pattern as affected by different fertilizer packages at Kishoreganj during 2003-04

Treat.	Tuber/grain yield (t/ha)			Straw yield (t/ha)		GR (Tk/ha)	VC (Tk/ha)	GM (Tk/ha)	MBCR
	Potato	T.Aus	T.Aman	T.Aus	T.Aman				
T_1	15.79b	2.86c	3.93b	3.38a	4.05ab	141555	9460	132095	8.55
T_2	21.59a	3.25b	4.08ab	3.39a	4.24a	178855	12497	166368	7.94
T_3	22.54a	3.54a	4.24a	3.74a	4.32a	187785	14162	173623	8.97
T_4	14.11b	2.66c	3.54c	2.85b	3.64c	123015	8329	114686	7.49
T_5	24.14a	2.26d	3.60c	2.70b	3.69c	179955	16006	163949	7.45
T_6	5.59c	1.35e	2.62d	2.29c	2.71d	60635	0	60635	-

Output (Tk/kg): Potato= 4.00, T.Aman rice = 7.00, Jute (fibre) = 8.00, Jute stick = 1.00, Rice straw = 0.50
Inputs (Tk/kg): Urea= 6.00, TSP = 14.00, MP = 10.00, Gypsum = 3.00, Zinc sulphate = 25.00, Mustard oil cake =10.00

Location : Chandina, Comilla (AEZ 19)
CP : Boro -T.Aus-T.Aman rice
Year : 2003-04

No significant yield difference was observed in grain yield of Boro rice among the different fertilizer packages except with no fertilizer treatment (T_6). However, the highest yield was recorded from IPNS treatment (T_3) closely followed by STB for HYG (T_2) and Farmers' practice (T_5). Similar trend was found in case of straw yield. In T.Aus rice the highest grain yield was obtained from T_3 which was identical with T_2 and T_5. Similar yield was also obtained with T_1 and T_4. No significant difference was found in straw yield except T_6. T.Aman rice was damaged due to flood.

Cost and return analysis showed that higher gross return as well as gross margin was calculated from T_3 followed by T_2. MBCR over control was almost same in all the treatments except with Farmers' practice (T_5). Farmers of that area used higher dose of fertilizers in rice that increase fertilization cost and reduce MBCR.

Table 26. Yield, cost and return of Boro- T.Aus- T.Aman cropping pattern as influenced by different fertilizer packages at Chandina, Comilla during 2003-04

Treat	Grain yield (t/ha)			Straw yield (t/ha)			GR	VC	GM	MBCR
	Boro	T.Aus	T.Aman	Boro	T.Aus	T.Aman				
T_1	5.66	2.97	Damaged	6.23	3.27	Damaged	65,160	6698	59,764	4.07
T_2	5.7	3.42	due to	6.27	3.76	due to	68,855	8999	61,208	3.35
T_3	6.14	3.63	flood	6.75	3.99	flood	73,760	9785	66,808	4.39
T_4	6.0	3.08		6.60	3.39		68,555	7368	61,830	3.77
T_5	6.0	3.24		6.61	3.56		69,765	15634	54,239	1.71
T_6	3.78	1.94		4.16	2.13		43,185	0	43,185	-
LSD	0.83	0.46		1.26	0.68		-	-	-	-

- Variable Cost = Fertilizer cost only.

Price (Tk./kg): Rice = 7.00, Rice straw=1.00, Urea =6.00, TSP=14.00, MP= 9.00, Gypsum= 4.00 & Cowdung 0.35

Location : Bramhan Baria (AEZ 9)
CP : Mustard-Boro
Year : 2003-04

Seed yield of Mustard vary significantly among the fertilizer packages. Higher yield was obtained with IPNS (T_3) which was also similar with STB fertilizer dose for HYG (T_2). Fertilizer dose from FRG'97 (T_4) gave significantly higher yield over STB for MYG (T_1), however, both are same MYG level fertilizer dose. Farmers' practice (T_5) gave similar yield with T_1. Almost similar result was found in Boro rice where higher yield was obtained with T_3 and T_2. Treatment T_1 gave similar yield with T_5 which was higher than T_4. More or less similar trend was observed in stover and straw yield of Mustard and Boro rice, respectively.

The highest gross margin was found in T_3 followed by T_2. MBCR over control was almost close to each other of all the treatments except with Farmers' practice (T_5). Farmers of that area used higher dose of fertilizers in rice that increase fertilization cost and reduce MBCR.

Table 27. Yield, cost and return of Mustard-Boro rice cropping pattern as influenced by different fertilizer packages at B.Baria, Comilla during 2003-04

Treatment	Seed/Grain yield (t/ha)		Stover/Straw yield (t/ha)		Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over control)
	Mustard	Boro	Mustard	Boro				
T_1	1.21	5.17	2.66	6.20	62,320	6,698	55,622	4.81
T_2	1.80	5.70	3.96	6.84	77,250	8,999	68,251	5.24
T_3	2.00	5.78	4.41	6.94	81,485	9,785	71,700	5.25
T_4	1.62	4.89	3.56	5.87	67,755	7,368	60,387	5.11
T_5	1.38	5.04	3.13	6.10	64,635	15,634	49,001	2.20
T_6	0.30	3.15	1.5	3.78	30,090	-	30,090	-
LSD	0.35	0.17	0.65	0.64	-	-	-	-

* Variable Cost = Fertilizer Cost only

Location : Lebukhali, Patuakhali (AEZ 13)
CP : Chilli -T.Aman
Year : 2001-02 to 2003-04

Average of three years data revealed that fruit yield of Chilli increased substantially with IPNS based fertilizer application. On an average about 92 kg/ha of yield increased with IPNS (T_3) over STB inorganic fertilizer for HYG (T_2). The 2nd highest yield was obtained with T_2 followed by STB fertilizer dose for MYG (T_1). Effect of higher level of fertilizer was observed to some extent in Chilli. However, both the fertilizers dose are based on MYG the yield was higher with STB fertilizer dose

(T_1) over FRG'97 (T_4). Almost similar trend was observed over the years. Higher and identical yield was obtained with T_3 and T_2. Similarly, in T.Aman rice higher grain yield was found in T_2 and T_3. Almost similar yield was obtained with fertilizer doses for MYG both STB as well as FRG'97 (T_1 and T_4). But during 2001-02 similar yield was obtained with T_1, T_2 and T_3. In 2002-03 significantly the highest yield was recorded from T_3 but in 2003-04 higher and identical yield was found in T_2 and T_3. More or less similar trend was found in straw yield. Farmers' usually apply lower dose of fertilizer and they do not use K and S fertilizer in their crops. Therefore, yield was very low in farmers' practice.

Cost and return analysis showed that the highest gross return as well as gross margin was obtained from IPNS based fertilizer dose (T_3) followed by STB inorganic fertilize (T_2). STB fertilizer dose for MYG (T_1) also gave satisfactory economic return. Marginal benefit cost ratio is the highest in Farmers' practice (T_5) and FRG'97 (T_4) due to lower fertilization cost. Based on three years of experimentation IPNS based fertilizer dose for HYG (T_3) was found superior in respect of yield and profit and it could be recommended for sustainable productivity as well as soil fertility concern.

Table 28. Yield of crops as influenced by different fertilizer packages in Chilli-T.Aman rice cropping pattern at Lebukhali, Patuakhali during 2001-02 to 2003-04

Treat	Fruit yield (kg/ha) and grain yield (t/ha)							
	2001-02		2002-03		2003-04		Mean	
	Chilli	T.Aman	Chilli	T.Aman	Chilli	T.Aman	Chilli	T.Aman
T_1	1245bc	3.84a	1642ab	3.90c	1665bc	3.88b	1556	3.87
T_2	1329ab	3.93a	1737a	4.11b	1788ab	3.96ab	1618	4.00
T_3	1492a	3.98a	1759a	4.26a	1879a	4.06a	1710	4.10
T_4	1089cd	3.73b	1535b	3.87c	1543cd	3.68c	1389	3.76
T_5	998de	3.31c	1302c	3.61d	1403de	3.42d	1234	3.44
T_6	863e	2.53d	1209c	2.88e	1291e	2.76e	1121	2.72

Table 28. Contd.

Treat	Stover (kg/ha) and Straw yield (t/ha)			
	2001-02	2002-03	2003-04	Mean
	T.Aman	T.Aman	T.Aman	T.Aman
T_1	4.67ab	4.75b	4.65ab	4.69
T_2	4.86a	5.16a	4.85a	4.96
T_3	4.72a	5.00a	4.76a	4.82
T_4	4.49bc	4.69bc	4.40c	4.53
T_5	4.43c	4.53c	4.48b	4.48
T_6	3.32d	3.76d	3.65d	3.58

Table 29. Cost and return of Chilli-T.Aman rice cropping pattern as influenced by different fertilizer packages at Lebukhali, Patuakhali during 2001-02 to 2003-04 (Average)

Treat	GR	VC	GM	MBCR
T_1	95399	12201	83198	2.21
T_2	99203	15942	83261	1.93
T_3	103616	16546	87770	2.17
T_4	87911	6859	81052	2.85
T_5	80785	3823	76962	3.24
T_6	68388	0	68388	0

* Variable Cost = Fertilizer Cost only

Location : Hathazari, Chittagong (AEZ 23)
CP : Chilli -T.Aman
Year : 2003-04

Fruit yield of Chilli varied significantly among the different nutrient packages. Higher and statistically identical fruit yield was recorded from STB fertilizer dose for HYG (T_2) and IPNS (T_3). Farmers' practice (T_5) gave similar yield with STB for MYG (T_1) but significantly higher than FRG'97 (T4). Effect of higher levels of nutrient was observed in Chilli to some extent. In T.Aman rice almost similar trend was found and higher grain yield was obtained from T_2 and T_3. Similar yield was obtained with T_1 and T_4 along with Farmers' practice (T_5). More or less similar result was found in straw yield.

From the cost and return analysis it was found that the highest gross return as well as gross margin was obtained from T_2 followed by T_3. Similarly, MBCR was also higher with the same treatments.

Table 30. Yield, cost and return of Chilli-T.Aman rice cropping pattern as influenced by different fertilizer packages at Hathazari, Chittagong during 2003-04

Treatment	Fruit/Grain yield (t/ha)		Straw yield (t/ha)	Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over control)
	Chilli	T.Aman	T.Aman				
T_1	0.92bc	4.02b	4.66bc	106240	12957	93283	3.22
T_2	1.36a	4.68a	4.90ab	146460	15004	131456	5.46
T_3	1.31a	4.86a	5.17a	143830	14342	129488	5.53
T_4	0.87c	3.97b	4.44c	101510	7168	94642	5.16
T_5	1.05b	3.72b	4.39c	114830	12450	102380	4.04
T_6	0.53d	2.71c	3.22d	64510	0	64510	-

* Variable Cost = Fertilizer Cost only

Location : Goyeshpur, Pabna (AEZ 11)
CP : Maize-T.Aman
Year : 2003-04

Grain yield of Maize varied significantly due to different fertilizer packages. The highest yield was obtained with fertilizer dose from BARI technology handbook (T_4) followed by STB fertilizer dose for HYG (T_2) and IPNS based fertilizer dose (T_3). The amount of fertilizer was much higher in T_4, even it is higher than STB for HYG (T_2). Effect of poultry manure applied as IPNS was not observed in Maize. Farmers' practice (T_5) also gave similar yield with T_2 and T_3. Higher and statistically identical stover yield was found in T_3 and T_4. In T.Aman rice the highest yield was obtained with T_3 followed by T_2 and T_4. However, nutrient dose was same in T_2 and T_3 but yield was higher in T_3 might be due to residual effect of poultry manure applied in Maize. Fertilizer dose from FRG'97 (T_4) gave higher yield than T_1 probably due to higher amount of fertilizers. Farmers' practice (T_5) gave similar yield with other fertilizer packages except with T_3. More or less similar trend was found in straw yield also.

Cost and return analysis showed that the highest gross return and gross margin was obtained in IPNS (T_3) treatment followed by T_2 and T_4. MBCR over control did not vary markedly, However, the highest MBCR was found in T_3 and the lowest from T_4.

Table 31. Yield, cost and return influenced by different fertilizer levels in the cropping pattern Maize-T.Aman at Goyeshpur, Pabna during 2003-04

Treatment	Grain yield (t/ha)		Straw yield (t/ha)		Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over control)
	Maize	T.Aman	Maize	T.Aman				
T_1	6.67c	4.02b	7.16d	5.35b	96480	9754	86726	2.04
T_2	7.55ab	5.22ab	8.13b	5.56b	115670	12555	103115	2.88
T_3	7.73ab	5.63a	8.80a	6.64a	121995	13706	108289	3.02
T_4	7.82a	5.11ab	9.05a	5.53b	117040	13453	103587	2.73
T_5	7.50b	4.87b	7.73c	5.40b	111515	11200	100315	2.98
T_6	4.62d	2.90c	3.20e	3.22c	66860	0	66860	-

Input price (Tk./kg): Urea= 6.00, TSP= 14.00, MP= 8.00, Gypsum= 3.00, ZnO=40.00 & Borax = 40.00
Output price (Tk./kg): Maize grain = 7.00, T.Aman grain = 8.00 & Stover/Straw= 0.50

Location : Boda, Panchaghar (AEZ 1)
CP : Wheat-T.Aman
Year : 2003-04

Grain yield of Wheat varied significantly due to different fertilizer packages. Significantly the highest yield was obtained with IPNS (T_3) based fertilizer dose. The next higher yield was obtained with fertilizer dose from FRG'97 (T_4) and Farmers' practice (T_5), however it was identical with STB fertilizer dose for MYG (T_1). Nutrient dose was same with T_2 and T_3 but cause of lower yield in T_2 was not clear. But effect of cowdung applied in IPNS was evident. Similarly, in T.Aman rice significantly the highest yield was obtained with T_3. But yield did not vary significantly among other fertilizer packages except with no fertilizer treatment. However, nutrient dose was same in T_2 and T_3 but yield was higher in T_3 might be due to residual effect of cowdung applied in Wheat. More or less similar trend was found in straw yield of Wheat and T.Aman rice. It is notice that farmers' fertilizer dose is almost similar with present recommendation (FRG'97). Therefore, similar yield was obtained in Farmers' practice

Cost and return analysis showed that the highest gross return and gross margin was obtained in IPNS (T_3) treatment. The 2nd highest gross margin was found in FRG'97 (T_4) treatment. MBCR over control did not vary markedly except in T_2. However, the highest MBCR was found in T_3 where IPNS concept was applied.

Table 32. Yield, cost and return influenced by different fertilizer levels in the cropping pattern Wheat-T.Aman at Boda, Dinajpur during 2003-04

Treatment	Grain yield (t/ha)		Straw yield (t/ha)		Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over control)
	Wheat	T.Aman	Wheat	T.Aman				
T_1	2.58	3.22	2.81	5.19	50400	6067	44333	3.16
T_2	2.44	3.19	3.56	5.83	49735	8411	41324	2.20
T_3	3.37	3.83	4.69	6.22	63055	9071	53984	3.51
T_4	2.83	3.19	4.39	5.44	53075	6667	46408	3.28
T_5	2.81	3.31	4.19	5.55	53830	6996	44134	3.23
T_6	1.39	2.11	2.39	4.03	31210	0	31210	-
LSD	0.29	0.30	0.55	0.88	-	-	-	-

Location : Khulna (AEZ 13)
CP : Sesame-T.Aman
Year : 2003-04

Grain yield of Sesame did not vary significantly due to different fertilizer packages except with no fertilizer treatment (T_6). However, higher yield was obtained with STB fertilizer dose for HYG (T_2) and IPNS (T_3). Almost similar yield was found in STB for MYG (T_1) and FRG'97 (T_4) along with Farmers' practice (T_5). In stover significantly the highest yield was obtained with T_3. Similarly, in T.Aman rice grain yield did not vary significantly with different fertilizer packages except with T_6. Effect of higher level of nutrient is not observed over moderate level. Almost similar trend was observed in straw yield also.

Cost and return analysis showed that gross margin did not vary markedly among treatment T_1, T_2 and T_3 but IPNS treatment failed to show higher MBCR due to high fertilizer cost.

Table 33. Yield, cost and return influenced by different fertilizer levels in the cropping pattern Sesame-T.Aman at Khulna during 2003-04

Treatment	Grain yield (t/ha)		Straw yield (t/ha)		Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over control)
	Sesame	T.Aman	Sesame	T.Aman				
T_1	1070ab	4.20a	3270b	5.12a	58,845	2,982	55,863	2.07
T_2	1173a	4.24a	3319b	5.25a	60,911	3,957	56,954	2.07
T_3	1165a	4.30a	3616a	5.05a	61,488	5,378	56,110	1.63
T_4	1058ab	4.17a	3114b	5.05a	57,980	4,586	53,394	1.15
T_5	1070ab	4.20a	3270b	5.12a	58,845	2,982	55,863	2.07
T_6	984 b	3.77b	2685c	4.31b	52,704	0	52,704	-

Location : Manikganj (AEZ 9)
CP : Mustard-Boro
Year : 2001-02 to 2004-05

The experiment was initiated in 2001-02 and due to rain and flood it was damaged in 2003-04. Results of 2001-02, 2002-03 and 2004-05 are presented in Table … Average of three years data revealed that seed yield of Mustard increased substantially with IPNS based fertilizer application. On an average about 110 kg/ha of yield increased with IPNS (T_3) over STB inorganic fertilizer (T_2). The 2^{nd} highest yield was obtained with T_2 followed by FRG'97 (T_4) and Farmers' practice (T_5). Almost similar trend was observed over the years. Significantly higher yield was recorded from T_3 during all the years. Almost similar yield was recorded with STB fertilizer dose for MYG (T_1) and FRG'97 (T_4) along with farmers' practice (T_5) during 2001-02 and 2004-05. However, in 2002-03 yield was significantly higher with T_4 and T_5. Similarly, in Boro rice the highest grain yield was found in T_3 and the 2^{nd} highest yield was obtained with T_2. However, nutrient dose was same in T_2 and T_3 but yield was significantly higher in T_3 probably due to residual effect of cowdung applied in T_3 in Mustard. More or less similar yield was obtained with FRG'97 (T_4), Farmers' practice (T_5) and STB for MYG (T_1). Regarding stover and straw yield of crops almost similar trend was found as observed in grain yield. A considerable response of crops to organic manure was observed in Mustard-Boro rice cropping pattern.

Cost and return analysis showed that the highest gross return as well as gross margin was obtained from IPNS based fertilizer dose (T_3). Fertilizer dose from FRG'97 (T_4) and STB inorganic fertilize for HYG (T_2) also gave satisfactory economic return. Marginal benefit cost ratio is the highest in FRG'97 (T_4) due to lowest fertilization cost. In spite of highest fertilization cost IPNS (T_3) also gave next higher value with T_1. Based on three years of experimentation the IPNS based fertilizer dose for HYG (T_3) was found superior in respect of yield and profit and it could be recommended for sustainable productivity as well as soil fertility concern.

Table 34. Yield of crops as influenced by different fertilizer packages in Mustard-Boro rice cropping pattern at Manikganj during 2001-02 to 2004-05

Treat	Seed (kg/ha) and grain yield (t/ha)							
	2001-02		2002-03		2004-05		Mean	
	Mustard	Boro	Mustard	Boro	Mustard	Boro	Mustard	Boro
T_1	609c	4.74c	718c	4.49b	670bc	5.88c	670	5.04
T_2	729b	5.40ab	885ab	5.14a	710b	6.73b	775	5.76
T_3	844a	5.72a	950a	5.31a	860a	7.43a	885	6.15
T_4	649c	5.15b	817ab	5.04a	640c	5.85c	702	5.38
T_5	679c	5.10bc	757bc	4.21b	690bc	6.59b	709	5.30
T_6	295d	2.56d	325d	3.13c	210d	2.94d	280	2.88

Table 34. Contd.

Treat	Stover (kg/ha) and Straw yield (t/ha)							
	2001-02		2002-03		2004-05		Mean	
	Mustard	Boro	Mustard	Boro	Mustard	Boro	Mustard	Boro
T_1	1192c	6.0c	1930b	5.72b	1430a	6.10b	1520	5.94
T_2	1451b	6.69ab	2130ab	6.15ab	1450a	7.25ab	1677	6.70
T_3	1720a	7.07a	2450a	6.49a	1660a	8.31a	1945	7.29
T_4	1337b	6.77ab	2010a	5.80b	1440a	6.50b	1596	6.36
T_5	1190c	6.20bc	1980b	5.96b	1460a	7.98a	1543	6.71
T_6	565d	3.92d	990c	3.91c	540b	4.50c	700	4.11

Table 35. Cost and return of Mustard -Boro rice cropping pattern as influenced by different fertilizer packages at Manikganj during 2001-02 to 2004-05 (Average)

Treat	GR	VC	GM	MBCR
T_1	64700	7264	57436	4.31
T_2	69175	10075	59100	3.55
T_3	79140	11122	68018	4.11
T_4	65540	5679	59861	5.66
T_5	65124	8685	56439	3.65
T_6	33375	0	33375	-

Location : Paba, Rajshahi (AEZ 11)
CP : Potato-T.Aman
Year : 2001-02 to 2003-04

Average of three years data revealed that tuber yield of Potato influenced substantially with different fertilizer packages. The highest tuber yield was obtained with IPNS (T_3) treatment which was closely followed by STB fertilizer dose for HYG (T_2). The next higher yield was found in Farmers' practice (T_5). Fertilizer dose from FRG'97 (T_4) gave higher yield over STB for MYG (T_1). Yield over the years showed that significantly higher and identical yield was obtained with T_2 and T_3. Almost similar trend was observed in T.Aman rice also. Higher grain yield was obtained with T_2 and T_3 followed by T_5. Similar yield was also obtained with T_1 and T_4. Over the years data showed that higher and identical yield was found in T_2 and T_3 along with Farmers' practice (T_5) during 2001-02 and 2002-03. But in 2003-04 yield was significantly lower in T_5. Regarding straw yield of T.Aman rice more or less similar result was observed. Initial soil status data of the experimental field showed that the soil was rich in nutrient except nitrogen. Status of P and K was very high and medium, respectively. Therefore, less amount of fertilizer required. But farmers' applied a very high dose of fertilizer in Potato.

Cost and return analysis showed that the highest gross return as well as gross margin was obtained from T_3 closely followed by T_2. Farmers' usually apply higher dose of fertilizers in Potato, therefore fertilization cost was the highest in Farmers' practice (T_5). The highest MBCR was found in T_2

followed by T_3. However, gross return and gross margin was higher in T_3 but due to additional cost of cowdung MBCR was less than T_2. The lowest MBCR was found in Farmers' practice (T_5) due to highest fertilization cost. Based on three years of experimentation IPNS and STB fertilizer dose for HYG was found superior in respect of yield and profit. Application of organic manure @ 2-5 t/ha once in a year could be recommended for sustainable productivity as well as soil fertility concern.

Table 36. Yield of crops as influenced by different fertilizer packages in Potato-T.Aman rice cropping pattern at Paba, Rajshahi during 2001-02 to 2003-04

Treat	Tuber/ grain yield (t/ha)							
	2001-02		2002-03		2003-04		Mean	
	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman
T_1	21.44c	2.87b	21.59d	2.73b	17.53c	2.84b	20.19	2.81
T_2	27.43ab	3.59a	27.87ab	3.57a	24.2a	3.63a	26.5	3.60
T_3	28.53a	3.77a	28.32a	3.64a	24.4a	3.72a	27.1	3.71
T_4	24.96b	2.73b	24.43c	2.86b	19.88b	2.73b	23.10	2.77
T_5	24.69b	3.71a	25.73bc	3.49a	24.15a	3.0b	24.85	3.40
T_6	13.13d	1.86c	10.82e	1.88c	9.2d	1.6c	11.15	1.78

Table 36. Contd.

Treat	Straw yield (t/ha)							
	2001-02		2002-03		2003-04		Mean	
	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman	Potato	T.Aman
T_1		3.60c		3.56b		4.02		3.73
T_2		4.03ab		4.16a		4.77ab		4.32
T_3		4.13a		4.3a		4.83a		4.44
T_4		3.76bc		3.68b		4.07cd		3.84
T_5		4.15a		3.92ab		4.42bc		4.02
T_6		2.78d		2.75c		2.74c		2.76

Table 37. Cost and return of Potato-T.Aman rice cropping pattern as influenced by different fertilizer packages at Paba, Rajshahi during 2001-02 to 2003-04 (Average)

Treat	GR	VC	GM	MBCR
T_1	124350	6300	118050	8.47
T_2	162020	8596	153424	10.59
T_3	165890	10490	155400	9.04
T_4	138720	8581	130139	7.90
T_5	152070	20414	131656	3.97
T_6	70970	0	70970	-

* Variable Cost = Fertilizer Cost only

Price (Tk./kg): Potato=6.00, Rice = 8.00, Straw= 1.00, Urea= 6.00, TSP= 16.00, MP= 12.00, Gypsum = 5.00 and Cowdung= 100 Tk/ton.

Location : Natore, Rajshahi
CP : Groundnut-T.Aman
Year : 2001-02 to 2003-04.

Average yield of three years data showed that yield of Groundnut influenced appreciably due to different fertilizer packages. The highest nut yield of Groundnut was obtained with IPNS (T_3) based fertilizer dose followed by STB fertilizer dose for HYG (T_2). However, groundnut is a leguminous crop but effect of cowdung was observed to some extent. STB fertilizer dose for MYG (T_1) gave similar yield with FRG'97 (T_4). Yield obtained with Farmers' practice (T_5) was lower than other fertilizer packages. Almost similar result was found over the years. However, higher and identical yield was obtained with T_2 and T_3 during 2001-02. In T.Aman rice higher yield was obtained with

IPNS (T_3) and STB fertilizer dose for HYG (T_2). Almost similar yied was obtained with T_1 and T_4 which was higher than Farmers' practice (T_5). More or less similar trend was observed in stover and straw yield of Groundnut and T.Aman rice, respectively.

Cost and return analysis showed that the highest gross return as well as gross margin was found with T_3 followed by T_2. Marginal benefit cost ratio (MBCR) over control did not vary considerably among the fertilizer packages except with Farmers' practice (T_5). However, the highest MBCR was obtained from T_4 due to lower fertilization cost. Based on three years of experimentation STB fertilizer dose for HYG as well as IPNS was found superior in respect of yield and profit.

Table 38. Yield of crops as affected by different fertilizer packages in Groundnut-T.Aman cropping pattern at Natore, Rajshahi during 2001-02 to 2003-04

Treatment	2001-02		2002-03		2003-04		Mean	
	Groundnut	T.Aman	Groundnut	T.Aman	Groundnut	T.Aman	Groundnut	T.Aman
Nut/Grain yield (t/ha)								
T_1	1.77b	3.93bc	1.58c	3.38b	1.83b	4.41a	1.63	3.71
T_2	2.02a	5.18a	1.89b	4.55a	1.87ab	4.50a	1.93	4.74
T_3	2.15a	4.97a	2.17a	4.67a	1.97a	4.49a	2.10	4.71
T_4	1.7bc	4.06b	1.63c	3.34b	1.35d	3.04b	1.60	3.76
T_5	1.54c	3.69c	1.53c	2.99b	1.83b	3.41b	1.47	3.36
T_6	1.05c	2.06d	0.88d	1.96c	0.74c	1.8c	0.89	1.94
Straw yield of T.Aman (t/ha)								
T_1		5.37b		4.89ab		5.08ab		4.65
T_2		5.75a		5.13a		5.18a		5.11
T_3		4.83c		4.82bc		4.88ab		5.35
T_4		4.48d		4.28c		4.0c		4.84
T_5		2.37c		2.56b		2.13d		4.25
T_6		5.37b		4.89ab		5.08ab		2.35

Table 39. Cost and return analysis of Groundnut-T.Aman cropping pattern as influenced by different fertilizer packages at Natore, Rajshahi during 2001-02 to 2003-04

Treatment	Gross return (Tk/ha)	Variable cost* (Tk/ha)	Gross margin (Tk/ha	MBCR (Over control)
T_1	59960	5023	54937	5.75
T_2	72460	6648	65812	6.22
T_3	76120	7548	68572	5.97
T_4	59960	4910	55050	5.89
T_5	54620	4810	49810	4.70
T_6	31050	0	31050	-

Recommendation

Based on three year study considering yield, economic benefit as well as soil fertility concern the following fertilizer doses could be recommended for different cropping patterns at different locations for sustainable productivity.

Location	AEZ	CP	Nutrient dose (kg/ha)						OM (t/ha)	Remarks
			N	P	K	S	Zn	B		
Gabtali, Bogra	AEZ 4	Mustard	90	30	30	20	0	1.5	3-5	The most available organic manure (FYM, CD, RS, PM etc) apply in the soil at least 7-10 days before planting
		Boro	120	25	55	10	2	0	0	
		T.Aman	90	15	40	5	1	0	0	
		Boro	120	8	20	10	2	0	0	
		T.Aman	80	6	20	5	1	0	0	
Sherpur	AEZ 9	Wheat	100	20	50	5	0	1.0	3-5	
		Jute	80	15	50	0	0	0	0	
		T.Aman	90	15	40	10	2	0	0	
Feni	AEZ 18	Boro	100	25	50	15	2	0	0	
		T.Aman	75	10	40	5	1	0	0	
Atkapalia, Noakhali	AEZ 18	Groundnut	20	20	25	5	0	0	0	
		T.Aman	70	10	30	10	3	0	0	
Laxmipur	AEZ 18	Groundnut	20	20	25	5	0	0	0	
		T.Aman	70	10	30	10	3	0	0	
Barind, Rajshahi	AEZ 26	Potato	150	30	120	0	0	0	3-5	
		T.Aman	80	15	40	10	0	0	0	
Mymensingh	AEZ 9	Mustard	100	30	50	20	0	1.0	3-5	
		Boro	120	20	50	10	2	0	0	
Lebukhali, Patuakhali	AEZ 13	Chilli	105	60	20	0	1	0	3-5	
		T.Aman	70	20	20	5	2	0	0	
Syedpur, Rangpur	AEZ 3	Potato	130	25	120	0	0	0	3-5	
		Boro	120	15	70	10	2	0	0	
		T.Aman	90	8	50	5	1	0	0	
Manikganj	AEZ 9	Mustard	80	25	20	20	0	1.5	3-5	
		Boro	120	20	40	10	3	0	0	
Natore	AEZ 11	Groundnut	30	30	30	0	0	0	0	
		T.Aman	85	10	20	5	3	0	0	
Paba, Rajshahi	AEZ 11	Potato	115	10	60	0	0	0	3-5	
		T.Aman	85	5	20	0	0	0	0	

Appendix table 1. Initial soil status of the experimental site

Location with AEZ	Land type	R/ I	pH	O.C (%)	Total N (%)	K (m.eq./100g soil)	P	S	Zn	B
							ppm			
Mymensingh (9)	MHL	I	5.8	1.80	0.10 (L)	0.18 (M)	2.15 (VL)	14.28 (VL.)	2.64 (VH)	0.18 (L)
Phulpur (9)	MHL	I	5.8	1.41	0.11 (L)	0.048 (VL)	11.74 (L)	6.52 (VL)	2.41 (H)	0.14 (VL)
Netrokona (9)	MHL	I	6.4	1.63	0.087 (VL)	0.051 (VL)	4.98 (VL)	6.95 (VL)	2.84 (VH)	0.15 (VL)
Hathazari (23)	MHL	I	5.35	1.15	0.07 (VL)	0.07 (L)	23.8 (Opt)	8.0 (L)	-	-
Narikeli (9)	MHL	I	5.8	1.0	0.06 (VL)	0.08 (VL)	8.15 (L)	12.72 (L)	0.67 (L)	1.39 (VH)
Melandah (9)	MHL	I	4.7-5.2	0.75-1.28	0.06-0.10 (L)	0.18-0.76 (M)	7.99-11.32 (L)	7.69-10.9 (L)	1.84-5.1 (M)	0.05-0.29 (L)
Sherpur (9)	MHL	I	5.5	0.55-1.31	0.025-0.11 (VL)	0.06-0.15 (VL)	4.2-11.5 (L)	6.66-15.5 (L)	0.28-0.79 (VL)	0.61-2.75 (VH)
Katiadi (9)	MHL	I	6.85	0.66	0.092 (L)	0.15 (L)	6.23 (VL)	8.85 (L)	-	-
Kishoreganj (9)	MHL	I	6.75	0.88	0.11 (L)	0.14 (L)	8.6 (L)	9.55 (L)	-	-
Palima (8)	MHL	I	6.27	1.16	0.07 (VL)	0.11 (L)	1.93 (VL)	7.61 (L)	1.34 (M)	0.63 (H)
Lebukhali (13)	MHL	R	5.3	1.44	0.08 (VL)	0.28 (Opt)	4.4 (VL)	33.46 (Opt)	0.34 (VL)	-
Paba (11)	MHL	I	8.2	1.53	0.11 (L)	0.25 (H)	32.0 (VH)	78.1 (VH)	1.35 (M)	0.66 (M)
Natore (11)	MHL	R	8.3	-	0.10 (L)	0.20 (O)	8.43 (L)	26.71 (L)	0.61 (L)	-
Barind (25)	MHL	I	5.6	1.04	0.06 (VL)	0.19 (M)	3.05 (VL)	4.83 (L)	2.30 (M)	0.33 (L)
Atkapalia (18)	MHL	R	7.2	1.66	0.091 (L)	0.18 (M)	2.0 (VL)	25.8 (O)	0.62 (L)	0.15 (L)
Feni (18)	MHL	I	6.78	1.54	0.08 (VL)	0.052 (VL)	1.40 (VL)	8.81 (VL)	0.52 (L)	0.25 (L)
Laxmipur (18)	MHL	R	6.6	2.12	0.12 (L)	0.19 (M)	1.5 (VL)	31.3 (VH)	0.85 (L)	0.47 (O)
Syedpur (3)	MHL	I	5.8	2.1	0.09 (L)	0.045 (VL)	11.65 (L)	8.52 (L)	10.64 (L)	0.24 (L)
Goyeshpur (11)	MHL	I	8.28	2.29	0.11 (L)	0.17 (L)	5.47 (VL)	10.82 (L)	-	0.29 (L)
Ishan Gopalpur (12)	MHL	I	7.5	-	0.18 (M)	0.42 (VH)	9.03 (L)	18.0 (M)	-	-
Gabtali (4)	MHL	I	5.9	1.85	0.09 (L)	0.125 (VL)	6.67 (L)	16.2 (M)	0.76 (L)	0.22 (L)
Nandigram (25)	MHL	I	4.9	1.16	0.12 (L)	0.08 (VL)	9.3 (L)	11.8 (L)	1.60 (M)	-
Dumuria (13)	MHL	R	6.8	2.65	0.15 (L)	0.60 (VH)	14.0 (M)	371 (VH)	0.34 (VL)	-
Chandina (19)	MHL	I	-	-	0.13 (L)	0.15 (L)	13.4 (M)	12.4 (L)	1.7 (Opt.)	-
Manikganj (AEZ 9)	MLL	I	7.15	1.47	0.09 (VL)	0.196 (M)	3.31 (VL)	13.13 (L)	0.62 (L)	0.047 (VL)

Appendix table 2. Crop management practices

Site	Cropping pattern	Variety	Seed rate (kg/ha)	Planting time	Harvesting time
Netrokona	Mustard	BARI Sarisha 9	10	2nd week of Nov	1st week of Feb
	Boro	BRRI dhan 29	40	2nd week of Feb	Last week of May
	T.Aman	BRRI dhan 32	40	4th week of July	1st week of Nov
Phulpur	Mustard	-	-	-	-
	Boro	BRRI dhan 28	40	1st week of Feb	1st week of May
	T.Aman	BRRI dhan 32	40	Last week of July	2nd week of Nov
Mymensingh	Mustard	BARI Sarisha 9	10	2nd week of Nov	4th week of Jan.
	Boro	BRRI dhan 28	40	1st week of Fe	1st week of May
Gabtali	Mustard	BARI Sarisha 9	08	1st week of Nov	Last week of Jan.
	Boro	BRRI dhan 28	50	1st week of Feb	1st week of May
	T.Aman	BRRI dhan 39	50	4th week of July	1st week of Nov.
Narikeli	Potato	Cardinal	2000	3rd week of Nov	2nd week of Feb
	Jute	O-9897	8	3rd week of March	3rd week of May
	T.Aman	BRRI dhan 33	40	1st week of Aug.	Last week of Oct.
Melandah	Potato	Cardinal	2000	3rd week of Nov	1st week of March
	Jute	O-9897	8	3rd week of March.	2nd week of July
	T.Aman	BRRI dhan 33	50	3rd week of July	Last week of Oct.
Sherpur	Wheat	Kanchan	100	4th week of Nov..	4th week of March
	Jute	O-9897	8	2nd week of April	4th week of July
	T.Aman	BRRI dhan 33	50	3rd week of Aug	1st week of Nov
Kishoregonj	Potato	Diamont	1500	3rd week of Nov.	1st week of March
	T.Aus	BR 26	50	2nd week of May	Last week of July
	T.Aman	BRRI dhan 32	50	2nd week of Aug	2nd week of Nov
Katiadi	Potato	Diamont	1500	3rd week of Nov.	1st week of March
	T.Aus	BR 26	50	2nd week of May	Last week of July
	T.Aman	BRRI dhan 32	50	2nd week of Aug	2nd week of Nov
Lebukhali	Chilli	Local	-	3rd week of Jan.	2nd week of May
	T.Aman	BR-23	40	1st week of Sept.	3rd week of Dec
Ishan Gopalpur	Wheat	Protiva	120	1st week of Dec.	4th week of March
	Jute	O-9897	8	3rd week of April	4th week of July
	T.Aman	BRRI dhan 32	50	2nd week of Aug	3rd week of Nov
Hathazari	Chilli	Local	600g	3rd week of Dec.	2nd week of April
	T.Aman	BRRI dhan 30	35	Last week of July	4th week of Nov
Lalmonirhat	Wheat	Kanchan	120	1st week of Dec.	4th week of March
	Jute	O-9897	8	2nd week of April	4th week of July
	T.Aman	BR 11	50	Last week of July	3rd week of Nov
Syedpur	Potato	Cardinal	1500	1st week of Dec.	2nd week of Feb.
	Boro	BRRI dhan 28	40	1st week of March	1st week of July
	T.Aman	BR 11	40	2nd week of July	3rd week of Nov.
Feni	Boro	BRRI dhan 29	40	1st week of Feb.	Last week of May
	T.Aman	BR 11	40	3rd week of July	3rd week of Nov
Paba	Potato	Cardinal	1800	Last week of Nov.	Last week of March
	T.Aman	BRRI dhan 39	40	3rd week of July	3rd week of Nov.
Natore	Groundnut	DG-1	-	4th week of Jan.	3rd week of May
	T.Aman	BR 11	40	2nd week of July	3rd week of Nov.
Barind	Potato	Cardinal	1800	4th week of Dec.	2nd week of March
	T.Aman	BRRI dhan 39	40	3rd week of July	4th week of Oct.
Atkapalia	Groundnut	Dhaka-1	-	1st week of Jan.	3rd week of May
	T.Aman	BRRI dhan 32	40	Last week of July	3rd week of Nov.
Laxmipur	Groundnut	DG-2	-	4th week of Jan.	Last week of May
	T.Aman	BRRI dhan 32	40	3rd week of July	3rd week of Nov.
Goyeshpur	Maize	Pacific-11	150	3rd week of Dec.	3rd week of May
	T.Aman	BRRI dhan 39	50	4th week of July	1st week of Nov
Chandina	Boro	BRRI dhan 29	40	3rd week of Jan.	3rd week of May
	T.Aus	BR20	40	Last week of May	Last week of Aug.
	T.Aman	BRRI dhan 39	40	1st week of Sept.	4th week of Nov.
Dumuria	Sesame	Local	10	Last week of Feb.	Last week of May
	T.Aman	BR23	40	3rd week of Aug.	3rd week of Dec.
Boda	Wheat	Shatabdi	120	1st week of Dec.	3rd week of March
	T.Aman	BRRI dhan 32	40	2nd week of Jul.	2nd week of Nov.
Manikganj	Mustard	Tori-7	8	1st week of Nov.	2nd week of Jan.
	Boro	BRRI dhan 29	40	1st week of Feb.	Last week of May

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Effects of Rice Straw on the performance of Boro-Fallow-T.Aman rice system

Abstract

An on-farm experiment was conducted at two different locations viz. Shahrasti (Chandpur) and Kolaroa (Khulna) during 2001-02 to 2003-04 to evaluate the effect of Boro rice straw in corporation on the yield of T.Aman rice in Boro-T.Aman rice cropping system. Boro rice was grown with recommended fertilizer and it was harvested at different height to remain straw in the soil as per treatment. In T.Aman rice, ⅓rd and ⅔rd Boro rice straw was incorporated to the soil along with full doses as well as reduced doses of inorganic fertilizers for MYG. Inorganic fertilizers of recommended dose for MYG and HYG and farmers' practice were also included to compare. Results showed that grain yield of T.Aman rice did not vary appreciably among the treatments at Shahrasti. However, the highest yield was obtained in T_2 where $^2/_3{}^{rd}$ rice straw was incorporated along with recommended fertilizer dose for MYG (RF_2). But at Kolaroa, T_2 produced higher yield along with T_5 and T_7. Incorporation of $^2/_3{}^{rd}$ rice straw along with RF_2 gave similar yield with recommended fertilizer dose for HYG (RF1). Treatment T_2 performed better in terms of yield as well as economic benefit at Kolaroa.

Introduction

Boro-T.Aman rice system is a predominant cropping pattern in Bangladesh under irrigated medium high to medium low land condition. Due to continuous practice of rice based cropping system the production seems to have reached in a stagnant position in spite of using more and more fertilizers. Use of organic matters like cowdung and farmyard manure is decreasing because of utilization as fuel materials. Further, continuous cultivation of HYV rice over the years is exhausting the soil nutrients. Thus, organic matter content and soil fertility is decreasing day by day. Recycling of organic matter is essential for maintaining soil fertility. Establishment of dhaincha or any other green manuring crop is very difficult because of heavy rainfall in the month of May. As such, alternative strategy might be incorporation of rice straw. Boro rice straw may be used as an alternate source of organic matter and may stabilize the yield of the crops under Boro-Fallow-T.Aman rice system.

Generally, Boro rice is harvested in the month of May and particularly in medium low land due to high rainfall and flash flood water where farmers are forced to harvest the crop at the top remaining the straw. Thus the Boro rice straw can be utilized as organic residue to the succeeding T.Aman rice. Therefore, the complementary use of rice straw with mineral fertilizer will help to increase use efficiency of applied fertilizers and maintaining soil fertility. With this view in mind the experiment was under taken to compare rice straw and inorganic fertilizer effects with conventional practice of chemical fertilizers application on Boro-T.Aman rice system.

Materials and Methods

The experiment was initiated from Boro season of 2001-02 and continued in 2003-04. It was conducted at 2 different locations Shahrasti and Kolaroa. Seven different treatment combinations were tested with 6 dispersed replications. The plot was divided into 7 (seven) sub-plot. The size of each unit plot was 10 m x 10 m.

In Boro rice recommended dose of fertilizers were applied in all the plots. Irrigation and other intercultural operations were done as and when necessary. Boro rice straw was harvested leaving1/3rd and $^2/_3{}^{rd}$ straw in the soil. Yield and yield contributing characters of Boro rice were recorded as per requirement. Rice straw of Boro was incorporated into the soil by ploughing. In T.Aman rice, fertilizers were applied as per following treatments combinations. Seven treatments were as follows:

T_1= $\frac{1}{3}$ Boro rice straw ($\frac{2}{3}$ should be harvested from top) incorporation then T.Aman with RF_2
T_2= $\frac{2}{3}$ Boro rice straw ($\frac{1}{3}$ should be harvested from top) incorporation then T.Aman with RF_2
T_3= T_2 + T.Aman with 65-6-20-4 kg NPKSZn/ha.
T_4= T_3 + T.Aman with 50-6-20-4 kg NPKSZn/ha.
T_5= Recommended fertilizer for high yield goal (RF_1)
T_6= Recommended fertilizer for moderate yield goal (RF_2)
T_7= Farmers practices (Harvesting).

Note: RF_1 = 90-8-26-5-2 kg/ha of NPKSZn
RF_2 = 70-6-20-4 kg/ha of NPKS
FP (Comilla): 90-37-32 kg/ha of NPK
FP (Kolaroa): 135-30-38-0-5 kg/ha of NPKSZn

Irrigation and other intercultural operations were done as and when necessary. Yield and yield contributing characters were recorded as per requirement and were statistically analyzed. Soil characteristics and different crop management practices followed in different sites are given in appendix I.

Results and Discussion

Location : Shahrasti, Comilla
Year of conduction: 2003-04

The experiment initiated with Boro rice grown with recommended fertilizer dose in 2003-04. After harvesting Boro rice treatments were imposed in T.Aman rice with different amount of rice straw incorporation along with inorganic fertilizers. During 2nd year Boro rice again grown with recommended dose. But yield of Boro rice did not vary significantly due to incorporation of rice straw in T.Aman rice. Average yield of Boro rice was 5.41 t/ha. Similarly, straw yield also did not very significantly among the different fertilizer packages. Grain yield of T.Aman rice did not influenced by different fertilizer combination. Recommended fertilizers gave similar yield with reduced rate of recommended dose along with rice straw incorporation. However, the highest yield was obtained with T3 where 1/3rd rice straw was incorporated along with reduced recommended fertilizer dose for HYG (RF1). Similar trend was found in straw yield also.

Table 1: Effect of rice straw incorporation on the yield of crops in Boro - T.Aman cropping system at Shahrasti, Chandpur during 2003-04

Treatment	Boro		T.Aman	
	Grain yield (t/ha)	Straw (t/ha)	Grain yield (t/ha)	Straw (t/ha)
T_1= 90-20-26-5-2+ ^{1}/3rd RS	5.36	6.2	4.56	6.2
T_2= 70-15-20-4+ ^{2}/3rd RS	5.38	6.3	4.11	6.4
T_3= 65-6-20-20-+ ^{1}/3rd RS	5.40	6.4	4.79	6.5
T_4= 50-6-20-20+ ^{2}/3rd RS	5.44	6.3	4.12	6.4
T_5= 90-20-26-5-2	5.40	6.4	4.14	6.6
T_6= 70-15-20-4	5.44	6.6	4.17	6.7
T_7= 90-37-32	5.49	6.2	4.34	6.9
LSD (5%)	NS	NS	NS	NS
CV (%)	7.81	8.23	3.64	11.18

Location : Kolaroa, Khulna
Year of conduction: 2001-02 to 2003-04

In the 1st year Boro rice was grown with recommended fertilizers. Grain yield was same in all the plots as the treatment was similar. On an average 5.4 and 6.34 t/ha of grain and straw yield was obtained, respectively. Similarly, in the 2nd (2002-03) and 3rd year (2003-04) no significant difference in yield was found. Effect of straw incorporation on the yield of Boro rice was not evident. However the highest yield was recorded from T_2 where ^{2}/$_3$rd Boro rice straw was incorporated along with recommended fertilizer dose in T.Aman rice (Table 2).

After harvesting of Boro rice, different amount of straw was incorporated along with inorganic fertilizer in T.Aman rice. On an average 1.88 and 3.6 t/ha of straw (dry wt. basis) was incorporated as ^{1}/$_3$rd and ^{2}/$_3$rd, respectively. The effect of rice straw on the yield of T.Aman has been shown in Table 3. Average of three years data showed that grain yield of T.Aman rice influenced by different fertilizer combinations. Effect of rice straw incorporation on the yield of T.Aman rice was observed to some extent. Two third rice straw incorporated along with recommended fertilizer dose for MYG (T_2) produced similar yield with recommended fertilizer dose for HYG (T_5). Almost similar trend was found over the years. Treatment T_2 also gave significantly higher yield over only inorganic fertilizer dose for MYG (T_6). On an average, about 16% yield increased with $^{2}/_{3}{}^{rd}$ rice straw + MYG (T_2) over only MYG (T_6). However, the highest yield was obtained with Farmers' practice where the farmers' applied a very high dose of NPK in T.Aman rice. Regarding straw yield more or less similar trend was observed.

Cost and return analysis showed that higher gross margin was obtained in T_5 and T_2 followed by T_5. Benefit cost ratio (BCR) did not very considerably among the treatments. The higher BCR was calculated from T_2, T_5 and T_6. From the three years of experimentation it was found that incorporation of rice straw ($^{2}/_{3}{}^{rd}$) along with recommended fertilizer dose for MYG performed better in terms of yield and economic benefits.

Table 2. Performance of Boro rice under Boro-T.Aman cropping pattern at Kalaroa MLT site during 2001-02 to 2002-03

Treatment	Grain yield (t/ha)				Straw yield (t/ha)			
	2001-02	2002-03	2003-04	Mean	2001-02	2002-03	2003-04	Mean
T_1	5.25	5.13	5.20	5.19	5.50	5.81	5.77	5.69
T_2	5.52	5.56	5.40	5.49	6.13	6.31	6.41	6.28
T_3	5.26	5.31	5.39	5.32	5.63	6.13	6.25	6.00
T_4	5.42	5.25	5.41	5.36	6.38	6.00	6.32	6.23
T_5	5.50	5.25	5.45	5.40	6.50	5.88	6.21	6.20
T_6	5.52	5.37	5.21	5.36	6.60	5.75	5.70	6.02
T_7	5.31	5.19	5.32	5.27	6.50	5.94	6.00	6.15
Average	5.40	5.29	5.34	5.34	6.18	5.97	6.13	6.09

Table 3. Effect of Boro rice straw and fertilizer on the yield of T.Aman rice under Boro-T.Aman cropping pattern at Kalaroa MLT site, 2001-02 to 2003-04

Treatment	Grain yield (t/ha)				Straw yield (t/ha)			
	01-02	02-03	03-04	Mean	01-02	02-03	03-04	Mean
T_1	4.17b	4.62ab	3.89cd	4.23	4.72a	5.25bc	4.35e	4.77
T_2	4.77a	4.88ab	4.15c	4.60	5.12a	5.67ab	4.72cd	5.17
T_3	4.02b	4.27ab	3.94cd	4.08	4.72a	4.42d	4.52de	4.55
T_4	4.27b	4.42ab	4.09c	4.26	4.77a	4.92cd	4.79c	4.83
T_5	4.82a	4.90a	4.43b	4.72	5.15a	6.02a	5.03b	5.40
T_6	4.02b	4.20b	3.68d	3.97	4.55a	5.07c	4.27e	4.63
T_7	4.97a	4.97a	5.15a	5.03	5.22a	6.00a	5.57a	5.60
CV (%)	5.23	9.20	3.95	6.13	9.33	6.48	3.52	6.44

Table 4. Cost and return analysis of the cropping pattern Boro-T.Aman rice system at Kalaroa during 2001-02 to 2003-04 (average)

Treatment	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)	BCR
T_1	33510	9950	23569	3.36
T_2	36440	10900	26498	3.36
T_3	32448	12620	19852	2.57
T_4	33969	12810	19592	2.63
T_5	37577	9970	27235	3.62
T_6	31605	9460	12980	3.27
T_7	40134	13560	26301	2.89

Price (Tk/kg): Urea= 6, Gypsum= 4, TSP= 14, MP= 10, $ZnSO_4$= 80, Rice grain= 7, Rice straw= 0.50

Appendix Table 1. Initial soil analysis results of Kalaroa MLT site

Nutrient	Soil test value	Soil test interpretation
pH	8.1	Slightly alkaline
Organic matter (%)	1.88	Medium
EC (mmhos/cm)	0.66	Non saline
Total N (%)	0.092	Low
Available P (ppm)	4.80	Very low
K (meq./100g)	0.22	Medium
S (ppm)	13.21	Low
Zn (ppm)	0.51	Low

Appendix Table 2. Crop management practices

Site	Crop	Variety	Seed rate (kg/ha)	Planting time	Harvesting time
Shahrasti	Boro	BRRI dhan 29	4040	1st week of Feb	3rd week of May
	T.Aman	BRRI dhan 33		3rd week of Aug	2nd week of Nov
Kolaroa	Boro	BRRI dhan 28	40	3rd week of Jan.	Last week of April
	T.Aman	BRRI dhan 30	40	1st week of Aug.	Last week of Nov.

Appendix Table 3. Amount of Boro rice straw incorporated into the soil before T.Aman transplanting under Boro-T.Aman cropping pattern at Kalaroa

Treatment	Before T.Aman transplanting Boro rice straw incorporated (t/ha)
T_1	1.86
T_2	3.60
T_3	1.90
T_4	3.61
T_5	1.09
T_6	1.09
T_7	1.09
Average	2.03

Improvement of soil fertility through integrated fertilizer management in Mungbean-T.Aus-T.Aman cropping pattern

Abstract

The experiment was conducted in farmers' field at FSRD site, Lebukhali, Patuakhali during 2001-02 to 2003-04 to find out the long term effect of integrated fertilizer management practices on Mungbean- T.Aus - T.Aman cropping patterns for sustaining soil fertility, crop productivity and for improvement of health. The result of three years average reveals that Application of crop residues and cow-dung increased crop yield significantly mainly due to low organic matter content of the soil (about 1%). So, it was recommended that residues of mungbean and T.Aus crop and cowdung or other organic fertilizer as must be incorporated in to the soil for sustainable crop production and maintaining soil health.

Introduction

Soil of tidal Ganges Floodplain (AEZ 13) is non-calcareous and silty clay to heavy clay in texture, slightly acidic in dry season to slightly alkaline in wet season (pH 5.5-7.4). Generally fertility is poor, soil organic matter content is about 1% and native soil nitrogen and phosphorus content is low to very low. Drainage is poor to very poor. Drying of soil results in very hard consistence difficult to plough for rabi crop cultivation with weak draft animal as available in the locality and type is medium high land to medium low land flooded twice daily usually from May to October. T.Aus, T.Aman and rabi crops (area coverage 25%) like Mungbean, Khesari, Cowpea, Chilli are main crops. Farmers use very low amount of inorganic fertilizer. It is necessary to study the long term effect of integrated fertilizer management practices on major cropping pattern for sustaining soil fertility, crop productivity and for improvement of soil health. With this point of view Mungbean-T.Aus -T.Aman cropping pattern was selected as brown mungbean plant is a good source of organic matter that can be easily incorporated in soil without any extra cost.

Materials and Methods

The experiment was initiated at FSRD site, Lebukhali, Patuakhali during 2001-2002 to 2003-2004 with Mungbean-T.Aus-T.Aman cropping pattern. Six treatments of fertilizer management with 5 dispersed replications were set in RCB design. Treatments are given in Table 1. First crop Mungbean (var.BARI Mung-2) at the rate of 30 kg/ha was sown in line sowing with distance 30 cm. Sowing was done on February 3-10. The land was manured 10 ton cowdung/ha was in final land preparation. Crop at ripening stage was infested by pod borer. Insecticide, Malathion was sprayed 2 times at 7 days interval. Pods were harvested two times first on April1 5-20 and finally on May 3-10. After then plants were incorporated in soil at the time of land preparation for T.Aus. Second crop T.Aus (var. BR-2) transplanted on May 12-20, with spacing 25cm x 15cm and harvested on September 05-0. For T.Aus, fertilizer dose was estimated by deducting the amount of nutrient element that was added by mungbean plants. In the same way straw of T.Aus was incorporated in the soil during land preparation for T.Aman. Third crop T.Aman transplanted on Sep, 10-15 and harvested on December 25-30. Fertilizer dose for T.Aman was estimated by deducting the amount of nutrient element that was added by T.Aus straw. Fertilizer doses were estimated on the basis of FRG'97 recommendation. Variety of T.Aus and T.Aman was BRRIdhan-2 and BR-23 respectively. At the beginning of the experiment soil sample was collected before mungbean sowing for chemical analysis and was send to SRDI regional laboratory, Khulna. Data was collected from sample plants. At the beginning of the experiment soil sample was collected and physical & chemical analysis was done. At the end of the experiment again soil physical and chemical analysis will be done to compare with that of beginning to identify the improvement of soil physical and chemical condition.

Objectives

1. To increase crop productivity of mungbean-T.Aus-T.Aman cropping pattern
2. To improve soil health by incorporation of mungbean residues.

Table 1.Treatments for fertilizer management

Treatment	Estimated chemical fertilizer								
	Mungbean			T.Aus			T.Aman		
	N	P	K	N	P	K	N	P	K
T_1: Crop residues + Cowdung (10 t / ha) + Estimated chemical fertilizer	0	0	0	20	4	20	12	2	0
T_2: Crop residues + Cowdung (5t / ha) + Estimated chemical fertilizer	0	3	0	20	4	20	12	2	0
T_3: Crop residues + Estimated chemical fertilizer	12	8	8	20	4	20	12	2	0
T_4: Recommended fertilizer dose (FRG' 97)	12	8	8	35	4	20	30	3	20
T_5: Farmers' practice (Mungbean: CD 3t/ha)	0	0	0	60	0	0	40	0	0
T_6: Control	0	0	0	0	0	0	0	0	0

To estimate the requirement of chemical fertilizer following information was followed.

Cowdung : 3-1-3 kg N-P-K per ton for following crop.
Crop residues (Mungbean) : 6 kg N per ton dry biomass to succeeding T.Aus.
Crop residues (T.Aus) : 2- 0.5-8 kg N-P-K per ton dry biomass to succeeding T.Aman

Results and Discussion

Mungbean: Treatment T_1 produced higher seed yield but statistically identical to T_2, T_3 and T_4 in 2001-02 and similar trend was followed in 2003-04 but T_1 and T_3 was similar yield in 2002-03. On an average, higher seed yield was recorded from T_1 treatment. Similar trend was followed in case of stover yield. Farmers' practice and control plots yields were almost similar. Addition of more 5 t/ha cowdung did not response in yield.

T.Aus: Similar trend was noticed in grain yield in treatment T_1, T_2, T_3 and T_4 in 2001-02 but yield was statistically identical in T_1, T_2 and T_4 treatment in 2002-03 whereas yield between T_1 to T_3 were statistically identical. On an average, higher grain yield was recorded from T_1 followed by T_2, T_3 and T_4. The lowest yield was obtained from control followed by farmers' practices. Straw yield also showed similar yield.

T.Aman: Treatment T_1 to T_4 showed identical grain yield and higher than treatment T_5 andT_6 in 2001-02. Similar trend was followed in 2002-03 and 2003-04. On an average, grain yield was similar in T_3, T_1, T_4 and T_2 and the lowest from control plot. Similar trend was followed in straw yield.

Cost and return analysis: Higher gross return was obtained from treatment T_1 followed by T_2, T_3 and T_4 but higher cost was involved in T_1. As a result higher gross margin was recorded from treatment T_3 followed by T_2, T_4 and T_1 treatment. Among the treatment, higher BCR was obtained from treatment T_3 where crop residues with estimated fertilizer dose were used. Much higher benefit was recorded from farmers practice and control where fertilizer was not used.

Recommendation

Three years result showed that Mungbean-T.Aus-T.Aman cropping could be grown in higher benefit with fertilizer dose 12-8-8, 20-4-20, 12-2-0 NKP kg/ha, respectively with added crop residues of mungbean and rice.

Table 1a. Effect of different nutrient management packages on yield of Mungbean in Mungbean-T.Aus-T.Aman cropping pattern

Treatments	Seed yield (kg/ha)				Stover yield (kg/ha)			
	2001-02	2002-03	2003-04	Mean	2001-02	2002-03	2003-04	Mean
T_1	1224a	1195a	1290a	1236	3054a	2764a	3220a	3013
T_2	1211a	1123ab	1240a	1191	3005a	2841a	3070a	2972
T_3	1196a	1094c	1210a	1166	2980a	2658a	2990a	2876
T_4	1183a	1065c	1235a	1161	2950a	2625a	3049a	2875
T_5	1080b	784d	860b	908	2680b	1935b	2140b	2252
T_6	760c	686d	890b	778	1870c	1831b	2230b	1977
CV (%)	8.6	6.43	8.54		10.15	11.60	7.95	
LSD (5%)	97.4	72	93.3		215.3	231.5	201.5	

Table 1b. Effect of different nutrient management packages on yield of T.Aus in Mungbean-T.Aus -T.Aman cropping pattern

Treatments	Grain yield (kg/ha)				Straw yield (kg/ha)			
	2001-02	2002-03	2003-04	Mean	2001-02	2002-03	2003-04	Mean
T_1	4121a	4310a	4280a	4237	4870ab	5253b	5146ab	5090
T_2	4146a	4290ab	4160ab	4199	4960a	5160a	4952a	5024
T_3	4026a	4153b	4060a	4074	4820a	4997a	4861a	4893
T_4	4067ab	4194ab	3980c	4080	4890bc	5090bc	4802c	4927
T_5	3205c	3178c	3220d	3201	3830c	3933c	3878b	3880
T_6	2662d	2670d	2760e	2697	3420d	3465d	3554d	3480
CV (%)	8.31	8.4	8.27		8.20	8.55	9.47	
LSD (5%)	149	142	135		198	201	211	

Table 1c. Effect of different nutrient management packages on yield and yield attributes of T.Aman in Mungbean-T.Aus-T.Aman cropping pattern

Treatments	Grain yield (kg/ha)				Straw yield (kg/ha)			
	2001-02	2002-03	2003-04	Mean	2001-02	2002-03	2003-04	Mean
T_1	4365a	4298a	4290a	4318	5185a	5163a	5146a	5165
T_2	4381a	4241a	4216a	4279	5230a	5060a	5125a	5138
T_3	4430a	4170a	4360a	4320	5350a	4997a	5265a	5104
T_4	4305a	4279a	42680a	4284	5180a	5160a	5092a	5144
T_5	3450b	3370b	3420b	3413	4230b	4133b	4178b	4180
T_6	2980c	2780c	2860c	2873	3620c	3365c	3454c	3480
CV (%)	10.80	8.19	9.71		8.61	7.65	9.55	
LSD (5%)	150.2	134.4	139.5		251.5	221.3	285.1	

Table 2. Average yield and Cost and return analysis of different nutrient management packages in Mungbean-T.Aus-T.Aman cropping pattern at FSRD site Lebukhali (2001-02 to 2003-04)

Treatment	Yield (kg/ha)				Gross return* (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	BCR
	Mung bean	T.Aus	T.Aman	T.Aman straw				
T_1	1236	4237	4318	5165	80583	43510	37073	1.85
T_2	1191	4199	4279	5138	79016	41235	37780	1.92
T_3	1166	4074	4320	5104	78010	39420	38590	1.98
T_4	1161	4080	4284	5144	77701	40327	37374	1.93
T_5	908	3201	3413	4180	61273	38542	22731	1.59
T_6	778	2697	2873	3480	51931	37240	14690	1.34

*with T.Aman straw

Input price (Tk./kg): Urea = 7, TSP = 16, MP = 12, Cowdung = 0.50, Mungbean seed = 40, T.Aus seed = 15 & T.Aman seed = 15

Output price (Tk./kg: Mungbean = 25, T.Aus rice = 5, T.Aman rice = 6 & Rice straw = 0.50

Improvement of soil fertility through integrated fertilizer management in Maize-Mungbean-T.Aman cropping pattern

Abstract

The experiment was conducted at Modhupur, expanded area of Goyeshpur FSRD site, Pabna during 2003-2004 to determine a suitable ratio of inorganic and organic fertilizer for long term use in cropping pattern basis and to increase soil health. Six different ratios of organic and inorganic fertilizer treatments along with absolute control were employed for the study. From the first years result, it was revealed that higher yield was obtained from 75% chemical + 25% poultry manure (pm) treatment in maize and from 50% chemical. + 50% poultry manure treatment in T.Aman but from the economical point of view, 100% chemical treatment is more profitable.

Introduction

The farmers at FSRD site, Goyeshpur and in the Pabna district as a whole are recently producing more high value crops like hybrid maize. Undoubtedly it is high nutrient needing crop. For example, of above 1400 kg ha^{-1} of different chemical fertilizers are being used for a single maize crop. Continuous use of such amount of chemicals (including some more in other cereal crop) in the pattern makes sense of a threat on soil complexities where no or very little organic recycling is under practice. On the other hand, the FSRD team introduced poultry litter in the district where a huge amount of droppings are being produced, which have seldom use in crop fields. At ARS Pabna, poultry based compost used at active stage of composting produced better/equal rice and stem amaranths yield. Further more, poultry droppings has become an environment polluting agent in spite its high promise as organic fertilizer. A huge production of which could contribute a great level in improving degraded soil of the country. Therefore, there has developed a concern on using PM for sustaining soil fertility and crop productivity.

Objective

i) To find out suitable ratio of inorganic and organic fertilizer for long-term use as cropping pattern basis

Materials and Methods

The experiment was conducted at Modhupur, expanded area of Goyeshpur FSRD site, Pabna during 2003-04 in Gopalpur soil series under High Ganges River Flood Plain Soil (AEZ-11). Before starting the experiment the cropping pattern Maize-Mungbean-T.Aman was selected based on the site needs identified through short PRA with local farmers, DAE personnel and available secondary information. After identification the cropping pattern, a composite soil sample was collected and analyzed. The soil analytical results indicated that soil was slightly alkaline, percent of organic matter and total N which calculated from organic carbon were very low. Status of P was very low, S was medium, K & Zn were low (Appendix-1). The experiment was laid out in randomized complete block (RCB) design with six replications (dispersed) and unit plot size was 6m × 5m. Five different organic and inorganic fertilizer doses were tested against control applied on the basis of high yield goal (HYG). The treatments were; T_1= 100% Chemical, T_2=75% ch. + 25% PM, T_3= 50% ch. + 50% PM, T_4= 25% ch.+ 75% PM, T_5= 100% PM & T_6= Control.

Treatment	NUTRIENT RATE (kg/ha)													
	Rabi (Hybrid Maize)							Kharif (T.Aman)						
	N	P	K	S	Zn	B	PM	N	P	K	S	Z	B	PM
T_1	200	66	88	21	3	0.74	-	92	15	29	5	-	-	-
T_2	150	50	66	16	2.25	0.56	3750	69	11.25	21.75	3.75	-	-	1750
T_3	100	33	44	11	1.5	0.37	7500	46	7.5	14.5	2.5	-	-	3500
T_4	50	17	22	5	0.75	0.19	11250	23	3.75	7.25	1.25	-	-	5250
T_5	-	-	-	-	-	-	15000	-	-	-	-	-	-	7000
T_6	-	-	-	-	-	-	-	-	-	-	-	-	-	-

HYG was calculated by using BARC's FRG-97 formula according to soil analysis data. Poultry manure (Active compost) was the organic source which was made by fresh poultry dropping 50%, chopped crop residues 50%, with Urea 1%, TSP 0.5%, Gypsum 1% of total organic manure and effective microorganism (EM) solution as needed. Poultry manure (PM) contain 1.32% N (Appendix-2) which was the base for calculation of required PM for different treatments. Here, N percent of PM was considered only because N has no residual effect and other nutrient is present in sufficient amount in the PM. Seeds of hybrid maize (Pacific-11) were sown in line at the rate of 15 kg ha^{-1}on December 09, 2003. The seeds were sown at a spacing of 75cm x 25cm. The maize crop was harvested during 09-10 May 2004. Only two irrigations could be provided at January 23 and February 24, 2004. Due to delaying of maize harvest, mungbean could not grow successfully. T.Aman (variety BR 11) crop was transplanted during August 3-5, 2004 and harvested during November 29-30, 2004. In maize ⅓ urea, ½ PM and other fertilizers were applied as basal. Rest ⅔ urea and ½ PM were applied in two equal installments as top dress at 8-10 leaf stage and tasseling stage. In T.Aman, except urea all fertilizers and ½ PM were applied as basal and rest ½ PM and all urea applied as top dress in 2 equal splits at 25 and 55 days after transplanting (DAT). Data on different parameters were collected and analyzed statistically.

Results and Discussion

Maize: Yield and yield contributing characters of maize were affected significantly due to different treatments (Table 1) higher grain yield was obtained from T_2 treatment and it might be due to the cumulative effect of higher 100 grain weight and second highest no. of grains cob^{-1} and it also statistically similar with T_1 and T_3 treatments. Higher stover yield also obtained from T_2 treatment which was statistically identical with T_3 and T_4 treatments. Significantly lowest yield and yield attributes were obtained from control (T_6) treatment. During the grain filling season there was a scarcity of irrigation and rain water and it might be the main cause of lower yield of maize in 100% PM (T_5) treatment.

T.Aman: Yield and yield contributing characters of T.Aman differed significantly among the treatments (Table-2). Higher plant height was obtained from T_4 treatment, which was statistically identical with T_2, T_3 and T_5 treatment. Higher grain and straw yield was obtained from T_3 treatment and it is the cumulative effect of higher value of other yield attributes. Grain yield of T_3 treatment is also statistically at par with other treatments except control. Yield and yield attributes were lowest in control treatment.

Cost and return analysis: Cost and return analysis of different fertilizer management packages showed that the highest MBCR was obtained from 100% chemical (T_1) treatment and the second highest was found in T_2 treatment (Table 3). The lowest MBCR was found in 100% PM (T_5) treatment. The MBCR of T_1 treatment was highest due to less fertilizer cost though the yield was higher at T_2 or T_3 treatments.

Farmer's reaction:

Farmer's of that location opined that both organic and inorganic fertilizer application is very good for their crop and soil but they need to have proper and available source of PM and water.

Conclusion

From the first year experiment it was revealed that higher maize yield was obtained from 75% chemical fertilizer with 25% PM and it is mainly due to available source of nutrient from chemical fertilizer and micronutrient from organic source (PM). If water source could be available during the whole cropping season then higher ratio of PM treatment would be more yielded because this trend was found in case of T.Aman. Poultry manure has considerable positive residual effect on soil; so, if PM could be used year after year, soil would be healthier and that will lead to more yield. This is first year's result, so it should be continued further for a concrete decision.

Table 1. Yield and yield contributing characters of Maize under Maize-Mungbean-T.Aman cropping pattern as affected by different treatments at expanded Modhupur during 2003-04

Treatment	Days to maturity	Plant height (cm)	Ear height (cm)	Grains cob^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{1})	Stover yield (t ha^{-1}))
T_1	151a	187.08b	95.67a	379.03a	296.00a	7.10a	7.27b
T_2	149b	193.07ab	100.08a	376.27ab	299.17a	7.31a	9.02a
T_3	149b	195.45a	99.90a	348.77ab	295.50a	7.14a	8.23ab
T_4	149b	191.33ab	99.95a	321.43ab	289.00b	6.64b	7.71ab
T_5	149b	179.30c	85.43b	309.83b	259.33c	5.99c	6.89b
T_6	147c	142.77d	59.10c	228.43c	257.50d	3.76d	3.89c
CV (%)	0.14	3.53	4.15	15.91	1.77	4.41	17.80
LSD (0.05)	0.25	7.62	4.44	61.93	5.99	0.34	1.55

Table 2. Yield and yield contributing characters of T.Aman under Maize-Mungbean- T.Aman cropping pattern as affected by different treatments at Modhupur during 2003-04

Treatment	Days to maturity	Plant pop. m^{-2} (no.)	Plant height (cm)	Panicle hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	1000-Grain wt.(g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_1	105.67a	27.99a	97.42b	8.63ab	23.33ab	129.50a	25.67a	5.44a	6.44c
T_2	106.00a	32.11a	99.47ab	8.65ab	22.87ab	123.50a	25.42a	5.49a	6.11d
T_3	105.67a	30.22a	98.95ab	8.87a	23.58a	137.50a	25.75a	5.68a	7.17a
T_4	105.17a	30.83a	100.15a	8.27ab	22.57b	122.17a	25.42a	5.66a	6.79b
T_5	105.67a	28.83a	98.02ab	9.03a	22.77ab	132.33a	25.00ab	5.46a	6.61bc
T_6	102.50b	29.17a	87.57c	7.17b	21.12c	100.17b	24.08b	2.94b	2.22e
CV (%)	0.61	12.59	1.84	14.58	3.11	9.68	3.46	4.00	3.25
LSD (0.05)	0.77	NS	2.12	1.46	0.84	14.30	1.04	0.25	0.24

Table 3. Cost and return analysis of maize T.Aman cropping pattern as affected by different treatments at Modhupur during 2003-04

Treatments	Gross return (Tk ha^{-1})	Variable cost (Tk ha^{-1})	Gross margin (Tk ha^{-1})	MBCR (over control)
T_1	114505	14620	99885	5.49
T_2	117290	17402	99888	4.78
T_3	118050	21116	96934	3.97
T_4	113650	24887	88763	3.19
T_5	106275	28600	77675	2.52
T_6	34195	-	34195	-

Input price (Tk./kg): Urea = 6.25, TSP = 14, MP = 14, Gypsum= 3, ZnO = 40, Borax= 40 & Cowdung = 1
Output price (Tk./kg: Maize = 7.5, T.Aman rice = 10 & Stover/Straw = 0.50

Appendix 1. Nutrient status of the initial soil sample (0.15 cm depth) at Goyeshpur (Modhupur)

Name of farmer	pH	OC (%)	Total N (%)	Available (PPM)				K(me/100g soil)
				P	S	Zn	B	
Md. Abdul Wahab	7.5	0.60	0.0864	2.63	14.53	1.00	-	0.12
Md. Amzad Hossain	7.5	0.56	0.081	2.75	18.25	0.64	-	0.13
Md. Mostafa Kamal	7.3	0.60	0.0864	2.63	17.91	0.90	-	0.16
Mean of Nutrient status	7.43	0.59	0.085	2.67	16.90	0.85	-	0.14
Interpretation		Slightly alkaline	VL	VL	M	L		L

Appendix 2. Nutrient status of the poultry manure (Active compost) made by ARS, Pabna during 2003-04

N (%)	Available (PPM)		K (me/100g PM)	Ca (%)	Mg (%)
	P	S			
1.32	1.59	0.27	1.79	2.93	0.67

Improvement of soil fertility through integrated fertilizer management for Cauliflower - Stem Amaranth - Jute

Abstract

Six different ratios of inorganic and organic fertilizer treatment along with absolute control were employed at MLT site Dashuria, Pabna during 2003-2004 to determine a suitable ratio of inorganic and organic fertilizer for long term use in cropping pattern basis and to increase soil health. All crops of first cycle viz. 1st crop- cauliflower, 2nd crop- stem amaranth and 3rd crop- Jute showed better performance in case of yield with 50% chmical + 50% poultry manure (PM) treatment. But from the whole pattern of first year, it was calculated that MBCR was higher in 100% chemical treatment and gross margin was higher in 50% chemical + 50% PM treatment.

Introduction

Cauliflower is one of the major commercial vegetable crop which is introduced to large area of Pabna. It is an exhausting crop. Continuous use of high amount of chemicals including some more in other cereal crop in the pattern makes sense of a threat on soil complexities where no or very little organic recycling is under practice. On the other hand, a huge amount of poultry refuses are being produced refuges, which have seldom use in crop fields. At ARS, Pabna poultry based compost used at active stage of composting produced better/equal rice and stem amaranths yields with 7.5 t/ha against 100% chemical dose. Further more, poultry manure has become an environment polluting agent in spite its high promise as organic fertilizer. A huge production of which could contribute a great level in improving degraded soil of the country. Therefore, there has developed a concern on using PM for sustaining soil fertility and crop productivity. Cauliflower cultivated in about 800 hectares in Pabna and getting popularity very quickly. With this view an experiment was designed with the objectives to find suitable ratio of inorganic and organic fertilizer for long-term use as cropping pattern basis

Materials and Methods

The experiment was conducted at MLT site, Dashuria, Pabna during 2003-04 in Gopalpur soil series under High Ganges River Flood Plain Soil (AEZ-11). Before starting the experiment, the cropping pattern Cauliflower-Stem amaranth-Jute was selected based on PRA with local farmers, DAE personnel and available secondary information. After identification the cropping pattern, a composite soil sample was collected and analyzed. The soil analytical results indicated that soil was slightly alkaline, percent of organic matter, total N and S were very low. Status of P was medium, K was high and Zn was low (Appendix-1). The experiment was laid out in randomized complete block (RCB) design with four replications (dispersed) and unit plot size was 4m x 3m. Five different organic fertilizer doses were tested against control applied on the basis of high yield goal (HYG). The treatments were T_1= 100% Chemical, T_2=75% ch. + 25% PM, T_3=50% ch. + 50% PM, T_4=25% ch. + 75% PM, T_5= 100% PM & T_6 = Control.

Treatment	NUTRIENT RATE (kg/ha)																				
	Rabi (Cauliflower)							Kharif (Stem amaranth)							Kharif-11(Jute)						
	N	P	K	S	Zn	B	PM	N	P	K	S	Zn	B	PM	N	P	K	S	Z	B	PM
T_1	173	30	42	30	3	1	-	156	15.4	53	3	-	-	-	124	6	14	11	-	-	-
T_2	129.75	22.5	31.5	22.5	2.25	.75	3.25	117	11.55	39.75	2.25			3	93	4.5	10.5	8.22			2.25
T_3	86.5	15	21	15	1.25	.50	6.5	78	7.7	26.5	1.5			6	62	3	7	5.5			4.5
T_4	43.25	7.5	10.5	7.5	.75	.25	9.75	39	3.85	13.25	.75			9	31	1.5	3.5	2.75			6.75
T_5	-	-	-	-	-	-	13	-	-	-	-			12	-	-	-	-			9
T_6	0	0	0	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0			0

HYG was calculated by using BARC's FRG-97 formula according to soil analysis data. Poultry manure (Active compost) was the organic source which was made by fresh poultry dropping 50%, chopped crop residues 50%, Urea 1%, TSP 0.5%, Gypsum 1% and effective microorganism (EM) solution as needed. Poultry manure (PM) contains 1.32% N (Appendix-2) which was the base for calculation of required PM for different treatments. Here, N percent of PM was considered only because N has no residual effect and other nutrient is present in sufficient amount in the PM. Seedlings of cauliflower (var. Lucky) were transplanted on November 11-12, 2003 in line.(spacing 60 cm x 45 cm) cauliflower was harvested during January 18-25, 2004. Seeds of stem amaranth (variety-Laboni) were sown on Feb, 22-25, 2004 in line at the rate of 2.25 kg ha^{-1} (spacing 30 cm x continues) stem amaranth was harvested during April 10-12, 2004. The seeds of Jute (0-9897) were sown on April 24-30, 2004 and harvested during July 23-25, 2004. In cauliflower K ½ MP, ½ PM and other fertilizers except urea were applied as basal. All urea ½ MP and ½ PM were applied in three equal installments as top dress at 10, 30 and 50 DAP. In stem amaranth ½ urea, ½ MP, and ½ PM and all other fertilizers were applied as basal rest ½ urea, ½ MP and ½ PM were applied as top dress in 2 equal splits at 20 and 30 DAS. In Jute, ½ urea, ⅔ PM and all other fertilizer were applied as basal. Rest ½ urea and ½ PM were applied as one top dress at 40-50 DAS. Date on different parameters were collected and analyzed statistically.

Results and Discussion

Cauliflower: Yield and yield attributes of cauliflower were insignificant among the treatments except control (Table 1). However, higher curd yield, and other yield attributes was found in 50% ch.+ 50% PM treatment which was also statistically identical with other treatments except control. Yield and other attributes were found lowest in control treatment. Here, all treatments except control gave very close results and it might be due to almost same nutrient (mainly N) treatment. But little higher yield was obtained from 50% ch. + 50% PM treatment and it might be due to slow and long time releasing of nutrient from PM and early stage of crop can get required nutrient from chemical source easily.

Stem amaranth: Yield and yield attributes of stem amaranth were affected significantly among the treatments (Table 2). Higher yield was obtained from 50% ch.+50% PM treatment and it might be the cumulative effect of highest number. of plant population, longest plant height and succeeding effect of pervious PM. Base circle was highest in 100% chemical treatment. Yield and yield contributing characters were found lowest in control treatment.

Jute: Yield and yield parameters were significantly differ among the treatments (Table-3). Higher Fiber yield was obtained from 50% chemical + 50% PM treatment which is the cumulative effect of higher plant population, longer size of plant and might be succeeding effect of previous used PM increased the soil health and JO condition. On the other hand, jute seed size is small which can germinate easily on that soil and it tends to higher plant population. All parameters were found lowest in control treatment.

Cost and return analysis: From cost and return analysis, it was found that highest MBCR was obtained from 100% ch. treatment and lowest from 100% PM treatment and it is mainly due to higher amount and value of PM of 100% PM treatment. But the highest gross return and gross margin was obtained from 50% chemical. + 50% PM treatment.

Farmers reaction

Farmers of that location choused 50% chemical with 50% PM treatment for higher yield of whole pattern. They opined that the organic crop is tasty.

Conclusion

From the first year result, it was revealed that poultry manure with chemical fertilizers always showed better performance. It might be the availability of nutrient from chemical fertilizers and micro nutrient from organic source (PM) and long time slow realizing nutrient from PM. Though PM treatment is not more economical but it tends to high yielding and more hygienic crop production, which is good for health. In future when organic crops value and demand will be high then it might be more economical. This is first year result, so it should continue for the next year for a solid conclusion.

Table 1. Effect of different doses of organic and inorganic fertilizers on yield and yield contributing characters of Cauliflower under Cauliflower-Stem Amaranth- Jute cropping pattern during 2003-04

Treatments	50% curd initiation (days)	Days to harvest (days)	Plant height (cm)	Whole plant wt. (kg)	Marketable weight (kg)	Curd length (cm)	Curd breath (cm)	Curd yield (t ha^{-1})
T_1	50	72.67	76.77a	2.57a	1.53a	11.71a	19.32a	47.25a
T_2	51.83	73	75.15a	2.39abc	1.50a	11.56a	19.36a	49.53a
T_3	50.17	73.67	76.57a	2.50ab	1.89a	11.77a	19.42a	49.64a
T_4	52.17	72.66	74.03a	2.32bc	1.44a	11.74a	19.24a	47.38a
T_5	52.83	73	73.23a	2.26c	1.41a	11.61a	18.62a	46.90a
T_6	54.17	73	53.01b	2.17d	0.83b	8.31b	13.35b	27.46b
CV (%)	-	-	4.3	8.1	9.3	5.1	5.0	11.5
LSD (0.05)	-	-	-	-	-	-	-	6.091

Table 2. Effect of different doses of organic and inorganic fertilizers on yield and yield contributing characters of Stem amaranth under Cauliflower-Stem Amaranth-Jute cropping pattern during 2003-04

Treatment	Days to harvest	No. of plant pop. ($5m^{-2}$)	Plant height (cm)	Base Circle (cm)	Wt. of 10 plants (kg)	Yield (t ha^{-1})
T_1	45	137.50c	79.60ab	6.85a	1.5b	27.96b
T_2	45	129.50d	79.75ab	6.40a	1.61ab	30.25ab
T_3	45	166.00a	83.45a	6.47a	1.73a	31.41a
T_4	45	138.50c	79.55ab	6.23a	1.53b	28.71ab
T_5	45	158.00b	75.85b	6.29a	1.42b	27.36b
T_6	45	159.00b	52.35c	4.70b	0.79c	14.64c
CV (%)	-	1.4	3.3	10.1	6.9	5.6
LSD (0.05)	-	3.80	4.52	1.15	0.18	2.74

Table 3. Effect of different doses of organic and inorganic fertilizers on yield and yield contributing characters of Jute under Cauliflower-Stem amaranth-Jute cropping pattern during 2003-04

Treatment	Plant population (no.$5m^{-2}$)	Plant height (cm)	Fibre yield (t ha^{-1})	Stalk yield (t ha^{-1})
T_1	34.33d	2.40a	2.45ab	4.00c
T_2	40.67bc	2.50a	2.58ab	4.67b
T_3	48.78a	2.60a	2.90a	5.50ab
T_4	42.00bc	2.47a	2.48ab	4.79abc
T_5	45.00ab	2.32a	2.85a	5.80a
T_6	38.89cd	2.01b	2.35b	3.00d
CV (%)	6.8	6.0	9.0	11.7
LSD (0.05)	5.14	0.26	0.43	0.99

Table 4. Cost and return analysis of maize as affected different treatment at MLT site Dashuria, Pabna during 2003-04

Treatments	Gross return (Tk ha^{-1})	Variable cost (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	MBCR (over control)
T_1	345300	16578	328722	8.10
T_2	364777	23484	341293	6.55
T_3	373525	30376	343149	5.35
T_4	348749	37294	311455	3.69
T_5	349130	44200	304930	3.13
T_6	210950	-	210950	-

Input price (Tk./kg): Urea = 6.25, TSP = 14, MP = 14, Gypsum= 3, ZnO = 40, Borax= 40 & Cowdung = 1
Output price (Tk./kg: Cauliflower = 5, Stem amaranth = 2.5, Fibre = 15 & Stick = 0.60

Appendix 1. Nutrient status of the initial soil sample (0-15cm depth) at MLT site, Dashuria

Replication	pH	OM (%)	Total N (%)	Available (PPM)			K (meq/100g soil)
				P	S	Zn	
R-I	7.4	0.92	0.051	26.73	3.63	0.55	0.48
R-II	7.6	0.99	0.048	24.57	5.45	0.26	0.28
R-III	7.6	0.71	0.046	9.99	3.63	0.35	0.34
R-IV	7.7	0.64	0.032	9.72	7.27	0.31	0.51
R-V	7.7	0.64	0.032	9.72	11.82	0.67	0.31
R-VI	7.7	0.42	0.030	20.52	12.27	0.60	0.30
Mean of Nutrient status	7.6	0.72	0.042	16.88	7.35	0.46	0.37
Interpretation	slight alkaline		VL	M	VL	L	H

Appendix 2. Nutrient status of the poultry manure (PM) made by ARS, Pabna during 2003-04

N (%)	Available (PPM)		K (meq/100g PM)	Ca (%)	Mg (%)
	P	S			
1.32	1.59	0.27	1.79	2.93	0.67

✵✵✵

SUBPROJECT: CROP RESPONSE TO ADDED NUTRIENTS

Response of crops grown in different cropping patterns and environments to added fertilizer nutrients

Abstract

The experiment was conducted at 24 different locations with 16 dominant cropping patterns during 2001-02 to 2003-04 to find out an optimum fertilizer dose for the crops grown in different cropping pattern. Four different levels of NPKS, viz. 0, MYG, HYG and HYG x 1.3 were tested. Results showed that a marked response on the yield of crops to N was evident irrespective of locations and crops.. Even in some locations the response was linear. A considerable response to P was also observed in most of the locations, particularly in P deficient soils. But response to K and S was not clear in some of the locations. From the yield data a response curve was drawn and optimum fertilizer dose for the crops were find out.

Introduction

Crops grown in different cropping patterns and environment responded differently to mineral fertilizer nutrients. The nature of response may vary over time. In the past, most of the fertilizer recommendations were individual crop basis. But there some residual effects of some nutrient elements particularly PKS and Zn are found in the succeeding crops. In Bangladesh different crops are grown in different cropping patterns under different agro-climatic condition. Recently BARC developed a national fertilizer recommendation guide '97 with fertilizer recommendation for different crops based on AEZ that needs to further update and verified for different dominant cropping patterns at different environments. Therefore, it is very important to verify and update the present recommendation of BARC FRG '97 for major crops under different agro-ecological condition.

Objective

- To determine optimum and economic dose of fertilizer nutrients for major crops grown in different environments.

Materials and Methods

The experiment was conducted during 2001-02 to 2003-04 at different locations under different AEZs to determine optimum and economic dose of fertilizer nutrients for major crops grown in different environments. A total of 16 dominant cropping patterns at 24 locations were tested. Details about site characteristics and crop management are given in appendix Table 1 & 2, respectively. The experiment was laid out in RCB design with six replications across the field. Four different levels of NPK and S for different crops grown in different cropping patterns were tested all over the country. The treatment concept was as follows-

Levels	N	P	K	S
0	0	0	0	0
1	MYG	MYG	MYG	MYG
2	HYG	HYG	HYG	HYG
3	HYG x 1.3	HYG x 1.3	HYG x 1.3	HYG x 1.3

Different cropping patterns tested in different locations

Sl. No.	Cropping pattern	Locations
1.	Mustard-Boro-T.Aman	Gabtali
2.	Wheat-Jute-T.Aman	Sherpur, Lalmonirhat
3.	Potato-Jute-T.Aman	Melandah, Paba
4.	Boro-T.Aus-T.Aman	Chandina
5.	Boro-T.Aman	Feni
6.	Chickpea-T.Aman	Chabbishnagar, Nachole
7.	Chilli-T.Aman	Lebukhali, Hathazari
8.	Groundnut-T.Aman	Atkapalia
9.	Mustard-Boro	Manikganj, Kaliakoir
10.	Potato-T.Aus-T.Aman	Kishoreganj
11.	Potato-Boro-T.Aman	Joypurhat, Syedpur
12.	T.Aus-T.Aman	Rajakhali
13.	Lentil-Jute-T.Aman	Rajbari, Magura, Keshobpur
14.	Potato-Mungbean-T.Aman	Bagherpara
15.	Wheat-Jute-Mungbean	Gangni
16.	Sesame-T.Aman	Dumuria

Intercultural operations such as irrigation, weeding and pest control were done properly. From the yield data a response curve was drawn and the relation ship was quadratic in nature in most cases. From the response curve fertilizer dose that maximized yield and profit were find out. Optimum rate for maximum yield was determined from the regression equation of yield by using the following formula:

Rate opt. = - b/2c,

where, b and c= regression coefficients

Fertilizer dose that maximized profit was estimated from regression equation by using following formula:

Rate Eco. = ½c (Pf ÷Py – b)

where, b and c are the estimates of the regression coefficients and Pf and Py are the prices of fertilizer and product, respectively.

Results and Discussion

Location : Sherpur MLT site, Jamalpur (AEZ 9)
Cropping pattern : Wheat-Jute- T.Aman
Year : 2001-02 to 2003-04

Wheat: Average of three years data showed that grain yield of wheat increased sharply with the increase of N levels and the highest yield was obtained from 135 kg/ha of N and then tended to decline. In case of P, K and S comparatively slower but positive response was found and yield increased up to 30, 75 and 25 kg/ha of P, K and S, respectively.

Jute: Fibre yield of Jute increased appreciably with the increase of N and the highest yield was recorded from 120 kg/ha and then tended to decrease. Almost similar trend was found in case of P, K and S. Fibre yield increased appreciably up to 20, 80 and 18 kg/ha of P, K and S, respectively.

T.Aman: Grain yield of T.Aman rice increased with the increase of N levels up to 100 kg/ha of N and then tended to decrease. However rate of increment was higher up to 70 kg/ha of N. Similarly, P, K and S showed a positive response towards the yield of T.Aman rice. Grain yield increased up to 15, 50 and 10 kg/ha of P, K and S, respectively. But the rate of increment was higher at 10, 40 and 7 kg/ha of P, K and S, respectively.

From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Wheat	143	31	76	27	138	28	73	24
Jute	135	21	83	19	120	20	77	17
T.Aman	105	16	52	11	98	14	48	9

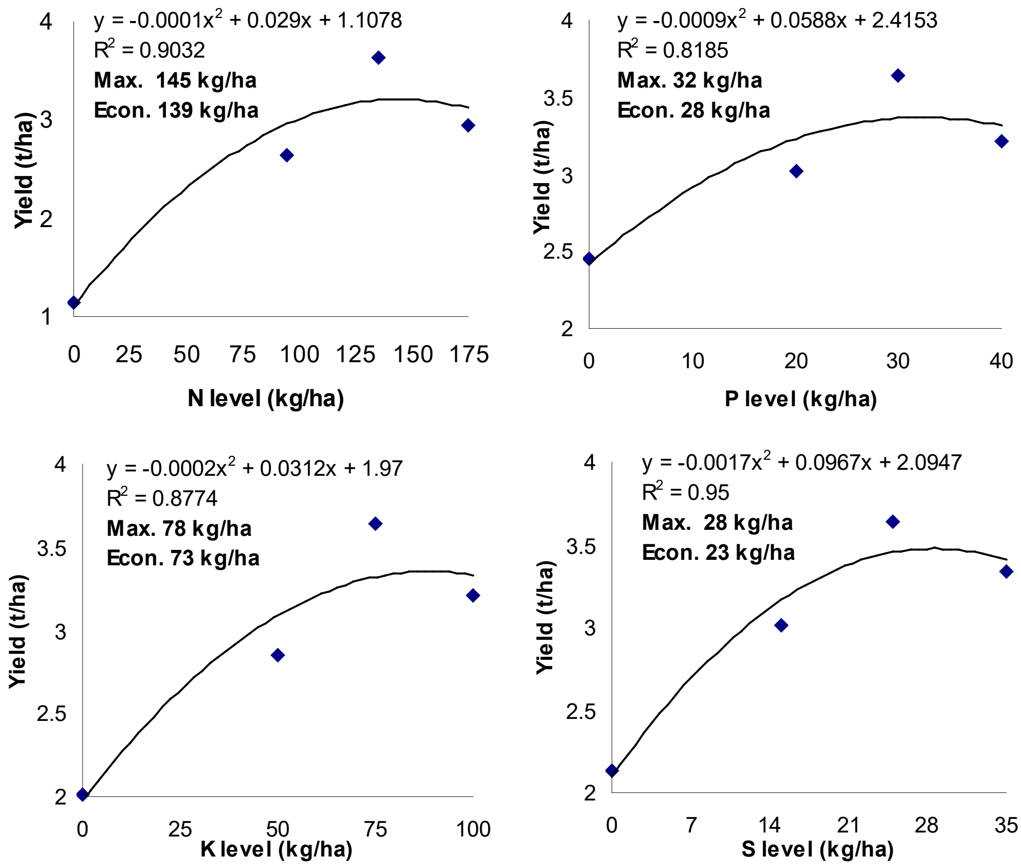


Figure 1. Response of Wheat to added NPKS in Wheat-Jute-T.Aman cropping pattern at MLT site, Sherpur during 2001-02 to 2003-04

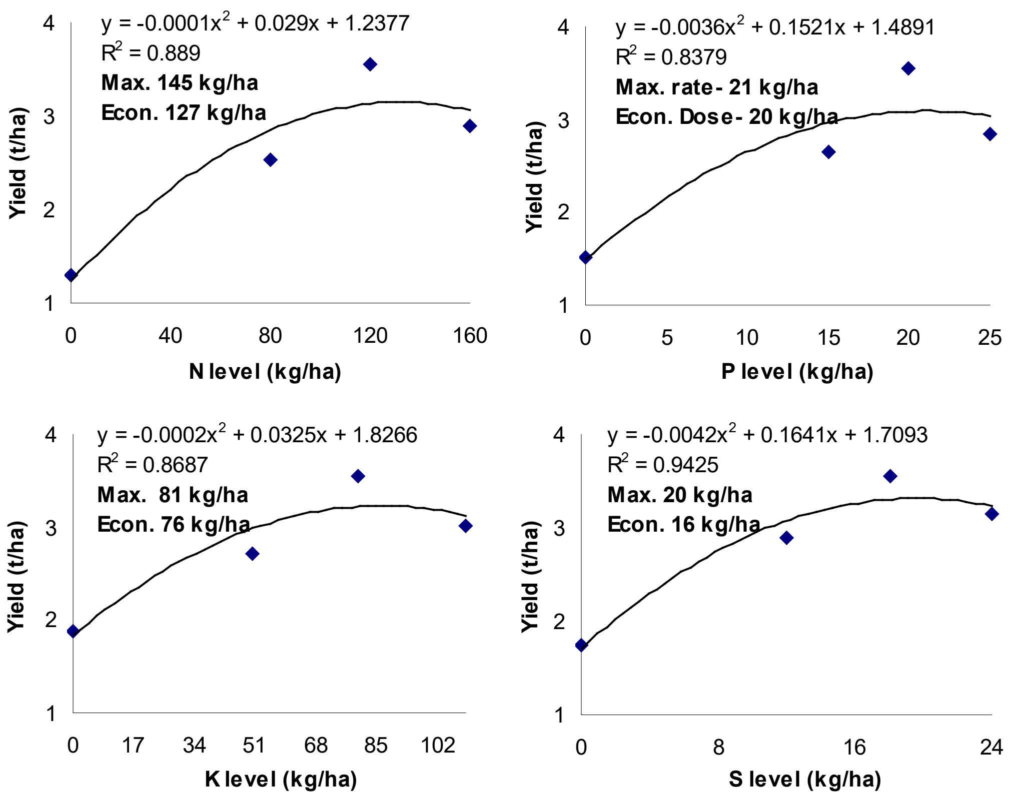


Figure 2. Response of Jute to added NPKS in Wheat-Jute-T.Aman cropping pattern at MLT site, Sherpur during 2001-02 to 2003-04

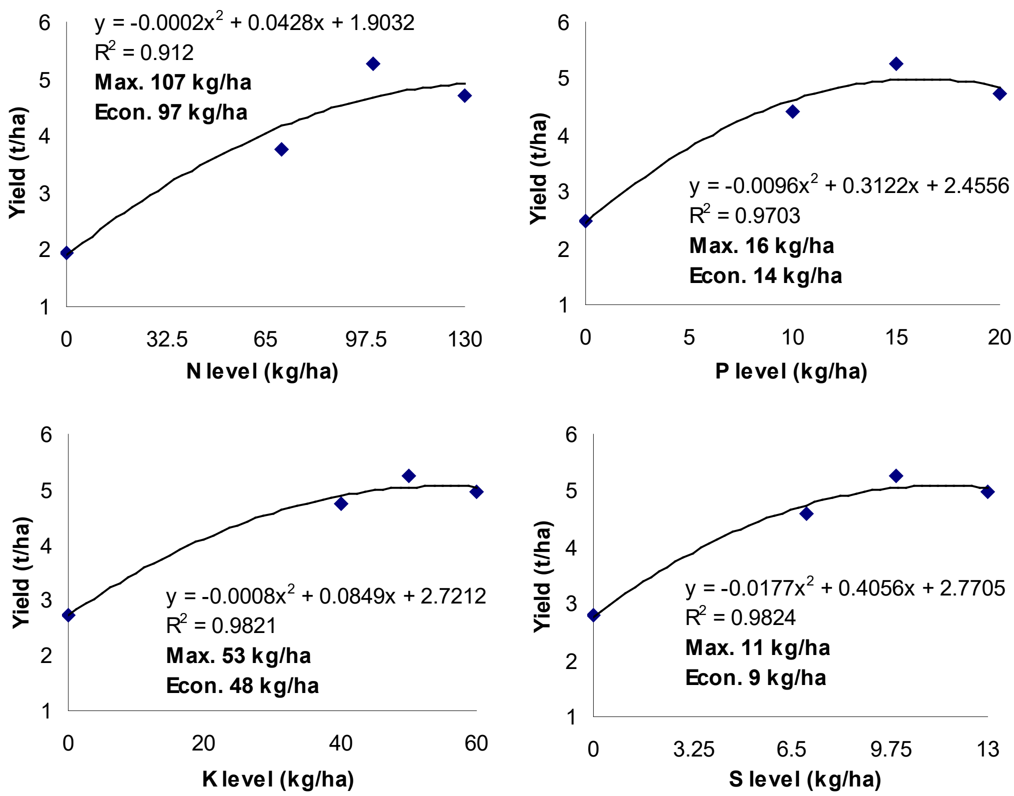


Figure 3. Response of T.Aman rice to added NPKS in Wheat-Jute-T.Aman cropping pattern at MLT site, Sherpur during 2001-02 to 2003-04

Table 1. Effects of different levels of fertilizer nutrients on the yield of Wheat in Wheat-Jute -T.Aman cropping pattern at Sherpur MLT site, Jamalpur during 2001-02 to 2003-04

Levels	Nutrient dose (kg/ha)	Tuber yield (t/ha)			
		2001-02	2002-03	2003-04	Average
N	0	0.89	0.96	1.15	1.00
	95	2.20	2.62	2.65	2.49
	135	3.25	3.40	3.64	3.43
	175	2.78	2.92	2.95	2.88
P	0	2.23	2.85	2.45	2.51
	20	2.58	3.20	3.02	2.93
	30	3.25	3.40	3.64	3.43
	40	2.90	3.27	3.21	3.13
K	0	2.25	2.65	2.01	2.30
	50	2.75	2.95	2.85	2.85
	75	3.25	3.40	3.64	3.43
	100	2.87	3.01	3.21	3.03
S	0	2.30	2.31	2.43	2.35
	15	2.62	3.12	3.01	2.92
	25	3.25	3.40	3.64	3.43
	35	2.88	3.17	3.34	3.13

Table 2. Effects of different levels of fertilizer nutrients on the yield of Jute in Wheat-Jute -T.Aman cropping pattern at Sherpur MLT site, Jamalpur during 2001-02 to 2003-04

Levels	Nutrient dose (kg/ha)	Fibre yield (t/ha)			
		2001-02	2002-03	2003-04	Average
N	0	1.22	1.27	1.29	1.26
	80	2.85	2.45	2.54	2.61
	120	4.02	3.05	3.55	3.54
	160	3.25	2.62	2.90	2.92
P	0	1.77	1.32	1.52	1.54
	15	3.10	2.55	2.65	2.77
	20	4.02	3.05	3.55	3.54
	25	3.50	2.75	2.85	3.03
K	0	1.74	1.38	1.88	1.67
	50	3.15	2.52	2.72	2.80
	80	4.02	3.05	3.55	3.54
	110	3.81	2.86	3.01	3.23
S	0	1.84	1.41	1.74	1.66
	12	3.31	2.49	2.89	2.90
	18	4.02	3.05	3.55	3.54
	24	3.75	2.74	3.14	3.21

Table 3. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Wheat-Jute - T.Aman cropping pattern at Sherpur MLT site, Jamalpur during 2001-02 to 2003-04

Levels	Nutrient dose (kg/ha)	Grain yield (t/ha)			
		2001-02	2002-03	2003-04	Average
N	0	2.25	1.72	1.96	1.98
	70	4.34	4.49	3.75	4.19
	100	5.43	5.03	5.25	5.23
	130	4.84	4.93	4.70	4.82
P	0	2.33	2.61	2.49	2.48
	10	4.51	4.69	4.41	4.53
	15	5.43	5.03	5.25	5.23
	20	4.53	4.91	4.75	4.73
K	0	2.54	2.31	2.73	2.53
	40	4.35	4.30	4.75	4.47
	50	5.43	5.03	5.25	5.23
	60	4.56	4.56	4.95	4.69
S	0	2.44	2.62	2.79	2.62
	7	4.36	4.40	4.60	4.45
	10	5.43	5.03	5.25	5.23
	13	4.44	4.77	4.97	4.73

Location : Melandah, Jamalpur (AEZ 9)
Cropping pattern : Potato -Jute - T.Aman
Year : 2003-04

Potato: A considerable response of Potato to nitrogen was observed. Tuber yield of Potato increased appreciably with the increase of nitrogen up to 130 kg/ha of N. After that level tuber yield tended to decrease. Similarly, P, K and S showed a positive response towards the yield of Potato. Tuber yield increased up to 30, 100 and 10 kg/ha of P, K and S, respectively.

Jute: Fibre yield of Jute increased markedly with the increase of N and the highest yield was recorded from 100 kg/ha and then tended to decrease. Almost similar trend was found in case of P, K and S. Fiber yield increased appreciably up to 12, 55 and 7 kg/ha of P, K and S, respectively.

T.Aman: Grain yield of T.Aman rice increased with the increase of N levels up to 90 kg/ha of N and then tended to decrease. Similarly, P, K and S showed a positive response towards the yield of T.Aman rice. Grain yield increased up to 10, 40 and 4 kg/ha of P, K and S, respectively. The soil was initially deficient in NPK and therefore, a positive response of crops to added nutrients was found. However, the status of S was medium but response was observed on the yield of crops.

From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Potato	145	32	114	12	128	29	96	9
Jute	102	13	56	7	95	11	50	6
T.Aman	97	11	42	4	86	9	38	4

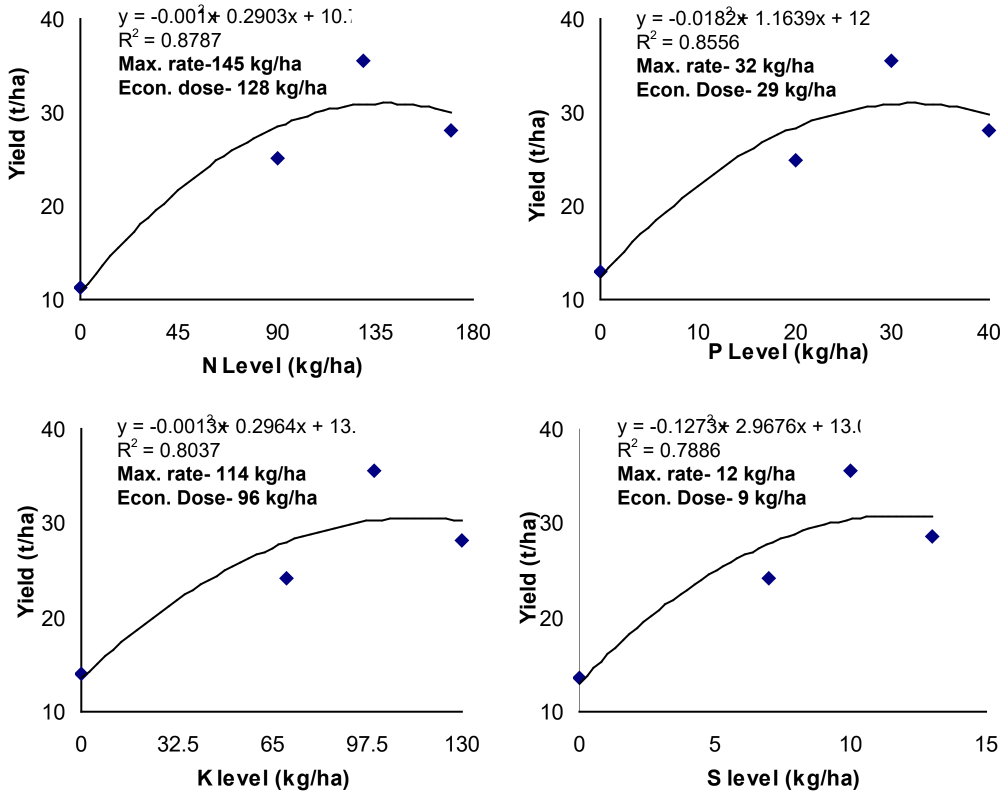


Figure 4. Response of Potato to added NPKS in Potato-Jute-T.Aman cropping pattern at MLT site, Melandah during 2003-04

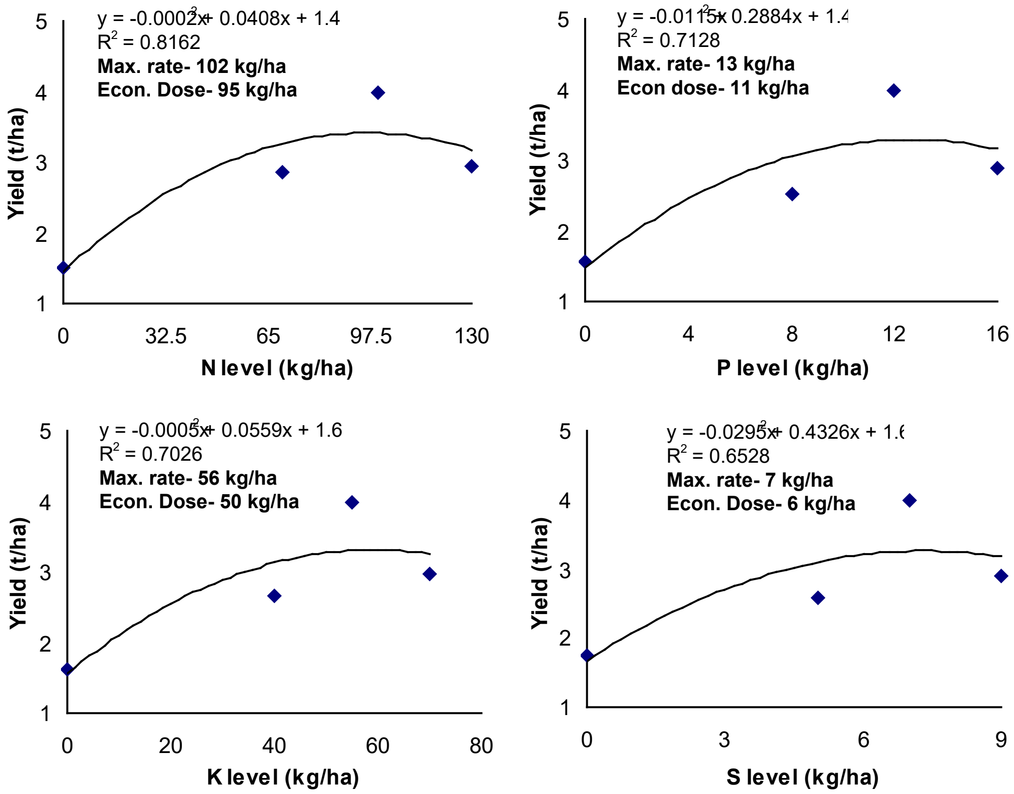


Figure 5. Response of Jute to added NPKS in Potato-Jute-T.Aman cropping pattern at MLT site, Melandah during 2003-04

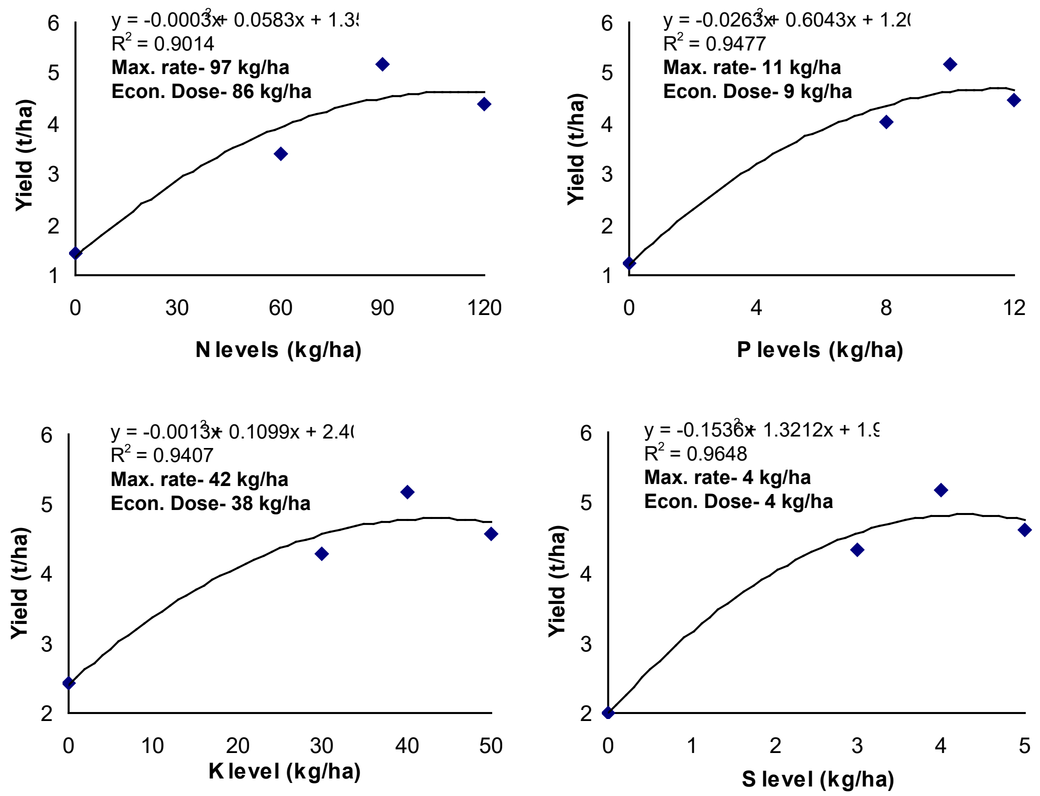


Figure 6. Response of T.Aman rice to added NPKS in Potato-Jute-T.Aman cropping pattern at MLT site, Melandah during 2003-04

Table 4. Effects of different levels of fertilizer nutrients on the yield of crops in Potato-Jute -T.Aman cropping pattern at Melandah MLT site, Jamalpur, 2003-04

levels	Nutrient levels (kg/ha)			Tuber/Fiber/Grain yield (t/ha)		
	Potato	Jute	T.Aman	Potato	Jute	T.Aman
N	0	0	0	11.25	1.51	1.44
	90	70	60	25.01	2.85	3.42
	130	100	90	35.63	4.00	5.17
	170	130	120	28.17	2.95	4.37
P	0	0	0	12.98	1.57	1.23
	20	8	8	24.83	2.52	4.02
	30	12	10	35.63	4.00	5.17
	40	16	12	28.01	2.89	4.45
K	0	0	0	14.05	1.62	2.43
	70	40	30	24.14	2.65	4.30
	100	55	40	35.63	4.00	5.17
	130	70	50	28.23	2.98	4.58
S	0	0	0	13.57	1.74	2.01
	7	5	3	24.08	2.58	4.33
	10	7	4	35.63	4.00	5.17
	15	9	5	28.59	2.89	4.61

Location : **Kishoreganj (AEZ 9)**
Cropping pattern : **Potato -T.Aus - T.Aman**
Year : **2003-04**

Potato: A considerable response of Potato to nitrogen was observed. Tuber yield of Potato increased appreciably with the increase of nitrogen up to 120 kg/ha of N. After that level tuber yield tended to decrease. Similarly, P and K showed a positive response towards the yield of Potato. Tuber yield increased considerably up to 30 and 90 kg/ha of P and K. But response to S was not very evident. However, yield increased up to 20 kg S/ha.

T.Aus: Grain yield of T.Aus rice increased appreciably with the increase of N and the highest yield was recorded from 90 kg/ha and then tended to decrease. Almost similar trend was found in case of P, K and S. Grain yield increased appreciably up to 18, 45 and 14 kg/ha of P, K and S, respectively.

T.Aman: Grain yield of T.Aman rice increased with the increase of N levels up to 120 kg/ha of N and then tended to decrease. Similarly, P, K and S showed a positive response towards the yield of T.Aman rice. Grain yield increased up to 18, 45 and 14 kg/ha of P, K and S, respectively. However, the rate of increment was higher up to 60, 12, 30 and 9 kg/ha of N, P, K and S, respectively. The soil was initially deficient in NPK and therefore, a positive response of crops to added nutrients was found. From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Potato	113	36	111	19	83	32	78	18
T.Aus	92	18	33	12	78	13	23	11
T.Aman	86	16	45	13	77	14	27	8

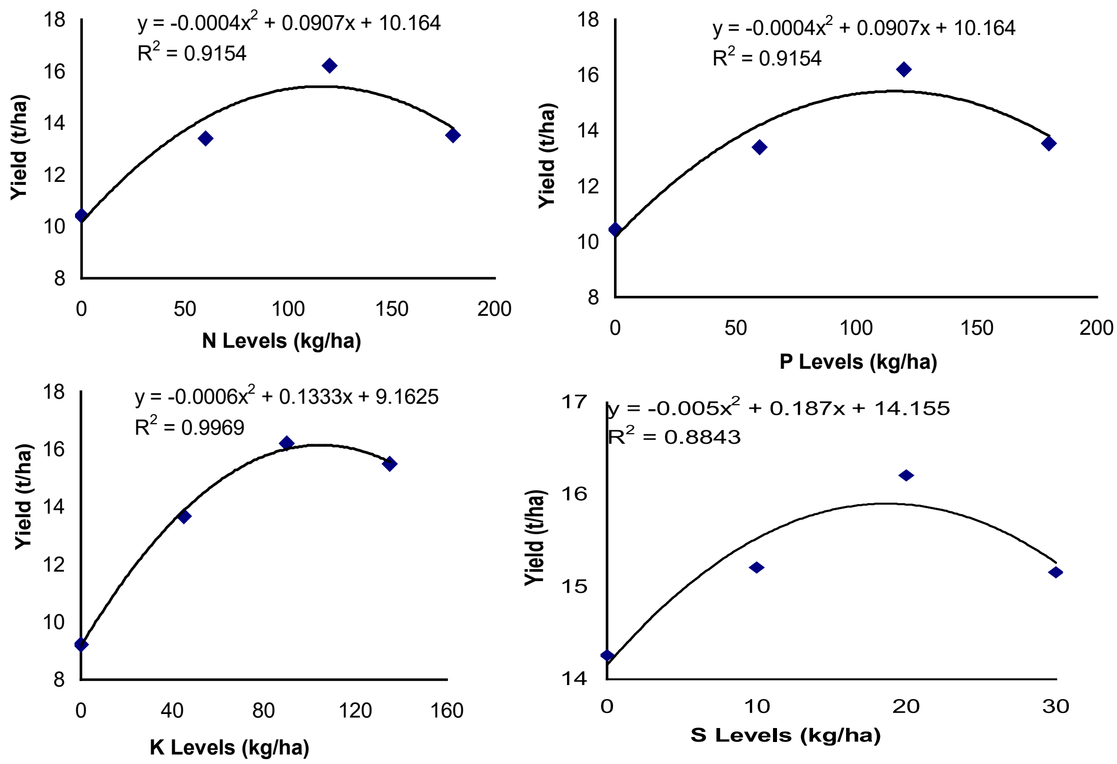


Figure 7. Response of potato to added NPKS grown in Potato-T.Aus-T.Aman cropping pattern at Kishoregonj Sadar MLT site during 2003-04

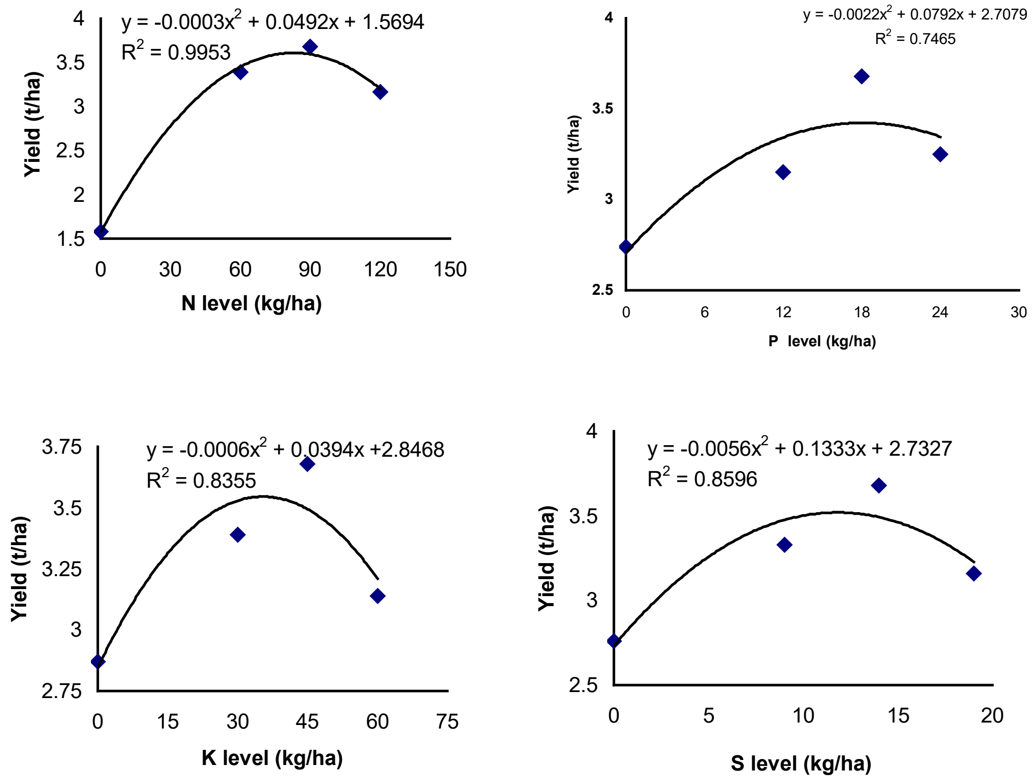


Figure 8. Response of T.Aus to added NPKS grown in Potato-T.Aus-T.Aman cropping pattern at Kishoregonj Sadar MLT site during 2003-04

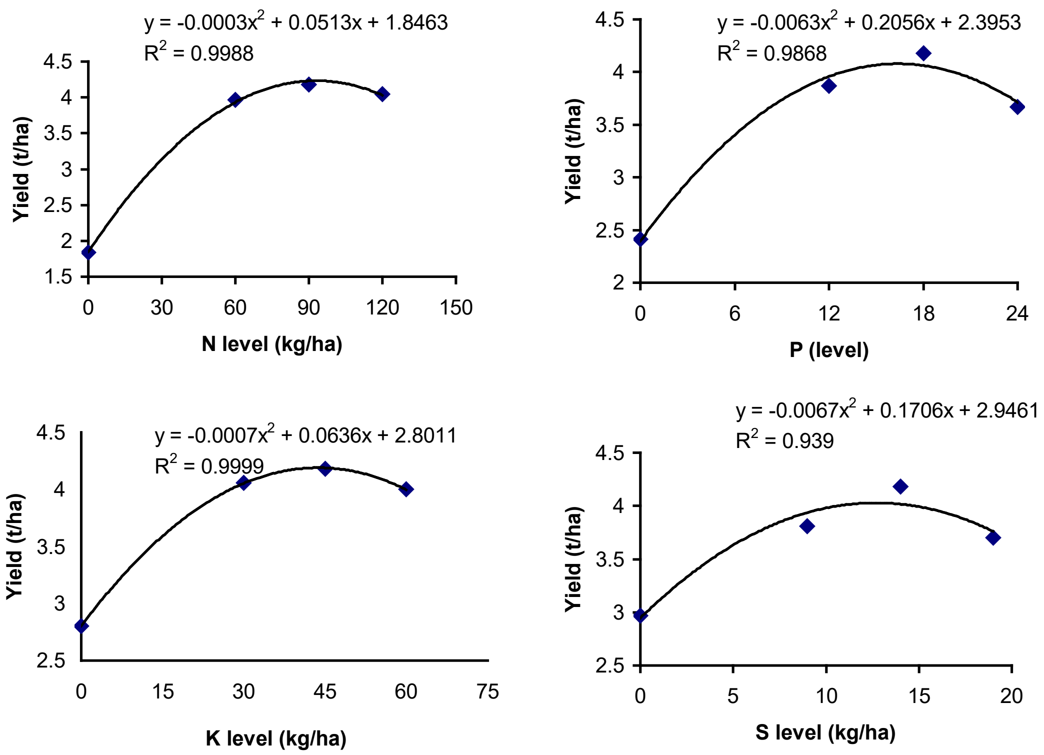


Figure 9. Response of T.Aman to added NPKS grown in Potato-T.Aus-T.Aman cropping pattern at Kishoregonj Sadar MLT site during 2003-2004

Table 5. Effect of different levels of nutrients on the yield of Potato crop grown in Potato – T.Aus – T.Aman rice cropping pattern at Kishoregonj sadar MLT site, 2003-2004.

levels	Nutrient levels (kg/ha)			Tuber/Grain yield (t/ha)		
	Potato	T.Aus	T.Aman	Potato	T.Aus	T.Aman
N	0	0	0	10.43	1.58	1.84
	60	60	60	13.40	2.39	3.97
	120	90	90	16.21	3.68	4.18
	180	120	120	13.54	3.17	4.05
P	0	0	0	8.28	2.74	2.41
	15	12	12	10.54	3.15	3.87
	30	18	18	16.21	3.68	4.18
	45	24	24	14.61	3.25	3.67
K	0	0	0	9.23	2.87	2.80
	45	30	30	13.67	3.39	4.06
	90	45	45	16.21	3.68	4.18
	135	60	60	15.50	3.14	4.00
S	0	0	0	14.26	2.76	2.97
	10	9	9	15.21	3.33	3.81
	20	14	14	16.21	3.68	4.18
	30	19	19	15.96	3.16	3.70

Location : Joypurhat, Bogra (AEZ 25)
Cropping pattern : Potato -Boro - T.Aman
Year : 2003-04

Potato: A considerable response of Potato to nitrogen was observed. Tuber yield of Potato increased appreciably with the increase of nitrogen up to 134 kg/ha of N. After that level tuber yield tended to decrease. Similarly, P and K showed a positive response towards the yield of Potato. Tuber yield increased considerably up to 22 and 24 kg/ha of P and S. Regarding K yield increased appreciably up to 134 kg/ha of K and after that level yield also increased but the rate of increment was slow. The highest yield was found in highest level of K and the trend was linear.

Boro: Grain yield of Boro rice increased appreciably with the increase of N and the highest yield was recorded from 134 kg/ha and then tended to decrease. Response to PKS was not very distinct. However, grain yield increased appreciably up to 18, 114 and 30 kg/ha of P, K and S, respectively.

T.Aman: Grain yield of T.Aman rice increased with the increase of N levels up to 88 kg/ha of N and then tended to decrease. But response to PKS was not very sharp. Grain yield increased up to 16, 72 and 16 kg/ha of P, K and S, respectively. From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Potato	121	24	172	21	120	22	130	15
Boro	130	20	119	27	120	18	90	20
T.Aman	128	20	85	17	95	15	70	15

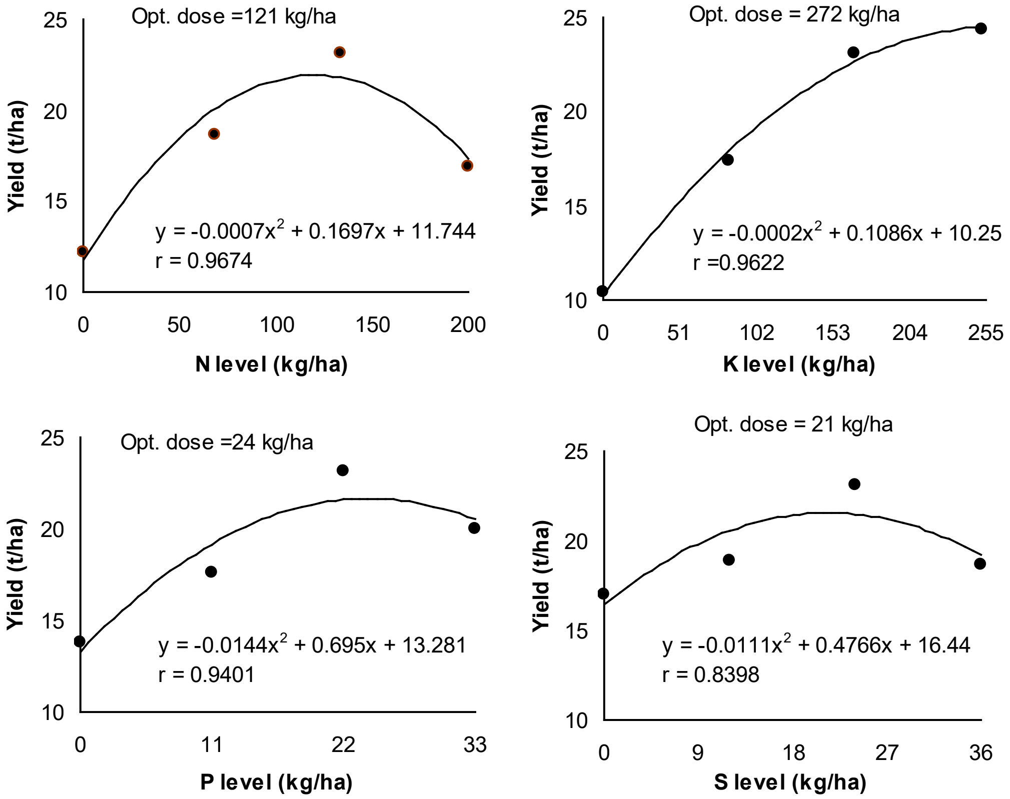


Figure 10. Response of Potato to added NPKS in Potato-Boro-T.Aman cropping pattern at MLT site, Joypurhat under Bogra during 2003-04

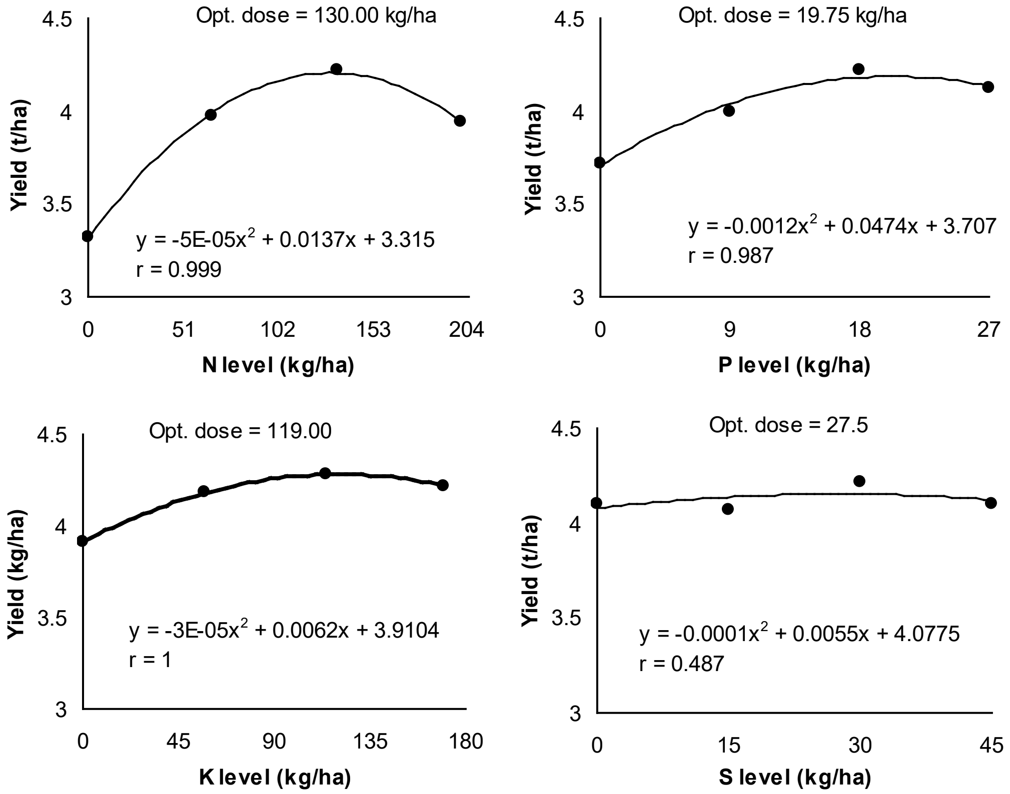


Figure 11. Response of Boro rice to added NPKS in Potato-Boro-T.Aman cropping pattern at MLT site, Joypurhat under Bogra during 2003-04

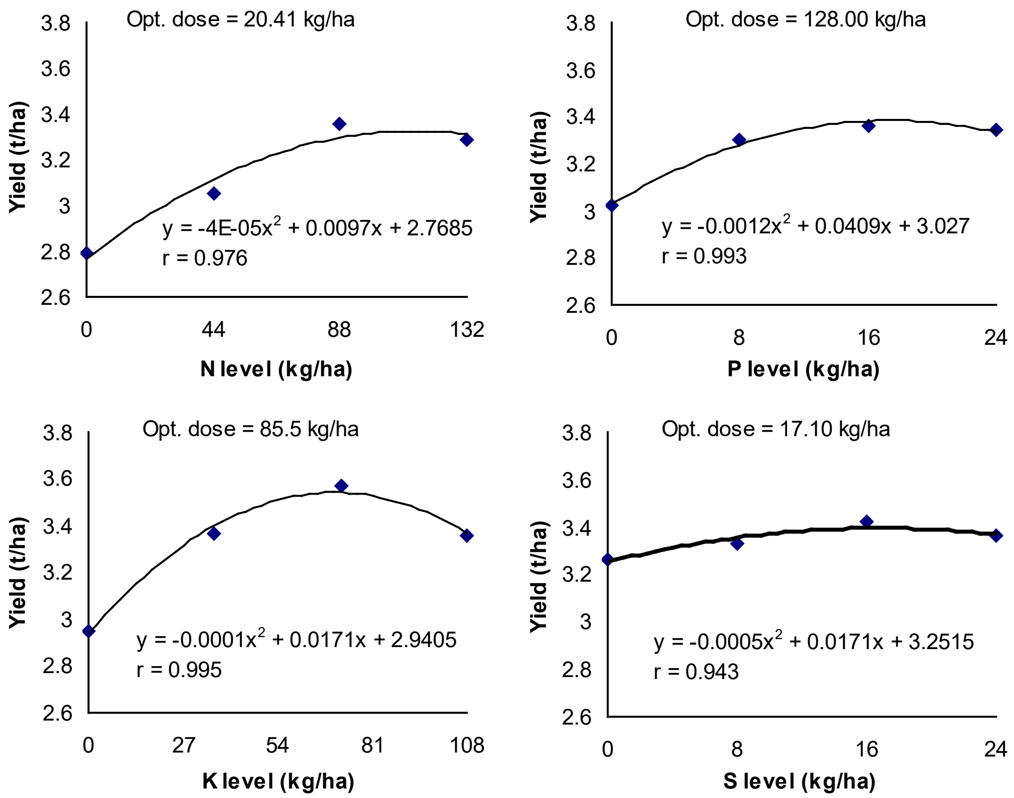


Figure 12. Response of T.Aman rice to added NPKS in Potato-Boro-T.Aman cropping pattern at MLT site, Joypurhat under Bogra during 2003-04

Table 6. Effect of different levels of nutrients on the yield of crops grown in Potato-Boro-T.Aman rice cropping pattern at Joypurhat, Bogra, 2003-04

Levels	Nutrient levels (kg ha^{-1})			Tuber/Grain yield (tha^{-1})		
	Potato	Boro	T.Aman	Potato	Boro	T.Aman
N	0	0	0	12.18	3.32	2.79
	68	67	44	18.67	3.98	3.05
	134	134	88	23.14	4.28	3.57
	201	201	132	16.93	3.94	3.29
P	0	0	0	13.80	3.72	3.02
	11	9	8	17.62	4.00	3.30
	22	18	16	23.14	4.28	3.57
	33	27	24	19.97	4.12	3.34
K	0	0	0	10.41	3.91	2.95
	84	57	36	17.43	4.18	3.37
	168	114	72	23.14	4.28	3.57
	252	171	108	24.33	4.22	3.36
S	0	0	0	16.99	4.10	3.26
	12	15	8	18.91	4.07	3.33
	24	30	16	23.14	4.28	3.57
	36	45	24	18.67	4.23	3.42

Location : **Gabtali, Bogra (AEZ 4)**
Cropping pattern : **Mustard -Boro - T.Aman**
Year : **2003-04**

Mustard: A considerable response of Mustard to nitrogen was observed. Seed yield of Mustard increased appreciably with the increase of nitrogen up to 90 kg/ha of N. After that level yield was tended to decline. Similarly, P, K and S showed some response towards the yield of Mustard. Seed yield increased up to 26, 64 and 28 kg/ha of P, K and S, respectively. .

Boro: Grain yield of Boro rice increased appreciably with the increase of N and the highest yield was recorded from 130 kg/ha and then tended to decrease. Response of crop to P was observed to some extent. Yield increased appreciably up to 14 kg P/ha and then slowly increased up to 28 kg/ha. But response to K and S was not very distinct. However, grain yield increased slowly up to56 and 14 kg/ha of K and S, respectively.

T.Aman: Grain yield of T.Aman rice increased with the increase of N levels up to 86 kg/ha of N and then tended to decrease. But response to PKS was not very sharp. Grain yield increased up to 16, 72 and 12 kg/ha of P, K and S, respectively. From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Mustard	98	25	60	30	90	20	55	25
Boro	145	22	90	22	130	18	60	15
T.Aman	86	20	70	12	82	15	50	10

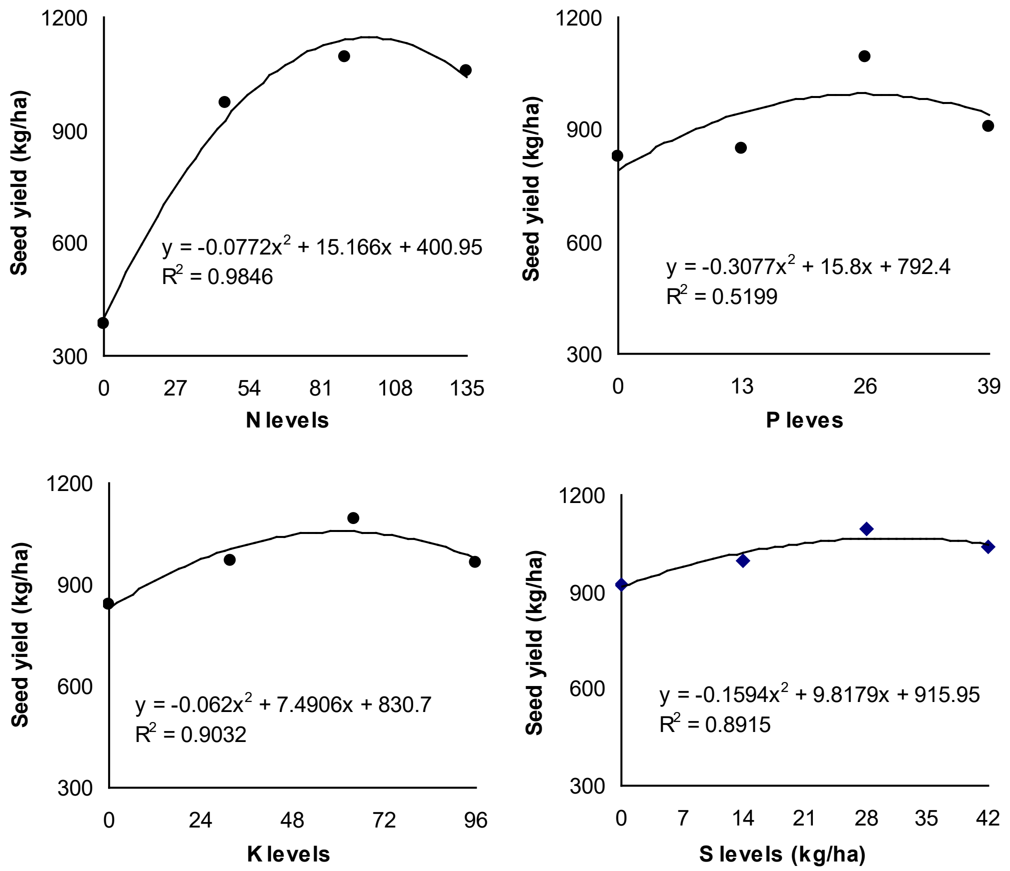


Figure 13. Response of Mustard to added NPKS in Mustard-Boro-T.Aman rice cropping pattern at Gabtali, Bogra, 2003-04

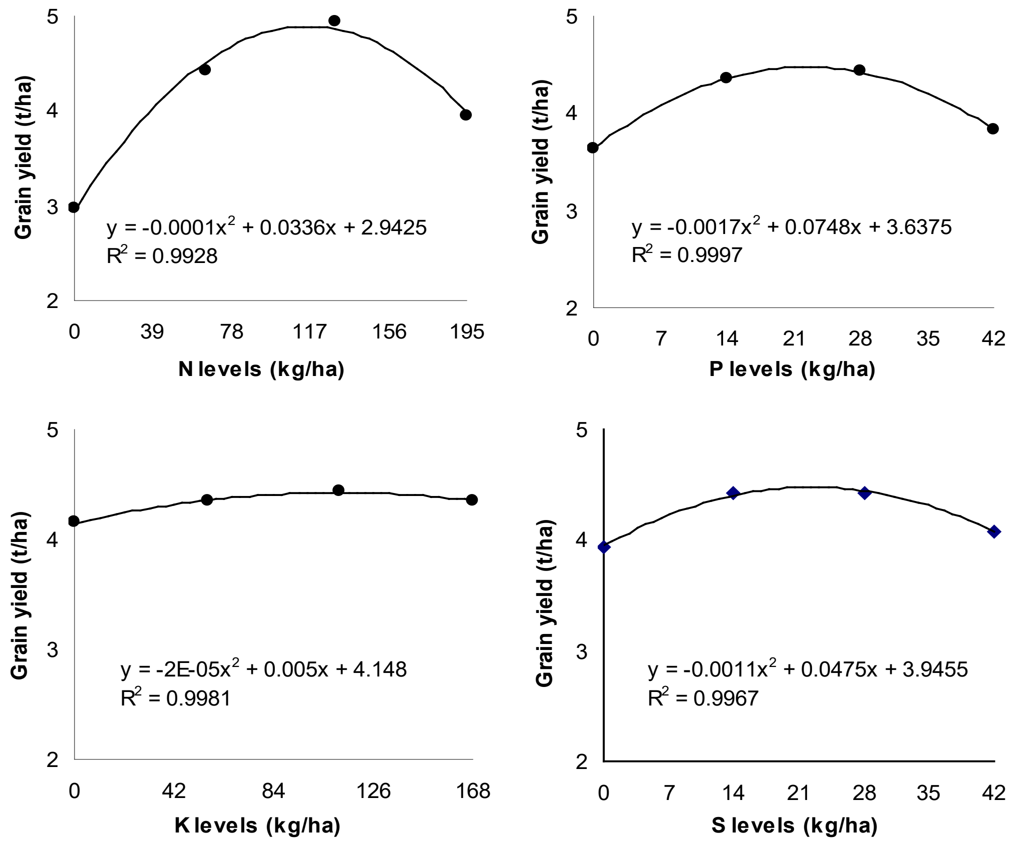


Figure 14. Response of Boro rice to added NPKS in Mustard-Boro-T.Aman rice cropping pattern at Gabtali, Bogra, 2003-04

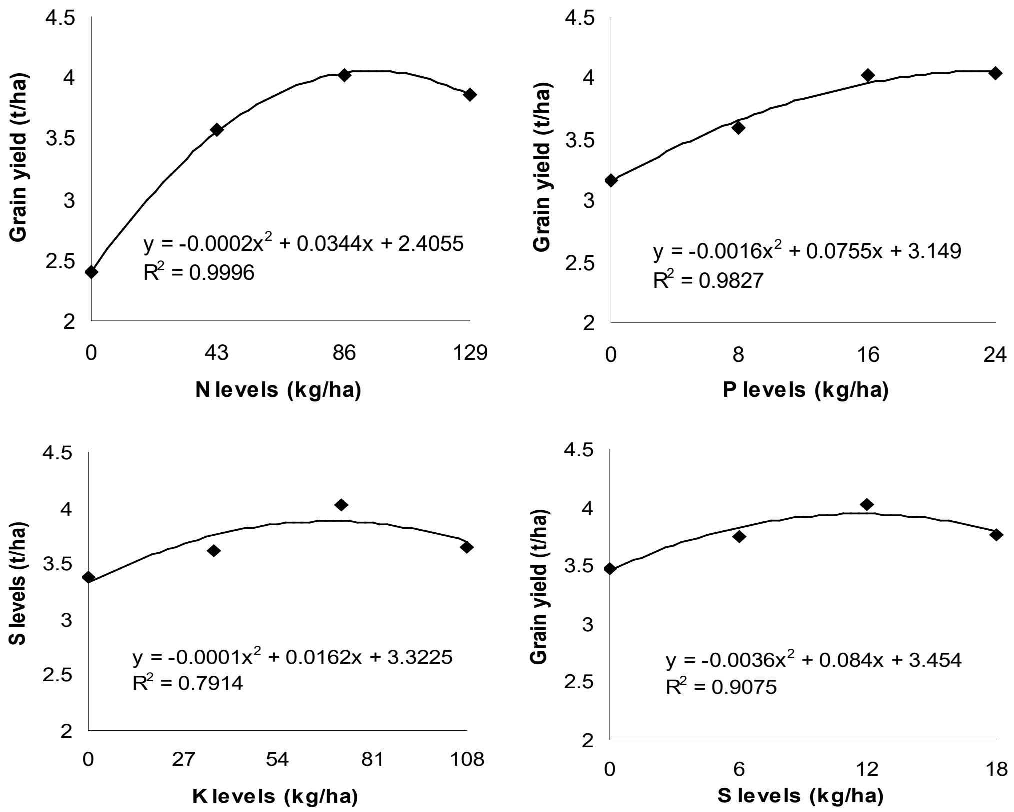


Figure 15. Response of T.Aman rice to added NPKS in Mustard-Boro-T.Aman rice cropping pattern at Gabtali, Bogra, 2003-04

Table 7. Effect of different levels of nutrients on the yield of crops grown in Mustard-Boro-T.Aman rice cropping pattern at Gabtali, Bogra, 2003-04

Levels	Nutrient levels (kg/ha)			Seed yield (kg/ha)/Grain yield (t/ha)		
	Mustard	Boro	T.Aman	Mustard	Boro	T.Aman
N	0	0	0	385	2.97	2.40
	45	65	43	975	4.43	3.57
	90	130	86	1093	4.94	4.02
	135	195	129	1058	3.95	3.86
P	0	0	0	825	3.64	3.17
	13	14	8	848	4.35	3.59
	26	28	16	1093	4.43	4.02
	39	42	24	908	3.83	4.04
K	0	0	0	843	4.15	3.37
	32	56	36	970	4.35	3.61
	64	112	72	1093	4.43	4.02
	96	168	108	966	4.35	3.65
S	0	0	0	925	3.94	3.48
	14	14	6	995	4.42	3.75
	28	28	12	1093	4.43	4.02
	42	42	18	1038	4.08	3.77

Location : **Chandina, Comilla (AEZ 19)**
Cropping pattern : **Boro-T.Aus- T.Aman**
Year of establishment : **2003-04**

Boro: Grain yield of Boro rice increased appreciably with the increase of N levels and the highest yield was obtained with 120 kg/ha of N. But response of Boro rice to P, K and S was not evident. However, grain yield increased slowly up to 23, 80 and 20 kg/ha of P, K and S, respectively. Average yield of Boro rice was quiet higher this year.

T.Aus: A considerable response of T.Aus rice to nitrogen was found. Grain yield increased up to 80 kg/ha of N and there after tended to decrease. But no considerable response to P, K and S was observed at all.

T.Aman: Due to flood the crop was damaged and therefore, no data were recorded.

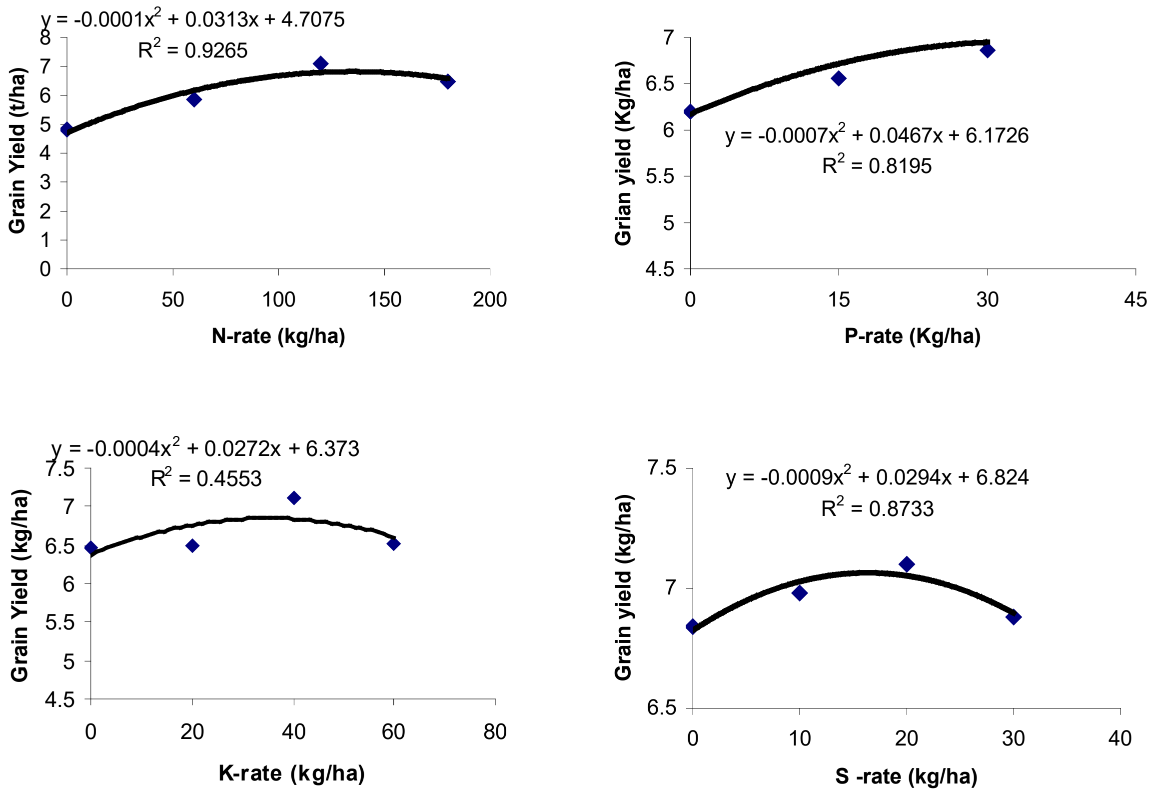


Figure 16. Response of Boro to NPKS in Boro-T.Aus –T.Aman cropping pattern at Chandina, Comilla during rabi 2003-04

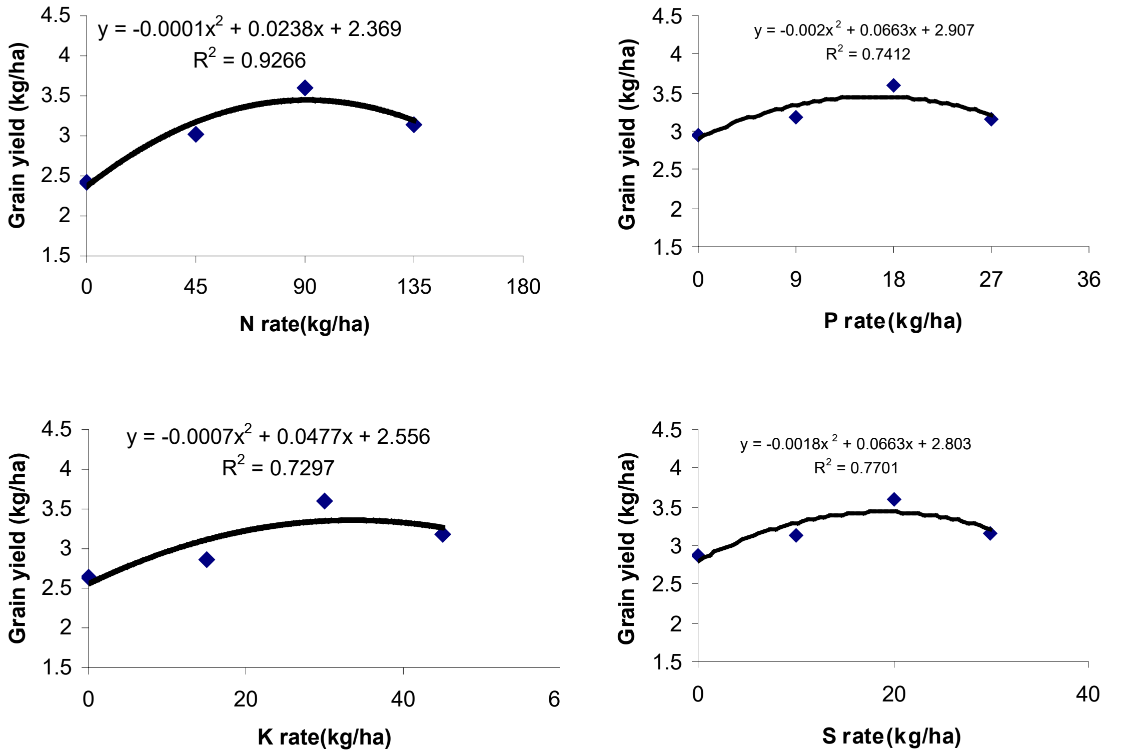


Figure 17. Response of T.Aus NPKS in Boro-T.Aus –T.Aman cropping pattern to at Chandina, Comilla during Kharif 2004

Table 8. Effects of different levels of fertilizer nutrients on the yield of crops in Boro-T.Aus -T.Aman cropping pattern at Chandina, Comilla, 2003-04

Levels	Nutrient levels (kgha^{-1})			Grain yield (tha^{-1})		
	Boro	T.Aus	T.Aman	Boro	T.Aus	T.Aman
N	0	0	0	4.81	2.42	Damaged due to flood
	80	60	60	5.86	3.02	
	120	80	80	7.10	3.60	
	160	100	100	6.48	3.14	
P	0	0	0	6.2	2.96	
	15	9	9	6.56	3.18	
	23	12	12	7.10	3.60	
	30	15	15	6.86	3.16	
K	0	0	0	6.46	2.64	
	60	36	36	6.50	2.86	
	80	48	48	7.10	3.60	
	100	60	60	6.52	3.18	
S	0	0	0	6.84	2.86	
	15	8	8	6.98	3.12	
	20	12	12	7.10	3.60	
	25	16	16	6.86	3.16	

Location : Feni, Noakhali
Cropping pattern : Boro-T.Aman
Year : 2001-02 to 2003-04

Boro: Average of three years data showed that **a** positive response of Boro rice was observed to nitrogen. Grain yield was increased with the increase of N levels sharply up to 130 kg/ha of N and after that level rate of increment was slow. However yield increased up to 180 kg/ha of N and then tended to decrease. Similarly, in case of P response was found to some extent. Grain yield increased appreciably up to 30 kg/ha of P and there after the increment was very slow. In case of K and S no considerable response towards yield was found at all.

T.Aman: Similar trend was found like Boro rice. Grain yield increased with the increase of N and the highest yield was obtained from 120 kg/ha of N. However, the rate of increment was higher up to 90 kg/ha. In case of P, K and S a positive response was also observed and grain yield increased up to the application of 30 kg/ha, 80 kg/ha and 16 kg/ha of P, K and S, respectively. But the rate of increment was higher up to the application of 24, 60 and 12 kg/ha of P, K and S, respectively. However, yield of T.Aman rice was comparatively higher and more or less similar with Boro rice. A response curve was drawn from the average yield data and a quadratic type of relationship was found. From the response curve the optimum doses of the nutrients for different crops were calculated.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Boro	157	48	100	26	130	30	80	20
T.Aman	93	43	85	18	90	24	60	12

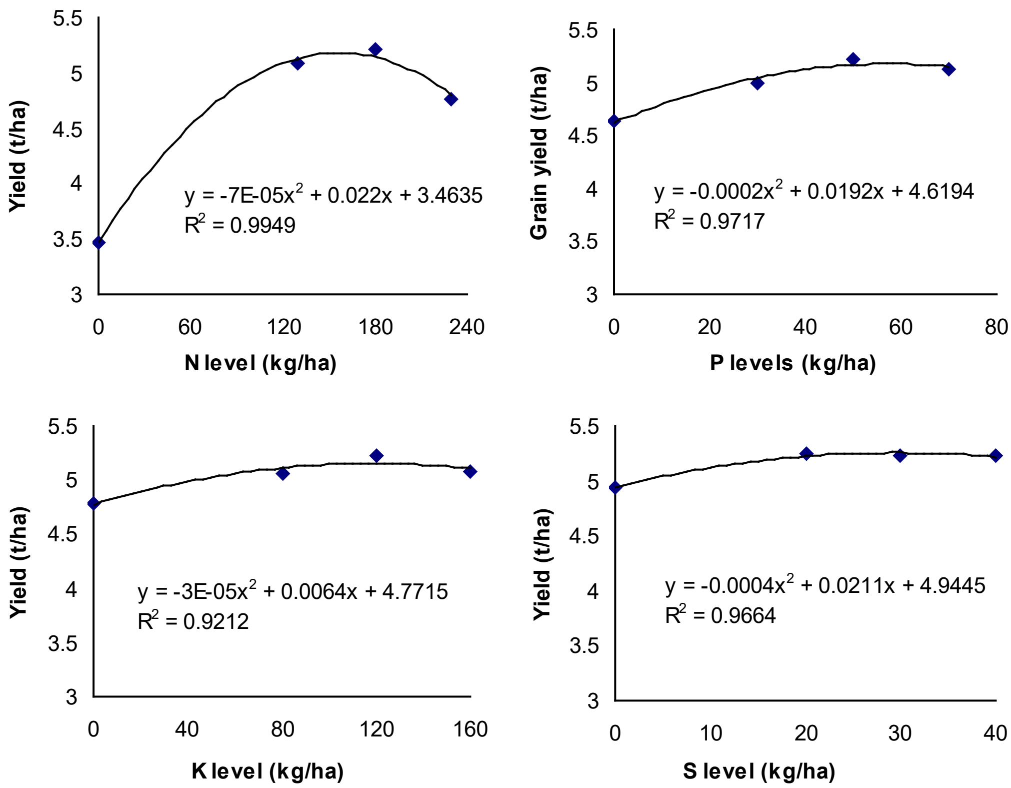


Figure 18. Response of Boro rice to added NPKS in Boro-Fallow-T.Aman cropping pattern at MLT site, Feni during 2001-02 to 2003-04

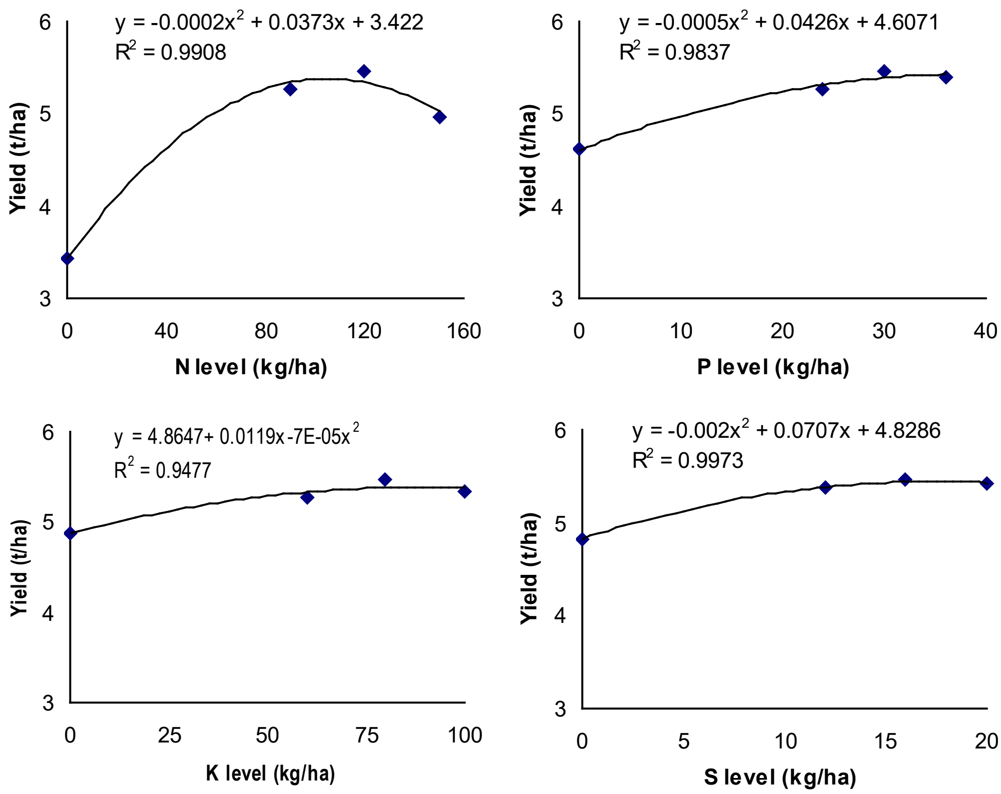


Figure 19. Response of T.Aman rice to added NPKS in Boro-Fallow-T.Aman cropping pattern at MLT site, Feni during 2001-02 to 2003-04

Table 9. Effect of different nutrient levels on the average yield of Boro-Fallow-T.Aman cropping pattern at MLT site, Feni Sadar, Feni during 2001-02 to 2003-04

Levels	Nutrient Levels (kg/ha)		Average yield (t/ha)	
	Boro	T.Aman	Boro	T.Aman
N	0	0	3.47	3.43
	130	90	5.08	5.26
	180	120	5.22	5.46
	230	150	4.77	4.97
P	0	0	4.63	4.61
	30	24	5.00	5.27
	50	30	5.22	5.46
	70	36	5.13	5.40
K	0	0	4.78	4.87
	80	60	5.06	5.28
	120	80	5.22	5.46
	160	100	5.08	5.34
S	0	0	4.94	4.83
	20	12	5.25	5.37
	30	16	5.22	5.46
	40	20	5.23	5.42

Location : Atkapalia, Noakhali
Cropping pattern : Groundnut-T.Aman
Year : 2001-02 to 2003-04

Groundnut: Average of three years data showed that nut yield of groundnut did not vary appreciably with the increase of nitrogen level. As the groundnut is a leguminous crop, therefore, response to N was not found. However, seed yield increased up to 20 kg/ha of N. Similarly, in case of P and K no considerable response was observed.

T.Aman: Response of T.Aman rice to N was observed. Grain yield increased up to 90 kg/ha of N. Similarly, response of T.Aman rice to P and K was observed to some extent and yield increased up to 12 kg/ha and 30 kg/ha of P and k, respectively. From the average data a response curve was drawn and the relationship was quadratic in nature.

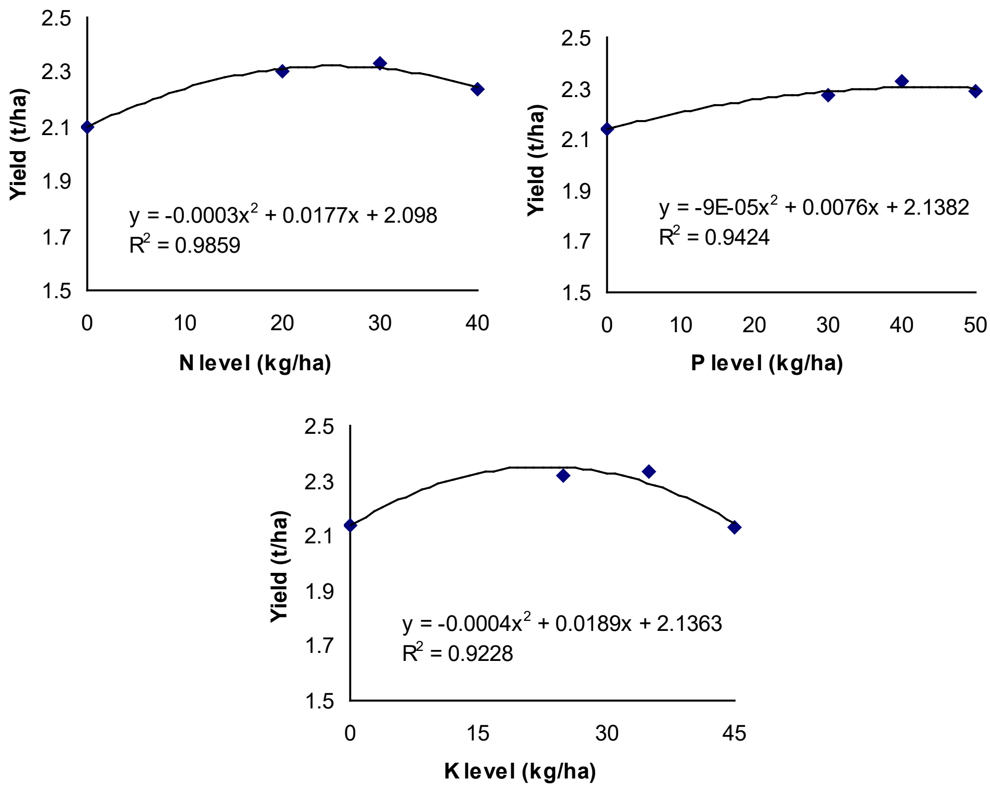


Figure 20. Response of Groundnut to added NPK in Groundnut-T.Aman cropping pattern at Atkapalia, Noakhali during 2001-02 to 2003-04

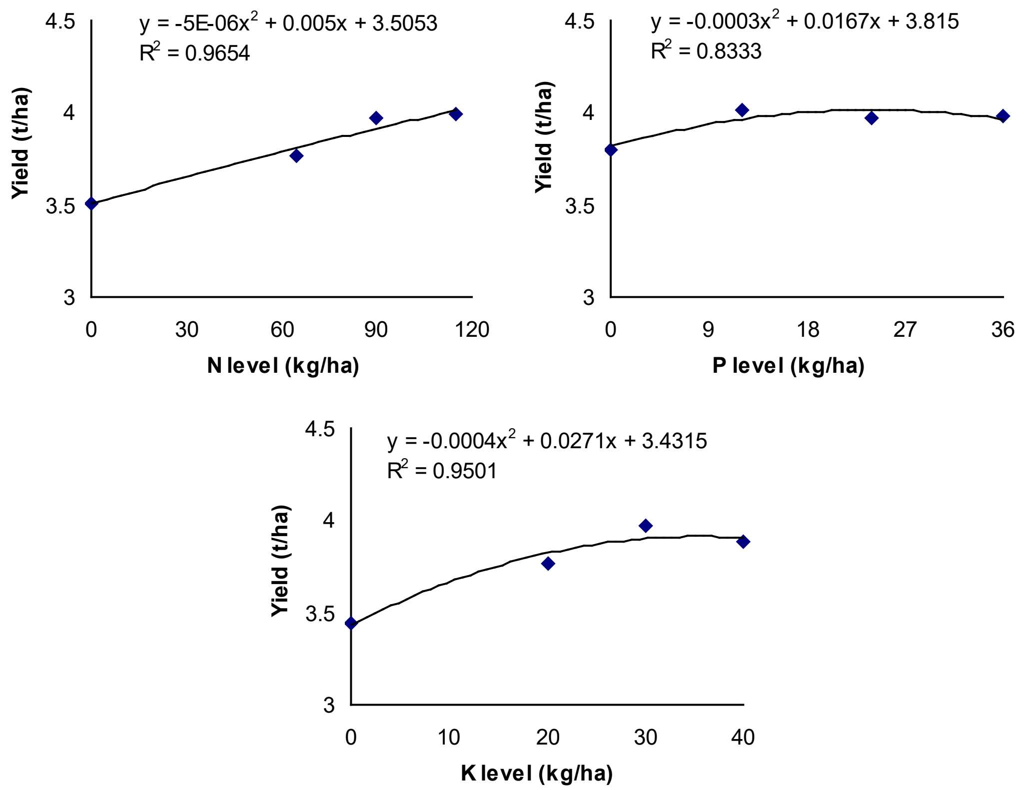


Figure 21. Response of T.Aman to added NPK in Groundnut-T.Aman cropping pattern at Atkapalia, Noakhali during 2001-02 to 2003-04

Table 10. Effect of different nutrient levels on the yield of Groundnut - T.Aman cropping pattern at Atkapalia, Noakhali during 2001-02 to 2003-04

Levels	Nutrient Levels (kg/ha)		Average yield (t/ha)	
	Groundnut	T.Aman	Groundnut	T.Aman
N	0	0	2.10	2.51
	20	65	2.30	3.77
	30	90	2.33	3.97
	40	115	2.24	3.99
P	0	0	2.14	3.80
	30	12	2.27	4.01
	40	24	2.33	3.97
	50	36	2.29	3.98
K	0	0	2.14	3.44
	25	20	2.32	3.77
	35	30	2.33	3.97
	160	100	5.08	5.34

Location : **Barind, Rajshahi**
Cropping pattern : **Chickpea -T.Aman rice**
Year : **2003-04**

Chickpea: Nitrogen was not included in Chickpea for response study. But response of Chickpea to P, K and S was not very distinct. However, seed yield increased up to 30, 30 and 20 kg/ha of P, K and S, respectively. But the rate of increment was higher up to 15, 20 and 10 kg/ha of P, K and S.

T.Aman: Response of T.Aman to nitrogen was observed. Grain yield increased markedly with the increase of N level up to 100 kg/ha of N. Then yield tended to decline. But response to other nutrient elements P, K and S was not evident. Grain yield did not increase appreciably due to increase of nutrient doses.

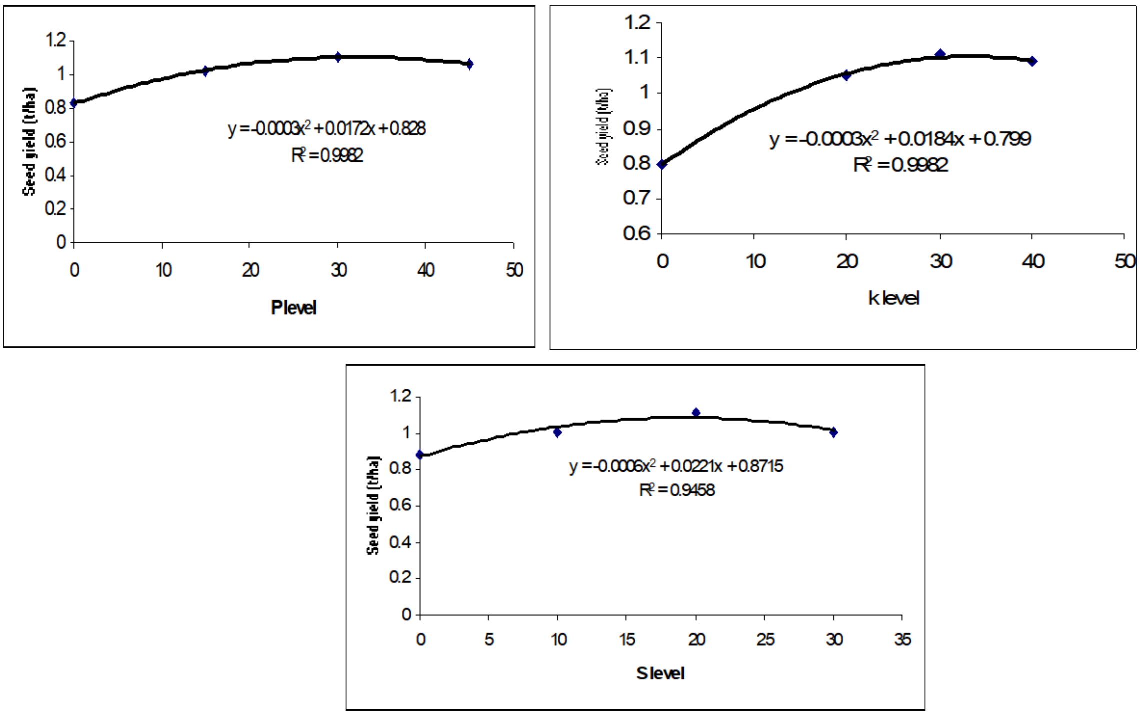


Figure 22. Response of Chickpea to added P, K and S in Chickpea-T.Aman cropping pattern at FSRD site, Chabbishnagar, Rajshahi during 2003-04

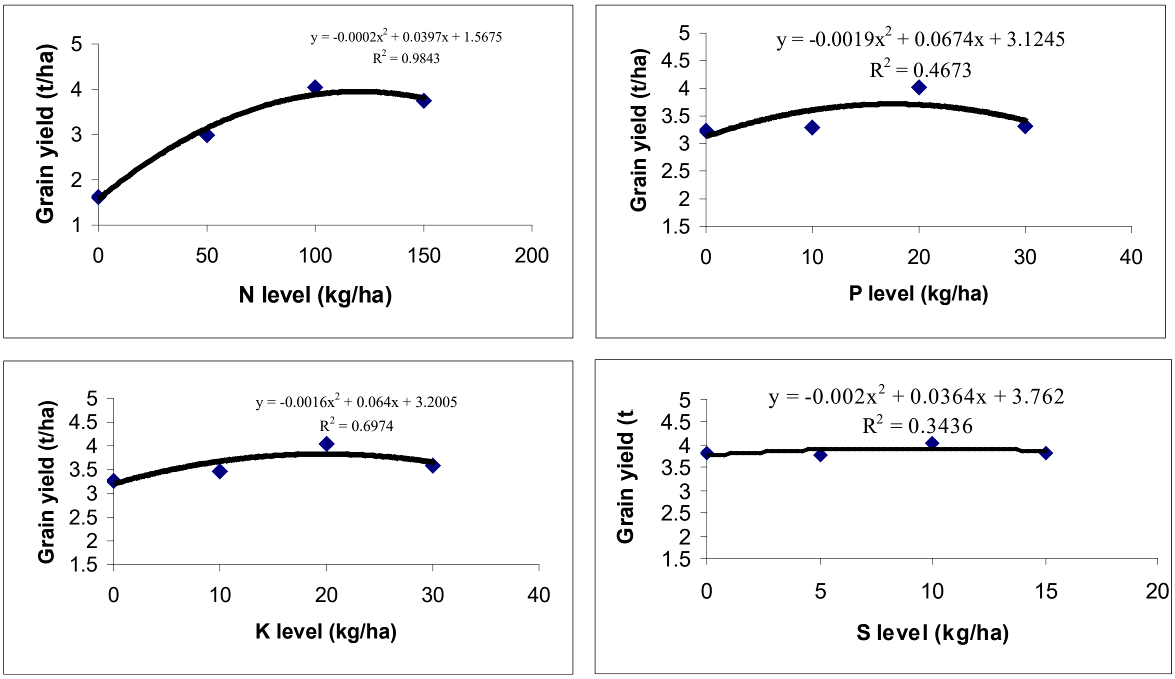


Figure 23. Response of T.Aman to added N, P, K and S in Chickpea-T.Aman cropping pattern at FSRD Site, Chabbishnagor, Rajshahi during 2003

Table 11. Effects of different levels of fertilizer nutrients on the yield of crops in Chickpea-T.Aman cropping pattern at Barind, Rajshahi, 2003-04

Levels	Nutrient Levels (kg/ha)		Seed/grain yield (t/ha)	
	Chickpea	T.Aman	Chickpea	T.Aman
N	Not studied	0	Not studied	2.05
		50		2.80
		100		3.30
		150		2.94
P	0	0	0.74	3.15
	15	10	1.07	3.25
	30	20	1.11	3.30
	45	30	1.09	3.27
K	0	0	0.80	2.72
	20	10	1.05	2.82
	30	20	1.11	3.30
	40	30	1.09	2.86
S	0	0	0.76	3.09
	10	5	1.01	3.26
	20	10	1.11	3.30
	30	15	1.01	2.98

Location : **Nachole, Barind, Rajshahi**
Cropping pattern : **Chickpea -T.Aman rice**
Year : **2003-04**

Chickpea: Nitrogen was not included in Chickpea for response study. But response of Chickpea to P, K and S was not very distinct. However, seed yield increased up to 30, 30 and 30 kg/ha of P, K and S, respectively.

T.Aman: Response of T.Aman to nitrogen was observed. Grain yield increased markedly with the increase of N level up to 80 kg/ha of N. Then yield tended to decline. But response to other nutrient elements P, K and S was not evident. Grain yield did not increase appreciably due to increase of nutrient doses. However yield increased slowly up to 16, 24 and 10 kg/ha of P, K and S, respectively.

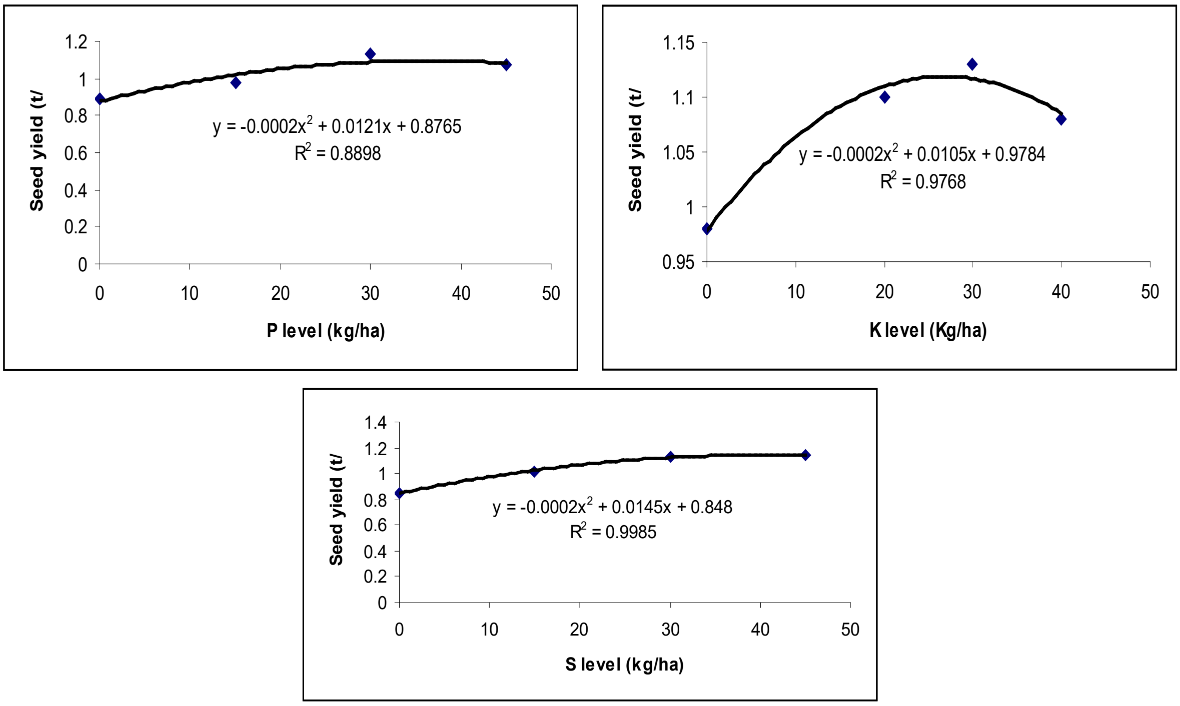


Figure 24. Response of Chickpea to added P, K and S in Chickpea-T.Aman cropping pattern at MLT Site, Nachole during 2003-04

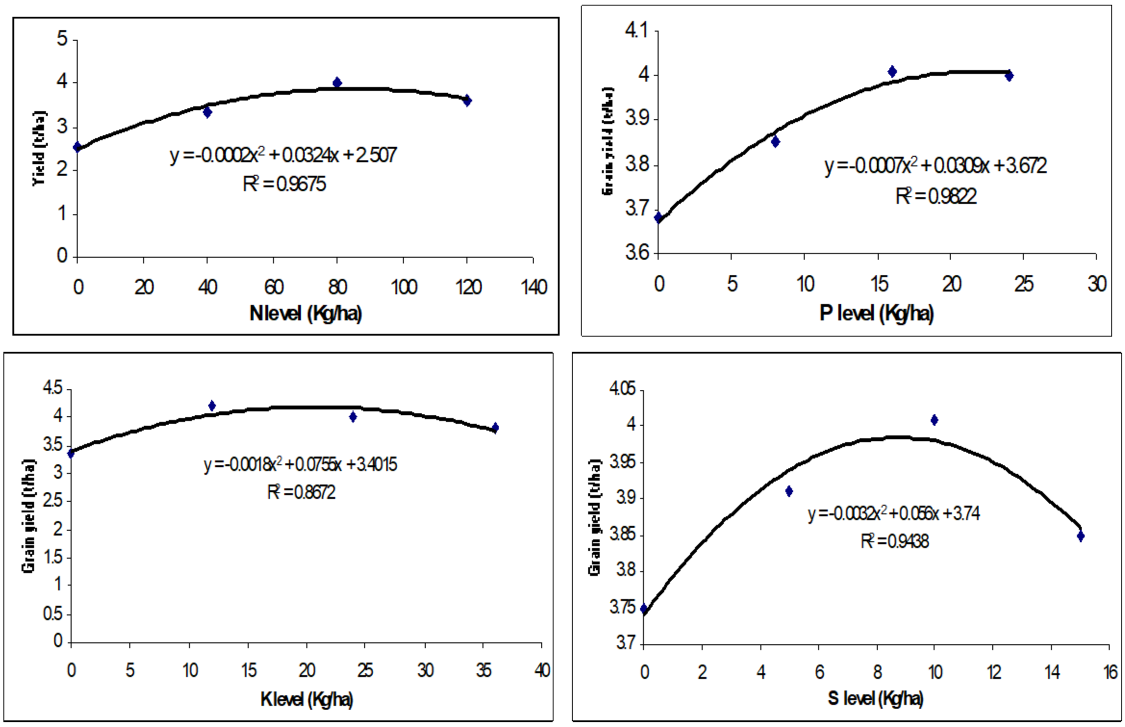


Figure 25. Response of T.Aman to added N, P, K and S in Chickpea-T.Aman cropping pattern at MLT Site, Nachole during 2004

Table 12. Effects of different levels of fertilizer nutrients on the yield of crops in Chickpea-T.Aman cropping pattern at Nachole, Barind, Rajshahi, 2003-04

Levels	Nutrient Levels (kg/ha)		Seed/grain yield (t/ha)	
	Chickpea	T.Aman	Chickpea	T.Aman
N	Not studied	0	Not studied	2.55
		40		3.37
		80		4.01
		120		3.61
P	0	0	0.89	3.68
	15	8	0.98	3.85
	30	16	1.13	4.01
	45	24	1.07	4.00
K	0	0	0.98	3.35
	20	12	1.10	4.20
	30	24	1.13	4.01
	40	36	1.08	3.81
S	0	0	0.85	3.75
	15	5	1.02	3.91
	30	10	1.13	4.01
	30	15	1.01	2.98

Location : **Paba, Rajshahi**
Cropping pattern : **Potato-Jute-T.Aman rice**
Year : **2003-04**

Potato: A considerable response of Potato to nitrogen was observed. The tuber yield of Potato increased markedly with increase of nitrogen up to 80 kg/ha and slowly increases up to 240 kg/ha. But response of Potato to P, K, & S was not evident. However, tuber yield increased slowly up to 10, 30 and 10 kg/ha P, K & S respectively.

Jute: Fibre yield of Jute increase markedly with the increase of N and the highest yield was recorded from 100 kg/ha and then trended to decrease. But response of Jute to P, K and S was not evident. However, fibre increased slowly upto 18, 22 and 10 kg/ha P, K, and S respectively.

T. Aman: Grain yield of T. Aman rice increased with the increase of N levels up to 65 kg/ha of N and than tended to decrease. But response of T. Aman to P, K & S was not evident. The soil of the experimental field was rich with nutrients. Except nitrogen other nutrients status were medium to high, Therefore, response of crops to added P, K and S was not found.

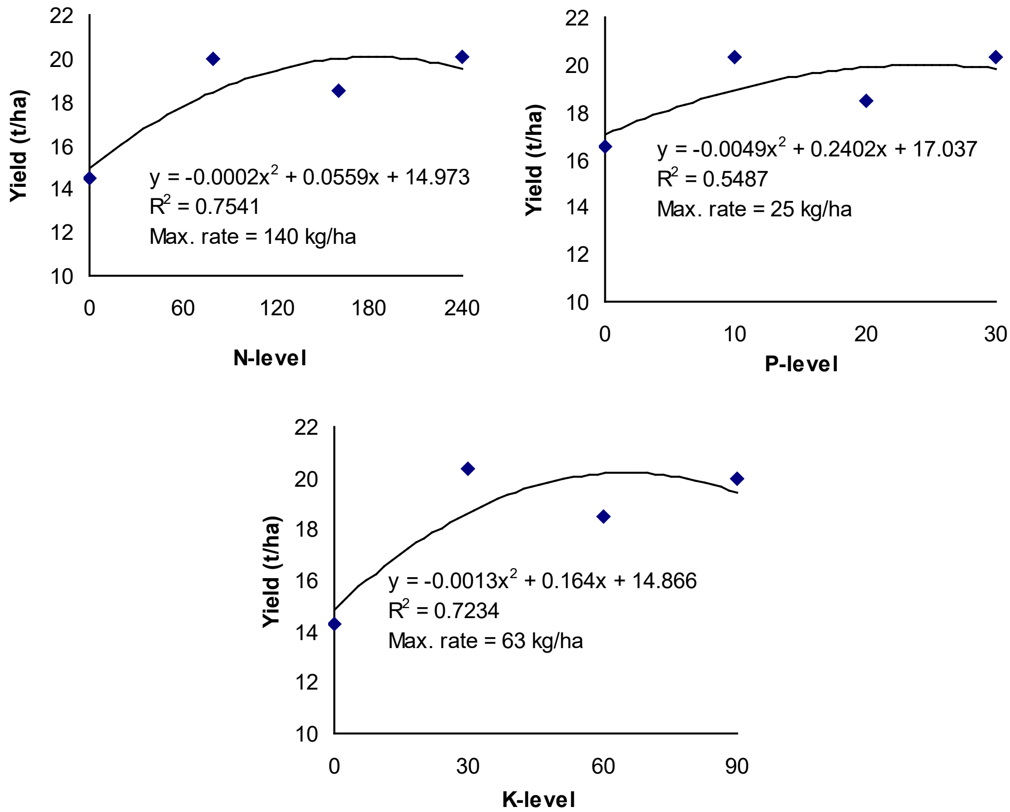


Figure 26. Response of Potato to added NPK in Potato-Jute-T.Aman cropping pattern at MLT Site, Paba, Rajshahi during 2003-04

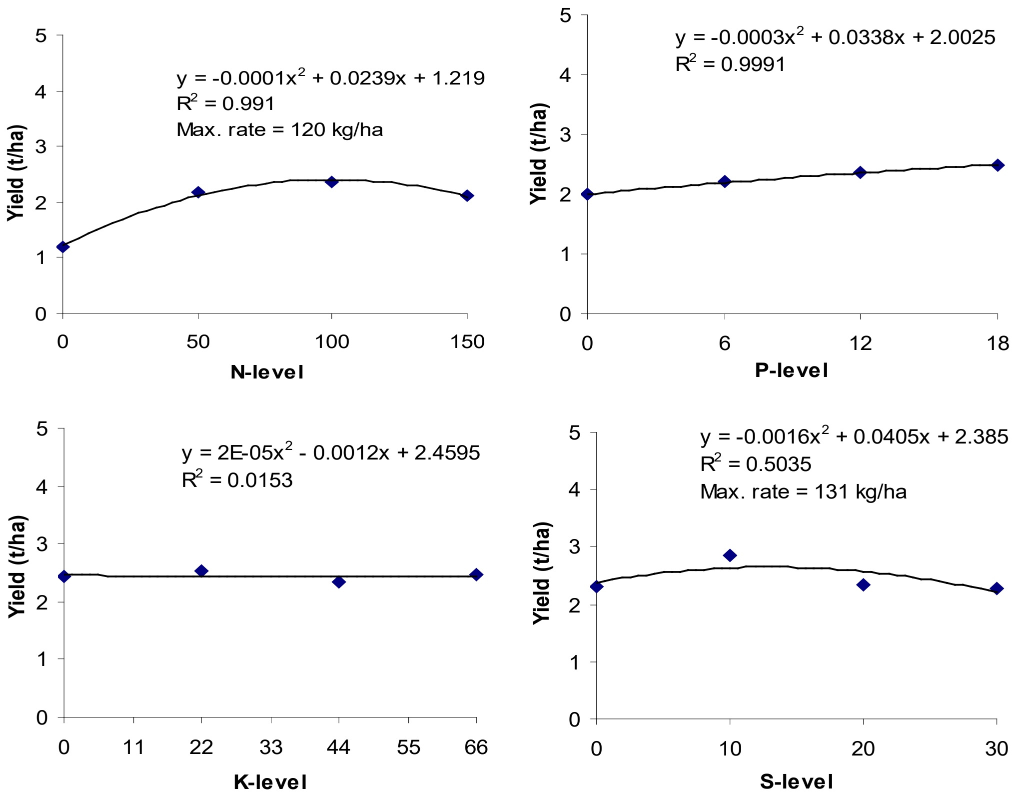


Figure 27. Response of Jute to added NPK in Potato-Jute-T.Aman cropping pattern at MLT Site, Paba, Rajshahi during 2003-04

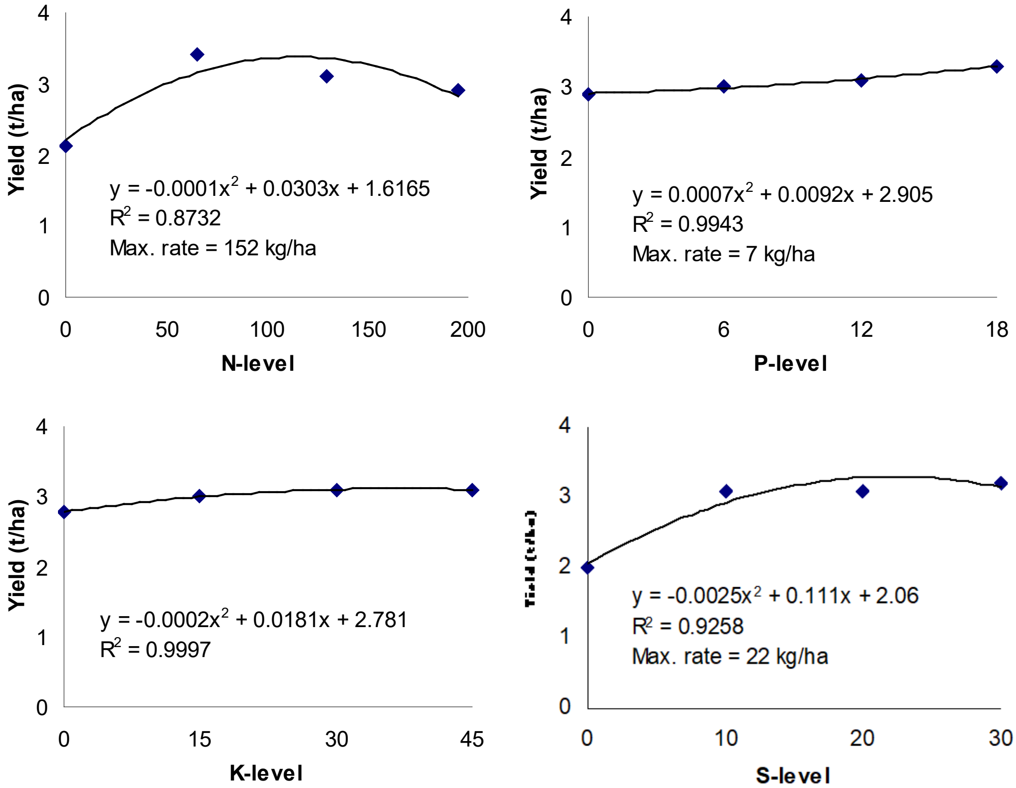


Figure 28. Response of T.Aman to added NPK in Potato-Jute-T.Aman cropping pattern at MLT Site, Paba, Rajshahi during 2003-04

Table 13. Effect of different levels of fertilizer nutrients on the yield of crops in Potato-Jute-T.Aman cropping pattern at Paba, Rajshahi during 2003-04

Nutrient	Levels (kg/ha)			Tuber/Fibre/Grain yield (t/ha)		
	Potato	Jute	T.Aman	Potato	Jute	T.Aman
N	0	0	0	14.47	1.20	2.12
	80	50	65	19.79	2.17	3.41
	160	100	130	18.48	2.35	3.10
	240	150	195	20.05	2.12	2.90
P	0	0	0	16.57	2.00	2.90
	10	6	6	20.35	2.20	3.00
	20	12	12	18.48	2.35	3.10
	30	18	18	20.3	2.58	3.30
K	0	0	0	14.3	2.43	2.78
	30	22	15	20.35	2.53	3.00
	60	44	30	18.48	2.35	3.10
	90	66	45	20	2.48	3.10
S	0	0	0	20	2.31	3.00
	10	10	10	20.33	2.86	3.10
	20	20	20	18.48	2.35	3.10
	30	30	30	19.9	2.28	3.20

Location Lebukhali, Patuakhali
Cropping pattern : Chilli-T.Aman rice
Year : 2001-02 to 2003-04

Chilli: Average of three years data showed that a positive response of Chilli to different nutrients was observed. Fruit yield increased with the increase of nitrogen and the highest yield was obtained with the application of 110 kg N/ha and after that level tended to decline. Almost similar trend was observed in case of P and K. Fruit yield increased appreciably with the increase of nutrient level up to 100 and 90 kg/ha of P and K. The soil was initially deficient in NPK. The status of N and K was low and it was very low in P. Therefore, a positive response of Chilli to added NPK was observed.

T.Aman: Response of T.Aman to nitrogen was observed to some extent. Yield increased appreciably up to 40 kg N/ha. However, yield increased up to 60 kg/ha but the rate of increment was very slow. But response of T.Aman to added P and K was not observed at all. Yield did not increase considerably with the increase of nutrients. Probably the native nutrient supply increased during Kharif II season, therefore, the response was not found. A response curve was drawn from the average yield data and a quadratic type of relationship was found. From the response curve the optimum doses of the nutrients for different crops were calculated.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Chilli	126	110	100	-	120	90	90	-
T.Aman	70	22	35	-	65	20	30	-

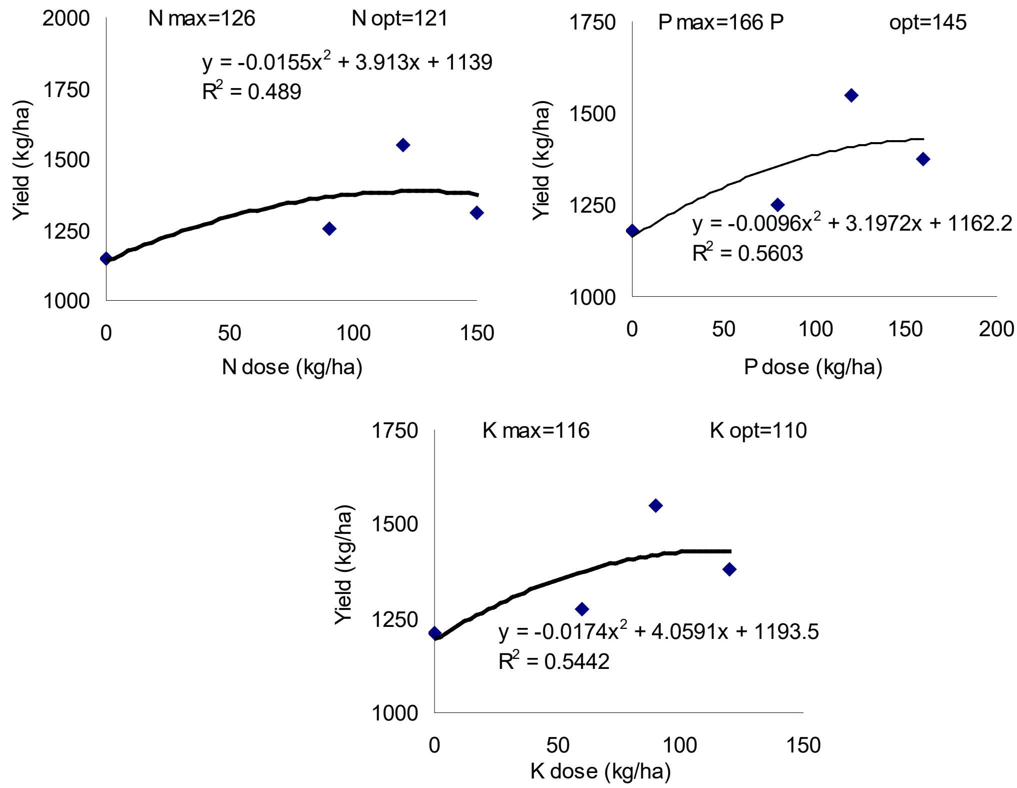


Figure 29. Response of Chilli to added NPK in Chilli-T.Aman cropping pattern at Lebukhali, Patuakhali, 2001-02 to 2003-04

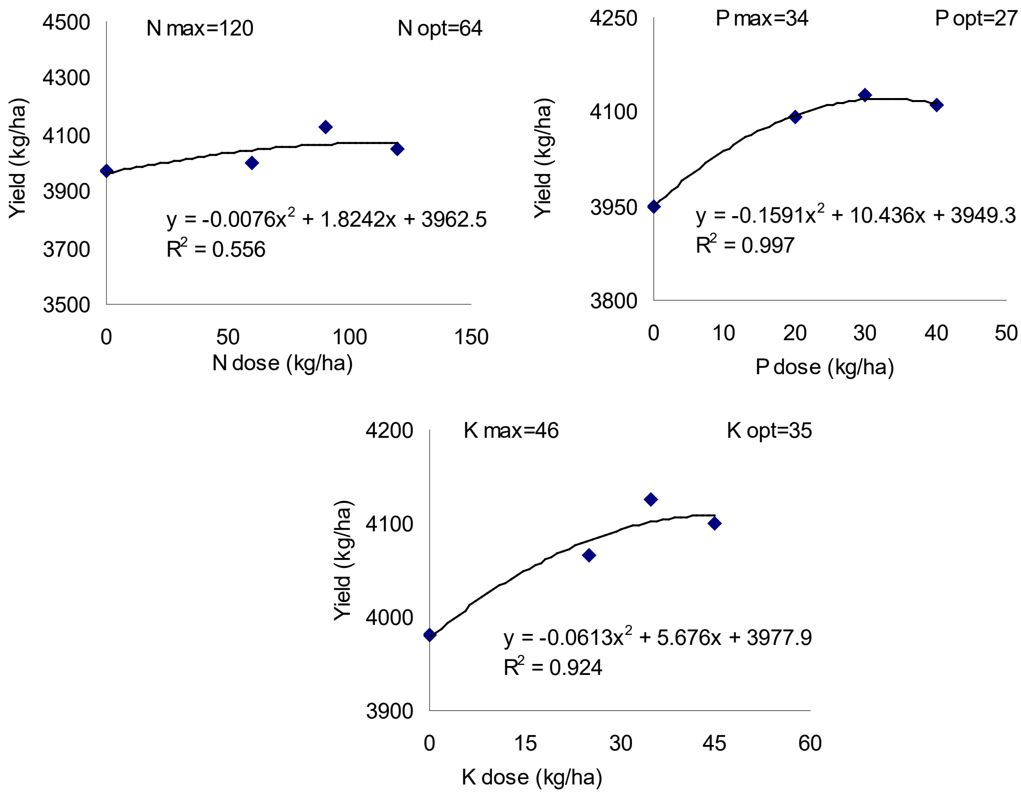


Figure 30. Response of T.Aman rice to added NPK in Chilli-T.Aman cropping pattern at Lebukhali, Patuakhali, 2001-02 to 2003-04

Table 14. Effect of different levels of fertilizer nutrients on the mean yield of crops in Chilli-T.Aman cropping pattern at Lebukhali, Patuakhali, 2001-02 to 2003-04

Nutrient	Levels (kg/ha)		Fruit/Grain yield	
	Chilli	T.Aman	Chilli (kg/ha)	T.Aman (t/ha)
N	0	0	1150	2970
	80	40	1255	4000
	110	60	1550	4125
	140	80	1310	4050
P	0	0	1180	3950
	75	15	1250	4090
	100	20	1550	4125
	125	25	1375	4110
K	0	0	1210	3980
	60	20	1275	3985
	90	30	1550	4125
	120	40	1380	4100

Location : **Rajakhali, Patuakhali**
Cropping pattern : **T.Aus -T.Aman rice**
Year : **2003-04**

T.Aus: Response of T.Aus to nitrogen was not found, however, the soil was deficient in nitrogen. But the reason is not clear. Yield did not increase markedly with the increase of nitrogen. However, yield increased slightly up to 80 kg N/ha. Similarly, no response to added P was observed.

T.Aman: Almost similar result was found in T.Aman rice also. Yield did not increase appreciably with the increase of N and P. More or less similar yield was obtained without nitrogen and phosphorus fertilizer. Response to added N and P was not observed at all.

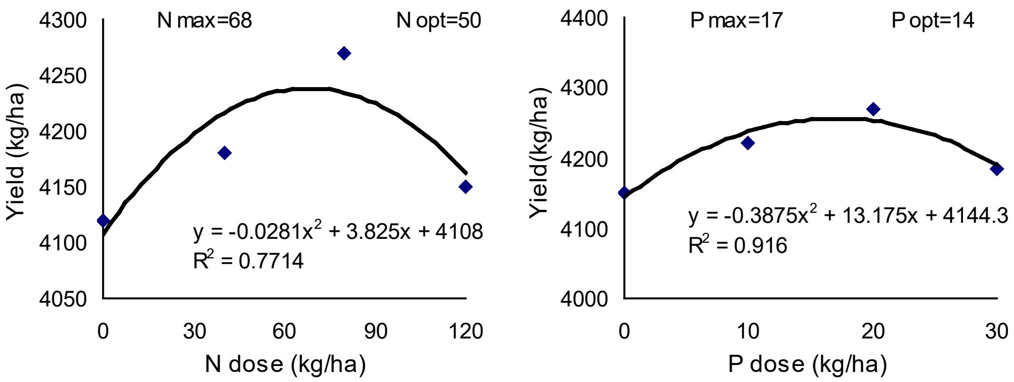


Figure 31. Response of T.Aus rice to added NP in T.Aus-T.Aman rice cropping pattern at Rajakhali, Patuakhali, 2003-04

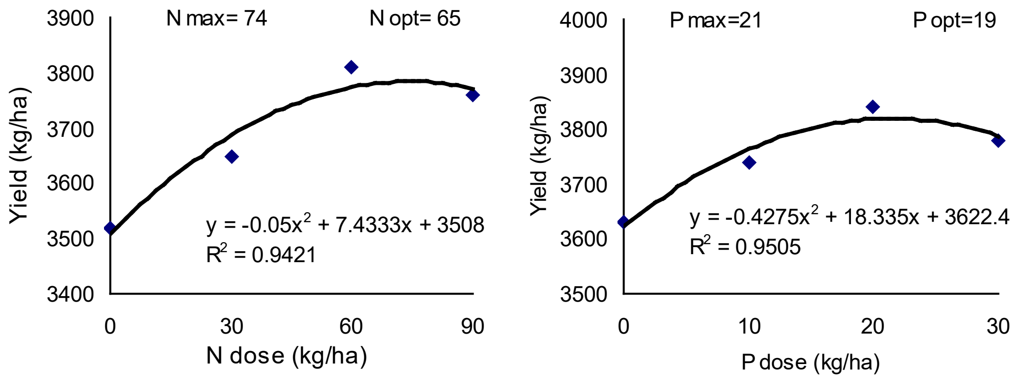


Figure 32. Response of T.Aus rice to added NP in T.Aus-T.Aman rice cropping pattern at Rajakhali, Patuakhali, 2003-04

Table 15. Effect of different levels of fertilizer nutrients on the mean yield of crops in T.Aus-T.Aman cropping pattern at Rajakhali, Patuakhali, 2003-04

Nutrient	Levels (kg/ha)		Grain yield (t/ha)	
	T.Aus	T.Aman	T.Aus	T.Aman
N	0	0	4.10	3.52
	40	30	4.18	3.65
	80	60	4.27	3.81
	120	90	4.15	3.76
P	0	0	4.15	3.63
	10	10	4.22	3.74
	20	20	4.27	3.81
	30	30	4.18	3.78

Location : Hathazari, Chittagong
Cropping pattern : Chilli-T.Aman rice
Year of establishment : 2003-04

Chilli: A positive response of Chilli to different nutrients was observed. Fruit yield increased with the increase of nitrogen significantly up to 120 kg/ha of N. Fruit yield tended to decrease after that level. From the initial soil status it was found that P status is optimum, therefore, response to P was not studied. A considerable response of Chilli to K and S was also observed. Fruit yield increased considerably up to 110 and 20 kg/ha of K and S, respectively.

T.Aman: Almost similar trend was found in T.Aman rice. Response of N, K and S was observed towards the grain yield of T.Aman rice. Yield increased appreciably up to 80, 40 and 10 kg/ha of N, K and S, respectively. But the rate of increment was higher up to 40, 20 and 5 kg/ha of N, K and S, respectively.

A response curve was drawn from the data and the relationship was quadratic in nature. From the response curve optimum doses of fertilizers for the crops grown in Chilli-T.Aman cropping pattern at Hathazari was found out.

Crop	Agronomically optimum dose			Economically optimum dose		
	N	K	S	N	K	S
Chilli	130	110	25	125	100	20
T.Aman	90	45	12	85	40	10

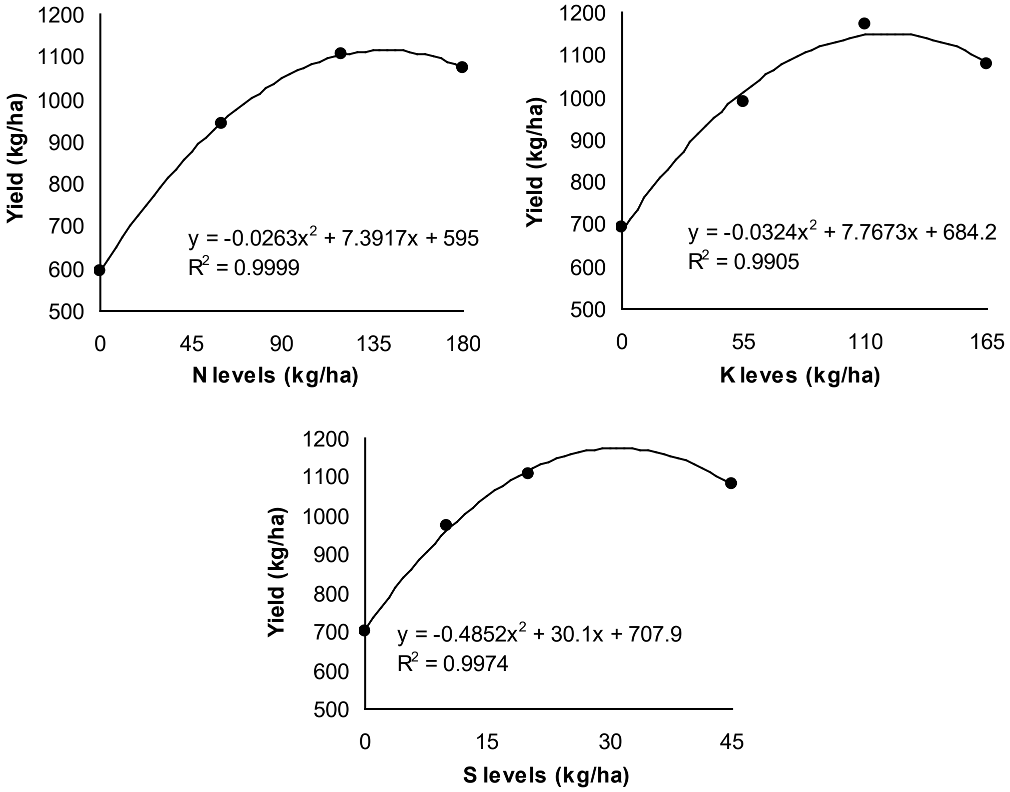


Figure 33. Response of Chilli to added NKS in Chilli-T.Aman rice cropping pattern at Hathazari, Chittagong, 2003-04

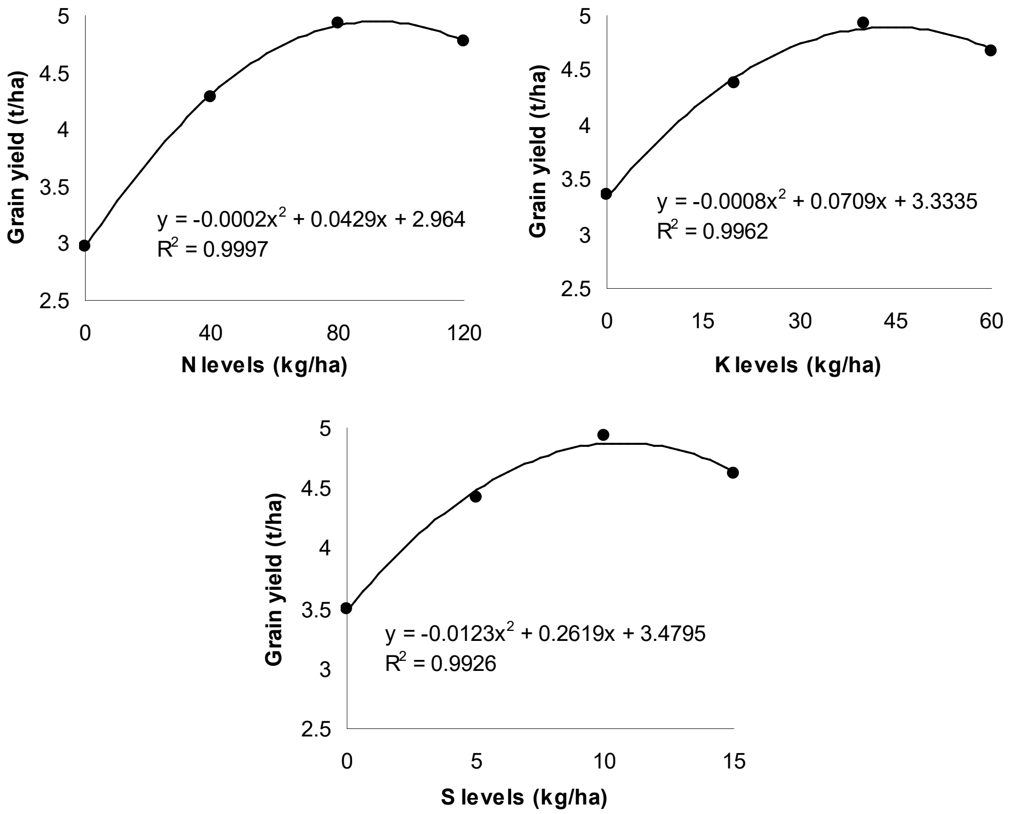


Figure 34. Response of T.Aman to added NKS in Chilli-T.Aman rice cropping pattern at Hathazari, Chittagong, 2003-04

Table 16. Effects of different levels of fertilizer nutrients on the yield of crops in Chilli-T.Aman cropping pattern at Hathazari, Chittagong, 2003-04

Nutrient	Levels (kg/ha)		Fruit/Grain yield	
	Chilli	T.Aman	Chilli (kg/ha)	T.Aman (t/ha)
N	0	0	596	2.97
	60	40	941	4.29
	120	80	1107	4.93
	180	120	1074	4.77
K	0	0	692	3.35
	55	20	990	4.38
	110	40	1170	4.93
	165	60	1076	4.67
S	0	0	703	3.50
	10	5	973	4.42
	20	10	1107	4.93
	30	15	1081	4.62

Location : Kaliakoir, Gazipur
Cropping pattern : Mustard-Boro
Year : 2003-04 to 2004-05

Mustard: Mean of two years data showed that response of Mustard to nitrogen was observed. Seed yield increased with the increase of nitrogen linearly and the highest yield was recorded from the highest level of nitrogen (135 kg/ha). Therefore, to find out the optimum dose of nitrogen for mustard another higher level of N should be included in next year. Response was also observed to P and K. Seed yield of Mustard increased up to 30 and 50 kg/ha of P and K, respectively and after that level tended to decrease.

Boro: Response of Boro rice to nitrogen was also observed. Similar trend was found in Boro rice like Mustard. Grain yield increased linearly with the increase of nitrogen and the highest yield was found in the highest level of nitrogen. Response to P was also observed to some extent. Yield increased appreciably up to 15 kg/ha and after that level rate of increment was slow. However, yield increased up to 30 kg/ha of P. Response of Boro rice to added K was not very clear. But yield increased very slowly up to 50 kg/ha of K. Almost similar trend was observed over the years.

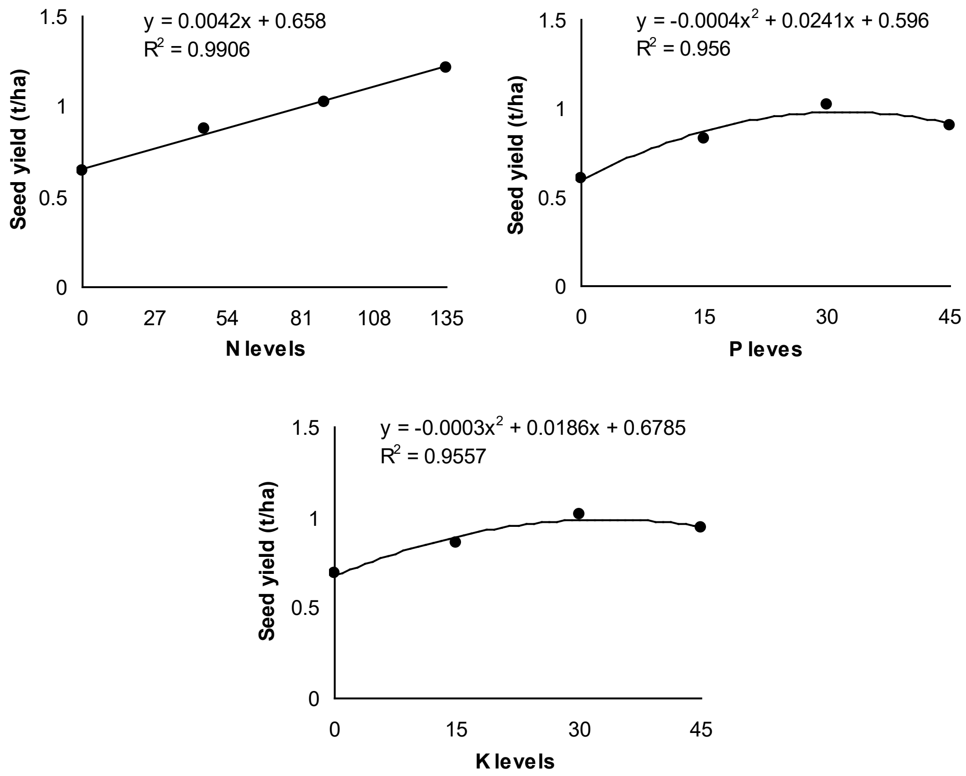


Figure 35. Response of Mustard to added NPK in Mustard-Boro cropping pattern at Kaliakoir, Gazipur during 2003-04 & 2004-05

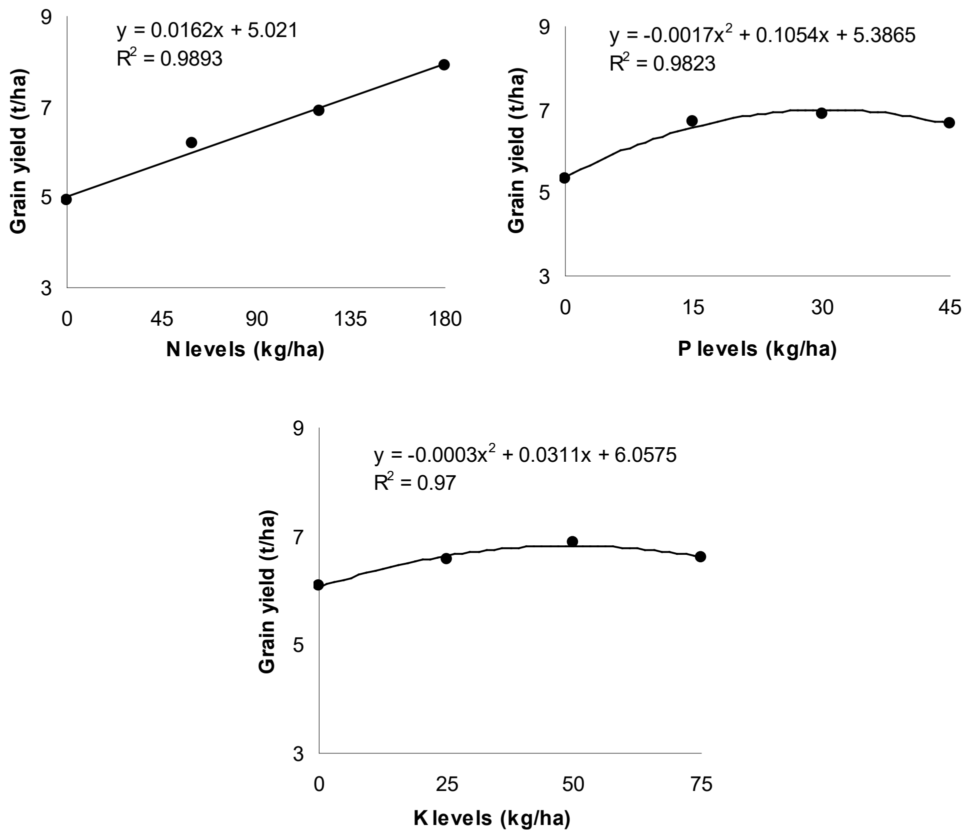


Figure 36. Response of Boro rice to added NPK in Mustard-Boro cropping pattern at Kaliakoir, Gazipur during 2003-04 & 2004-05

Table 17. Effect of different levels of fertilizer nutrients on the yield of mustard in Mustard-Boro rice cropping pattern at Kaliakoir MLT site during 2003-04 & 2004-05

Fertilizer levels (kg/ha)		Seed yield (t/ha)		
		2003-04	2043-05	Mean
N	0	0.672	0.60	0.64
	45	0.912	0.85	0.88
	90	0.960	1.07	1.02
	135	1.158	1.29	1.22
P	0	0.595	0.62	0.61
	15	0.816	0.85	0.83
	30	0.960	1.07	1.02
	45	0.859	0.95	0.90
K	0	0.682	0.69	0.69
	15	0.872	0.84	0.86
	30	0.960	1.07	1.02
	45	0.890	0.99	0.94

Table 18. Effect of different levels of fertilizer nutrients on the yield of Boro rice in Mustard-Boro rice cropping pattern at Kaliakoir MLT site during 2003-04 & 2004-05

Fertilizer levels (kg/ha)		Grain yield (t/ha)		
		2002-03	2003-04	Mean
N	0	5.41	4.42	4.92
	60	6.62	5.73	6.18
	120	7.47	6.31	6.89
	180	8.23	7.60	7.92
P	0	5.81	4.89	5.35
	15	6.95	6.43	6.69
	30	7.47	6.31	6.89
	45	7.39	5.96	6.68
K	0	6.38	5.77	6.08
	25	6.85	6.28	6.57
	50	7.47	6.31	6.89
	75	7.37	5.81	6.59

Cropping pattern : Mustard-Boro
Location : Manikganj
Year of establishment : 2004-05

Mustard: Response of Mustard to nitrogen was observed. Seed yield increased with the increase of nitrogen linearly and the highest yield was recorded from the highest level of nitrogen (120 kg/ha). Therefore, to find out the optimum dose of nitrogen for mustard another higher level of N should be included in next year. Response of Mustard to P and K was found to some extent. Seed yield increased up to 30, 30 and 20 kg/ha of P, K and S, respectively, and after that level yield tended to decrease.

Boro: Response of Boro rice to nitrogen was also observed. Similar trend was found in Boro rice like Mustard. Grain yield increased linearly with the increase of nitrogen and the highest yield was found in the highest level of nitrogen. Response to P, K and S was also observed to some extent. Yield increased appreciably up to 15, 20 and 10 kg/ha of P, K and S, respectively.

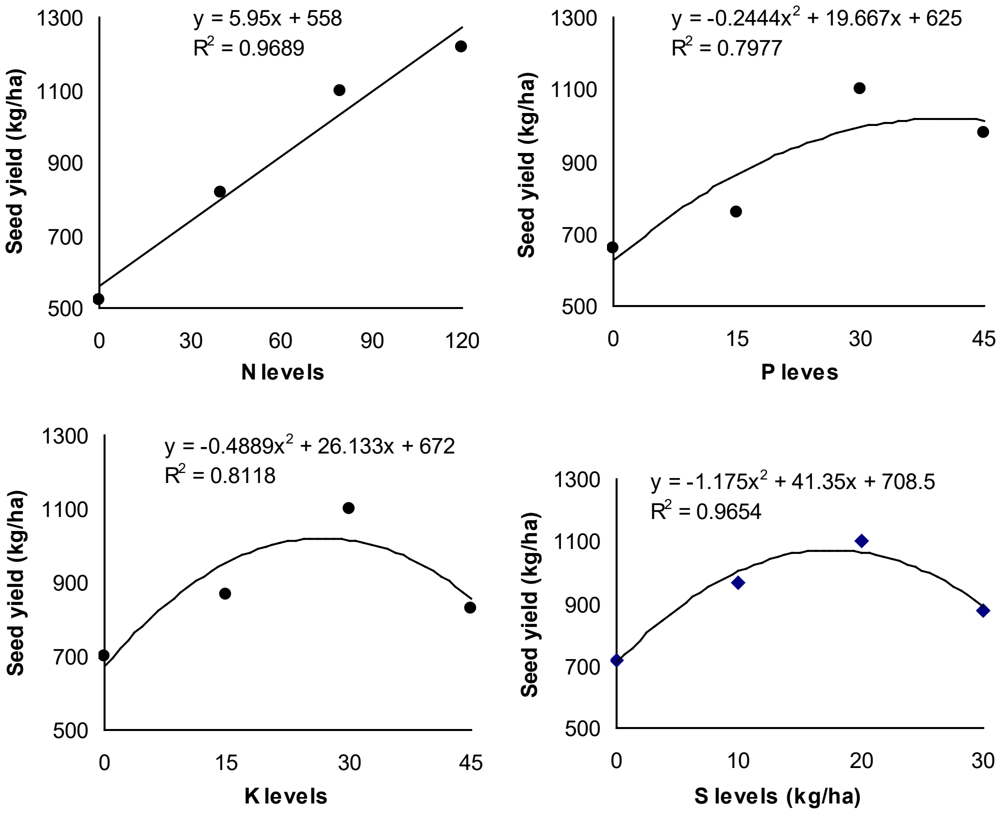


Figure 37. Response of Mustard to added NPK in Mustard-Boro cropping pattern at MLT site, Manikganj during 2004-05

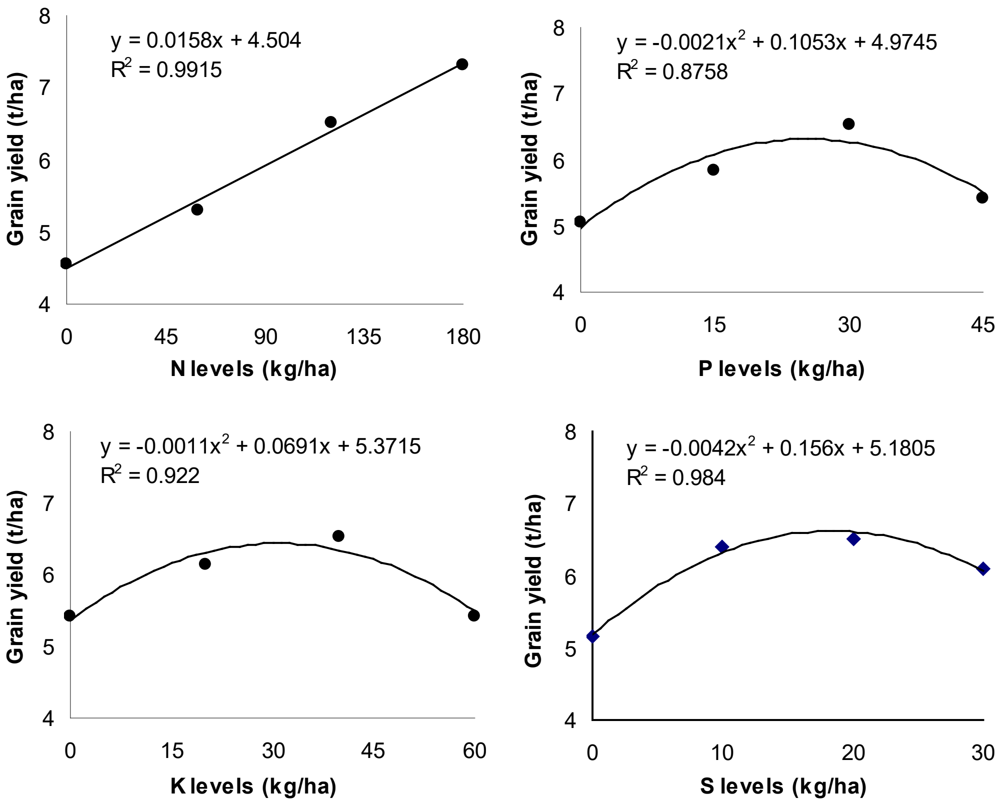


Figure 38. Response of Boro rice to added NPK in Mustard-Boro cropping pattern at MLT site, Manikganj during 2004-05

Table 19. Effect of different levels of fertilizer nutrients on the yield of mustard in Mustard-Boro rice cropping pattern at Manikganj MLT site during 2004-05

Nutrient	Levels (kg/ha)		Grain yield	
	Mustard	Boro	Mustard (kg/ha)	Boro (t/ha)
N	0	0	520	4.56
	40	60	820	5.31
	80	120	1100	6.52
	120	180	1220	7.32
P	0	0	660	5.06
	15	15	760	5.83
	30	30	1100	6.52
	45	45	980	5.42
K	0	0	700	5.43
	15	20	870	6.13
	30	40	1100	6.52
	45	60	830	5.43
S	0	0	720	5.15
	10	10	970	6.41
	20	20	1100	6.52
	30	30	880	6.09

Location : Lalmonirhat MLT site, Rangpur (AEZ 3)
Cropping pattern : Wheat-Jute- T.Aman
Year : 2002-03 to 2003-04

Wheat: Average of two years data showed that grain yield of wheat increased sharply with the increase of N levels and the highest yield was obtained from 110 kg/ha of N and then tended to decline. Response of Wheat to P was also very distinct. Yield increased appreciably up to 6 kg/ha and after that level the rate of increment was slow. But yield increased up to 12 kg P/ha. In case of K and S comparatively slow but positive response was found and yield increased up to 60 and 30 kg/ha of K and S, respectively.

Jute: Fibre yield of Jute increased appreciably with the increase of N. Yield increased considerably up to 50 kg/ha and after that level the rate of increment was slow. However, yield increased up to 100 kg N/ha. Almost similar trend was found in case of P, K and S. Fibre yield increased appreciably up to 5, 30 and 10 kg/ha of P, K and S, respectively. But yield increased slowly up to 10, 60 and 20 kg/ha of P, K and S, respectively.

T.Aman: Grain yield of T.Aman rice increased with the increase of N levels up to 90 kg/ha of N and then tended to decrease. Similarly, P, K and S showed a positive response towards the yield of T.Aman rice. Grain yield increased up to 40 and 12 kg/ha of K and S, respectively.

From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Wheat	130	13	62	34	110	11	50	28
Jute	113	10	61	25	90	8	55	15
T.Aman	94	-	46	14	90	-	35	10

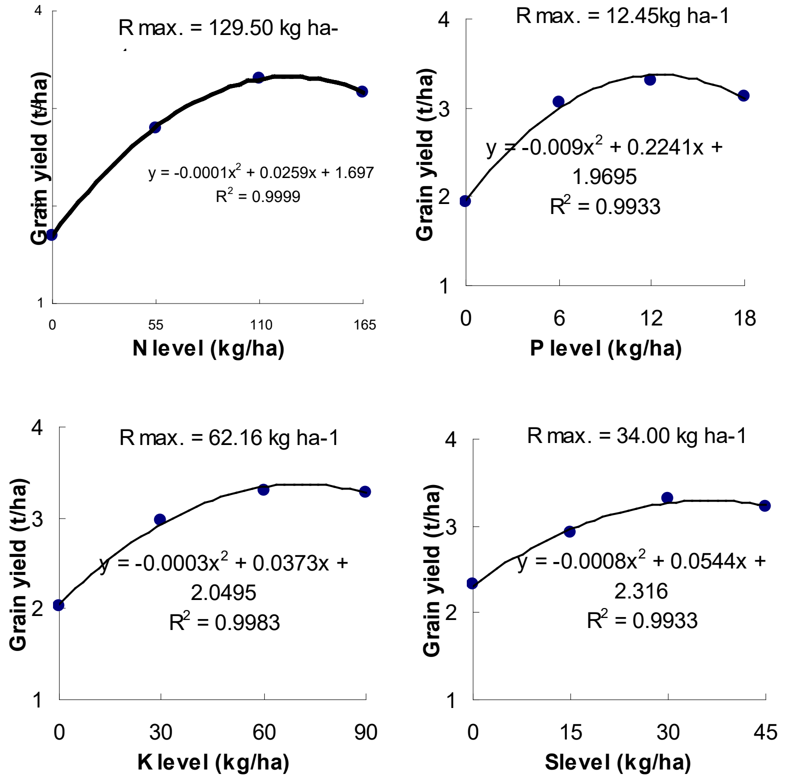


Figure 39. Response of Wheat to added NPKS in Wheat-Jute T.Aman rice cropping pattern at Lalmonirhat MLT site during 2002-03 & 2003-04

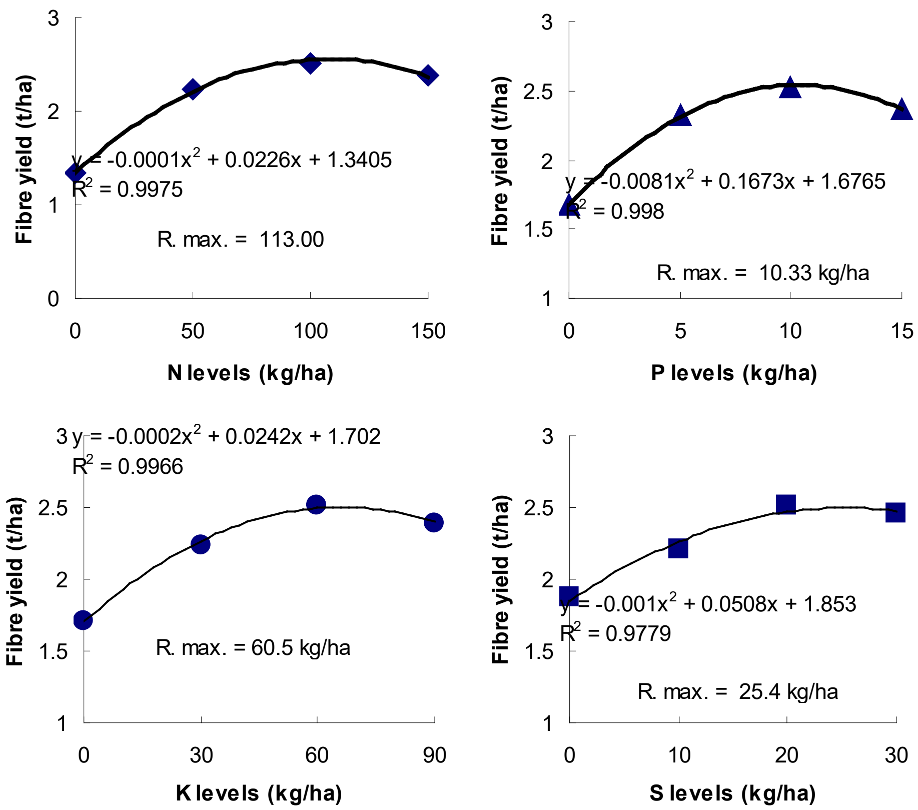


Figure 40. Response of Jute to added NPKS in Wheat-Jute T.Aman rice cropping pattern at Lalmonirhat MLT site during 2002-03 & 2003-04

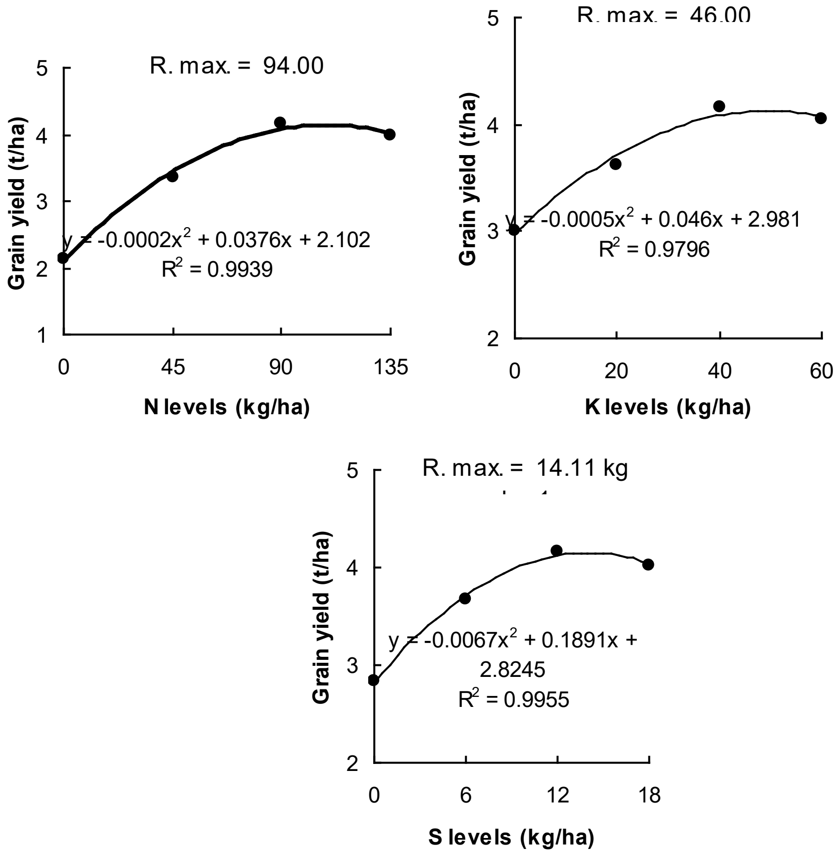


Figure 41. Response of T.Aman to added NKS in Wheat-Jute T.Aman rice cropping pattern at Lalmonirhat MLT site during 2002-03 & 2003-04

Table 20. Effect of different levels of fertilizer nutrients on the yield of Wheat in Wheat-Jute T.Aman rice cropping pattern at Lalmonirhat MLT site during 2002-03 & 2003-04

Fertilizer levels (kg/ha)		Grain yield (t/ha)		
		2002-03	2003-04	Mean
N	0	1.76	1.64	1.70
	55	2.90	2.70	2.80
	110	3.40	3.22	3.31
	165	3.25	3.09	3.17
P	0	2.01	1.88	1.95
	6	3.16	2.94	3.05
	12	3.40	3.22	3.31
	18	3.22	3.01	3.12
K	0	2.11	1.97	2.04
	30	3.04	2.88	2.96
	60	3.40	3.22	3.31
	90	3.36	3.19	3.28
S	0	2.39	2.27	2.33
	15	3.02	2.81	2.92
	30	3.40	3.22	3.31
	45	3.29	3.14	3.22

Table 21. Effect of different levels of fertilizer nutrients on the yield of Jute in Wheat-Jute T.Aman rice cropping pattern at Lalmonirhat MLT site during 2002-03 & 2003-04

Fertilizer levels (kg/ha)		Fibre yield (t/ha)		
		2002-03	2003-04	Mean
N	0	1.28	1.38	1.33
	50	2.23	2.25	2.24
	100	2.46	2.58	2.52
	150	2.30	2.46	2.38
P	0	1.61	1.72	1.67
	5	2.26	2.39	2.33
	10	2.46	2.58	2.52
	15	2.30	2.44	2.37
K	0	1.63	1.78	1.71
	30	2.15	2.32	2.24
	60	2.46	2.58	2.52
	90	2.35	2.42	2.39
S	0	1.85	1.89	1.87
	10	2.20	2.22	2.21
	20	2.46	2.58	2.52
	30	2.41	2.50	2.46

Table 22. Effect of different levels of fertilizer nutrients on the yield of T.Aman in Wheat-Jute T.Aman rice cropping pattern at Lalmonirhat MLT site during 2002-03 & 2003-04

Fertilizer levels (kg/ha)		Grain yield (t/ha)		
		2002-03	2003-04	Mean
N	0	2.35	1.95	2.13
	45	3.66	3.05	3.36
	90	4.46	3.87	4.17
	135	4.29	3.70	4.00
P				
K	0	3.23	2.79	3.01
	20	3.93	3.32	3.63
	40	4.46	3.87	4.17
	60	4.41	3.68	4.05
S	0	2.69	2.19	2.44
	6	4.01	3.32	3.67
	12	4.46	3.87	4.17
	18	4.38	3.68	4.03

Cropping pattern : Potato-Boro - T.Aman
Location : Syedpur FSRD site, Rangpur (AEZ 3)
Year : 2002-03 to 2003-04

Potato: Average of two years data showed that tuber yield of Potato increased sharply with the increase of N levels up to 55 kg/ha and there after the rate of increment was comparatively slower. But yield increased up to 110 kg N/ha and then tended to decline. Response of Potato to P, K and S was also observed. Yield increased appreciably up to 15, 35 and 10 kg/ha of P, K and S, respectively and after that level the rate of increment was slow. But yield increased up to 30, 70 and 20 kg/ha of P, K and S, respectively.

Boro: Response of Jute to added N and K was evident. Fiber yield increased appreciably with the increase of nutrient level. Yield increased sharply up to 55 and 15 kg/ha of P and K and after that level the rate of increment was slow. However, yield increased up to 110 and 30 kg/ha of N and P. But response to K and S was not very distinct. However, yield increased up to, 60 and 20 kg/ha of K and S, respectively.

T.Aman: Grain yield of T.Aman rice increased with the increase of N levels up to 70 kg/ha of N and then tended to decrease. Similarly, P also showed a positive response towards the yield of T.Aman rice. Grain yield increased up to 20 kg/ha of phosphorus. But response to K and S was not so distict. But grain yield increased appreciably up to 40 and 10 kg/ha of K and S, respectively.

From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Potato	118	36	78	23	115	30	70	20
Boro	102	33	60	23	98	25	55	20
T.Aman	73	23	43	12	70	18	35	10

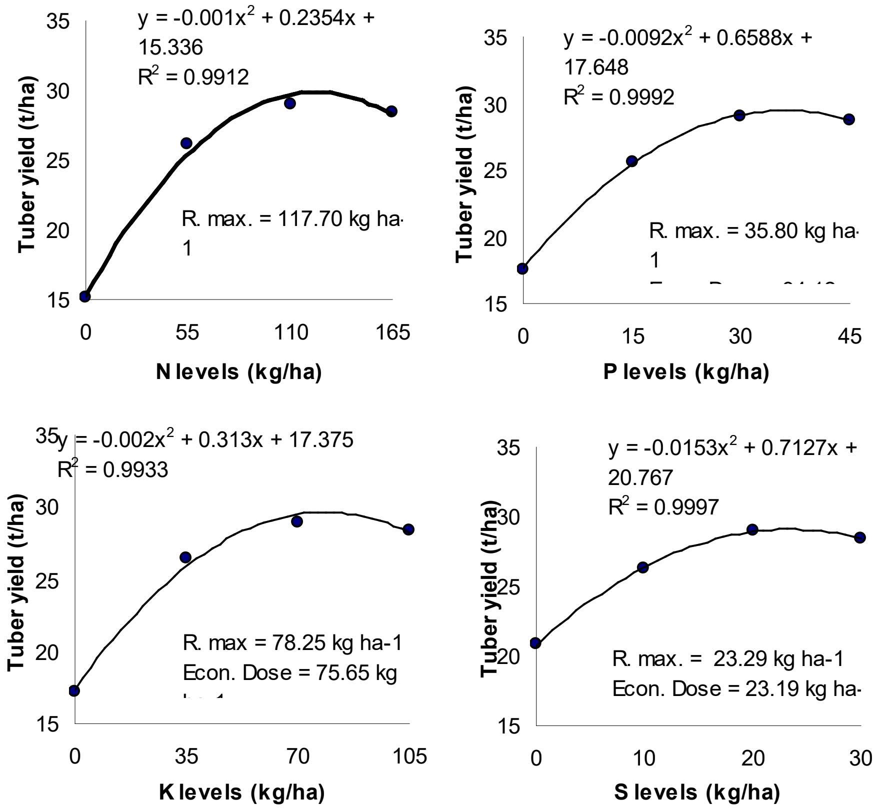


Figure 42. Response of Potato to added NPKS in Potato-Boro-T.Aman rice cropping pattern at Syedpur, Rangpur during 2002-03 & 2003-04

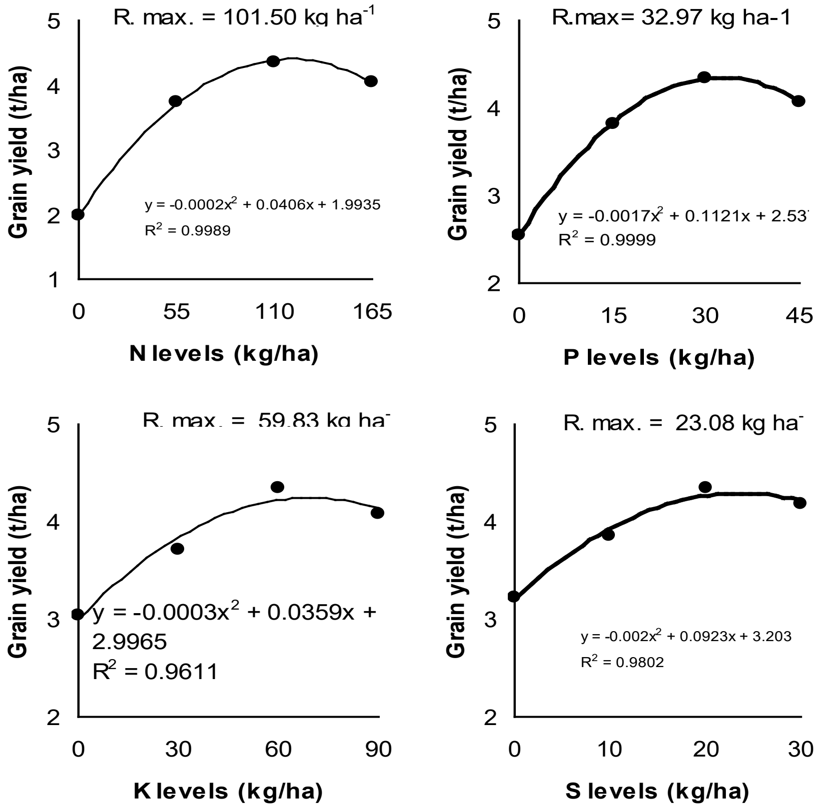


Figure 43. Response of Boro rice to added NPKS in Potato-Boro-T.Aman rice cropping pattern at Syedpur, Rangpur during 2002-03 & 2003-04

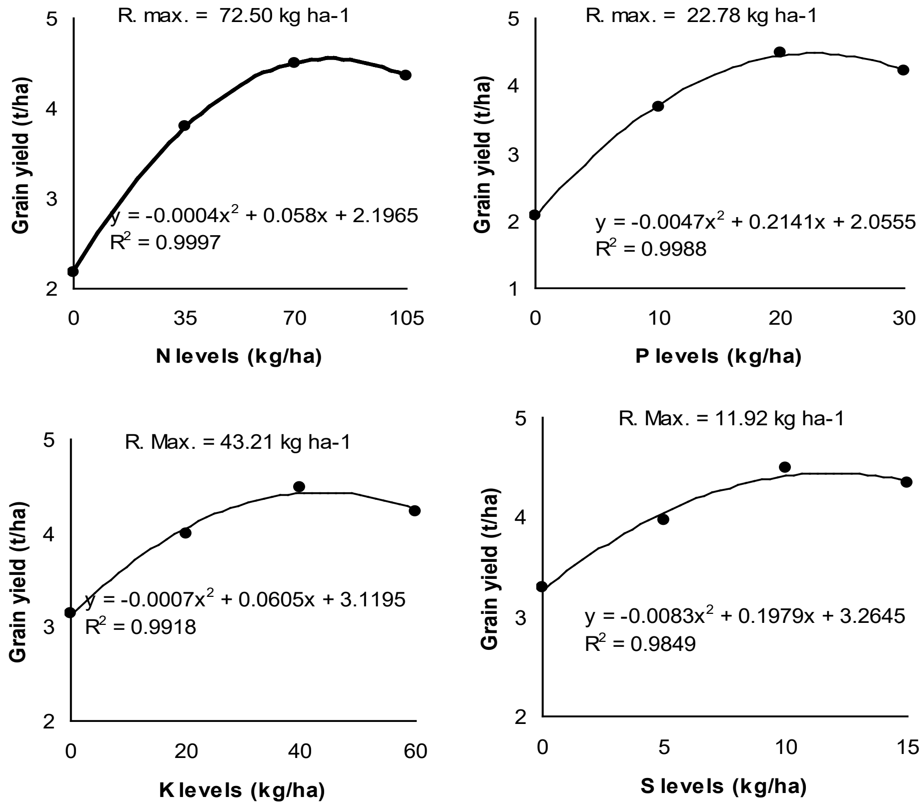


Figure 44. Response of T.Aman rice to added NPKS in Potato-Boro-T.Aman rice cropping pattern at Syedpur, Rangpur during 2002-03 & 2003-04

Table 23. Effect of different levels of fertilizer nutrients on the yield of Potato in Potato-Boro-T.Aman rice cropping pattern at Syedpur, Rangpur during 2002-03 & 2003-04

Fertilizer levels (kg/ha)		Tuber yield (t/ha)		
		2002-03	2003-04	Mean
N	0	15.86	14.34	15.10
	55	27.10	25.11	26.11
	110	29.94	28.03	28.99
	165	29.41	27.53	28.47
P	0	18.39	16.79	17.59
	15	26.52	24.76	25.64
	30	29.94	28.03	28.99
	45	29.71	27.86	28.79
K	0	17.78	16.61	17.20
	35	27.25	25.56	26.41
	70	29.94	28.03	28.99
	105	29.25	27.61	28.43
S	0	21.80	19.77	20.79
	10	27.33	25.27	26.30
	20	29.94	28.03	28.99
	30	29.38	27.42	28.40

Table 24. Effect of different levels of fertilizer nutrients on the yield of Boro rice in Potato-Boro-T.Aman rice cropping pattern at Syedpur, Rangpur during 2002-03 & 2003-04

Fertilizer levels (kg/ha)		Grain yield (t/ha)		
		2002-03	2003-04	Mean
N	0	2.07	1.89	1.98
	55	3.93	3.56	3.75
	110	4.49	4.21	4.35
	165	4.20	3.90	4.05
P	0	2.63	2.44	2.54
	15	3.98	3.65	3.82
	30	4.49	4.21	4.35
	45	4.20	3.93	4.07
K	0	3.15	2.92	3.04
	30	3.86	3.55	3.71
	60	4.49	4.21	4.35
	90	4.24	3.94	4.09
S	0	3.34	3.11	3.23
	10	3.99	3.71	3.85
	20	4.49	4.21	4.35
	30	4.31	4.07	4.19

Table 25. Effect of different levels of fertilizer nutrients on the yield of T.Aman rice in Potato-Boro-T.Aman rice cropping pattern at Syedpur, Rangpur during 2002-03 & 2003-04

Fertilizer levels (kg/ha)		Grain yield (t/ha)		
		2002-03	2003-04	Mean
N	0	2.42	1.95	2.19
	35	4.15	3.47	3.81
	70	4.95	4.03	4.49
	105	4.71	4.00	4.36
P	0	2.20	1.93	2.07
	10	4.02	3.33	3.68
	20	4.95	4.03	4.49
	30	4.62	3.80	4.21
K	0	3.28	3.00	3.14
	20	4.35	3.62	3.99
	40	4.95	4.03	4.49
	60	4.60	3.85	4.23
S	0	3.54	3.04	3.29
	5	4.37	3.56	3.97
	10	4.95	4.03	4.49
	15	4.73	3.95	4.34

Cropping pattern : Lentil-Jute - T.Aman
Location : Rajbari, Faridpur (AEZ 12)
Year : 2003-04

Lentil: Grain yield of lentil did not increase appreciably with the increase of N levels. Lentil is a legume crop and therefore, response to nitrogen was not evident. However, seed yield increased slowly up to16 kg/ha of N and then trended to decline. Similarly, response to P, K and S was not observed at all. However, grain yield increased slowly up to 24, 20 and 10 kg/ha of P, K and S, respectively.

Jute: No considerable response of Jute to N, P, K and S was found. Fibre yield of Jute did not increase markedly with the increase of nutrients levels. However, fiber yield of Jute increased up to 60, 16, 40 and 5 kg/ha of N, P, K and S, respectively.

T.Aman: Response of T.Aman rice to nitrogen was observed to some extent. Grain yield increased with the increase of N level up to 75 kg/ha of N and then trended to decrease. But response to P, K and S was not evident. However, grain yield increased slowly up to 22, 35 and 6 kg/ha of P, K and S, respectively. From the response curve the optimum dose of nutrients were found out.

Crop	Agronomically optimum dose				Economically optimum dose			
	N	P	K	S	N	P	K	S
Lentil	20	23	9	21	18	20	8	18
Jute	92	20	45	10	85	20	40	5
T.Aman	66	18	31	6	62	15	27	5

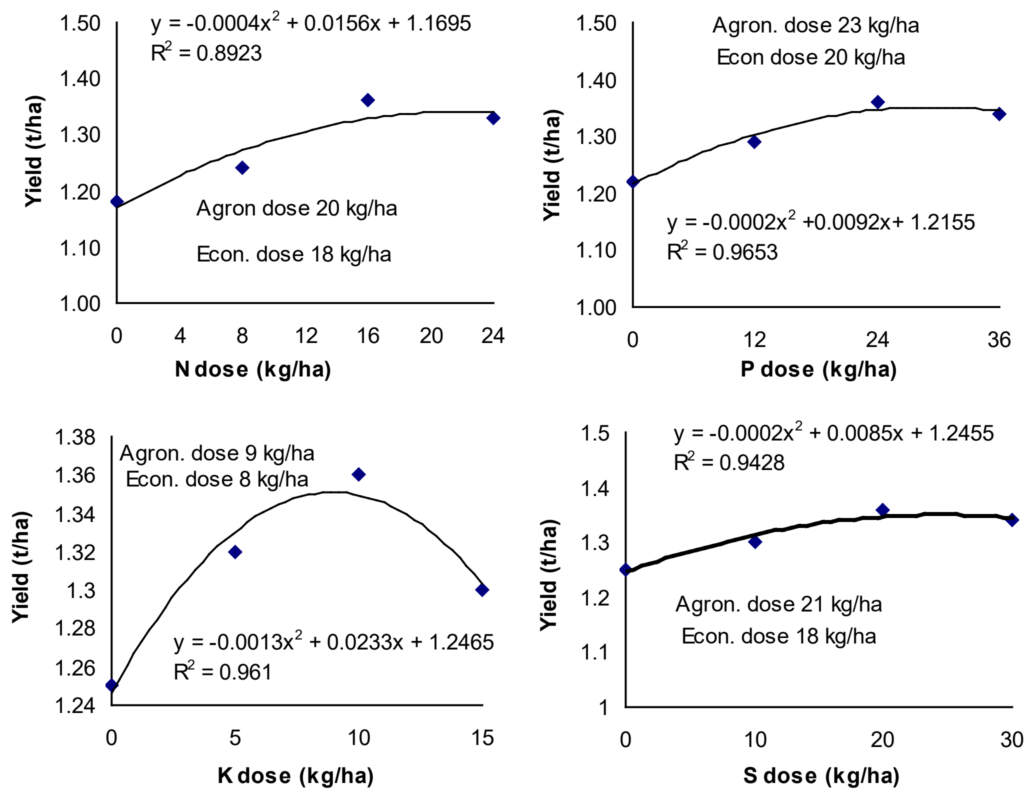


Figure 45. Response of Lentil to added NPKS in Lentil-Jute-T.Aman cropping pattern at MLT site, Rajbari during 2003-04

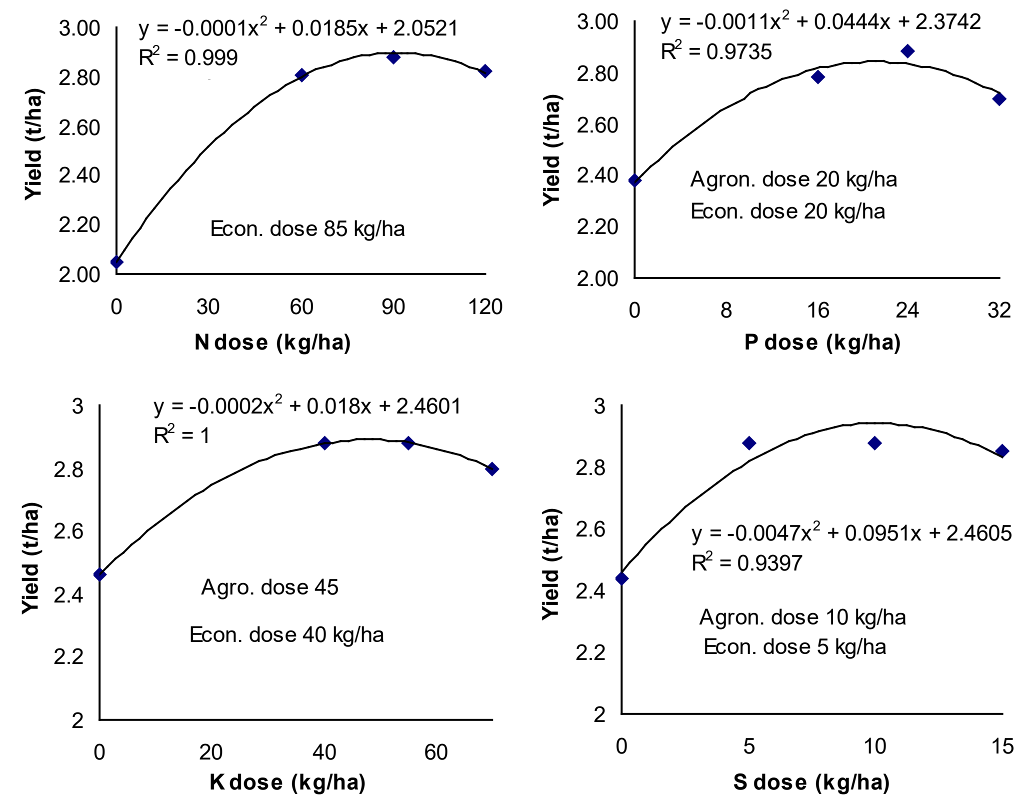


Figure 46. Response of Jute to added NPKS in Lentil-Jute-T.Aman cropping pattern at MLT site, Rajbari during 2003-04

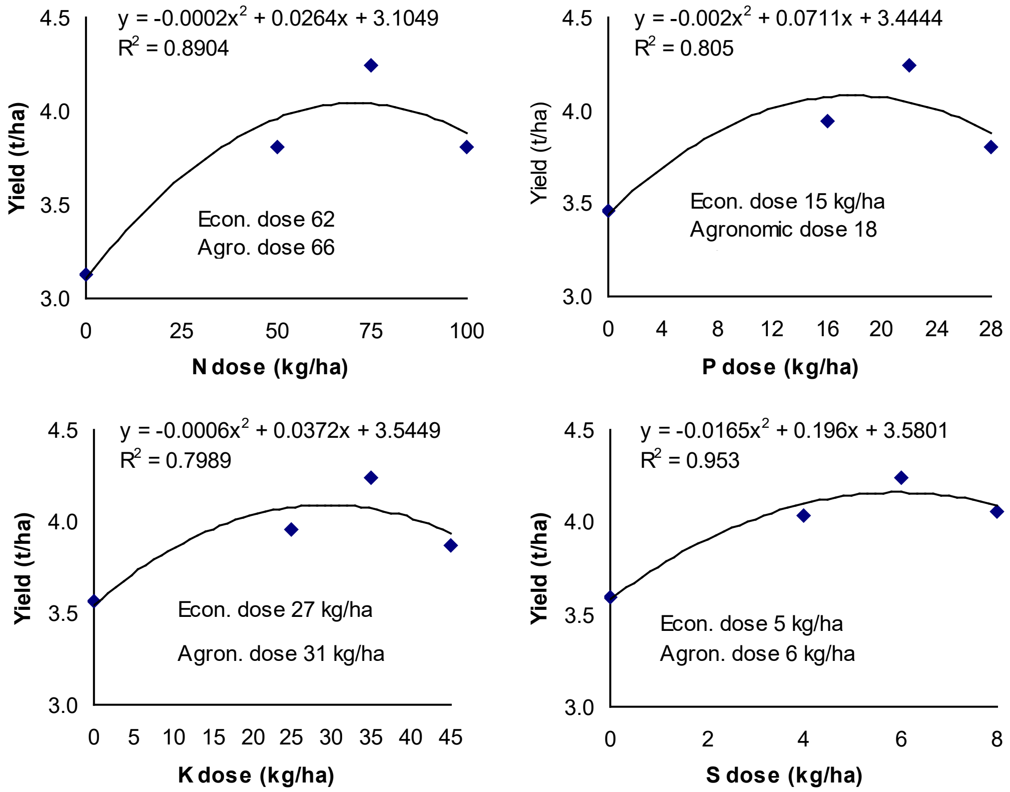


Figure 47. Response of T.Aman to added NPKS in Lentil-Jute-T.Aman cropping pattern at MLT site, Rajbari during 2003-04

Table 26. Effects of different levels of fertilizer nutrients on the yield of crops in Lentil-Jute-T.Aman cropping pattern at Rajbari, Faridpur, 2003-04

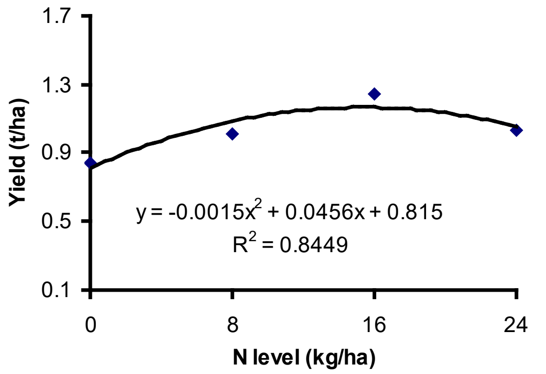
Nutrients	Levels (kg/ha)			Seed/Fibre/Grain yield (t/ha)		
	Lentil	Jute	T.Aman	Lentil	Jute	T.Aman
N	0	0	0	1.18	2.05	3.13
	8	60	50	1.24	2.81	3.81
	16	90	75	1.36	2.88	4.25
	24	120	100	1.33	2.82	3.81
P	0	0	0	1.22	2.38	3.46
	12	16	16	1.29	2.78	3.94
	24	24	22	1.36	2.88	4.24
	36	32	28	1.34	2.70	3.80
K	0	0	0	1.25	2.46	3.56
	10	40	25	1.30	2.88	3.96
	20	55	35	1.36	2.88	4.24
	30	70	45	1.34	2.80	3.87
S	0	0	0	1.25	2.44	3.59
	5	5	4	1.32	2.88	4.04
	10	10	6	1.36	2.88	4.24
	15	15	8	1.30	2.85	4.06

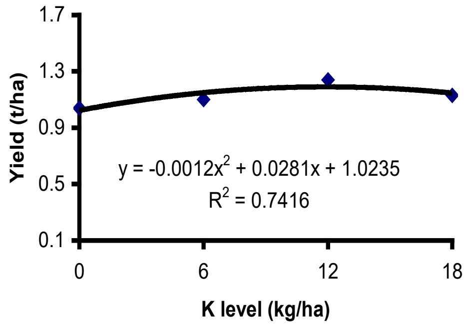
Location	**:**	**Magura, Jessore (AEZ 11)**
Cropping pattern	**:**	**Lentil-Jute - T.Aman**
Year	**:**	**2003-04**

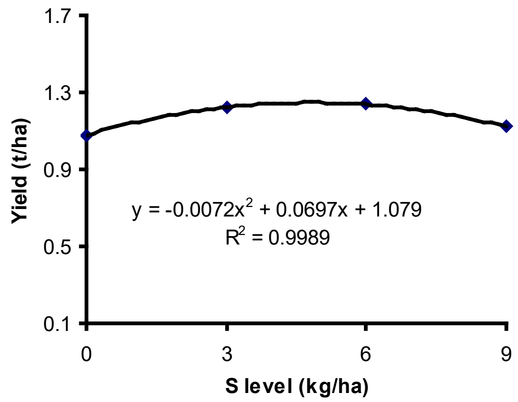
Lentil: Response of Lentil to nitrogen was found. Seed yield increased appreciably up to16 kg/ha of N and then trended to decline. Similarly, response to P and K was observed to some extent. Seed yield increased up to 28 and 12 kg/ha of P and K, respectively.

Jute: A considerable response of Jute to N, P, K and S was found. Fibre yield of Jute increased with the increase of nutrients levels. Fiber yield of Jute increased appreciably up to 45, 12 and 30 kg/ha of N, P and K, respectively.

T.Aman: Response of T.Aman rice to nitrogen and phosphorus was observed to some extent. Grain yield increased with the increase of N and P level up to 80 and 20 kg/ha of N and P. But response to K was not evident. However, grain yield increased slowly up to 10 kg/ha of K.

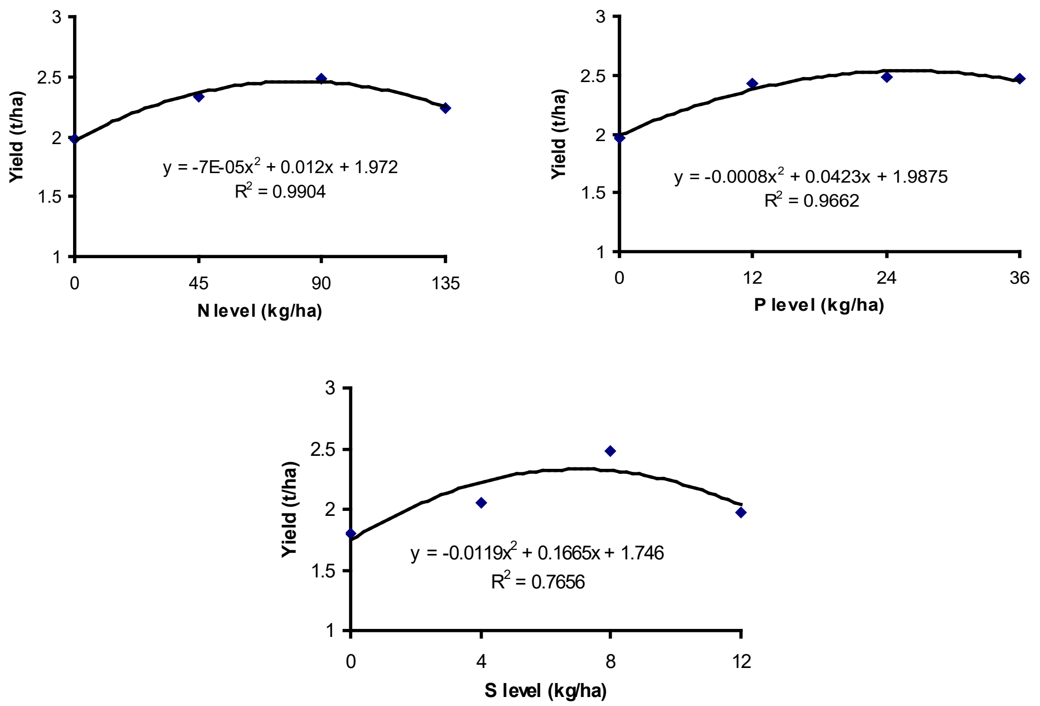






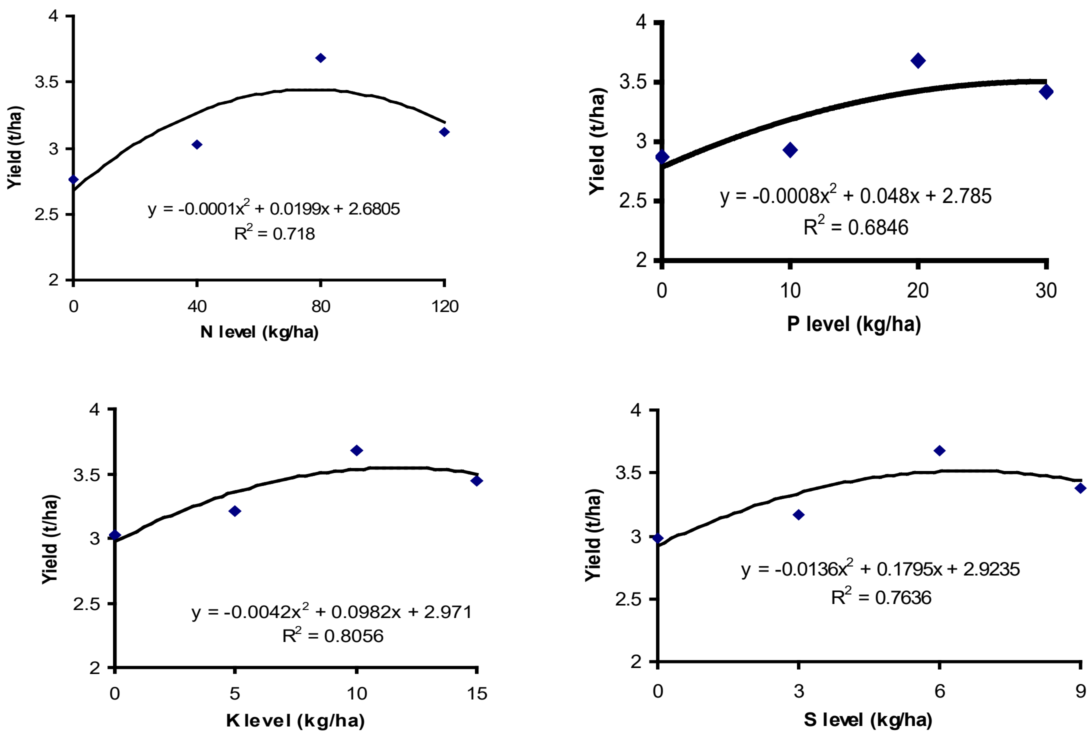
Optimum dose of nutrients: N = 15 kg/ha, K = 12 kg/ha, S = 5 kg/ha.

Figure 48. Response of Lentil to added NKS in Lentil-Jute-T.Aman cropping pattern at Magura, Jessore, 2003-04



Optimum dose of nutrients: N = 86 kg/ha, P= 26 kg/ha, S = 7 kg/ha

Figure 49. Response of Jute to added NKS in Lentil-Jute-T.Aman cropping pattern at Magura, Jessore, 2003-04



.Figure 50. Response of T.Aman to added NPKS in Lentil-Jute-T.Aman cropping pattern at Magura, Jessore, 2003-04

Optimum dose of nutrients: N = 100 kg/ha, P = 30 kg/ha, K = 12 kg/ha, S = 7 kg/ha.

Table 27. Effects of different levels of fertilizer nutrients on the yield of crops in Lentil-Jute-T.Aman cropping pattern at Magura, Jessore, 2003-04

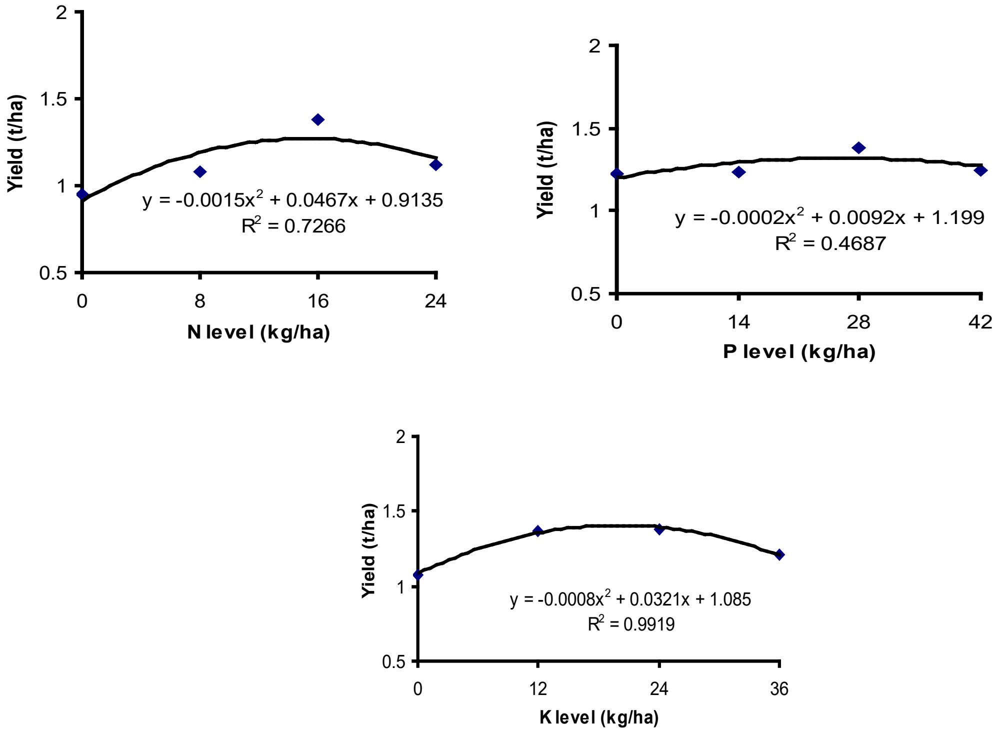
Nutrients	Levels (kg/ha)			Grain yield (t/ha)		
	Lentil	Jute	T.Aman	Lentil	Jute	T.Aman
N	0	0	0	840	1.98	2.76
	8	45	40	1010	2.34	3.03
	16	90	80	1240	2.48	3.68
	24	135	120	1030	2.24	3.12
P	0	0	0	890	1.97	2.87
	14	12	10	1010	2.43	2.93
	28	24	20	1240	2.48	3.68
	42	36	30	1340	2.47	3.42
K	0	0	0	1040	1.84	3.02
	6	15	5	1100	2.17	3.21
	12	30	10	1240	2.48	3.68
	18	45	15	1130	2.68	3.45

Location : Keshobpur, Jessore (AEZ 11)
Cropping pattern : Lentil-Jute-T.Aman
Year : 2003-04

Lentil: Response of Lentil to nitrogen was found. Seed yield increased appreciably up to16 kg/ha of N and then trended to decline. But response to P was not observed at all. Response of Lentil to K was observed to some extent. Seed yield increased appreciably up to 12 kg/ha of K.

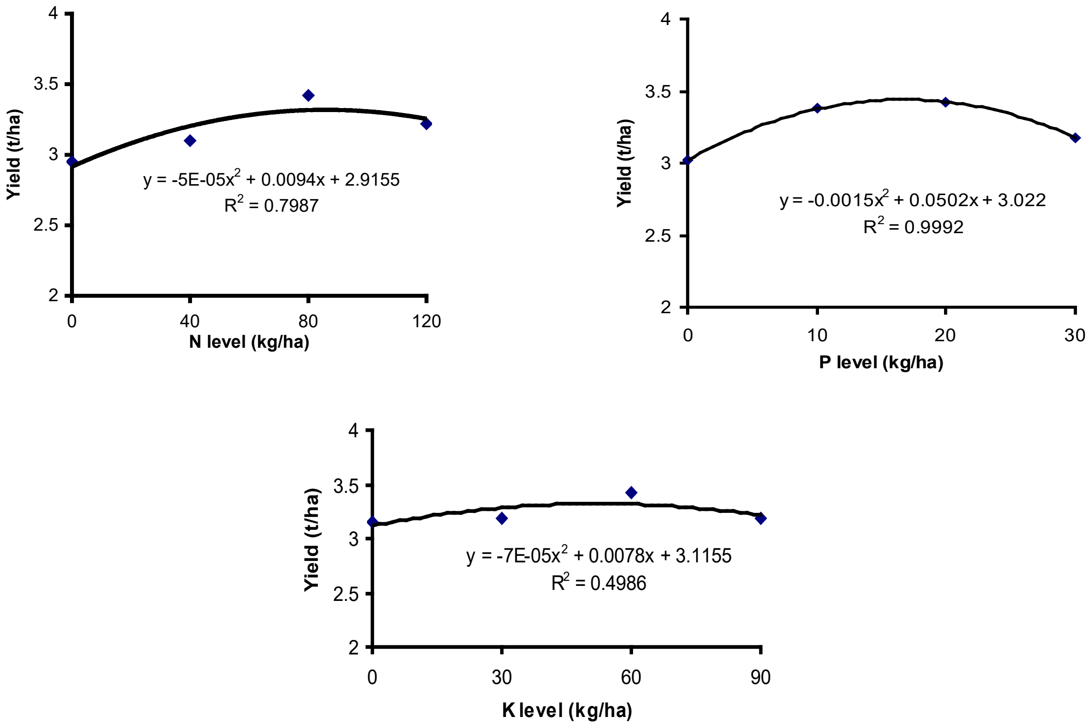
Jute: A considerable response of Jute to nitrogen was found. Fibre yield of Jute increased with the increase of nitrogen levels. The highest yield was found with 80 kg/ha of N. But response to P and K was not evident.

T.Aman: Response of T.Aman rice to nitrogen and phosphorus was observed to some extent. Grain yield increased appreciably with the increase of N and P level up to 70 and 14 kg/ha. But response to K was not evident. However, grain yield increased slowly up to 32 kg/ha of K.



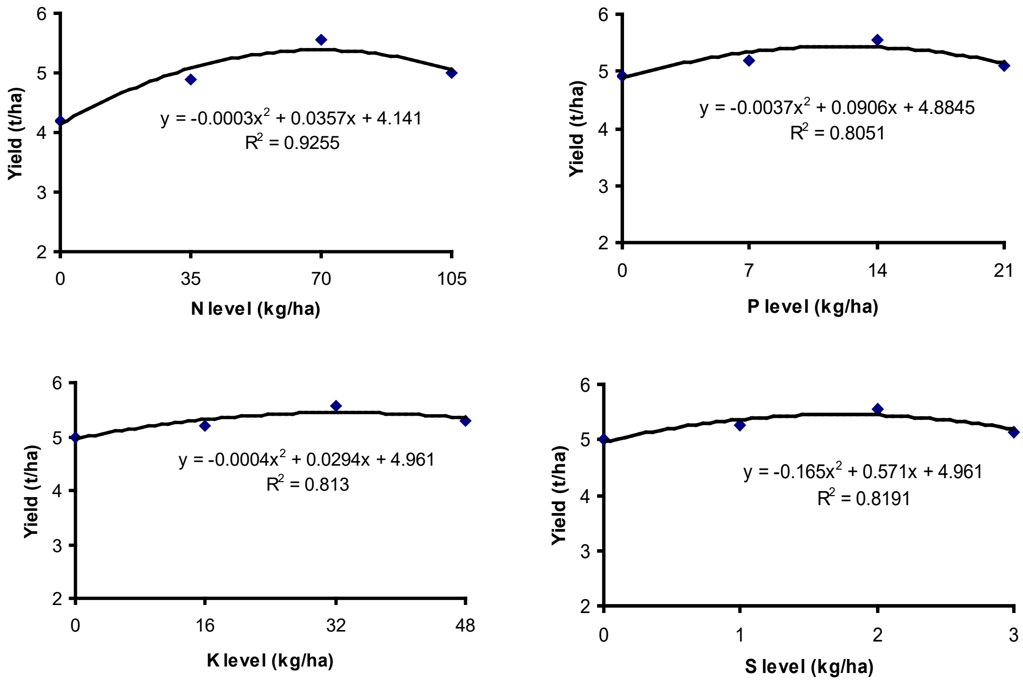
Optimum dose of nutrients: N = 16 kg/ha, P = 23 kg/ha, K = 20 kg/ha.

Figure 51. Response of Lentil to added NPS in Lentil-Jute-T.Aman cropping pattern at MLT site Keshobpur, Jessore during 2003-04



Optimum dose of nutrients: N = 94 kg/ha, P = 17 kg/ha, K = 56 kg/ha.

Figure 51. Response of Jute to added NPS in Lentil-Jute-T.Aman cropping pattern at MLT site Keshobpur, Jessore during 2003-04



Optimum dose of nutrients: N = 60 kg/ha, P = 12 kg/ha, K = 37 kg/ha, S = 2 kg/ha.

Figure 52. Response of T.Aman rice to added NPKS in Lentil-Jute-T.Aman cropping pattern at MLT site Keshobpur, Jessore during 2003-04

Table 28. Effects of different levels of fertilizer nutrients on the yield of crops in Lentil-Jute-T.Aman cropping pattern at Keshobpur, Jessore, 2003-04

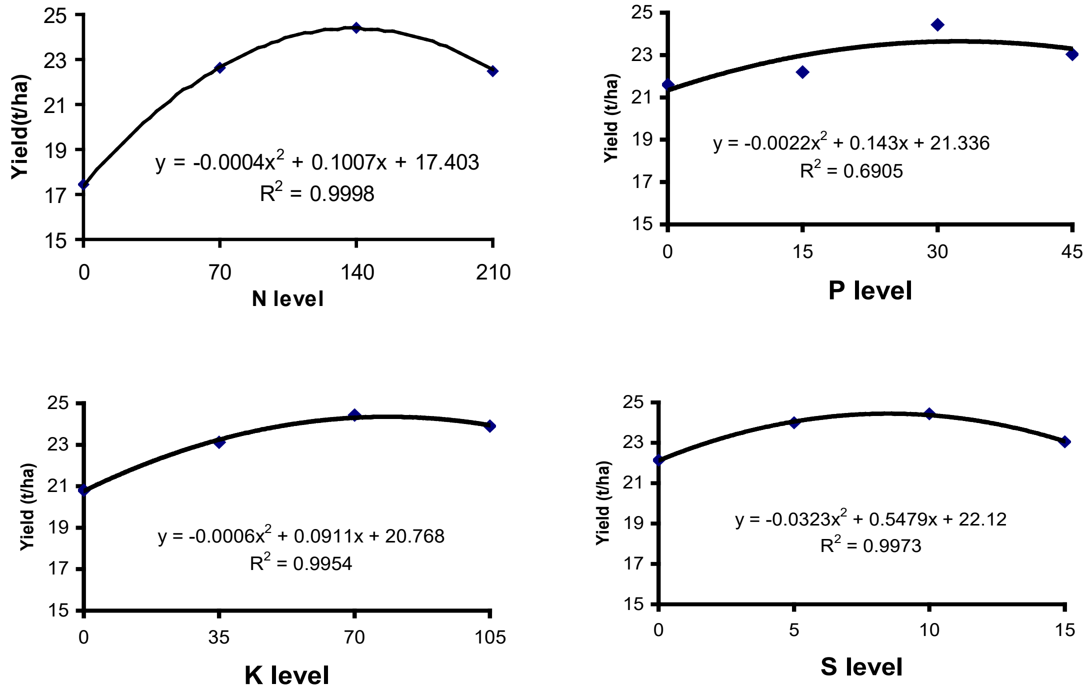
Nutrients	Levels (kg/ha)			Seed/Fibre/Grain yield (t/ha)		
	Lentil	Jute	T.Aman	Lentil	Jute	T.Aman
N	0	0	0	950	2.95	4.20
	8	40	35	1080	3.10	4.90
	16	80	70	1380	3.42	5.56
	24	120	105	1120	3.22	5.00
P	0	0	0	1220	3.02	4.93
	14	10	7	1230	3.38	5.20
	28	20	14	1380	3.42	5.56
	42	30	21	1250	3.18	5.10
K	0	0	0	1080	3.15	5.00
	12	30	16	1370	3.18	5.20
	24	60	32	1380	3.42	5.56
	36	90	48	1210	3.18	5.30

Location : **Bagherpara, Jessore (AEZ 11)**
Cropping pattern : **Potato-Mungbean - T.Aman**
Year : **2003-04**

Potato: Response of Potato to nitrogen was found. Tuber yield increased appreciably with the increase of nitrogen up to140 kg/ha and then trended to decline. Similarly, response to P and K was observed to some extent. Tuber yield increased up to 30 and 70 kg/ha of P and K, respectively.

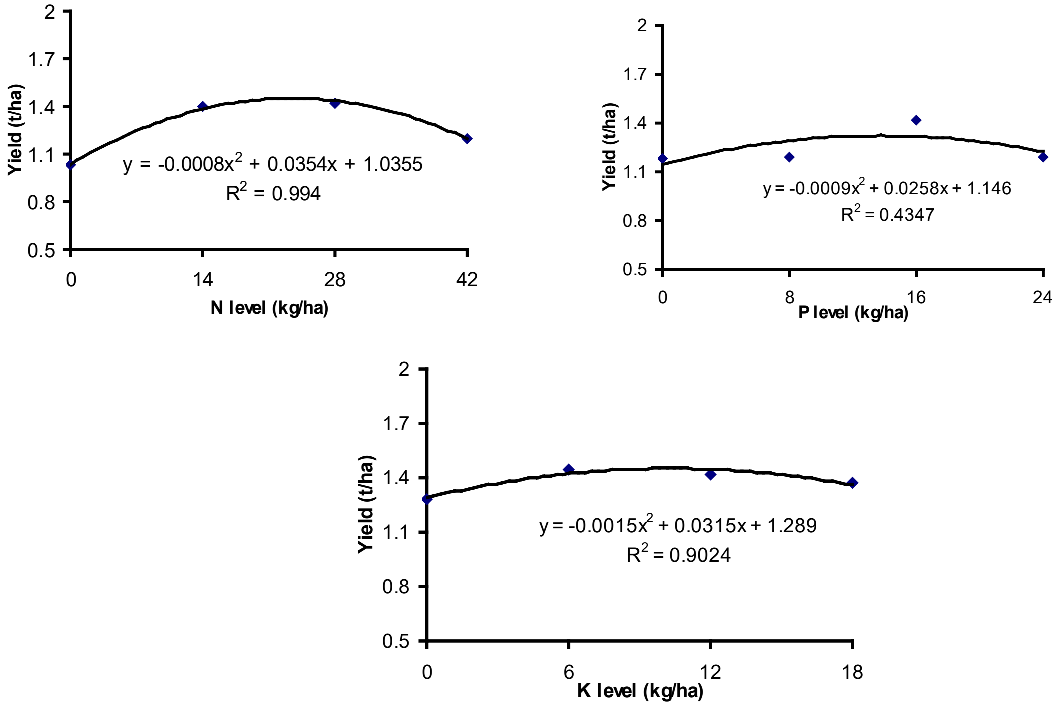
Mungbean: A considerable response of Mungbean to nitrogen was found and seed yield increased considerably up to 14 kg/ha of N. Response to phosphorus was not evident. But a considerable response to added K was observed. Seed yield increased up to 6 kg/ha of K.

T.Aman: Response of T.Aman rice to nitrogen was observed to some extent. Grain yield increased appreciably with the increase of N up to 70 kg/ha of N and after that level yield increased slowly up to 140 kg/ha. A positive response to P and K was also found to some extent. Yield increased appreciably up to the application of 16 and 24 kg/ha of P and K, respectively.



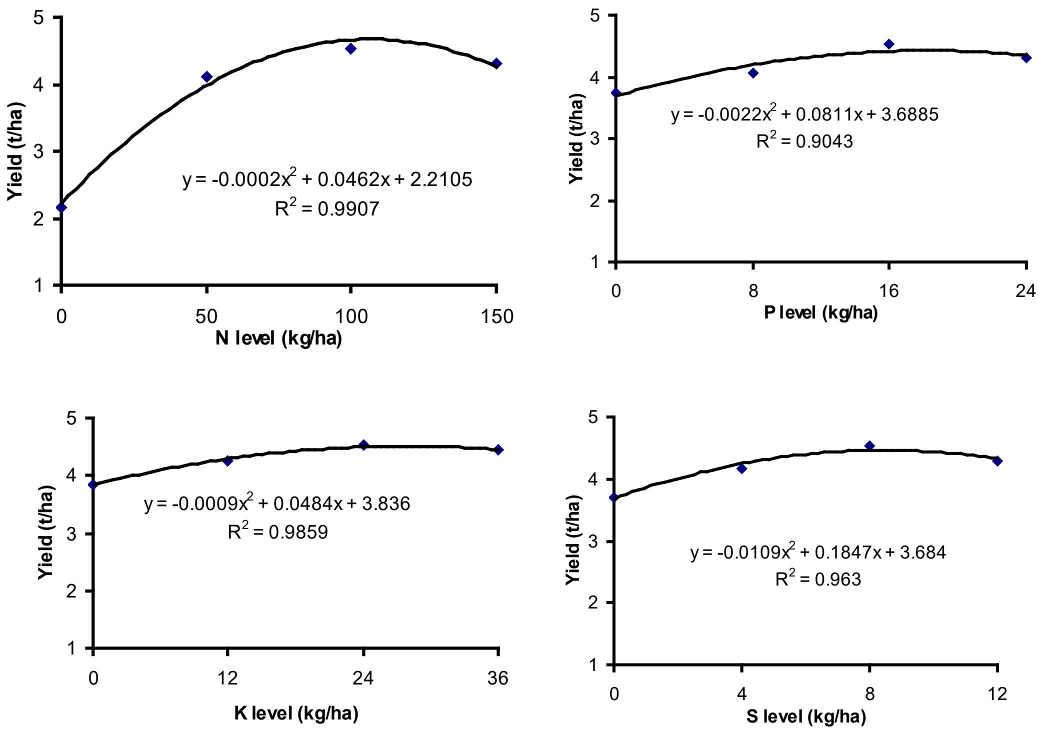
Optimum dose of nutrients: N = 126 kg/ha, P = 33 kg/ha, K = 76 kg/ha, S = 8 kg/ha.

Figure 53. Response of Potato to added NPKS in Potato-Mungbean-T.Aman cropping pattern at MLT site Bagherpara, Jessore during 2003-04



Optimum dose of nutrients: N = 22 kg/ha, P = 14 kg/ha, K = 11 kg/ha

Figure 54. Response of Mungbean to added NPK in Potato-Mungbean-T.Aman cropping pattern at MLT site Bagherpara, Jessore during 2003-04



Optimum dose of nutrients: N = 116 kg/ha, P = 18 kg/ha, K = 27 kg/ha, S = 9 kg/ha.

Figure 55. Response of T.Aman to added NPKS in Potato-Mungbean-T.Aman cropping pattern at MLT site Bagherpara, Jessore during 2003-04

Table 29. Effects of different levels of fertilizer nutrients on the yield of crops in Potato-Mungbean-T.Aman rice cropping pattern at Bagherpara, Jessore, 2003-04

Nutrients	Levels (kg/ha)			Tuber/Seed/Grain yield (t/ha)		
	Potato	Mungbean	T.Aman	Potato	Mungbean	T.Aman
N	0	0	0	17.42	1.03	2.17
	70	14	50	22.62	1.40	4.10
	140	28	100	24.43	1.42	4.54
	210	42	150	22.51	1.20	4.30
P	0	0	0	21.60	1.18	3.73
	15	8	8	22.19	1.19	4.07
	30	16	16	24.43	1.42	4.54
	45	24	24	23.03	1.19	4.31
K	0	0	0	20.81	1.28	3.85
	35	6	12	23.12	1.45	4.25
	70	12	24	24.43	1.42	4.54
	105	18	36	23.90	1.37	4.44

Location : **Gangni, Kushtia (AEZ 11)**
Cropping pattern : **Wheat- Jute-Mungbean**
Year : **2003-04**

Wheat: response of Wheat to nitrogen was observed. Grain yield was increased linearly over nitrogen application. Highest grain yield (4.31 t/ha) was obtained from the highest level of N (150 kg/ha). The result indicates that the nitrogen requirement of the crops is more then the applied rate. Response to P and K was also found. Yield increased linearly with the increase of nutrient levels and the highest yield was obtained with the highest level of P and K. But the rate of increment was slow.

Jute: Fibre yield of Jute increased up to the application of N @ 90 kg/ha and there after the yield decreased slowly. In case of phosphorus, the rate of increment was not so high but tended to increase up to the highest level of P. In case of K yield increase appreciably up to 20 kg/ha but after that yield also increased up to the highest level but at slower rate. Therefore, to find out the optimum dose of nitrogen, phosphorus and potassium for wheat another higher level of NPK should be included in next year.

Mungbean: Response of Mungbean to added P was observed to some extent. Seed yield increased up to 24 kg/ha of P and then tended to decrease. Similarly, yield increased up to the application of 12 kg/ha of K.

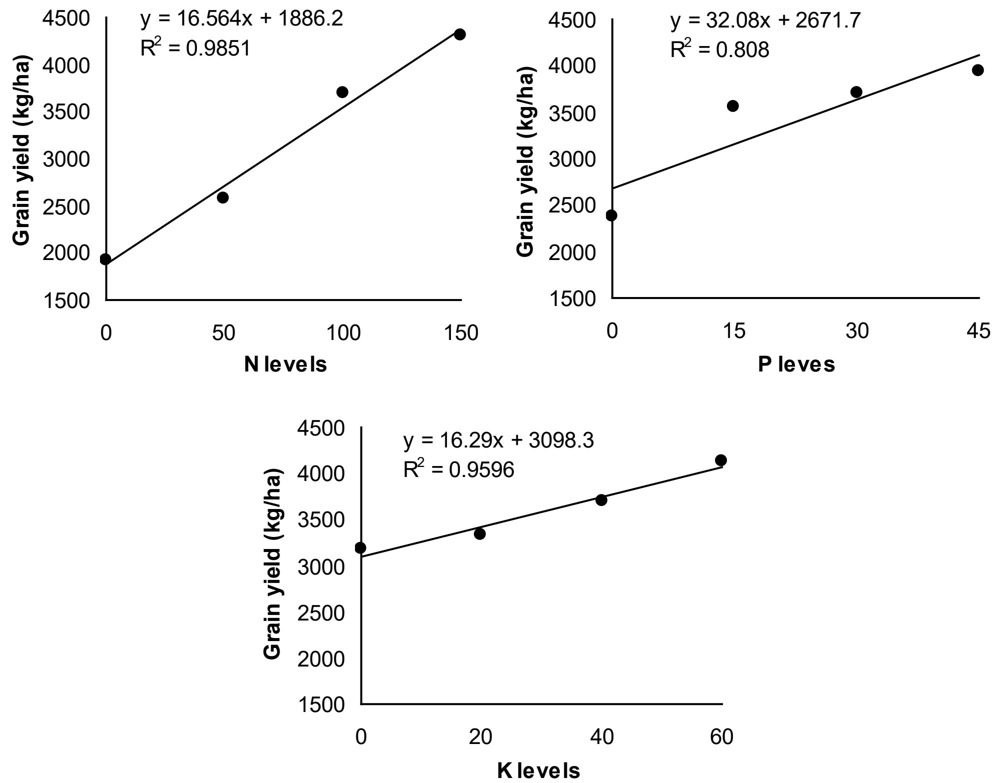


Figure 56. Response of Wheat to added NPK in Wheat-Jute-Mungbean- cropping pattern at Gangni, Kushtia, 2003-04

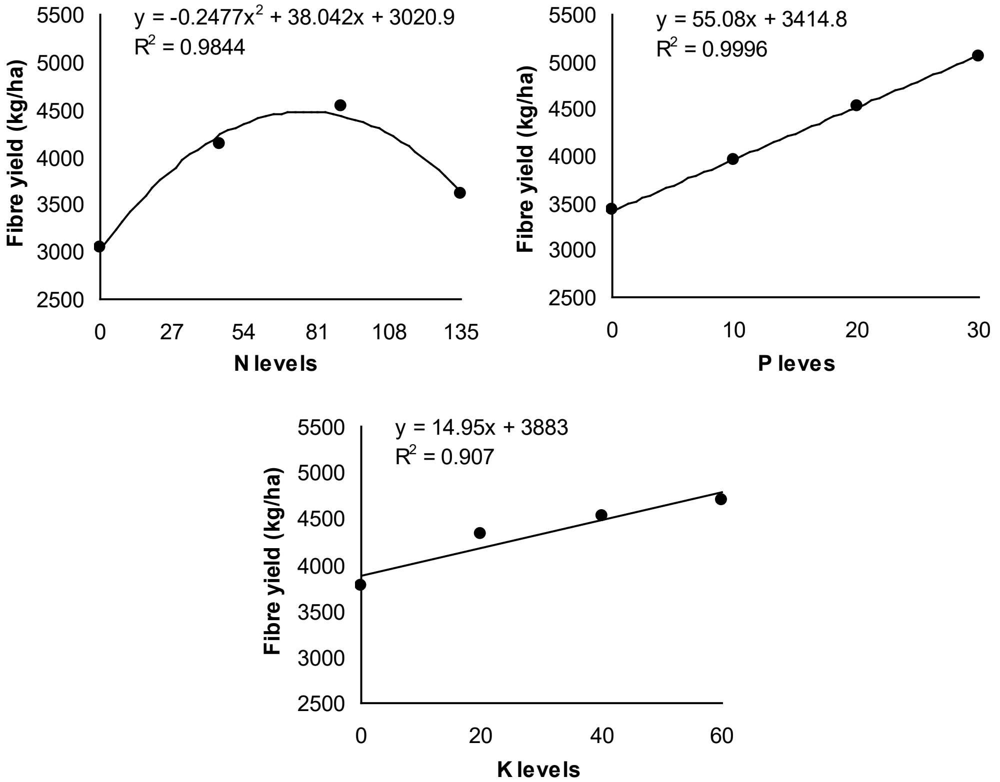
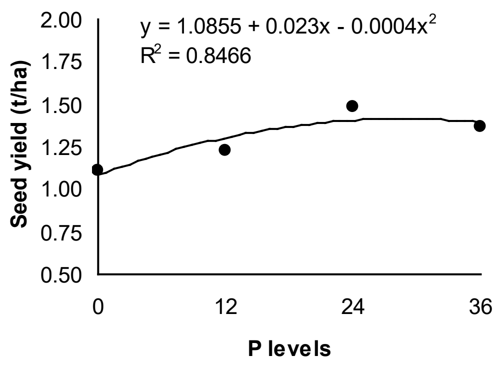


Figure 57. Response of Jute to added PK in Wheat-Jute-Mungbean- cropping pattern at Gangni, Kushtia, 2003-04



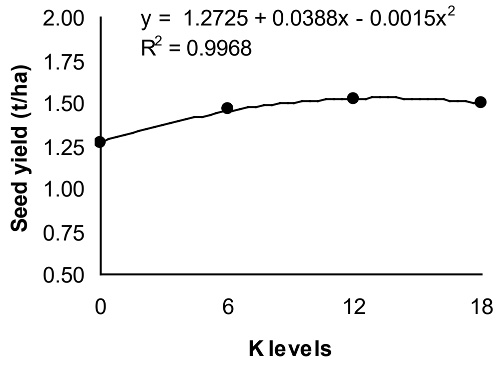


Figure 58. Response of Mungbean to added PK in Wheat-Jute-Mungbean- cropping pattern at Gangni, Kushtia, 2003-04

Table 30. Effects of different levels of fertilizer nutrients on the yield of crops in Wheat-Jute-Mungbean- cropping pattern at Gangni, Kushtia, 2003-04

Nutrients	Levels (kg/ha)			Grain/Fibre/Seed yield (t/ha)		
	Wheat	Jute	Mungbean	Wheat	Jute	Mungbean
N	0	0	10	1.93	3.05	-
	50	45	10	2.57	4.14	-
	100	90	10	3.70	4.53	-
	150	135	10	4.3	3.61	-
P	0	0	0	2.39	3.42	1.105
	15	10	12	3.55	3.95	1.23
	30	20	24	3.7	4.53	1.48
	45	30	36	3.94	5.06	1.37
K	-	0	0	3.18	3.77	1.27
	20	20	6	3.33	4.33	1.46
	40	40	12	3.7	4.53	1.52
	60	60	18	4.14	4.70	1.5

Location : Dumuria, Khulna (AEZ 13)
Cropping pattern : Sesame-T.Aman rice
Year : 2003-04

Sesame: Response of Sesame to nitrogen was observed. Seed yield increased appreciably with the increase of nitrogen up to 60 kg/ha of N and after that level started to decline. Similarly yield increased considerably up to 12 kg/ha of P. But yield increase slowly up to 24 kg/ha of P. Soil was not deficient in K and S. Therefore response of crops to K and S was not included.

T.Aman: Response of T.Aman rice to nitrogen was also observed. Grain yield increased appreciably up to 40 kg/ha of N. But yield also increased after that level but a slower rate up to the application of 80 kg/ha of nitrogen. Almost similar trend was observed in case of phosphorus. Yield increased considerably up to 12 kg/ha of P. However, after that yield also increased up to 24 kg/ha of P but a slower rate.

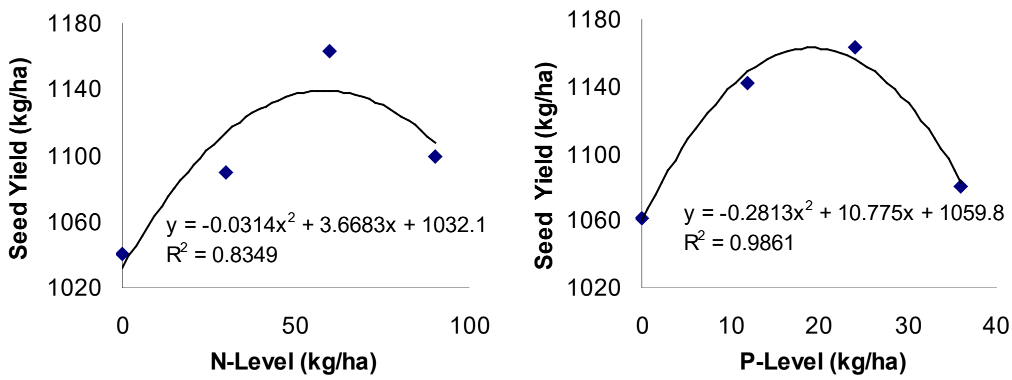


Figure 58. Response of Sesame to added NP in Sesame- T.Aman cropping pattern at Dumuria, Khulna during 2003-04

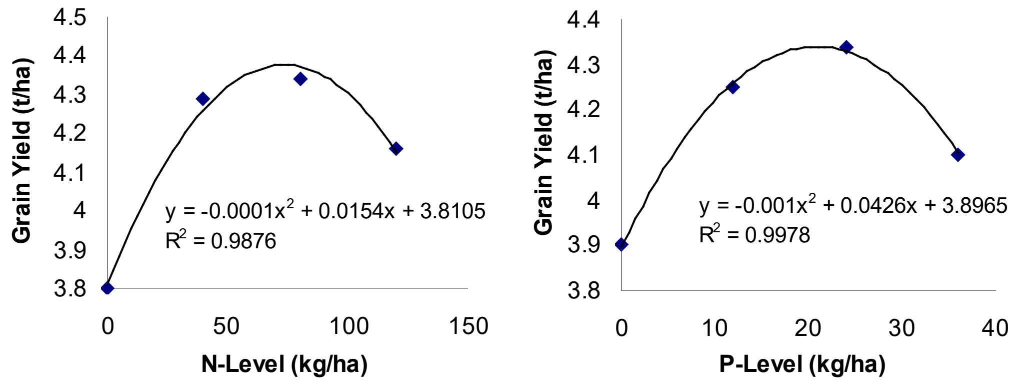


Figure 58. Response of T.Aman rice to added NP in Sesame- T.Aman cropping pattern at Dumuria, Khulna during 2003-04

Table 31. Effect of different levels of fertilizer nutrients on the yield of crops in Sesame-T.Aman rice cropping pattern at Dumuria, Khulna during 2003-04

Nutrient	Levels (kg/ha)		Seed/Grain yield	
	Sesame	T.Aman	Sesame (kg/ha)	T.Aman (t/ha)
N	0	0	1040	3.80
	30	40	1090	4.29
	60	80	1163	4.34
	90	120	1100	4.16
P	0	0	1062	3.90
	12	12	1142	4.25
	24	24	1163	4.34
	36	36	1081	4.10

Appendices

Appendix table 1. Initial soil status of the experimental site

Location with AEZ	Land type	R/I	pH	O.C (%)	Total N (%)	K (m.eq./100g soil)	P	S	Zn	B
							ppm			
Melandah (9)	MHL	I	5.2-5.9	0.75-1.38	0.05-0.10 (L)	0.06-0.76 (M)	4.75-11.3 (L)	5.08-10.9 (L)	0.78-5.1 (M)	0.05-0.29 (L)
Sherpur (9)	MHL	I	5.0-6.2	0.55-1.31	0.025-0.101 (L)	0.06-0.15 (VL)	4.2-11.5 (L)	6.6-15.5 (L)	0.28-0.79 (VL)	0.61-2.75 (VH)
Kishoreganj (9)	MHL	I	6.8	0.90	0.11 (L)	0.14 (L)	8.52 (L)	9.56 (L)	-	-
Lebukhali (13)	MHL	R	5.3	1.44	0.08 (VL)	0.28 (Opt)	4.4 (VL)	33.46(O)	0.34(VL)	-
Chabbishnagar (26)	MHL	R	5.7	1.12	0.07 (VL)	0.26 (M)	6.17 (VL)	15.0 (L)	1.22 (M)	0.18 (L)
Nachole (26)	MHL	R	-	-	0.07 (VL)	0.20 (M)	16.0 (M)	6.62 (VL)	2.24 (H)	0.46 (O)
Atkapalia (18)	MHL	R	7.06	1.41	0.03	0.23	5.7	65.2	0.66	-
Hathazari (23)	MHL	I	5.00	1.23	0.08 (VL)	0.10 (VL)	30.0 (O))	11.8(L)	-	-
Joypurhat (25)	MHL	I	4.93	0.60	0.06 (VL)	0.07 (VL)	13.41 (L)	7.15 (VL)	1.66 (O)	-
Gabtali (4)	MHL	I	5.95	-	0.10 (L)	0.07 (VL)	8.49 (L)	8.93 (L)	-	-
Kaliakoir (28)	MLL	I	6.03	1.62	0.086 (VL)	0.20 (M)	6.25 (VL)	22.8 (O)	0.98 (M)	0.24 (L)
Manikganj (9)	MLL	I	7.15	1.47	0.09 (L)	0.20 (M)	3.31 (VL)	13.1 (L)	0.62 (L)	0.05 (VL)
Chandina (19)	MHL	I	5.78	-	0.12 (L)	0.11 (L)	13.4 (L)	8.4 (L)	1.08 (O)	-
Rajbari (12)	MHL	I	7.36	2.85	0.14 (L)	0.19 (M)	6.09 (VL)	19.18 (M)	-	-
Magura (11)	MHL	I	-	-	0.12 (L)	0.26 (M)	5.79 (VL)	24.0 (O)	0.48 (L)	-
Keshobpur (11)	MHL	I	-	-	0.14 (L)	0.15 (L)	7.64 (L)	31.1 (O)	0.81 (L)	-
Bagherpara	MHL	I	-	-	0.06 (VL)	0.20 (M)	6.96 (VL)	19.3 (M)	0.95 (M)	-
Dumuria (13)	MHL	I	8.0	1.74	0.17 (L)	0.39 (VH)	3.60 (VL)	95.6 (VH)	0.44 (L)	-
Gangni (11)	MHL	I	-	1.80	0.09 (L)	0.22 (M)	9.0 (L)	17.2 (M)	-	-
Lalmonirhat (3)	MHL	I	5.37	-	0.07 (VL)	0.13 (L)	21.6 (M)	7.35 (VL)	0.31 (VL)	0.44 (M)
Syedpur (3)	MHL	I	6.0	-	0.12 (L)	0.12 (L)	6.33 (VL)	12.8 (L)	0.55 (L)	0.40 (M)
Paba (11)	MHL	I	8.39	3.83	0.09 (L)	0.21 (M)	16.0 (M)	6.63 (VL)	2.29 (O)	0.46 (O)

Appendix table 2. Crop management practices

Site	Cropping pattern	Variety	Seed rate (kg/ha)	Planting time	Harvesting time
Melandah	Potato	Cardinal	2000	4th week of Nov	4th week of March
	Jute	O-9897	8	3rd week of March	4th week of July
	T.Aman	BRRI Dhan 33	50	1st week of Aug.	Last week of Oct.
Sherpur	Wheat	Kanchan	120	4th week of Nov.	Last week of March
	Jute	O-9897	8	3rd week of April	Last week of July
	T.Aman	BRRI Dhan 33	50	Last week of Aug	Last week of Oct.
Lebukhali	Chilli	Local	-	3rd week of Jan.	2nd week of May
	T.Aman	BR-23	40	1st week of Sept.	3rd week of Dec
Hathazari	Chilli	Local	600g	3rd week of Dec.	2nd week of April
	T.Aman	BRRI Dhan 30	35	Last week of July	4th week of Nov
Chabbishnagar	Chickpea	BARI chola 5	60	2nd week of Nov	Last week of March
	T.Aman	BRRI Dhan 39	40	3rd week of July	Last week of Oct.
Nachole	Chickpea	BARI chola 5	60	2nd week of Nov	Last week of March
	T.Aman	BRRI Dhan 39	40	3rd week of July	Last week of Oct.
Atkapalia	G.nut	Dhaka-1	-	1st week of Jan.	3rd week of May
	T.Aman	BRRI Dhan 32	40	2nd week of Aug.	3rd week of Nov.
Rajbari	Lentil	BARI masur-4	50	3rd week of Nov.	1st week of March
	Jute	O-9897	10	1st week of April	4th week of July
	T.Aman	BRRI Dhan 32	40	Last week of July	1st week of Nov.
Dumuria	Sesame	Local	8	3rd week of Feb.	Last week of May
	T.Aman	BR 23	40	4th week of Aug.	4th week of dec.
Chandina	Boro	BRRI Dhan 29	40	3rd week of Jan.	3rd week of May
	T.Aus	BR 20	40	Last week of May	Last week of Aug.
	T.Aman	-	-	-	.-
Kishoreganj	Potato	Diamont	1500	3rd week of Nov.	1st week of March
	T.Aus	BR 26	50	2nd week of May	Last week of July
	T.Aman	BRRI Dhan 32	50	2nd week of Aug	2nd week of Nov
Kaliakoir	Mustard-	Tori-7 (Imp.)	8	3rd week of Nov.	1st week of Feb.
	Boro	BRRI Dhan 29	40	2nd week of Feb.	3rd week of May
Manikganj	Mustard-	Tori-7 (Imp.)	8	1st week of Nov.	3rd week of Jan.
	Boro	BRRI Dhan 29	40	1st week of Feb.	4th week of May
Gabtali	Mustard	BARI sharisa-9	10	3rd week of Nov.	2nd week of Feb.
	Boro	BRRI dhan-28	40	Last week of Feb.	Last week of May
	T.Aman	Pajam	40	Last week of July.	2nd week of Nov.
Gangni	Wheat	Protiva	120	1st week of Dec	3rd week of March
	Jute	Falguni Tosa	10	3rd week of April	3rd week of Aug.
	Mungbean	BARI Mung-5-	40	Last week of Aug.	1st week of Nov.
Feni	Boro	BRRI dhan-28	40	1st week of Feb	Last week of May
	T.Aman	BR 11	40	Last week of July	3rd week of Nov.
Lalmonirhat	Wheat	Protiva	120	1st week of Dec	3rd week of March
	Jute	O-9897	8	2nd week of April	3rd week of July.
	T.Aman	BR 11	40	Last week of July	2nd week of Nov.
Syedpur	Potato	Cardinal	1500	1st week of Dec	1st week of March
	Boro	BRRI dhan-28	40	1st week of March	1st week of June
	T.Aman	BR 11	40	3rd week of July	3rd week of Nov.
Shyampur	Potato	Cardinal	1500	1st week of Dec	3rd week of March
	Jute	Tosa	8	2nd week of April	3rd week of July.
	T.Aman	BRRI dhan-39	40	Last week of July	1st week of Nov.

✡ ✡ ✡

Effects of different levels of Magnesium on the performance of Potato, Tomato and Maize

Abstract

The experiment was conducted at FSRD site, Syedpur, Rangpur during Rabi season of three consecutive years (2002-03 to 2004-05). Five different levels of magnesium varied from crop to crop were tested against potato, tomato and maize to find out the optimum and economic dose of Mg for the crops grown in magnesium deficient area of greater Rangpur. Average of three years results revealed that a positive response of crops to magnesium was evident. Yield of potato increased significantly with the increase of Mg level up to 10 kg/ha. After that, the yield tended to decrease slowly. However, yield was identical to 15 and 20 kg/ha of Mg. Similarly, In potato response to Mg was observed. Fruit yield increased significantly up to 16 kg/ha. In case of hybrid maize, grain yield increased up to 20 kg/ha of Mg. Almost similar trend was observed over the years. From the average data a response curve was drawn for potato, tomato and maize. The response was quadratic in nature and from the equation Mg dose that maximized yield as well as profit was find out for potato, tomato and maize at greater Rangpur region under AEZ 3.

Introduction

Magnesium is one of the essential secondary nutrient elements for crop production. It is an important constituent of chlorophyll and therefore, essential for photosynthesis. It also promotes uptake and translocation of phosphorus. Generally, magnesium does not need to apply in the soil as its status in soil is optimum. But recently its deficiency was reported in medium highland soil of grater Rangpur under Tista Flood Plain (AEZ 3). Initial soil nutrient status also showed that Mg content of that area is low (0.14 meq/100 g of soil) and below the critical level (0.8meq/100 g of soil). The deficiency was observed in different crops particularly in rabi crops like Potato, Tomato and other vegetables crops and Maize. Potato, Tomato and Maize is widely grown in Rangpur and area under those crops is expanding over the years. Magnesium recommendation for different crops is not yet available in our country even not mentioned in the national fertilizer recommendation guide (FRG'97). Therefore, it is very important to find out the optimum dose of Mg for different crops for successful crop production. Keeping this view in mind the experiment was undertaken to find out the optimum dose of Mg for Potato and Tomato for magnesium deficient area of AEZ # 3.

Materials and Methods

The experiment was conducted at FSRD site, Syedpur during Rabi in three consecutive year of 2002-03 to 2004-05 to find out the optimum dose of Mg for Potato and Tomato. Five levels of Mg varied from crop to crop were tested against the crops. The trial was conducted in randomized complete block design with 6 dispersed replications. Initial soil samples were also collected from experimental plots and analyzed in SRDI laboratory, Rajshahi. The results of soil analysis are given in appendix Table 1, 2 & 3. The unit plot size was 5 m × 3 m. Details of the crop and fertilizer managements are given in appendix table 3. At maturity crops were harvested and necessary data were collected and analyzed statistically.

Different levels of magnesium were tested in different crops

Crop	Mg levels (kg/ha)				
Potato	0	5	10	15	20
Tomato	0	8	16	24	32
Maize	0	10	20	30	40

Results and Discussion

Potato

The results presented in table 2 and 3 revealed that both the years there was significant difference among the treatments in respect of tuber weight/hill and tuber yield. The higher tuber yield was obtained each year from the plot where 10 kg Mg ha–1 was applied that was statistically identical to 15 and 20 kg Mg ha^{-1}, respectively. The lowest yield was also obtained each year from the treatment where Mg was not applied (control). The highest tuber yield was attributed due to the highest tuber weight/hill. The three years' average results recorded that tuber yields were 30.66, 29.26, 29.00, 27.59 and 23.38 t due to application of 10, 15, 20, 5 and 0 kg Mg-1, respectively.

From the average of three years cost and return analysis showed the highest gross return (Tk. 127852 ha^{-1}), gross margin (Tk. 80424 ha^{-1}) and BCR (2.70) was calculated from the treatment where 10 kg Mg ha^{-1} was applied. On the other hand the highest MBCR (18.29) and marginal rate of return (1729%) were recorded from the treatment where 5 kg Mg ha^{-1} was applied. But it is observed from the response curve with Mg levels and potato tuber yield (3 years mean) showed that 13.37 kg Mg ha^{-1} was found as an agronomic optimum dose for maximum tuber yield and 13.06 kg Mg ha^{-1} as optimum economic dose for potato production.

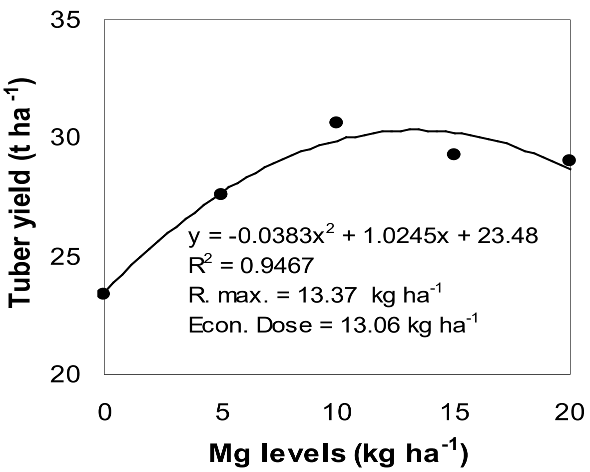


Figure 1. Response of Potato to added Magnesium at FSRD site, Syedpur, Rangpur (average yield of 2002-03 to 2004-05)

Table 1. Effects of different levels of Mg on the tuber yield of Potato at Syedpur FSRD site, Rangpur during 2002-23 to 2004-05

Levels of Mg (kg ha^{-1})	Tuber yield (t/ha)			
	2002-03	2003-04	2004-05	Mean
0	25.33c	24.20c	20.60c	23.38
5	29.55b	28.31b	24.91b	27.59
10	32.33a	31.63a	28.03a	30.66
15	30.95ab	30.26ab	26.56ab	29.26
20	30.75ab	30.07ab	26.17ab	29.00
CV (%)	6.2	8.6	8.3	-

Means followed by the same letter (s) in a column are not significantly different at 5% level by DMRT

Tomato

The results presented in table 2 and 3 revealed that both the years there was significant difference among the treatments in respect of fruit weight per plant and fruit yield per hectare in each year. Higher fruit yield was obtained each year from the plot where 16 kg Mg ha^{-1} was applied but it was statistically identical to 24 and 32 kg Mg ha^{-1}, respectively. Significantly the lowest yield was also obtained each year from the treatment where Mg was not applied (control). The highest fruit yield was attributed due to the highest fruit weight/plant. The three years' average per hectare recorded fruit yields were 70.67, 69.88, 68.04, 62.8 and 56.91 t ha^{-1} due to application of 16, 24, 32, 8 and 0 kg ha^{-1}, respectively.

From the average of three years cost and return analysis, shown in that the highest gross return (Tk. 312369 ha^{-1}), gross margin (Tk. 266248 ha^{-1}), BCR (6.77), MBCR (18.45) and marginal rate of return (1987%) were calculated from the treatment where 16 kg Mg ha^{-1} was applied. But it is observed from the response curve with Mg levels and fruit yield of tomato (3 years mean) showed that 22.78 kg Mg ha^{-1} was found as an agronomic optimum dose for maximum fruit yield and 22.48 Kg Mg ha^{-1} as optimum economic dose for tomato production (Figure 2).

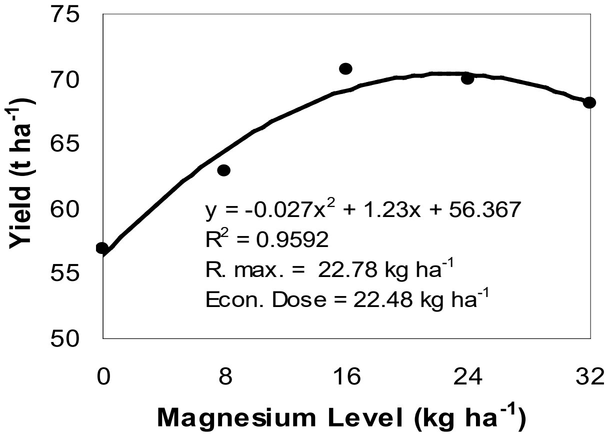


Figure 2. Response of tomato to added Magnesium at FSRD site, Syedpur, Rangpur (average yield of 2002-03 to 2004-05)

Table 2. Effects of different levels of Mg on the marketable fruit yield of Tomato at Syedpur FSRD site, Rangpur during 2002-03 and 2003-04

Levels of Mg (kg ha^{-1})	Marketable fruit yield (t/ha)			
	2002-03	2003-04	2004-05	Mean
0	56.09c	59.20b	55.43c	56.91
8	61.52b	64.46b	62.65b	62.88
16	70.59a	72.63a	68.80a	70.67
24	68.97a	71.97a	68.69a	69.88
32	66.46a	70.10a	67.55a	68.04
CV (%)	6.3	6.7	6.3	-

Maize

The results presented in Table 2 and 3 revealed that there was significant difference among the treatments in respect of number of grains per cob, 1000-grain weight and grain yield. The higher grain yield was obtained from 20 kg Mg ha^{-1} that was statistically identical to 10, 30 and 40 kg Mg ha^{-1}, respectively. Significantly the lowest yield was obtained from the treatment where Mg was not applied (control). From the cost and return analysis, showed that the average highest gross margin (Tk. 77057/ha), MBCR (6.6) and marginal rate of return (560%) was recorded from the treatment where 10 kg Mg ha^{-1} was applied. But it was observed from the response curve with Mg levels and maize yield shown in Figure 3, that 24.15 kg Mg ha^{-1} could be applied for maximum grain yield but the economically viable dose could be applied for maximum grain yield but the economically viable dose could be 13.83 kg ha^{-1} for hybrid maize production.

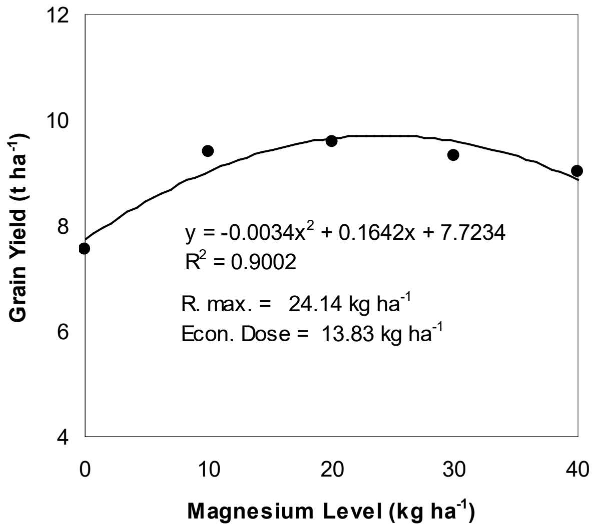


Figure 3. Response of maize to added Magnesium at FSRD site, Syedpur, Rangpur (average yield of 2002-03 to 2004-05)

Table 3. Effects of different levels of Mg on the grain yield of Maize at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 to 2004-05

Levels of Mg (kg ha^{-1})	2002-03	2003-04	2004-05	Mean
		Grain yield (t/ha)		
0	7.85b	7.67b	7.14b	7.55
10	9.77a	9.52a	8.90a	9.40
20	9.85a	9.70a	9.21a	9.59
30	9.69a	9.34a	8.96a	9.33
40	9.49a	9.13a	8.42a	9.01
CV (%)	7.2	6.6	8.2	-
		Stover yield (t/ha)		
0	11.42	11.26	10.67	11.12
10	11.73	11.60	10.90	11.41
20	11.95	11.83	10.75	11.51
30	11.67	11.62	10.63	11.31
40	11.43	11.22	10.41	11.02
CV (%)	6.6	6.9	6.8	-

Means followed by the same letter (s) in a column are not significantly different at 5% level by DMRT

Conclusion

On the basis of three years result showed that 13.37 (agronomically dose) and 13.06 (economically dose) kg Mg/ha for potato production whereas 22.78 (agronomically dose) and 22.48 (economically dose) kg/ha for tomato cultivation but 24.15 (agronomically dose) and 13.83 (economically dose) kg/ha for hybrid maize could be recommended for Rangpur region of AEZ-3.

Appendix 1. Initial soil status of the experimental plots of Potato

SL.	Soil Characteristic	Status	SL.	Soil Characteristic	Status
1.	pH	5.37	6.	P (Micro gram g^{-1} soil)	38.95 (VH)
2.	OM (%)	2.17	7.	S (Micro gram g^{-1} soil)	13.12 (L)
3.	Mg (m eq/100g soil)	0.82 (M)	8.	Zn (Micro gram g^{-1} soil)	0.55 (L)
4.	K (m eq/100g soil)	0.42 (H)	9.	B (Micro gram g^{-1} soil)	0.29 (L)
5.	N (%)	0.11 (L)			

Appendix 2. Initial soil status of the experimental plots of Tomato

SL.	Soil Characteristic	Status	SL.	Soil Characteristic	Status
1.	pH	6.22	6.	P (Micro gram g^{-1} soil)	53.11 (VH)
2.	OM (%)	1.68	7.	S (Micro gram g^{-1} soil)	14.58 (L)
3.	Mg (m eq/100g soil)	0.46 (L)	8.	Zn (Micro gram g^{-1} soil)	0.58 (L)
4.	K (m eq/100g soil)	0.49 (VH)	9.	B (Micro gram g^{-1} soil)	0.25 (L)
5.	N (%)	0.11 (L)			

Appendix 3. Initial soil status of the experimental plots of Maize

SL.	Soil Characteristic	Status	SL.	Soil Characteristic	Status
1.	pH	5.53	6.	P (Micro gram g^{-1} soil)	21.00 (M)
2.	OM (%)	1.78	7.	S (Micro gram g^{-1} soil)	9.00 (L)
3.	Mg (m eq/100g soil)	0.95 (M)	8.	Zn (Micro gram g^{-1} soil)	1.10 (M)
4.	K (m eq/100g soil)	0.16 (L)	9.	B (Micro gram g^{-1} soil)	0.39 (M)
5.	N (%)	0.08 (VL)			

Appendix 4. Crop management and fertilization

Crop Management

Crop	Variety	Spacing (cm)	Planting time	Harvesting time	Irrig. (no.)	Pesticide use
Potato	Cardinal	60cm x 25cm	1st week of Dec.	1st week of Feb.	3	-
Tomato	Ratan	60cm x 45cm	4th week of Nov.	1st week of April	3	-
Maize	Pacific 11	75cm x 25 cm	12 to 15 Dec.	1st week to 2nd week of April	3	-

Fertilization

Crop	Fertilizer rate (NPKSZn in kg/ha)	Application (Method & time)
Potato	Mg: 0, 5, 10, 15, 20 NPKSZnB: 160-15-50-27-1-1.8 + CD @ 7.5 t/ha	In Potato, all PKS Mg Zn B and ½ of urea and cowdung were applied as basal and rest half of urea was side dressed at 30 DAP.
Tomato	Mg: 0, 8, 16, 24, 32 NPKSZnB: 160-15-50-27-1-1.8 + CD @ 5 t/ha	All P, S, Mg, Zn, B and cowdung was applied as basal. But N and K was applied in 2 equal splits at 15 and 35 DAP.
Maize	Mg: 0, 10, 20, 30, 40 NPKSZnB:250-45-150-40-3-1.5 + CD 5 @ t/ha	In Maize, all PKS Mg Zn B and ½ of urea and cowdung were applied as basal and rest half of urea was side dressed at 40 and 70 DAP.

Apendix 5. Effects of different levels of Mg on the yield attributes of potato at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 to 2004-05

Levels of Mg (kg ha^{-1})	Plant height (cm)	Shoot $hill^{-1}$ (no.)	Tuber $plant^{-1}$ (no.)	Tuber wt. $hill^{-1}$ (g.)
		Year 1 : Rabi 2002-03		
0	77.8	3.6	10.4	420c
5	81.1	3.6	10.8	479b
10	78.6	3.8	11.0	530a
15	79.2	3.7	10.8	505ab
20	80.4	3.8	10.5	499ab
CV (%)	3.2	5.8	5.6	5.9
		Year 2 : Rabi 2003-04		
0	79.3	3.6	9.6	406c
5	81.3	3.6	10.2	452b
10	79.2	3.7	10.7	508a
15	82.4	3.8	9.9	488ab
20	79.8	3.8	10.1	486ab
CV (%)	4.5	4.5	5.9	6.1
		Year 3 : Rabi 2004-05		
0	79.8	3.7	9.6c	363d
5	80.6	3.8	10.4ab	415c
10	79.9	3.6	10.9a	468a
15	83.2	3.7	9.8bc	449a
20	81.4	3.9	10.0bc	426bc
CV (%)	6.0	7.9	5.3	6.3

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

Apendix 6. Cost and return of potato as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 to 2004-05

Mg Levels (kg ha^{-1})	Gross return (Tk ha^{-1})	Variable cost (Tk ha^{-1})	Gross margin (Tk ha^{-1})	BCR	MBCR	MRR (%)
	Rabi 2002-03					
0	101320	41282	60038	2.45	-	-
5	118200	42476	75602	2.78	14.14	1183
10	129320	43689	85406	2.96	11.63	745
15	123800	45005	78570	2.75	6.04	-
20	123000	46321	76460	2.66	4.30	-
Rabi 2003-04						
0	121000	46527	74473	2.60	-	-
5	141550	47276	94274	2.99	27.44	2311
10	158150	48016	110134	3.29	24.95	1851
15	151300	48873	102427	3.10	12.92	-
20	150350	49730	100620	3.02	9.16	-
Rabi 2004-05						
0	72100	48702	23398	1.48	-	-
5	87185	49641	37544	1.76	16.06	1506
10	98105	50580	47525	1.94	13.85	1063
15	92960	51519	41441	1.80	7.41	-
20	91595	52464	39131	1.75	5.18	-
Mean						
0	97495	45504	51991	2.14	-	-
5	115050	46464	68586	2.48	18.29	1729
10	127852	47428	80424	2.70	15.78	1228
15	122014	48466	73548	2.52	8.28	-
20	120930	49505	71425	2.44	5.86	-

Appendix 7. Effects of different levels of Mg on the yield attributes of tomato at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 to 2004-05

Levels of Mg (kg ha^{-1})	Plant height (cm)	Fruit plant^{-1} (no.)	Fruit wt. plant^{-1} (kg.)
2002-03			
0	74	27.5	1.69c
8	74	27.7	1.88bc
16	76	28.4	2.12a
24	75	28.4	2.04a
32	76	27.9	1.98ab
CV (%)	3.5	8.4	9.3
2003-04			
0	76	29.5	1.80c
8	78	29.9	1.98b
16	76	30.4	2.25a
24	78	30.4	2.13ab
32	77	30.3	2.10ab
CV (%)	4.3	7.0	6.8
2004-05			
0	78	27.7	1.67c
8	80	28.4	1.94b
16	78	26.7	2.14a
24	74	29.4	2.05ab
32	79	28.7	1.99ab
CV (%)	7.3	7.7	6.9

Means followed by the same letter (s) in a column are not significantly different at 5% level by DMRT

Appendix 8. Cost and return of tomato as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 to 2004-05

Levels of Mg (Kg ha^{-1})	Gross return (Tk ha^{-1})	Variable cost (Tk ha^{-1})	Gross margin (Tk ha^{-1})	BCR	MBCR	MRR (%)
	Rabi 2002-03					
0	182292	41295	140997	4.41	-	-
8	199940	43218	156722	4.63	9.18	818
16	229418	45150	184268	5.08	12.22	1426
24	224153	47161	176992	4.75	7.14	-
32	215995	49266	166729	4.38	4.23	-
Rabi 2003-04						
0	266400	42752	223648	6.23	-	-
8	290070	44267	245803	6.55	15.62	1462
16	326835	45783	281052	7.14	39.86	2325
24	323865	47298	276567	6.85	37.93	-
32	315450	48814	266636	6.46	32.35	-
Rabi 2004-05						
0	304865	44403	260462	6.87	-	-
8	344575	45905	298670	7.51	26.44	2544
16	378400	47407	330993	7.98	24.48	21.52
24	377795	49005	328790	7.71	15.85	-
32	371525	50729	320796	7.32	10.54	-
Mean						
0	251542	42817	208725	5.87	-	-
8	277930	44463	233467	6.25	16.03	1503
16	312361	46113	266248	6.77	18.45	1987
24	308870	47821	261049	6.46	11.46	-
32	300737	49603	251134	6.06	7.25	-

Appendix 9. Yield contributing characters of hybrid maize as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 to 2004-05

Levels of Mg (kg ha^{-1})	Plant height (cm)	Cobs/plant (no.)	Grains/cob (no.)	1000-grain weight (g)
2002-03				
0	197	1.33	419b	320b
10	197	1.35	459a	345a
20	200	1.33	470a	346a
30	189	1.30	476a	344a
40	196	1.28	467a	342a
CV (%)	6.1	5.7	6.5	2.3
2003-04				
0	195	1.37	395b	325b
10	196	1.32	465a	341a
20	192	1.35	460a	344a
30	198	1.32	458a	344a
40	188	1.32	448a	340a
CV (%)	6.9	6.9	7.0	2.2
2004-05				
0	198	1.30	397b	319b
10	194	1.32	438a	342a
20	195	1.30	456a	345a
30	202	1.28	453a	341a
40	190	1.33	442a	342a
CV (%)	6.1	6.5	7.7	2.5

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

Appendix 10. Cost and return (partial economic analysis) of hybrid maize as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 to 2004-05

Mg Levels (kg ha^{-1})	Gross return (Tk ha^{-1})	Variable cost (Tk ha^{-1})	Gross margin (Tk ha^{-1})	MBCR	MRR (%)
			2002-03		
0	64585	0	64585	-	-
10	79193	2632	76561	5.6	455
20	79850	5264	74586	2.9	-
30	78510	7896	70614	1.8	-
40	76890	10528	66362	1.2	-
			2003-04		
0	66990	0	66990	-	-
10	81960	1895	80065	7.9	690
20	83515	3790	79725	4.4	-
30	80530	5685	74845	2.4	-
40	78650	7580	71070	1.5	-
			2004-05		
0	62455	0	62455	-	-
10	76650	2105	74545	6.7	574
20	79055	4210	74845	3.9	14
30	76995	6315	70680	2.3	-
40	72565	8420	64145	1.2	-
			Mean		
0	64677	0	64677	-	-
10	79268	2211	77057	6.6	560
20	80807	4421	76385	3.6	-
30	78678	6632	72046	2.1	-
40	76035	8843	67192	1.3	-

Response of vegetable crops to added fertilizer nutrients

Abstract

The experiment was conducted at Sylhet, Tangail, Narsingdi and Rangpur during rabi season of 2004-05 to find out an optimum fertilizer dose for the hybrid variety of different vegetable crops. Hybrid variety of Tomato, Cabbage and Cauliflower were tested against five different levels of NPK. A considerable response on the yield of crops to added nutrients was observed at all the locations. Yield increased with the increase of nutrients levels and the relationship was quadratic in nature in most cases. However, a linear relationship was also found in some locations.

Introduction

Tomato, Cabbage and Cauliflower are very popular winter vegetable crops in Bangladesh. Farmers' grow the vegetables all over the country. Recently, hybrid varieties of the vegetable crops are available in the market and farmers' grow the hybrid varieties. Due to higher yield hybrids become very popular to the farmers and area is increasing day by day. But fertilizer recommendations for hybrid varieties are not available in Bangladesh and no research work has so far been done in this regard. Therefore, it is very important to develop a national fertilizer recommendation for hybrid varieties for the country.

Materials and Methods

The experiment was conducted during 2004-05 at 4 different locations to determine optimum and economic dose of fertilizer nutrients for hybrid variety of vegetables. Hybrid variety of Cabbage, Cauliflower and Tomato were tested at Rangpur, Tangail, Narsingdi and Sylhet. Details about site characteristics and crop management are given in appendix table 1 & 2, respectively. The experiment was laid out in RCB design with six dispersed replications across the field. Five different levels of NPK for different crops were verified at different locations. The treatment concept was as follows-

Crop	Levels	N	P	K
Cabbage	0	0	0	0
	1	60	20	40
	2	120	40	80
	3	180	60	120
	4	240	80	160
Cauliflower	0	0	0	0
	1	50	25	40
	2	100	50	80
	3	150	75	120
	4	200	100	160
Tomato	0	0	0	0
	1	80	30	50
	2	160	60	100
	3	240	90	150
	4	320	120	200

Crop management practices followed at different locations are given in appendix table. Intercultural operations such as irrigation, weeding and pest control were done properly. From the yield data a response curve was drawn and the relation ship was quadratic in nature in most cases.

Results and Discussion

Location : Rangpur
Crop : Cauliflower

Response of cauliflower to added nutrients was found. Curd yield increased appreciably with the increase of nitrogen levels up to the application of 150 kg N/ha and after that level tended to decrease. Almost similar response to P and K was observed. A considerable yield increase was noticed up to 75 and 120 kg/ha of P and K. Curd yield started to decline after that level. More or less similar trend was observed in curd length, curd diameter and individual curd weight. From the yield data a response curve was drawn and the relationship was quadratic in nature. Fertilizer dose that maximized yield as well as profit was found out from the equation.

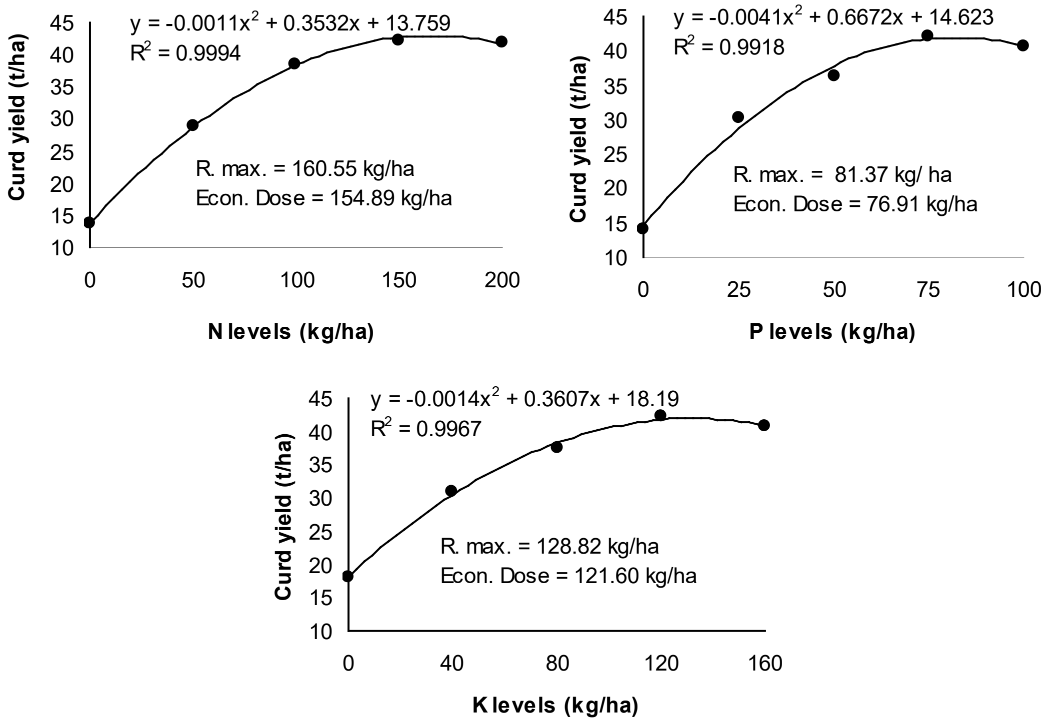


Figure 1. Response of Cauliflower to added NPK during 2004-05 at Rangpur

Table 1. Effects of different levels of fertilizer nutrients on the yield and yield attributes of Cauliflower at Rangpur during 2004-05

Level	Fertilizer (kg/ha)	Curd length (Cm)	Curd diameter (cm)	Curd weight with leaves (g)	Curd weight without leaves (g)	Yield (t/ha)
N	0	5.66	11.50	0.77	0.54	13.65
	50	6.45	16.03	1.65	1.13	28.89
	100	7.42	18.59	2.14	1.51	38.63
	150	7.50	20.44	2.31	1.68	42.25
	200	7.26	19.83	2.45	1.62	41.85
P	0	6.62	12.56	1.11	0.57	14.17
	25	6.78	16.31	1.70	1.20	30.13
	50	7.48	18.40	2.11	1.44	36.41
	75	7.50	20.44	2.31	1.68	42.25
	100	7.20	19.97	2.22	1.61	40.62
K	0	6.24	12.67	1.15	0.76	18.02
	40	6.78	16.00	1.59	1.23	31.04
	80	7.30	18.60	2.11	1.47	37.49
	120	7.50	20.44	2.31	1.68	42.25
	160	7.41	20.12	2.20	1.60	40.80

Location : Tangail
Crop : Cabbage

Response of Cabbage to added nutrients was found. Head yield increased markedly with the increase of nitrogen levels up to 60 kg N/ha and after that level yield also increased up to 180 kg/ha but comparatively a slower rate. But in case of P yield increased linearly with the increase of P and the highest yield was obtained with the highest level of P. A considerable response to potassium was also observed. Yield increased with the increase of K up to 120 kg/ha and after that level showed to decrease. More or less similar trend was observed in individual head weight. From the yield data a response curve was drawn and the relationship was quadratic in nature. Fertilizer dose that maximized yield as well as profit was found out from the equation.

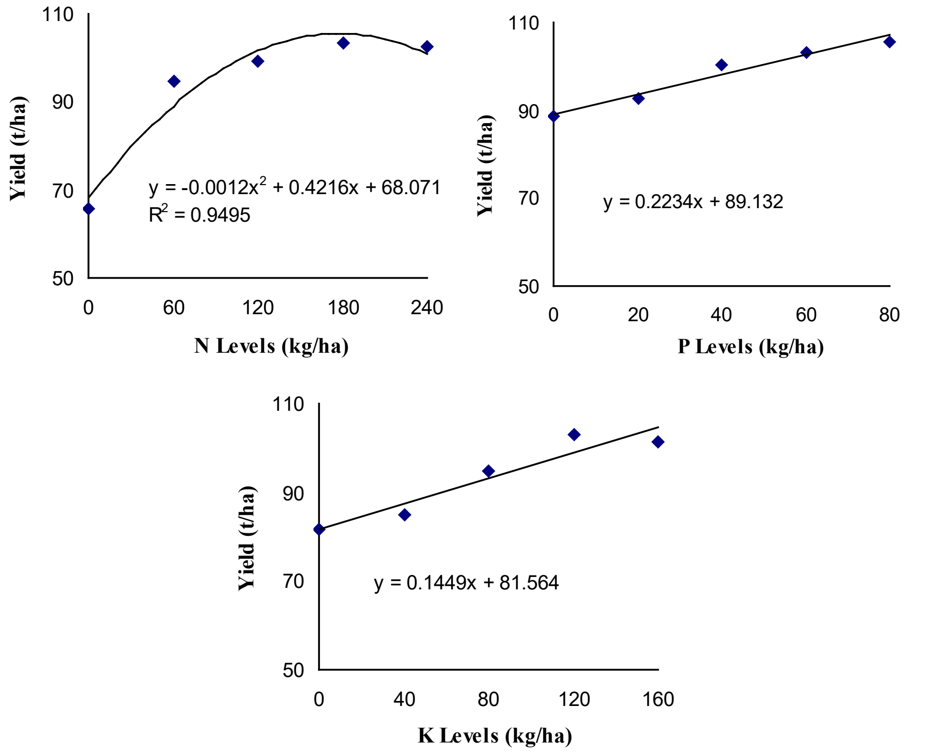


Figure 2. Response of Cabbage to added NPK during 2004-05 at Tangail

Table 2. Effects of different levels of fertilizer nutrients on the yield and yield attributes of Cabbage at Tangail during 2004-05

Level	Fertilizer (kg/ha)	Head diameter. (cm)	Individual head wt. (kg)	Head yield (t/ha)
N	0	20.31	2.36	65.72
	60	23.50	3.41	94.60
	120	24.33	3.57	99.14
	180	24.27	3.75	103.20
	240	23.77	3.67	102.40
P	0	22.33	3.19	88.68
	20	23.22	3.33	92.56
	40	23.50	3.60	100.20
	60	24.27	3.75	103.20
	80	24.33	3.80	105.70
K	0	22.22	2.93	81.53
	40	22.88	3.13	84.78
	80	23.00	3.47	94.97
	120	24.27	3.75	103.20
	160	23.66	3.57	101.30

Location : Shibpur, Narsingdi
Crop : Cauliflower

Response of Cauliflower to added nutrients was found. Curd yield increased appreciably with the increase of nitrogen levels linearly and the highest yield was obtained with the highest level of nitrogen (200 kg/ha). Regarding P and K a considerable response was found. Yield increased appreciably up to the application of 50 and 80 kg/ha of P and K. Curd yield started to decline after that level. From the yield data a response curve was drawn and the relationship was quadratic in nature. Fertilizer dose that maximized yield as well as profit was found out from the equation.

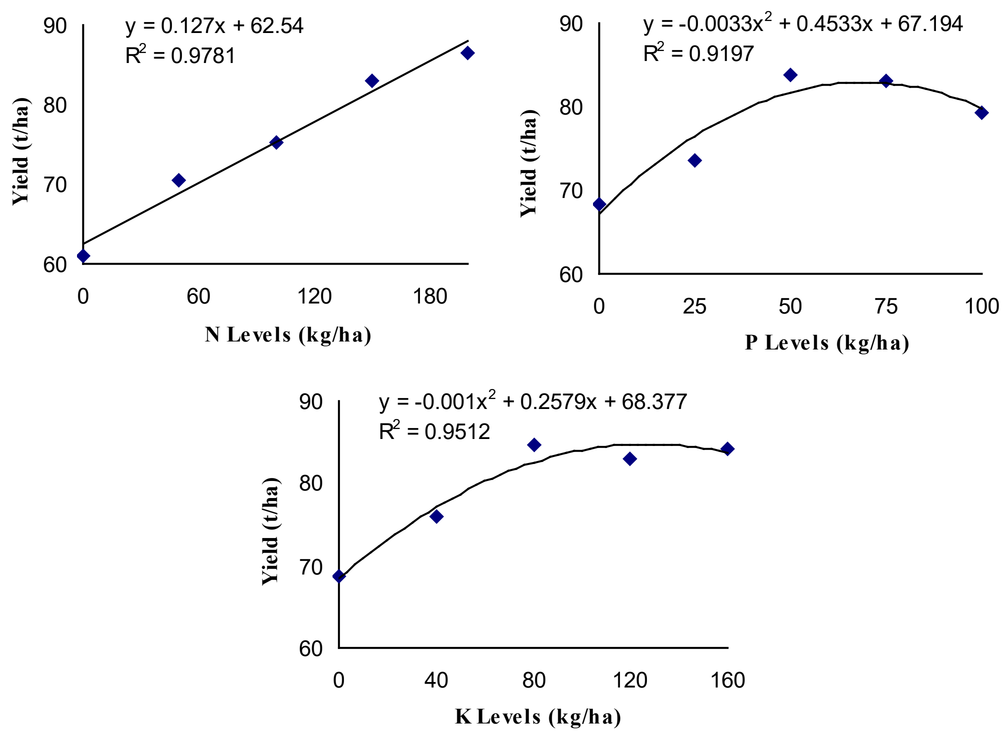


Figure 3. Response of Cauliflower to added NPK during 2004-05 at Narsingdi

Table 3. Effects of different levels of fertilizer nutrients on the yield of Cauliflower at Shibpur, Narsingdi during 2004-05

Level	Fertilizer (kg/ha)	Yield (t/ha)
N	0	61.0
	50	70.5
	100	75.2
	150	83.0
	200	86.5
P	0	68.3
	25	73.6
	50	83.7
	75	83.0
	100	79.4
K	0	68.6
	40	75.9
	80	84.7
	120	83.0
	160	84.2

Location : Sylhet
Crop : Tomato

Response of Tomato to added nutrients was found. Fruit yield increased considerably with the increase of nitrogen levels up to the application of 240 kg N/ha and after that level tended to decrease. Almost similar trend was observed in case of P and K. A considerable yield increase was noticed up to 90 and 150 kg/ha of P and K. Yield started to decline after that level. More or less similar trend was observed in individual fruit weight and yield in g/plant. But plant height and branches/plant increased linearly with the increase of nitrogen. From the yield data a response curve was drawn and the relationship was quadratic in nature. Fertilizer dose that maximized yield as well as profit was found out from the equation.

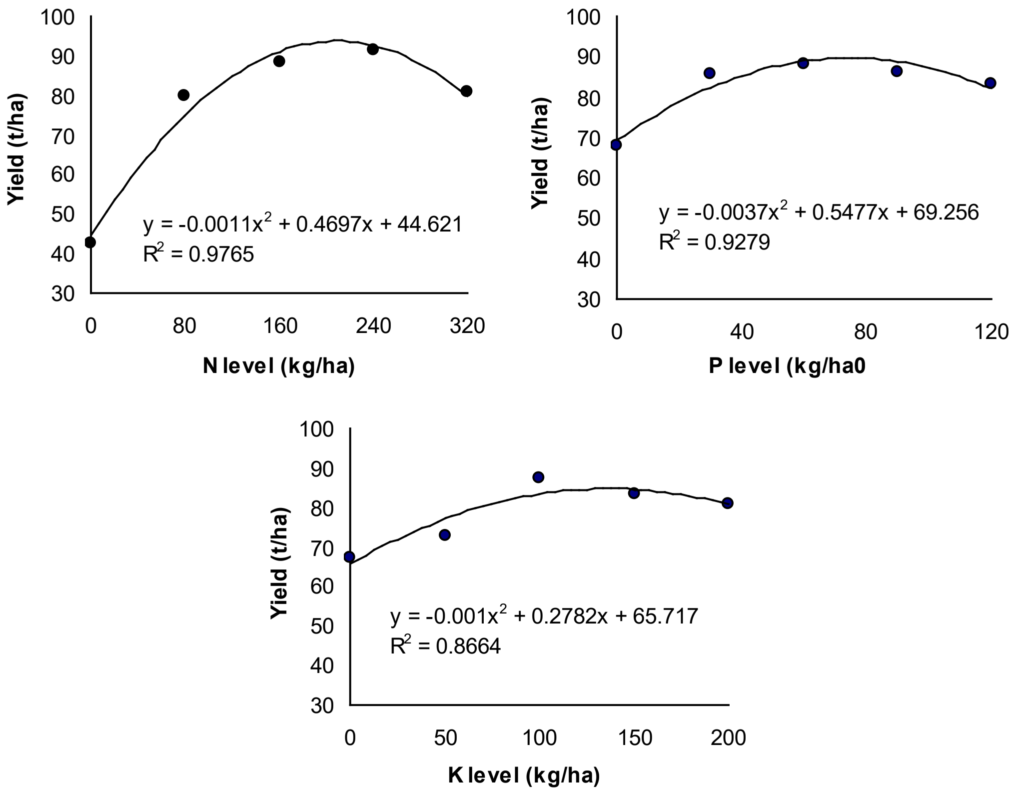


Figure 4. Response of Tomato to added NPK during 2004-05 at Sylhet

Table 4. Effects of different levels of fertilizer nutrients on the yield and yield attributes of Tomato at Sylhet during 2004-05

Level	Fertilizer (kg/ha)	Plant height (cm)	Branch/plant (no.)	Fruit wt. (g/fruit)	Yield (g/pl)	Yield (t/ha)
N	0	42.67	4.33	50.70	1.431	72.67
	80	79.77	4.55	53.55	1.443	79.77
	160	81.00	4.55	57.42	2.006	88.44
	240	83.44	5.11	60.37	2.657	91.33
	320	91.33	5.66	56.58	2.012	81.00
P	0	67.77	2.33	49.45	0.473	67.77
	30	85.55	4.33	50.82	1.503	85.55
	60	88.33	4.44	52.96	1.824	88.33
	90	83.44	5.11	60.37	2.657	91.33
	120	86.44	6.88	52.53	2.505	83.44
K	0	67.11	4.22	54.97	1.810	67.11
	50	72.99	4.56	57.02	1.971	72.99
	100	87.33	5.77	59.23	2.744	87.33
	150	83.44	5.11	60.37	2.657	91.33
	200	80.66	6.99	54.18	2.037	80.66

Appendix table: Crop management practices

Location	Crop	Variety	date of transplanting	Age of seedling	Spacing	Harvesting
FSRD Site	Tomato	Epock	20-12-04-04.01.05	30 days	80 cm x 60 cm	22 Mar.-15 Apr.'05
Rangpur	Cauliflower	Snow crown	01-04 Dec. 05	25-30 days	60 cm x 60 cm	10-15 Feb.05
Shibpur	Cauliflower	Atlas-70	3-15 Nov. 05	30 days	60 cm x 60 cm	5-10 Jan. 05
Tangail	Cabbage	Atlas-70	Last week of Oct.	30 days	60 cm x 60 cm	1st week of Jan.

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SUBPROJECT: VERIFICATION OF FERTILIZER MANAGEMENT PRACTICES

Effect of different time and depth of USG application on the growth and yield of Cabbage, Cauliflower and Tomato

Abstract

The experiment was conducted at FSRD site, Palima, Tangail during 2003-04 and 2004-05 two consecutive years to evaluate the effect of time and depth of USG placement on the performance of cabbage, cauliflower and tomato production. The treatments were 3 levels of depth and 4 levels of Urea Super Granule (USG) application in different days of interval. The effect of time on different yield contributing characters of cabbage, cauliflower and tomato were found significant. It was found that the higher head, curd and fruit yields were obtained from the combination of D_2T_2, i e. 8 cm depth and 10 days after transplant (DAT) of USG application followed by 4 cm depth and 10 DAT. Similar trend were observed for weight of head with outer leaves, pericycle, head diameter, head weight, head yield of cabbage, curd of cauliflower, individual fruit weight, number of fruit/plant and fruit yield of tomato, respectively. The results revealed that USG application 10 DAT at 8cm depth producing higher yield of cabbage, cauliflower and tomato production in Tangail region.

Introduction

Nitrogen is the most deficient nutrient element in Bangladesh soil, in general, farmers of the country apply at least nitrogenous fertilizer to their crops for better yield. 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. It is said that USG is more efficient than prilled urea in supplying N to crops as it is minimize loss by leaching and volatilization. USG is mostly used by farmers in boro rice and it is reported that 20-30 % nitrogen could be saved by using USG compared to prilled urea. During the last couple of years farmers in some parts of the country using USG in upland vegetables and fruit crops like brinjal , cabbage, cauliflower, tomato, papaya and banana. However, there is no recommendation of USG on upland crops, so far research findings in this regard are very scanty. Environment in wetland rice is quite different from upland condition and efficiency of USG in upland crops are yet to be ascertained. Recently OFRD, BARI, Tangail has established from their research that10-20 % less then recommended USG application was economically profitable in comparison to prilled urea in different vegetables such as potato, tomato, cabbage, cauliflower and brinjal. Most of the farmers apply USG in different times and depth in different vegetables. As a result applied N is not properly utilized for the growth and yield of vegetables. Proper time and placement depth of USG is the most important factor for the efficient use of N, maximum growth and yield of vegetables. In the context the experiment was designed with the following objectives-

- > To find out the optimum time and depth placement of USG
- > To increase of N use efficiency and profitability of the farmers

Materials and Methods

The experiment was conducted at FSRD site, Palima, Tangail during 2003-2004 and 2004-05 two consecutive years in the medium highland under AEZ-8. The experiment consists of 3 levels of depth and 4 levels of time of USG application followed by split plot design with 6 replications. Treatments were as depth of placement (03) i.e., 04, 08 and 12 cm (D_1 = 04 cm, D_2 = 08 cm, D_3 = 12 cm) and time of application (04) i.e., 0, 10, 15 and 20 DAT (T_1= 0 DAT, T_2= 10 DAT, T_3=15 DAP, T_4= 20 DAT). The unit plot size was 4mx5m. Before conducting the field experiment soil samples were collected from each plot and its chemical analysis was done. Details about initial nutritional status of soils, crop management and fertilization are provided in appendix tables A, B and C. All fertilizers were applied on the basis of soil analysis value as per recommendation (FRG'97, BARC) during the final land preparation except USG. The USG was applied at 0,10 , 15 and 20 DAT as ring method

8 cm apart from plant stalk in different depth which were mentioned in appendix table E. The necessary crop management practices were done as a when necessary (appendix table-D). The data on different plant characters and yield components were collected from the sample of 10 plants selected at random in each plot and yield was recorded plot wise. Data were analysed statistically using MSTATC package.

Results and Discussion

Cabbage

Effect of depth: Head yield and yield attributes of cabbage were significantly influenced by depth of USG application (Table 1). The bigger head diameter contributed higher head yield in 8 cm depth of USG application of variety Atlas-70, 2003-04. But Autumn Queen gave higher yield in 4 cm depth of USG application.

Effect of placement time: Marketable head yield, head diameter and weight of single head were presented in Table 2. Bigger size of head was produced by 10 days application of USDG, which contributed the higher head yield in each variety of both the years.

Interaction effect of depth and placement time: Interaction effect of depth and placement time of USG was found significant on yield and yield attributes (Table 3 & 4). In both the year, number of outer leaves/plant was affected by the different time of USG application and depth. The maximum number of outer leaves/plant was recorded from the treatment combination D_2T_2 followed by D_2T_4 (Table 3). The lowest outer leaves/plant was produced by the treatment combination D_1T_3. The highest head diameter was obtained from D_1T_2 which was followed by D_2T_2 (Table 4). The lowest head diameter was recorded from the treatment combination D_1T_1. The highest head yield was obtained from D_2T_2 treatment combination which was followed by D_1T_2 in both the year for each variety, i.e. similar trend of results were observed in both the of each variety.

Conclusion

The results revealed that USG application 10 DAT at 8cm depth producing higher yield of cabbage, cauliflower and tomato production in Tangail region.

Table 1. Effect of different depth of USG on yield and yield attributes of cabbage (hybrid- Autum Queen, 2004-05 and Atlas-70 in 2003-04

Depth (cm)	Autumn Queen, 2004-05			Atlas-70, 2003-04		
	Head dia.(cm)	Wt. single head. (Kg)	Yield t/ha)	Head dia.(cm)	Wt. single head. (Kg)	Yield t/ha)
D_4	27.27	2.89	91.34	21.20	2.37	66.04
D_8	24.93	3.28	87.28.	21.33	2.39	66.45
D_{12}	22.07	3.14	80.48	21.30	2.22	61.56
CV (%)	4.96	6.83	6.83	0.57	0.38	10.68
LSD	1.39	0.08	2.26	3.99	1.76	4.91

Table 2. Effect of placement of time on yield and yield attributes of cabbage (hybrid-Autum Queen, 2004-05 and Atlas-70 in 2003-04

Time (Days)	Autumn Queen, 2004-05			Atlas-70, 2003-04		
	Head dia.(cm)	Wt. single head. (Kg)	Yield t/ha)	Head dia.(cm)	Wt. single head. (Kg)	Yield t/ha)
T_0	24.27	3.48	96.87	21.15	2.44	67.90
T_{10}	24.93	3.75	104.30	22.35	2.59	71.92
T_{15}	22.07	2.59	72.15	21.06	2.24	62.22
T_{20}	22.91	2.59	72.18	20.57	2.04	56.69
CV (%)	3.99	6.83	6.83	3.99	0.38	10.68
LSD	1.58	0.10	2.92	0.84	0.24	6.84

Table 3. Interaction effects of Depth and Time on yield and yield attributes of Cabbage (hybrid-Autum Queen), 2004-05

Depth (cm) x Time(day)	No. of outer leaves//plant	Head diameter (cm)	Wt. single head (Kg)	Head yield (t/ha)
4 × 0	14.20	22.87	3.27d	91.01d
4 × 10	13.73	21.47	3.56c	98.88c
4 × 15	13.53	22.13	2.37f	65.92f
4 × 20	14.27	24.87	2.38f	66.10f
8 × 0	14.07	25.87	3.48c	96.84c
8 × 10	14.80	25.73	4.23a	117.60a
8 × 15	13.73	21.67	2.74e	76.10e
8 × 20	14.67	23.27	2.69e	74.81e
12 × 0	14.67	25.07	3.70b	102.80b
12 × 10	14.13	25.13	3.46c	96.29c
12 × 15	14.07	23.07	2.68e	74.43e
12 × 20	14.27	23.33	2.72e	75.63e
LSD(0.05)	1.49	2.00	0.10	2.92
CV (%)	4.92	3.99	8.37	6.83

Table 4. Interaction effects of Depth and Time on yield and yield attributes of Cabbage (cv.Atlas-70), 2003-04

Depth (cm) x Time(day)	No. of outer leaves/plant	Head diameter (cm)	Wt. single head (Kg)	Head yield (t/ha)
4 × 0	12.35	19.77	2.38	66.36
4 × 10	11.84	22.55	2.81	74.18
4 × 15	11.77	20.93	2.27	63.17
4 × 20	13.11	21.55	2.15	59.73
8 × 0	13.35	21.75	2.50	69.47
8 × 10	12.00	22.53	2.69	74.92
8 × 15	12.27	21.18	2.32	64.51
8 × 20	12.47	19.87	2.07	57.66
12 × 0	12.27	21.91	2.44	67.88
12 × 10	12.11	21.95	2.39	66.66
12 × 15	12.33	21.07	2.12	58.99
12 × 20	12.67	20.29	1.90	52.70
LSD(0.05)	1.04	1.47	0.42	11.85
CV (%)	4.92	3.99	1.77	4.92

Cauliflower

Effect of depth: Yield and yield attributes were significantly influenced by depth of USG application in cauliflower (Table 1). No. of outer leaves were insignificant in 2003-04 but highest in 8 cm depth in 2004-05. Similar trend was followed in case of weight of curd. Curd yield with outer leaves were insignificant to 2003-04 but significantly higher yield was recorded from 8 cm depth followed by 4 cm depth. Higher curd yield was recorded from 8 cm depth followed by 4 cm depth. Similar trend was followed in both the years. On an average 8cm and 4cm depth of USG application showed similar curd yield and higher than 12 cm depth.

Effect of placement of time: Number of outer leaves /plant was not significantly influenced by time of USG application. Curd weight showed higher in 10 days after transplantation in both the years. Decrease curd yield with the increasing of days and lowest from delayed placement. Similar trend was observed in case of yield attributes. On an average, higher curd yield was obtained from 10 days after application of USG (Table 2).

Interaction between depth and time: Yield and yield attributes were significantly influenced by depth and time of application (Table-3). There was trend to decrease yield attributes with the advancement of time of application from 10 days to 20 days in all depth. Significantly highest curd yield was recorded from 8-cm depth and application of USG after 10 days in 2004-2005 but in 2003-2004, higher curd yield was obtained from 8-cm depth 10 days application followed by 4 cm depth after 10 days application. On an average of 2 years 8 cm depth with 10 days application of USG showed higher curd yield as compared to others treatments.

Table 1. Effect of different depth of USG on the yield and yield attributes of cauliflower, 2003-05

Depth (cm)	No. of outer leaves/plant		Curd wt. (kg/plant)		Curd yield with outer leaves (t/ha)		Curd yield (t/ha)		Mean yield (t/ha)
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	
$D_{1(04)}$	19.82	23.35	0.43	0.99	48.64	54.75	30.86	39.72	35.29
$D_{2(08)}$	19.80	2382	0.44	1.06	49.65	56.69	31.76	39.53	35.64
$D_{3(12)}$	19.57	23.17	0.42	0.94	48.73	51.82	29.59	35.83	32.71
LSD(0.05)	NS	0.40	NS	0.07	NS	3.83	1.22	2.26	-
CV (%)	3.22	1.89	3.80		2.31	3.57	3.12	3.13	

Table 2. Effect of placement of time on the yield and yield attributes of cauliflower, 2003-05

Time (Days)	No. of outer leaves		Curd wt. (kg/plant)		Curd yield with outer leaves (t/ha)		Curd yield (t/ha)		Mean yield (t/ha)
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	
$T_{1\ (0)}$	19.67	23.41	0.44	1.02	50.82	54.02	31.81	37.77	34.79
$T_{2\ (10)}$	19.87	23.84	0.48	1.05	50.70	57.57	33.17	40.12	36.64
$T_{3\ (15)}$	19.89	23.62	0.41	0.98	47.69	53.74	29.21	36.54	32.87
$T_{4\ (20)}$	19.49	22.90	0.38	0.94	46.82	52.34	28.63	35.02	31.82
LSD(0.05)	0.63	0.79	0.03	0.04	1.32	2.94	0.94	1.82	------
CV (%)	3.22	1.89	3.80		2.31	3.57	3.12	3.13	

Table 3. Interaction effects of Depth and Time of USG placement on the growth, yield and yield attributes of cauliflower, 2003-05

Depth (cm) x Time (day)	No. of outer leaves /plant		Individual curd weight kg)		Curd yield with outer leaves (t/ha)		Curd yield (t/ha)		Mean Curd yield (t/ha)
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	
4 × 0	20.20	23.13	0.45	1.00	50.49	53.45	32.59	37.03	34.81
4 × 10	20.07	23.97	0.49	1.05	51.60	59.01	33.45	38.88	36.16
4 × 15	20.00	23.93	0.40	0.98	46.66	53.58	29.13	36.54	32.83
4 × 20	20.00	22.37	0.38	0.93	45.80	52.96	28.39	34.44	31.41
8 × 0	19.80	24.33	0.47	1.11	50.86	55.15	32.96	41.11	37.03
8 × 10	19.80	24.10	0.51	1.16	51.85	61.11	33.95	43.08	38.51
8 × 15	19.67	23.53	0.42	1.01	48.26	56.91	29.34	37.65	33.49
8 × 20	19.60	23.30	0.39	0.98	47.65	53.58	28.63	36.29	32.46
12 × 0	19.47	22.77	0.41	0.95	51.11	53.45	29.87	35.18	32.52
12 × 10	19.47	23.47	0.46	0.94	48.64	52.59	32.10	38.39	35.24
12 × 15	19.33	23.40	0.41	0.95	48.14	50.74	29.13	35.43	32.28
12 × 20	19.33	23.03	0.39	0.92	47.03	50.49	28.88	34.32	31.60
LSD(0.05)	1.09	1.37	0.05	0.08	2.29	5.10	1.64	3.14	-

Tomato

Effect of depth: Yield and yield attributes were significantly influenced by depth of USG application in Tomato. Number of fruits per plant was significant in years 2003-04 and 2004-05. The maximum number of fruits was recorded in 8 cm depth in 2004-05. Similar treat was followed in case of weight of fruits per plant and individual fruit weight. The highest fruit weight 128.20g was recorded in 8 cm depth in 2004-05. Fruit yield were significantly varied in 2003-04 and 2004-05. Higher yield (112 t/ha) was recorded from 8 cm depth followed by 4 cm depth in 2004-05. Average of two years, 8 cm depth of USG application gave maximum fruit yield and higher than 4 and 12 cm depth (Table 1).

Effect of placement of time: Yield, individual fruit weight and number of fruits per plant were significantly influenced by time of placement of USG in Tomato. Maximum numbers of fruits per plant were in USG placement after 10 days of transplantation in both the years. Decrease individual fruit weight with the increasing of days and lowest from delayed placement. Similar treat was observed in case of yield and yield attributes. On an average, higher fruit yield (105.46 t/ha) was obtained from the USG placement after 10 days of transplantation (Table 2).

Interaction between depth and time: Yield and yield attributes were significantly influenced by depth and time of application (Table 3). There was trend to decrease yield and yield attributes with the advancement of time of USG application from 10-20 days in all depth. Significantly highest fruit yield of Tomato was recorded from 8 cm depth and application of USG after 10 days in both the years. On an average of two years result showed that 8 cm depth with application of USG after 10 days of transplantation gave higher fruit yield as compared to others treatments.

Table 1. Effect of different depth of USG placement on the growth, yield and yield attributes of Tomato, 2003-05

Depth (cm)	No. of fruits /plant		Wt. of fruit (kg/plant)		Individual fruit weight (g)		Fruit yield (t/ha)		Average of two years (t/ha)
	2003 -04	2004 -05	2003 -04	2004-05	2003-04	2004-05	2003-04	2004 -05	
$D_{1(04)}$	24.64	29.42	1.90	2.68	76.83	124.3	76.13	107.2	91.66
$D_{2(08)}$	25.39	29.28	1.96	2.76	77.33	128.2	76.05	112.0	94.02
$D_{3(12)}$	24.68	26.94	1.73	2.59	69.92	120.3	69.14	103.9	86.52
LSD(0.05)	0.71	2.58	0.55	0.18	3.17	3.12	4.49	6.26	2.63

Table 2. Effect of different time of USG application on the growth, yield and yield attributes of Tomato, 2003-05

Time of placement (days)	No. of fruits /plant		Wt. of fruit (kg/plant)		Individual fruit weight (g)		Fruit yield (t/ha)		Mean yield (t/ha)
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	
$T_{1\,(0)}$	24.55	30.37	1.69	2.78	69.33	142.8	67.90	111.5	89.70
$T_{2\,(10)}$	26.79	35.44	2.16	3.11	80.89	149.4	84.43	126.5	105.46
$T_{3\,(15)}$	25.37	26.67	1.90	2.63	74.89	107.0	76.04	105.6	90.82
$T_{4\,(20)}$	22.89	21.70	1.68	2.18	73.67	97.89	66.72	87.29	77.00
LSD(0.05)	0.47	2.49	0.14	0.12	2.01	4.47	4.36	6.94	2.62

Table 3. Interaction effects of Depth and Time of USG placement on the yield and yield attributes of Tomato 2003-05

Depth (cm) X Time (day)	No. of fruits /plant		Wt. of fruit (kg/plant)		Individual fruit weight (g)		Fruit yield (t/ha)		Average of two years (t/ha)
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	
4 × 0	24.33	31.67	1.71	2.80	70.00	141.70	68.35	112.0	90.17
4 × 10	26.55	36.56	2.14	3.13	81.67	149.00	85.91	125.3	105.60
4 × 15	25.22	26.78	1.95	2.65	76.33	108.00	78.13	106.0	92.06
4 × 20	22.44	22.67	1.79	2.14	79.33	98.67	72.14	85.60	78.87
8 × 0	24.77	30.89	1.80	2.87	73.67	150.70	72.11	114.9	93.50
8 × 10	27.55	38.00	2.44	3.27	89.00	153.30	91.15	136.7	113.92
8 × 15	26.00	26.67	1.90	2.64	74.00	108.00	76.17	105.7	90.93
8 × 20	23.22	21.56	1.68	2.26	72.67	100.70	64.75	90.53	77.64
12 × 0	24.55	28.56	1.58	2.68	64.33	136.00	63.24	107.5	85.42
12 × 10	26.27	32.78	1.91	2.94	72.00	146.00	76.23	117.6	96.91
12 × 15	24.89	26.55	1.84	2.62	74.33	105.00	73.82	104.9	89.36
12 × 20	22.99	20.89	1.58	2.14	69.00	94.33	63.26	85.73	74.49
LSD(0.05)	0.81	4.31	1.02	0.21	3.48	7.74	7.55	12.02	4.64

Appendix table A. Initial Soil test values of experimental plots of cabbage

Soil texture	%			K (meq. /100g soil)	µg/g soil			
	PH	OM	Total N		P	S	B	Zn
Sandy clay loam	5.8 S. acidic	1.72 Medium	0.15 Low	0.10 Low	5.20 Very low	13 low	0.188 Low	7.534 High

Appendix table B. Initial soil test values of the experimental plots of cauliflower

Soil texture	PH	%		µg / g soil				K meq / 100 g soil
		OM	Total N	P	S	B	Zn	
Sandy clay loam	5.9	1.75 Medium	0.061 Very low	5.22 Very low	14 Low	0.190 Low	8.00 Very high	0.12 Low

Appendix table C. Initial soil test values of the experimental plots of tomato

Soil texture	PH	OM (%)	N (%) (Total)	P (µg/g)	K (meq/100g)	S (µg/g)	B (µg/g)	Zn (µg/g)
Sandy clay loam	6.14 Sl. acidic	1.72 Medium	0.09 V. low	21.23 Medium	0.09 Very Low	9.05 Low	1.58 Very high	1.26 Medium

Appendix table D. Crop management

Crop	Variety	Spacing	Planting time	Harvesting time	Irrigation (no.)	Weeding (no.)	Pesticide
Cabbage	Atlas-70	60cm x 60cm	22, October /04	Last week of December	01	3	Dithane M-45
Cauliflower	Milkway	60 cm x 60 cm	22,October /04	2nd week of January	01	4	Acrobat MZ
Tomato	BARI tomato-8	60 cm x 40 cm	25,October /04	2nd week of February	01	02	Dithane M-45,

Appendix Table E. Fertilization

Crop	Fertilizer rate (kg/ha)	Application Method
	NPKS and CD	
Cabbage	152-56-162-13+3000	10 balls of USG (1g/ball)was applied as ring method 8cm apart from the plant at 0,10,15 and 20DAT in 3 levels of depth viz.04 cm,08 cm and 12 cm
Cauliflower	97-50-80-10+3000	8 balls of USG (1g/ball)was applied as ring method 8 cm apart from the plant at 0,10,15 and 20DAT in 3 levels of depth viz.04 cm,08 cm and 12 cm
Tomato	155 -21-163-37	8 balls of USG (1g/ball)was applied as ring method 8 cm apart from the plant at 0,10,15 and 20DAT in 3 levels of depth viz.04 cm,08 cm and 12 cm

Effect of Urea Super Granule (USG) on the performance of Banana

Abstract

The experiment was conducted at MLT site, Modhupur, Tangail and Syedpur, FSRD, Rangpur for consecutive years of 2003-04 and 2004-05 in medium high land under AEZ-28 to observe the efficiency of USG application on Banana production in comparisons to application of prilled urea. There were five treatments viz. T_1- prilled urea (rec.), T_2-USG (rec.), T_3- USG 10 % < rec., T_4-USG 20 % <rec., and T_5-farmers practice. Effect of urea super granule on different parameters was found significant. The result revealed that the highest BCR (4.57) was obtained from 10% less USG treatment.

Introduction

In our country different types of fertilizer materials are becoming available in the market. Urea Super Granule (USG) is one of the most popular nitrogenous fertilizer which is now available in the market and the farmers are already using it in boro rice and also using it in different upland vegetables and fruit crops such as brinjal, cabbage, cauliflower, banana etc. Banana is one of the profitable crops at Tangail and now about 2000 ha of land under its cultivation. The cultivation area of this crop is increasing day by day. But the efficiency of USG to this crop is yet to be established, however the farmers already using it in their crop. Therefore it is very important to evaluate the efficiency of USG on Banana. Hence the experiment was undertaken to find out the optimum and economic dose of USG for Banana.

Materials and Methods

The experiment was carried out at MLT site, Modhupur, Tangail and Syedpur FSRD, Rangpur for consecutive two years of 2003-04 and 2004-05 in the medium highland under AEZ-28. The study was laid out having RCB design with four dispersed replications. The unit plot size was 8 m X 10 m, with spacing 2 m X 2 m. The variety Amrit Sagar was used in this experiment. The crop was sown in October. The crop was sown in October. The suckers were planted in 60 cm x 60 cm x 60 cm size of pit. The size of the USG granule is 19m. The five treatments were considered as T_1 = Prilled urea .(Recommended dose),T_2 = USG (Recommended dose),T_3 = USG 10 % < Rec. dose, T_4= USG 20 % < Rec. dose and T_5= Farmers practices. Soil samples were collected and its chemical analysis was done, before setting of the experiments. The soil analysis values based on chemical analysis were P^H (5.0), OM (1.50 %), N (0.10 %), P (21.97 mg), K (0.05 mg), S (4.13mg), B (0.04 mg/g) and Zn (91.01 mg/g). The values showed that NKS and B very low, P optimum, Zn medium respectively at Tangail whereas at Rangpur soil analysis showed pH 6.26, N (0.07%), P (64.49 mg), K (0.37mg), S (11.49 mg), B (0.52 mg/g) and Zn (1.33 mg/g). The values showed that N very low, K high, Mg & S low, P very high, Zinc medium , B optimum respectively.

Fertilizer dose for each treatment were calculated on the basis of soil test values followed by FRG, BARC, 1997. They are as follows-

T_1= Prilled urea for HYG (Rec.) = 0.650-0.400-0.300-4.000 kg/plant
T_2= USG for HYG (Rec.) = 0.650-0.400-0.300-4.000 kg/plant
T_3= USG 10 % less than T_2 = 0.585-0.400-0.300-4.000 kg/plant
T_4= USG 20 % less than T_2 = 0.520-0.400-0.300-4.000 kg/plant and
T_5= Farmer's practices = 0.750-1.000-1.000-5.000-1.500 kg/plant
Urea, TSP, MP, CD and OC/pit

USG was applied as ring method 30 cm, 60 cm and 90 cm from plant stalk for 1, 2 and 3 top dress of fertilizer respectively and 7.5-10 cm depth in soil. Twice weeding and irrigation was done in a cropping season before fertilization of soil. Plant protection measures viz- insecticides and fungicides were necessary because banana is susceptible to pest and diseases. Furadan and tilt were applied as recommended dose for controlling beetle and sigatoga diseases respectively. Collected data were analyzed statistically using computer package MSTATC. Cost and return analysis was done.

Methods of fertilizer application

For treatment T_1 (50 % cow dung during land preparation, 50 % cow dung and 50 % TSP during pit preparation, 25 % urea, 50 % TSP , 50 % MP applied 60 DAP, 50% Urea, 50 % MP applied at 135 DAP, rest 25 % Urea applied at flowering stage). For T_2, T_3 and T_4 same as T_1 except, urea. USG was applied in 3 equal splits at 60, 135 DAP and before flowering. For T_5 same as T_1, but mustard oil cake was applied in 3 equal splits at 60, 135DAP and before flowering followed by ring method. The ring was also covered with soil just after application of fertilizer.

Results and Discussion

Location: Palima, Tangail

2003-04: The yield and yield contributing characters were studied and presented in Table 1. Results revealed that significantly highest number of suckers per plant (7.86) was obtained in T_1 treatment. The higher number of leaves per plant was recorded from the treatment T_2 which was statistically different from treatment T_4 and T_5 but similar to that of treatments T_1 and T_3. Highest number of banana /charry was obtained from farmer's dose but statistically as per to other treatments except T_2. The significant variation was not found in case of Banana length. The highest weight of charry (22.70 kg) was recorded in farmer's dose, which was statistically different from other treatments. Remarkable variation was not found among the treatments in case of number of flowered plant / 80 m^2 and weight of Banana. Higher yield was obtained from treatment T_2 which was closely followed by T3 but significantly different from treatment T_4.

2004-05: Results for the year of 2004-05 are presented in Table 2, insignificant number of suckers per plant, number of flowered and length of banana was found. Maximum number of leaves per plant was recorded in T_1 treatments followed by T_2 and T_3. The plants received recommended dose of USG (T_2) gave maximum number of banana per charry but statistically as par to treatment T_1. The lowest number of banana per charry was produced by T_3 followed by T_5. Remarkable variation was measured in individual weight of charry where significantly highest weight of charry (28.52kg) was recorded from treatment T_2. Maximum weight of a single banana was recorded from T_2, but statistically identical to T_3. Higher yield was obtained from T_2 which was statistically as per to treatment T_3. On an average higher yield was recorded from treatment T_2 which was closely followed by T_3 and lowest from T_5.

Cost and return analysis: Higher gross return and net return was recorded from treatment T_2 which was followed by T_3 but higher cost than other treatments except farmer's practices**.** The cost of cultivation was much higher than the other treatments, because farmer used higher doses of fertilizers Though higher return was recorded from treatment T_2 but slightly lower BCR was recorded as compared to treatment T_3 i.e. 10% less USG was used. Prilled urea showed slightly lower cost than USG, but lower return & BCR was obtained.

Location: Syedpur, Rangpur

The result presented in table 4 indicated that there was significant difference among the treatments in respect of all characters studies except plant height length and diameter of finger. Higher yield (55.64 t/ha in 1st year and 54.12 t/ha in 2nd year) of banana was obtained from T_2, where recommended doses of N from USG was applied but it was statistically identical to the yield obtained from T_3 where 10% less N as USG. The lowest yield was recorded from farmer dose which was statistical at par to the yield of T_3, T_4 and T_1 respectively. Higher banana head yield of T2 might be due to higher weight of bunch per plant. These results indicated that urea super granule had significant effect on banana production as compare to prilled urea in both the years. On an average USG showed 13% increase yield over prilled urea and 16% over farmer practice.

The two years results of economic analysis have been shown in table 3. The average highest gross return (Tk. 168295 t/ha), gross margin (Tk. 110462 t/ha), BCR (2.91), MBCR over prilled urea (11.87) calculated from the application of 100% USG as a source of N which was followed by 10% less recommended N as USG. These results implied that the use of both 100 and 10% less recommended N from USG were found economically viable for the production of banana.

Conclusion

Based on two years results it could be concluded that urea super granule (USG) is better for banana cultivation and 10% less than recommended dose of USG is more profitable for the farmers is both the sites (Tangail and Rangpur).

Table 1. Effect of USG and prilled urea on yield and yield contributing characters of Banana at MLT site, Modhupur, Tangail during 2003-04

Treat.	No. of Sucker/ plant	No. of leaves /plant	No. of Banana /chari	Length of Banana	Wt. of chari (kg)	No. of Flowered / 80m²	Wt. of Banana (g)	Yield (t/ha)
T_1	7.86a	17.07ab	117.7ab	18.27a	19.00c	17.00b	156.7a	45.54ab
T_2	5.33b	17.60a	114.7b	17.40a	20.90b	19.67a	159.3a	48.72a
T_3	6.13b	17.00ab	115.9ab	18.00a	20.47b	18.67ab	160.3a	48.58a
T_4	6.20b	16.33b	115.6ab	17.80a	17.53d	19.00a	158.0a	42.30b
T_5	6.13b	16.63b	127.3a	14.33a	22.70a	19.00a	161.3a	46.28ab
LSD (0.05)	1.47	0.922	11.86	NS	1.23	1.78	NS	4.31

Means followed by same letter is not significantly different at 5% level by DMRT

Table 2. Effect of USG and prilled urea on yield and yield contributing characters of Banana at MLT site, Modhupur, Tangail during 2004-05

Treat.	No. of Sucker/ plant	No. of leaves /plant	No. of Banana /chhari	Length of Banana	Wt. of chhari (kg)	No. of Flowered/ 80m²	Wt. of Banana (g)	Yield (t/ha)
T_1	9.40a	21.00a	156.2ab	19.60a	26.40c	19.67a	169.3c	66.00c
T_2	9.66a	20.53ab	161.5a	20.07a	28.52a	19.67a	198.3a	71.30a
T_3	9.53a	20.40ab	145.5c	20.00a	27.50b	19.33a	192.7a	68.75a
T_4	9.53a	19.73b	153.6b	21.47a	27.07b	19.67a	181.7b	67.68b
T_5	9.26a	19.93b	150.7bc	21.73a	23.83d	19.33a	177.7bc	59.58bc
LSD(.05)	NS	2.17	2.07	NS	2.61	NS	2.80	2.41

Means followed by same letter is not significantly different at 5% level by DMRT

Table 3. Cost - benefit analysis of USG on Banna cultivation (average of 2 years)

Treatment	Yield (t/ha)	Gross return (Tk/ha)	Total cost (Tk/ha)	Net Return (Tk/ha)	BCR
T_1	55.77	200687	44637	156050	4.49
T_2	60.01	220935	48950	171985	4.51
T_3	58.66	219708	48075	171633	4.57
T_4	54.99	2011087	47125	153984	4.27
T_5	52.93	195461	121337	74124	1.61

Price (TK/Kg): T1= 3.60, T2= 3.68, T3= 3.74, T4= 3.66 and T5= 3.69

Table 4. Effect of USG on yield contributing characters of banana at Syedpur FSRD site, OFRD, BARI Rangpur during 2002-03 and 2003-04

Treatment	Plant height (cm)	No. of finger/hand (no.)	Length of finger (cm)	Diameter of finger (cm)	Weight of bunch/plant (kg)
	2002-03				
T_1	298	15.6ab	21.0	12.0	23.28b
T_2	313	16.4a	21.5	12.8	25.96a
T_3	302	16.0a	21.6	12.4	24.39ab
T_4	301	14.5bc	22.0	12.1	23.77ab
T_5	309	13.43c	21.0	12.1	22.77b
CV (%)	7.8	6.9	2.8	4.9	7.8
	2003-04				
T_1	294.0	15.81a	21.2	11.85	22.59b
T_2	310.3	16.36a	21.6	12.40	25.47a
T_3	307.7	16.15a	21.5	12.26	23.85ab
T_4	302.9	14.04b	21.7	11.71	23.17b
T_5	304.3	13.04b	21.4	11.61	21.77b
CV (%)	6.4	9.1	3.3	5.2	7.0

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

Table 5. Effect of urea super granule (USG) as a source of N on the yield of banana Syedpur, Rangpur, during 2002-03 and 2003-04

Treatment	Yield (t ha^{-1})				
	2002-03	2003-04	Mean of 2 years	% Increased over T_1	% Increased over T_5
T_1	49.63b	47.83bc	48.73	-	2.76
T_2	55.64a	54.12a	54.88	12.62	15.73
T_3	52.98ab	51.39ab	52.19	7.10	10.06
T_4	49.96b	48.46bc	49.21	0.99	3.77
T_5	48.82b	46.02c	47.42	-	-
CV (%)	7.6	7.9	-	-	-

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

Table 6. Cost and return of banana as affected by USG application at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03 and 2003-04

Treatment	Gross return (Tk ha^{-1})	Total variable cost (Tk ha^{-1})	Gross margin (Tk ha^{-1})	BCR	MBCR over PU (100%)
Rabi 2002-03					
T_1	146634	57085	89549	2.57	-
T_2	164391	58676	105715	2.80	11.16
T_3	156532	58040	98492	2.70	10.36
T_4	147609	57403	90206	2.57	3.07
T_5	144241	78930	65311	1.83	-
Rabi 2003-04					
T_1	152186	55401	96785	2.75	-
T_2	172200	56992	115208	3.02	12.58
T_3	163514	56356	107158	2.90	11.86
T_4	154191	55719	98472	2.77	6.31
T_5	146427	82180	64247	1.78	-
Mean of 2 years					
T_1	149410	56243	93167	2.66	-
T_2	168295	57834	110462	2.91	11.87
T_3	160023	57198	102825	2.80	11.11
T_4	150900	56561	94339	2.67	4.69
T_5	145334	80555	64779	1.80	-

T_1 = Recommended dose (143 g/pit) of N from prilled urea + 0-0-40-4-6000-0 g P-K-S-Mg-CD-MOC ha^{-1}
T_2 = Recommended dose (143 g/pit) of N from USG + 0-0-40-4-6000-0 g P-K-S-Mg-CD-MOC ha^{-1}
T_3 = 90% of recommended dose (129 g/pit) of N from USG + 0-0-40-4-6000-0 g P-K-S-Mg-CD-MOC ha^{-1}
T_4 = 80% of recommended dose (114 g/pit) of N from USG + 0-0-40-4-6000-0 g P-K-S-Mg-CD-MOC ha^{-1}
T_5 = Farmer's dose (105 g/pit) from prilled urea + 60-200-30-0-3500-250 g P-K-S-Mg-CD-MOC ha^{-1}

Effect of plant spacing and fertilizer on the yield of Potato at Munshiganj

Abstract

The experiment was conducted at Munshiganj MLT site during the Rabi season of 2004-05 to find out the optimum and economic dose fertilizer and plant spacing for Potato at Munshiganj. The experiment was laid out in split plot design with plant spacing in main plot and fertilizer doses in sub plots with six dispersed replications. Soil test based (STB) fertilizer dose for HYG and two IPNS treatment with poultry manure and cowdung along with farmers' practice and no fertilizer treatment were tested against two recommended practices and farmers' spacing (30 x 15 cm). Recommended practices were i) whole tuber with 60 x 30 and cut tuber (15-20 g) with 45 x 15 cm. Results revealed that tuber yield of potato influenced significantly due to plant spacing. The highest yield was recorded from farmers' spacing followed by recommended practice with cut tuber. Recommended practice with whole tuber gave the lowest yield due to less plant population. But weight of tuber/plant was significantly higher in recommended spacing with whole tuber. Effect of different fertilizer packages on the yield of potato was observed. The highest yield was obtained from farmers' dose which was identical with STB fertilizer dose and IPNS with PM. Between the IPNS treatment yield was higher with poultry manure over cowdung. Interaction effect of spacing and fertilizer dose was found significant. The highest tuber yield was recorded from farmers' fertilizer dose with farmers' spacing which is statistically similar with farmers' dose with recommended spacing ii. Regarding cost and return analysis the highest gross margin was found in STB fertilizer dose with recommended spacing ii. Due to higher seed and fertilizer cost gross margin was less in farmers' practice in spite of higher yield.

Introduction

Munshiganj is one of the leading Potato growing areas in Bangladesh. Farmers' grow Potato as a cash crop and usually applied a very high dose of chemical fertilizers. Previous survey reveals that the farmers' of Munshiganj applied 400-250-400 kg/ha of NPK in Potato which is extremely higher than present national recommendation. Previous research works showed that 120-10-40 kg/ha of NPK along with CD @ 10 t/ha produced similar yield with farmers' dose. Excessive and continuous use of chemical fertilizers is also detrimental for soil health and environment. The farmers' did not apply any organic fertilizer in Potato, however, a response of cowdung was found in previous study. Due to unavailability of cowdung as organic manure other sources of organic manure could be explore. Poultry manure is now available because of rapid expansion of poultry farm in greater Dhaka. Application of organic manure will improve soil fertility for sustainable crop production and reduce undesirable effects in soil as a consequence of high dose of chemical fertilizers.

Optimum plant population is also very important factor for higher yield of Potato. Farmers' of Munshiganj usually grow Potato in closer spacing. Average plant spacing followed by farmers' is 30 x 10 cm against recommended spacing of 60 cm x 20 cm. Therefore, plant population is much higher in farmers' practice. Farmers' belief that higher plant population and higher fertilizer dose is responsible for higher yield. Therefore, recommended and farmers' spacing needs to be verified against different fertilizer packages for higher yield and profit.

Objectives

1. To evaluate the effect of different fertilizer packages with different spacing on the yield of Potato
2. To find out the optimum and economic dose fertilizer and plant spacing of Potato for Munshiganj

Materials and Methods

The experiment was carried out at farmers' field of Munshiganj MLT site to evaluate the effect of different fertilizer packages with different spacing on the yield of potato during rabi 2004-05. The land type was medium low land and the soil texture of the experimental plot was silty clay which belongs to Old Meghna Estuarine Floodplain soil (AEZ 19d). Before conduction of the experiment the initial soil samples were collected and analyzed at BINA laboratory. The P^H of the soil was slightly acidic and except nitrogen all other nutrient elements were optimum to high in the soil (Appendix 1).The experiment was laid out in split-plot design with six dispersed replication. Two recommended plant spacing and farmers' spacing (30cm x 15cm) was given in the main plot. Two recommended plant spacing were i) whole tuber with 60 x 30 and cut tuber (15-20 g) with 45 x 15 cm. Five different fertilizer packages- IPNS with poultry manure (T_1) and cowdung (T_2), Soil test based fertilizer (STB) dose for HYG (T_3), Farmers' dose (T_4) and no fertilizer (T_5) was given in the sub-plot. Fertilizers were applied as per treatment. Well decomposed poultry manure and cowdung was applied one week before planting. Potato, variety `Diamont' was planted during the last week of November as per treatment. Seed rate was 2.0, 2.2 and 2.7 t/ha, for recommended practices and farmers' practice, respectively. Ridomil gold was sprayed 3 times to control late blight disease. Crop was irrigated twice and mulched with water hyacinth. Plant population was about 20% less due to poor quality of seed. At maturity the crop was harvested on last week of February, 2005. Necessary data were collected and analyzed statistically.

Treatment (Fertilizer dose (kg/ha) for Potato)

Treatment	N	P	K	
T_1 = IPNS with PM for HYG	115	5	45	2.5 t/ha PM
T_2= IPNS with CD for HYG	125	15	45	5 t/ha CD
T_3= Soil test based fertilizer dose for HYG	140	20	60	-
T_4= Farmers' dose	368	150	350	-
T_5= No fertilizer	0	0	0	-

Results and discussion

Effect of plant spacing: Effect of plant spacing on the yield of Potato is given in Table 1. Tuber yield of potato influenced significantly due to plant spacing. The highest yield was recorded from farmers' spacing (30 x 15 cm) but it was similar with recommended practice with cut tuber planted in 45 x 15 cm spacing. Significantly lower yield was obtained from recommended practice with whole tuber grown in 60 x 20 cm spacing. Farmers' practice gave about 6 and 2 t/ha higher yield over recommended practice i and ii, respectively. Higher yield obtained in farmers' spacing is due to higher plant population. Plant population varied with plant spacing and it was 83300, 148149 and 222200/ha in recommended practice i, recommended practice ii and farmers' practice, respectively. Weight of tuber/plant also varied significantly. But the trend was just reverse to tuber yield. Significantly higher tuber wt./plant was recorded from recommended spacing. Tuber weight/plant increased with the increase of plant spacing. However, wt. of tuber/plant was higher in recommended spacing but due to higher plant population tuber yield/ha was higher in farmers' spacing. Closer spacing required higher seed rate and therefore, seed rate was highest in farmers' spacing. Seed rate was 2700 kg/ha in farmers' spacing where as it was 2000 kg and 2200 kg/ha in recommended practice i and ii, respectively.

Effect of fertilizer: Effect of different fertilizer packages on the yield of Potato is shown in Table 2. Tuber yield varied significantly among the treatments. The highest tuber yield of Potato was obtained from farmers' practice but it was identical with IPNS with PM (T1) and STB for HYG (T3) treatment. Effect of organic manure applied in IPNS was not evident. IPNS with CD produced significantly lower yield against farmers' practice. Soils of Munshiganj remain submerge at least for 3-4 months and a considerable siltation take place. Residues of water hyacinth and jute leaves accumulated in the soil. Therefore, response of organic manure may not be observed. Farmers' of Munshiganj traditionally apply a very high dose of inorganic fertilizers in Potato which was much higher than recommended dose. But the yield was not much higher in comparison to recommended dose. The soil of Munshiganj is initially not very deficient in nutrients. From the soil test data it was found that except nitrogen the status of other nutrient elements are satisfactory. Therefore, yield did not increase significantly in farmers' practice. On an average about 1 t/ha yield increased over recommended fertilizer. But the cost of fertilizer is much higher in farmers' practice. The cost of fertilizer is about Tk. 21000/ha in farmers' practice against about 5000 Tk./ha over recommended practice.

Interaction between Spacing and fertilizer: Effect of spacing x fertilizer interaction on the tuber yield of Potato is given in Table 3. The interaction was significant. The highest tuber yield (39.03 t/ha) was recorded from T_4S_3 which was followed by T_4S_2 and T_3S_3. Generally, all the fertilizer packages produced higher yield at farmers' spacing over recommended spacing mainly due to population. Recommended spacing with cut tuber almost gave similar yield with farmers' spacing irrespective of fertilizer dose. Recommended fertilizer with recommended spacing (T_3S_2) also produced satisfactory yield (34.51 t/ha). However, from the interaction table it was evident that higher plant population responded positively to higher fertilizer rate. The lowest yield (16.32 t/ha) was obtained from no fertilizer treatment with recommended spacing.

Cost and return analysis: Cost and return analysis was done from spacing x fertilizer interaction. The highest gross return was obtained from farmers' fertilizer dose with Farmers' spacing due to higher yield. Variable cost (seed and fertilizer) was also the highest in the same standard. Farmers usually apply a very high dose of inorganic fertilizer in Potato with a very close spacing that increased the variable cost. The highest gross margin was recorded from T_4S_3 but due to higher cost its gross margin was much less than T_3T_2, T_3S_3, T_4S_2, T_1S_2 and T_1S_3.

Conclusion

From the above result it was found that higher yield was obtained from Farmers' spacing with farmers' fertilizer dose. But the highest gross margin was obtained from STB recommended fertilizer dose with recommended spacing ii (cut tuber with 45 x 15 cm).

Table 1. Effect of plant spacing on the yield of Potato at Munshiganj during 2004-05

Spacing (cm)	Wt. of tuber /plant (g)	Tuber yield (t/ha)	Plant pop./ha	Seed rate (t/ha)	Seed cost (Tk./ha)
S_1= Recom. i (whole tuber with 60 x 20)	487a	30.16b	83300	2.0	34000
S_2 = Recom. ii (cut tuber with 45 x 15)	383b	33.93ab	148149	2.2	37400
S_3= Farmers (30 x 15)	285c	36.21a	222200	2.7	47600

Table 2. Effect of different fertilizer doses on the yield of Potato at Munshiganj during 2004-05

Treatment	Tuber yield (t/ha)	Fertilizer cost (Tk./ha)
T_1 = IPNS with PM for HYG	34.66ab	3287
T_2= IPNS with CD for HYG	32.80b	5060
T_3= Soil test based fertilizer dose for HYG	34.74ab	4400
T_4= Farmers' dose	35.80a	21284
T_5= No fertilizer	17.85c	0

Table 3. Cost & return analysis of Potato affected by spacing and fertilizer doses at Munshiganj during 2004-05

Treatment	Tuber yield (t/ha)	Variable cost (Tk./ha)	Gross return (Tk./ha)	Gross margin (Tk./ha)
T_1S_1	30.60c	37287	122400	85113
T_1S_2	32.45bc	40687	129800	89113
T_1S_3	34.92b	50887	139680	88793
T_2S_1	28.48c	39060	113920	74860
T_2S_2	32.80bc	42460	131200	88740
T_2S_3	34.04b	52660	136160	83500
T_3S_1	30.95c	38400	123800	85400
T_3S_2	34.51bc	41800	138040	96240
T_3S_3	35.80ab	52000	143200	91200
T_4S_1	30.51c	55284	122040	66756
T_4S_2	36.86ab	58684	147440	88756
T_4S_3	39.03a	68884	156120	87236
T_5S_1	16.32e	34000	65280	31280
T_5S_2	17.80de	37400	71200	33800
T_5S_3	18.56d	47600	74320	26720

Variable cost = Seed + fertilizer cost.

Appendix 1. Initial soil status of the experimental plots of Potato at Munshiganj

SL.	Soil Characteristic	Status	SL.	Soil Characteristic	Status
1.	pH	6.3	7.	P (Micro gram g^{-1} soil)	16.3 (M)
2.	OC (%)	1.59	8.	S (Micro gram g^{-1} soil)	31.8 (H)
3.	Ex. Mg (m eq/100g soil)	1.84 (H)	9.	Zn (Micro gram g^{-1} soil)	3.15 (VH)
4.	K (m eq/100g soil)	0.19 (M)			
5.	Ex. Ca (m eq/100g soil)	4.73 (Opt.)			
6.	Total N (%)	0.11 (L)			

Effect of inorganic and organic fertilizers on the yield of Summer Onion

Abstract

An experiment was conducted at Shibpur MLT sites, Narsingdi during 2004 kharif I and kharif II seasons, Faridpur 2005, Noakhali 2005 and Bogra 2005 to determine the optimum dose of inorganic and organic fertilizer on the yield of summer onion. The experiment was laid out in RCBD with three replications. Summer onion variety BARI Piaj OF-5 was used as test crop. Four different inorganic and organic fertilizers doses along with no fertilizer treatments were employed for the experiment. The highest bulb yield (38.34 t/ha) was obtained from fertilizer combination 120-43-100-40 kg N-P-K-S/ha along with 5 t/ha cowdung, which was 227% higher than control at Narsinghdi and similar trend was found at Faridpur and Bogra. But the treatment T_4 gave the highest yield in three locations of Noakhali. Regarding cost and return analysis the highest gross margin was calculated from T_1 (120-43-100-40 kg N-P-K-S/ha+5 t/ha cowdung).

Introduction

Onion (*Allium cepa*. L) is one of the major important spices in Bangladesh. It stands second in respect of area and production in Bangladesh. Bangladesh produces only 1.31 lakhs metric tons of onion as against the total requirement of 4.50 thousand MT per year on an area of 33.26 thousand hectares of land (BBS, 2001). 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 as per hectare yield. This can be done by many ways of which the most important are the judicious application of fertilizer and introduction of summer onion varieties. In Bangladesh, onion is mainly grown in the Rabi season (winter). Usually, onion is not cultivated during Kharif (summer) season in the country. Recently BARI has released two summer onion varieties for growing in kharif season. There is a significant response of onion to inorganic and organic fertilizer (Nasreen and Hossain, 2000; Ullah, 2002). Although, the weather conditions seem to be congenial for the proper growth of summer onion but research work of summer onion is very scarce in Bangladesh. It is therefore, necessary to explore the possibilities of growing this crop in farmers' field in order to raise its yield potential through inorganic and organic fertilization. The study was undertaken to find out optimum dose of fertilizer for summer onion.

Materials and Methods

The experiment was conducted at MLT site, Shibpur, Narsingdi during 2004 and at Faridpur, Noakhali and Bogra during 2005. The seedlings were planted at 24 February to 24 May in kharif I and 23 August to 30 December in kharif II, 2004 at Narsinghdi whereas 5 April at Faridpur, February 2005 at Noakhali and 15 March at Bogra. Before starting the experiment a composite soil sample was collected and analyzed. The experiment was laid out in Randomized complete block design with three replications. The unit plot size was 2m x 2m. Five treatments of the experiment were:

T_1= 120-43-100-40 kg N-P-K-S/ha + 5 t/ha cowdung (Recom. from Ph.D. Work)
T_2= 90-54-75-20 kg N-P-K-S/ha + 5 t/ha cowdung (Recom. from SRC)
T_3= 60-35-54-20 kg N-P-K-S/ha + 3 t/ha poultry manure
T_4 = 75-49-60-20 kg N-P-K-S/ha + 5 t/ha cowdung
T_5 = Absolute control

Forty days old seedlings of summer onion variety BARI Piaj OF-5 were transplanted 2004 with 15 x 10cm spacing. All fertilizer except urea and muriate of potash were applied as per treatment at final land preparation. Urea was applied in three installment at 10, 28, 42 DAT and muriate of Potash was applied in two installments at 10 and 42 DAT. The crop was irrigated three times at 10, 32 and 45 DAT. The crop was harvested on 24 May in kharif I and 30 December in kharif II, 2004 at Narsinghdi, 10 June 2005 at Faridpur and 10-12 June 2005 at Bogra. Necessary data were collected and analyzed statistically.

Results and Discussion

Location: Shibpur, Narsinghdi

Yield and yield attributes of summer onion in Kharif I: Plant height, bulb length, single bulb weight and yields were significantly affected by fertilizer treatments. The treatments T_1, T_3 and T_4 were statistically identical in respect of plant height, bulb length and single bulb weight. The higher plant height was obtained from T_1 which was statistically identical to T_4 & T_3 whereas the lowest height from T_5. There was no significant difference in bulb length in between T_1, T_2, T_3 and T_4. The maximum individual bulb weight (59.13 g) was recorded in T_1 which was statically identical with T_2, T_3 and T_4. The minimum bulb weight (27.21 g) was recorded in T_5 treatment. The total bulb yield of summer onion varied significantly due to fertilizer application. Higher bulb yield (23.54 t/ha) was recorded in T_1 but statistically identical to T_2, T_3, T_4 and T_5. The lowest bulb yield (7.50 t/ha) was recorded from unfertilized control plot.

Yield and yield attributes of summer onion in kharif II: Plant height, bulb length, single bulb weight and yields were significantly affected by fertilizer treatments. The treatments T_1, T_3 and T_4 were statistically identical in respect of plant height, bulb length and single bulb weight. The higher plant height was obtained from T_1 which was statistically identical to T_4 and T_3 whereas the lowest height from T_5. There was no significant difference in bulb length in between T_1, T_2, T_3 and T_4. The maximum individual bulb weight (65.34 g) was recorded in T_1 which was statically identical with T_2, T_3 and T_4. The minimum bulb weight (27.21 g) was recorded in T_5 treatment. The total bulb yield of summer onion varied significantly due to fertilizer application (Table 1). Higher bulb yield (33.14 t/ha) was recorded in T_1 but statistically identical to T_2, T_3 and T_4. The lowest bulb yield (9.81 t/ha) was recorded from unfertilized control plot due to shortage of nutrient.

On an average, higher bulb yield was recorded from treatment T_1. The onion sown in kharif II gave much higher yield than kharif I because the former crop took 127 days as compared to only 90 days in kharif I. Economic analysis was done on an average of kharif I and II. The highest gross return and gross margin was obtained from T_1 but higher cost was involved in this treatment. Though in treatment T_3 showed lower variable cost as compared to other treatments except control but to low yield gross margin was lower.

Location: Faridpur

Significantly highest (2.48 t/ha) onion yield was obtained from the application of 120-100-120-40 kg N-P_2O_5-K_2O-S plus 5 ton cowdung per hectare. Yields from the application of different inorganic and organic fertilizer combinations are identical. Control treatment gave the lowest yield. Diameter of the onion also varied significantly and the highest was obtained from application of high dose of inorganic fertilizers. Fertilizers showed insignificant response to plant population and plant height. The yield of onion is low due to very high temperature throughout the growing period and non-availability of irrigation water at later stage of crop.

Location: Noakhali

Atkapalia: The highest plant height (34.11 cm) was found in T_4 that is statistically similar with T_1, T_2 and T_3. The lowest plant height (29.77 cm) was obtained in T_5. The highest diameter (4.01 cm) of bulb was found in T_4 that is statistically similar with T_3 (3.46 cm). Higher bulb yield (9.06 t/ha), bulb weight (3.62 g) and bulb length (21.63 cm) was observed also in T_4 that is statistically significant difference with other treatments.

Feni: The yield and yield contributing characters other than bulb diameter were found highest in T_4. The bulb diameter was found highest in T_1 (3.6 cm) and T_3 (3.36cm) which was statistically similar with T_4 (3.5). Highest yield was seen in T_4 (12.24 ton / ha.) and it is statistically identical with T_1 (11.94 ton /ha.) which is followed by T_3 (10.18 ton /ha.). The lowest yield was found in T_5 (7.23 ton /ha.) which were absolute control.

Laxmipur: The highest yield was found in T_4 and it was 7.24 ton /ha which is followed by T_2 (6.03 ton /ha.). Beside this yield attributing characters other than plant height were found highest in T4. Plant was seen height in T_1, which was not dissimilar to T_4. Control produced the lowest yield (4.85 ton /ha).

Location: Gabtali, Bogra

The highest plant population (226) was observed in T_2 which was statistically identical to T_1, T_3 and T_4. The lowest plant population/plot (209) was found in control plot (T_5). The highest plant height (37.55) was showed in treatment T_1 and the second highest (36.90) of plant height was found in treatment T_2. The highest no. of leaves/plant (4.38) was observed in T_1 which was statistically identical T_2, T_3 and T_4. The lowest no. of leaves/plant (3.27) was found in control plot (T_5). The highest weight of bulb/plant (35.03) and leaves + bulbs/plant (38.78) was observed in T_1 which was statistically identical to T_2 and T_3. The lowest weight was found in control plot. The biggest size of bulb diameter (14.40 cm) was found in T_1 which was statistically identical to T_2, T_3 and T_4. The smallest size of bulb diameter (22.95 cm) was showed in control plot. The highest bulb yield (12.07 t/ha) was observed in T_1 which was statistically identical to T_2 (11.49 t/ha), T_3 (11.79 t/ha) and T_4 (10.89 t/ha). The lowest bulb yield (6.40 t/ha) was found in T_5 (control). The highest bulb + leaves yield (15.78 t/ha) was showed in T_1 which was statistically identical to T_2 and T_3. The lowest bulb + leaves yield (8.26 t/ha) was showed in T_5.

The highest gross return (Tk. 168980/ha) and gross margin (Tk. 127364/ha) was obtained from T_1 but the highest BCR (4.20) was obtained from T_3.

Farmers' reactions

Farmers are interested to grow summer onion if the seeds and proper training will be given.

Conclusion

From the above discussion it is clear that treatment T_4 produces highest yield in three locations at Noakhali. Yield differs from location to location due to soil salinity and non availability of water during later stage of crop at Atkapalia and Laxmipur. In Feni the soil was non saline. So it's production was highest among the three locations. Plant population was found highest (85%) in Feni while 70% and 62% were found in Atkapalia and Laxmipur respectively. Higher dose of fertilizer (120-43-100-40 kg N-P-K-S/ha) gave higher yield and benefit but another year trial is needed for confirmation.

Table 1. Effect of inorganic and organic fertilizer on the yield and yield attributes of summer onion, Kharif I, 2004 at Narsinghdi

Treatment	Plant height (cm)	Bulb length (cm)	Single bulb weight (g)	Yield (t/ha)
T_1	43.33a	2.69a	59.13a	23.54a
T_2	41.00b	2.51a	57.63a	21.16a
T_3	41.33ab	2.48a	53.16a	19.53a
T_4	41.66ab	2.57a	54.11a	19.71a
T_5	28.00c	1.69b	27.21b	7.50b
CV (%)	2.73	6.12	6.93	8.78

Table 3. Effect of inorganic and organic fertilizer on the yield and yield attributes of summer onion, kharif II, 2004 at Narsingdi

Treatment	Plant height (cm)	Bulb length (cm)	Single bulb weight (g)	Yield (t/ha)
T_1	71.25a	3.61a	65.34a	33.14a
T_2	69.20a	3.21a	60.53a	31.05a
T_3	69.60a	3.18a	64.16a	31.14a
T_4	68.75a	3.11a	62.22a	29.46a
T_5	31.00b	1.60b	27.21b	9.81b
CV(%)	3.74	6.14	6.52	7.11

Table 3. Cost and return analysis of summer onion during Kharif I and Kharif II, 2004 at Narsingdi

Treatment	Kharif I			Kharif II		
	Gross return	Variable cost (Tk/ha)	Gross margin (Tk./ha)	Gross return	Variable cost (Tk/ha)	Gross margin (Tk./ha)
T_1	235400	11224	224176	331400	11224	320176
T_2	211600	10218	201382	310500	10218	300282
T_3	195300	6918	188382	311400	6918	304482
T_4	197100	9264	187836	294600	9264	285336
T_5	7500	0	75000	98100	0	98100

331400

Price (Tk/kg): Onion= 10, Urea= 6, TSP = 14, MP = 14, Gypsum= 6, Cowdung= 0.50, Poultry manure = 0.50

Table 4. Yield and yield attributes of summer onion under different fertilizer management at Faridpur during 2005

Treatment	Plant population/m^2 (Nos.)	Plant height (cm)	Diameter/onion (cm)	Yield (kg/ha)
T_1	44.9	16.9	3.08	2.48
T_2	41.2	16.2	2.84	2.10
T_3	40.5	18.0	3.06	2.47
T_4	41.0	18.4	2.87	2.38
T_5	35.3	14.6	2.52	1.04
LSD (0.05)	NS	NS	0.48	0.92

Table 5. Effect of organic and inorganic fertilizer on summer onion 2005 at Atkapalia, Noakhali

Treatments	Plant height (cm)	Bulb wt (gm)	Diameter (cm)	Bulb length (cm)	Yield (t/ha)
T_1	31.34ab	17.13b	3.45b	2.77c	8.11b
T_2	32.78ab	15.67b	3.27b	2.92bc	7.91b
T_3	31.90ab	16.98b	3.46ab	3.12b	7.92b
T_4	34.11a	21.63a	4.01a	3.62a	9.06a
T_5	29.77b	13.92b	3.06b	2.87bc	5.46c

Table 6. Effect of organic and inorganic fertilizer on summer onion 2005 at Feni

Treatments	Plant height (cm)	Bulb wt (gm)	Diameter (cm)	Bulb length (cm)	Yield (t/ha)
T_1	31.23a	26.93a	3.60a	3.23a	11.94a
T_2	29.20b	26.43a	3.47a	3.18a	11.24ab
T_3	31.93a	27.13a	3.60a	3.00b	10.18b
T_4	32.20a	27.53a	3.50a	3.18a	12.24a
T_5	22.93c	19.13b	2.90b	2.72c	7.23c

Table 7. Effect of organic and inorganic fertilizer on summer onion 2005 at Laxmipur

Treatments	Plant height (cm)	Bulb wt (gm)	Diameter (cm)	Bulb length (cm)	Yield (t/ha)
T_1	33.93a	13.03ab	3.31a	3.20b	6.53ab
T_2	31.83ab	12.20b	2.69b	3.05b	6.03b
T_3	30.83bc	13.23ab	2.99ab	2.92b	6.26ab
T_4	33.37a	14.93a	3.48a	3.95a	7.24a
T_5	29.33c	8.10c	2.20c	2.94b	4.85c

Table 8. Effect of inorganic and organic fertilizers on the yield and yield attributes of summer onion at MLT site, Gabtali, Bogra during Kharif 2005

Treatments	Plant pop./ plot (no.)	Plant height (cm)	No. of leaves/ plant	Bulb wt./ plant (gm)	Bulb + leaves wt (gm)	Diameter (cm)	Bulb yield (t/ha)	Bulb + leaves yield (t/ha)
T_1	224a	37.55a	4.38a	35.03a	38.78a	14.40a	12.07a	15.78a
T_2	226a	36.90b	4.17a	34.03a	38.50a	14.23a	11.49a	15.53a
T_3	225a	36.17c	4.35a	34.86a	38.73a	13.98a	11.79a	15.90a
T_4	223a	35.83c	4.32a	31.95b	36.35b	13.63a	10.89a	13.03c
T_5	209b	26.18d	3.27b	20.55c	22.95c	7.90b	6.40b	8.20c
CV (%)	2.92	1.13	5.92	2.27	3.62	3.96	7.50	4.55

Table 9. Cost and return analysis of summer onion during 2005 at Bogra

Treatment	Gross return	Variable cost (Tk/ha)	Gross margin (Tk./ha)	BCR
T_1	168980	41616	127364	4.06
T_2	160860	41003	119857	3.92
T_3	165060	39337	125723	4.20
T_4	152460	40091	112369	3.80
T_5	89600	31330	58270	2.86

331400

Price (Tk/kg): Onion= 14, Urea= 6, TSP = 12, MP = 14, Gypsum= 5, Cowdung= 0.50, Poultry manure = 1

Effect of different nutrient management packages on the yield of cabbage and tomato

Abstract

The experiment was conducted at MLT site Kendua, Netrakona, during rabi season of 2003-04 and 2004-05 to evaluate the proper nutrient management packages and determine the economic dose of fertilizer for Cabbage and Tomato under irrigated condition. The cabbage variety Atlas-70 and Tomato variety Ratan was tested against six different fertilizer management packages (soil test based fertilizer dose for MYG & HYG, IPNS for HYG, BARI Rec. dose, Crop removal and farmers practice). Average of two years data showed that the highest head yield of Cabbage (91.26 t ha^{-1}) was obtained with IPNS based fertilizer dose (T_3) followed by BARI recommended dose (T_4). Similarly, in Tomato higher fruit yield was obtained with the same treatments. Regarding cost and return higher gross margin was calculated from T_3 followed by T_4. But benefit cost ratio (BCR) was higher in STB based fertilizer dose for MYG (T_1) due to less fertilizer cost involvement.

Introduction

The importance of cabbage (*Brassica oleracea* var. capitata Lin.) and Tomato as vegetables due to supply of adequate vitamins, carbohydrates and minerals is well known. It is one of the most important winter vegetables and is grown throughout Bangladesh. Cabbage and tomato are intensively grown under irrigated Medium High Land of Kendua MLT site, Netrakona. But a recent field survey and soil test data reveals that yield of cabbage and tomato is lower than expected yield which might be due to imbalance use of inorganic fertilizer, less use of organic manure and lack of using modern crop varieties.

A judicious integration use of macro and micro-nutrients along with organic manure may not only help to maintain soil fertility but may also increase crop productivity. Therefore, keeping all these in mind the present study was carried out to find out the proper nutrient management packages for cabbage and tomato and to determine the economic dose of fertilizer for cabbage and tomato under irrigated medium high land at Kendua, Netrakona under AEZ 9.

Materials and Methods

The experiment was conducted under irrigated condition during the period from November 2004 to February 2005 at Kendua MLT site, Netrakona. However the experiment was initiated in 2003-04. The soil of the experimental field belongs to the Agro-ecological region Old Brahmaputra Floodplain (AEZ 9). The surface soil was loamy to clayey in texture. The pH of soil is 6.3 with OM 1.66%, total N 0.10, available P (10.76), exchangeable K (0.12) and available S (9.69) which show that all the nutrients area low. The experiment was laid out in RCB design with six dispersed replications. The unit plot size was 5m × 8m. Six different fertilizer packages were tested and the details of the treatments are i) T_1= Estimated mineral fertilizer dose for moderate yield goal (MYG), ii) T_2 = Estimated mineral fertilizer dose for high yield goal (HYG), iii) T_3 = Integrated nutrient management for high yield goal, iv) T_4 = BARI recommended dose, v) T_5 = Nutrients rate based on crop removal for high yield & T_6 = Farmer's practice (FP).

Nutrient rate kg ha^{-1}

Cabbage						Tomato				
CD	N	P	K	S		CD	N	P	K	S
-	131	26	102	25		-	119	27	114	20
-	191	36	145	36		-	170	38	157	29
8000	167	28	121	36		6000	152	32	139	29
8000	150	44	138	0		10000	254	88	125	0
-	414	28	466	89		-	126	18	183	17
8000	99	39	80	11		6000	90	35	69	16

The entire amount of cowdung P, S 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 10-15, 25-30 and heading time of cabbage and two splits for tomato and 21 and 35 DAT as ring method. The cabbage variety Atlas-70 and tomato variety Ratan were tested. The thirty days old seedling of cabbage were transplanted on 6-11 November 2004 and harvested 1-12 February 2005, respectively whereas tomato seedling transplanted on 6-11 November 2004 and harvested on 23 January to 14 February 2005. One seedling was transplanted at a spacing 60 cm × 45cm for both the crops. Irrigation was given six time which supplied 4.8 cm available water in 6 decimal plot. Intercultural operations such as weeding, irrigation and pest control were done in order to maintain the normal crop growth. Data on yield and yield attributes along with other parameters were collected properly and subjected to statistical analysis and means were compared by DMRT and economic analysis was done.

Result and Discussion

Cabbage

The effect of different nutrient management packages on the head yield of cabbage is presented in Table1. Average of two years data showed that the highest marketable head yield was obtained with T_3 where IPNS based fertilizer dose was applied. The yield was higher than only inorganic fertilizer for HYG (T_2). Yield was significantly higher in T_3 during 2004-05. But in 2003-04 it was identical with other fertilizer packages except with T_1 where STB fertilizer dose for MYG was applied. Fertilizer dose based on BARI recommendation gave higher yield over STB fertilizer dose for HYG and MYG (T_1 and T_2). The lowest yield was found with STB fertilizer dose for MYG (T_1) which was also lower than Farmers' practice (T_6). Fertilizer dose based on crop removal for HYG (T_5) also gave satisfactory yield and it was higher than STB fertilizer dose for HYG (T_2). Similar trend was followed in case of head yield with outer leaves. The highest yield was obtained with T_3 which `was closely followed by T_4 and T_5.

Cost and return analysis: The cost and return analysis of cabbage has been presented in Table 2. The highest gross return as well as gross margin was calculated from T4 followed by T_3. The variable cost was the highest in T_5 due to crop removal basis fertilizer dose was very high in cabbage. The second highest figure was found in T_4 followed by T_3 (Tk.11102 ha^{-1}) due to the cost of cowdung involved in these treatments. BCR was the highest in T1 due to lowest fertilization cost.

Tomato

The effect of different nutrient management packages on the yield of Tomato is presented in Table 3. Fruit yield of Tomato was influenced by different fertilizer treatments. Average of two years data showed that higher yield was obtained from treatment T_3 and T_4. Significantly higher yield was obtained with IPNS (T_3) and BARI recommended dose (T_4) during 2003-04 and 2004-05. Similarly, STB fertilizer dose for HYG (T2) and fertilizer dose based on crop removal (T_5) gave identical yield. The lowest yield was found in farmers' practice (T_6).

Cost and return: The cost and return analysis of tomato has been presented in Table 4. The highest gross margin was calculated from T_3 closely followed by T_4. The variable cost (Tk.16172 ha^{-1}) was the highest in T_4 followed by T_3 due to higher fertilizer dose and cost of cowdung involved in these treatments. BCR was the highest in T1 due to lowest fertilization cost.

Conclusion

Based on two years study it revealed that IPNS based fertilizer dose was found superior to other treatments in respect of yield and economic benefits for Cabbage and Tomato at Kendua, Netrokona.

Table 1. Effect of different nutrient management packages on the yield of cabbage at MLT site Kendua during 2003-04 to 2004-05

Treatment	Head yield with outer leaf (t ha^{-1})		Mean yield (t ha^{-1})	Marketable head yield (t ha^{-1})		Mean yield (t ha^{-1})
	2003-04	2004-05		2003-04	2004-05	
T_1	71.10b	67.43c	69.27	62.92b	58.28d	60.60
T_2	93.67a	92.48ab	90.08	85.85a	80.68b	83.27
T_3	99.89a	100.35a	100.12	92.15a	90.37a	91.26
T_4	102.99a	93.11ab	98.05	95.14a	82.37b	88.76
T_5	107.88a	89.74b	98.81	89.21a	79.66b	84.44
T_6	92.52a	83.47b	88.00	84.50a	66.73c	75.62
CV (%)	8.10	8.25	8.18	16.92	7.85	12.39

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

Table 2. Cost and return analysis of different nutrients management packages in cabbage at Kendua MLT site during 2002-03 to 2004-05

Treatment	Gross return (Tk ha-1)	Variable cost (Tk ha-1)	Gross margin (Tk ha-1)	BCR
T1	90668	6525	84143	13.9
T2	124639	10001	114638	12.5
T3	136801	11828	124973	11.6
T4	132496	12306	120190	10.8
T5	126175	20497	105678	6.1
T6	112534	10154	102380	11.0

Table 3. Effect of different nutrient management packages on yield of tomato at MLT site Kendua during 2003-04 to 2004-05

Treatment	Fruit yield (t ha^{-1})		Mean
	2003-04	2004-05	
T_1	60.50b	59.00b	59.75
T_2	61.95b	62.98b	62.46
T_3	71.38a	72.53a	71.95
T_4	74.38a	72.55a	73.26
T_5	62.08b	60.71b	61.39
T_6	55.10c	54.14c	56.62
CV (%)	5.55	5.28	5.41

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

Table 4. Cost and return analysis of different nutrients management packages in tomato at Kendua MLT site during 2003-04 to 2004-05

Treatment	Gross return (Tkha^{-1})	Variable cost (Tkha^{-1})	Gross margin (Tkha^{-1})	BCR
T_1	149000	6613	142387	22.5
T_2	156420	10056	146364	15.5
T_3	180175	11182	168993	16.1
T_4	182605	17340	165265	10.5
T_5	153145	7683	145462	19.9
T_6	136310	8252	128058	16.6

Appendix table1: Effect of different nutrient management packages on yield parameters of cabbage at Kendua, Netrakona during rabi, 2003-04 and 2004-05

Treatment	Plant height (cm)		Head pericycle (cm)		Whole plant wt. (kg)		Marketable head weigh (kg)	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
T_1	20.60	18.16	66.18ab	64.08b	2.27b	2.85b	1.98b	2.30b
T_2	21.08	17.88	69.37a	70.46a	2.82b	3.58a	2.57a	2.81a
T_3	20.88	17.97	67.82ab	69.52a	3.13a	3.64a	2.74a	2.96a
T_4	20.50	17.96	66.83ab	70.20a	3.22a	3.45a	2.85a	2.78a
T_5	20.75	18.58	67.26ab	68.74a	3.32a	3.27ab	2.72a	2.37b
T_6	20.80	17.22	62.95b	65.84b	2.77b	2.81b	2.55a	2.12b
CV (%)	2.81	5.99	5.82	3.16	9.29	10.61	13.92	8.60

Appendix table 2: Effect of different nutrient management packages on yield parameters of tomato at Kendua during 2003-04 and 2004-05

Treatment	Plant height (cm)		Fruits/plant (no.)		Yield/plant (kg)	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
T_1	75.58b	75.48a	22a	15a	1.67c	1.67c
T_2	78.18ab	75.62a	23a	16a	1.83b	1.80bc
T_3	81.30a	74.96a	24a	16a	1.91ab	1.94ab
T_4	81.98a	73.66a	24a	17a	2.02a	1.99a
T_5	85.23a	74.6a	24a	15a	1.96ab	1.79bc
T_6	82.18a	75.52a	19b	13b	1.65c	1.48d
CV (%)	4.59	2.07	6.33	12.34	6.13	6.55

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Response of lentil to newly developed Bio-fertilizer in the farmer's field

Abstract

A field trial was carried out at Kushtia, Pabna, Faridpur and Jessore in the rabi season 2004-05 to evaluate the benefit of using bio-fertilizer compared chemical fertilizer. Result revealed that application of bio-fertilizer along with PKS produced higher seed yield but statistically identical to the yield obtained from only bio-fertilizer. Farmer dose showed the lowest yield among the treatment.

Introduction

Nitrogen deficiency is a common feature in Bangladesh. Farmers usually use Urea as a source of nitrogen to produce their crops. But the price and its availability, sometimes, goes beyond the capacity of the farmers. As such bio-fertilizer may be used as a cheaper substitute for urea in the production of food legume crops. The objective of the experiment to compare bio-fertilizer with chemical fertilizer is along or in combination for higher yield of lentil.

Materials and Methods

The experiment was conducted at Bheramara, Kushtia, Goyeshpur, Pabna, Ishan Gopalpur, Faridpur and Bagherpara, Jessore in rabi, 2004-05. The trial was laid out in RCB design with 6 replications. The unit plot size was 5m x 4m. There were 4 treatments (i) PKS (ii) Only Bio-fertilizer (iii) Bio-fertilizer + PKS (iv) Farmers' dose. Bio-fertilizer was mixed with lentil using adhesive material (water) to coated seed properly. The inoculated seeds @ 30 kg/ha sown broadcast on 31 October at Kushtia, 24 November at Pabna, 8 November at Faridpur and 20-30 November 2004, respectively in the early morning. Chemical fertilizer were used in the specified treatments at the rate of 22-42-20 kg/ha and F.P. (20-18-17 kg) NPK/ha respectively as basal. The crop was harvested on 20 February at Kushtia & Faridpur, 6 March at Pabna and 2-5 March at Jessore 2005, respectively. Data on yield and yield components were recorded and analyzed statistically.

Results and Discussion

Location: Bheramara, Kushtia

Plants/m^2, 1000-seeds wt. seeds and stover yield were significantly affected by different fertilizer treatments. But plant height & pods/plant were not significantly influenced by the treatment. Higher plants/m^2 was recorded from T_4 treatment which was significantly identical to T_3 & T_2 treatments. Seeds weight showed higher in treatment T_2 which was followed by treatment T_3. There was no significant different in seed yield among treatments T_3 & T_2 which was significantly higher than farmer dose. Similar tread was followed in stover weight. Only bio-fertilizer gave reasonable yield in lentil.

Location: Goyeshpur, Pabna

Yield of seed and stover, plant population and nodule number plant^{-1} were significantly differing among the treatment and other parameters were insignificant. Higher seed yield was obtained from T_3 (only inoculated plot) treatment which was also statistically identical with T_1 and T_4 treatment. Higher yield of T_3 treatment is also supported by the yield contributing parameters, i.e. higher 1000-seed weight, number of pods plant^{-1}, number of primary branches plant^{-1} and plant population. Lower seed and straw yield was obtained from T_2 treatment (Inoculum + other fertilizer but N) and it might be due to lower plant population. From the cost and return analysis data revealed that only inoculum (T_3) applying is more profitable.

Location: Ishan Gopalpur, Faridpur

Application of inoculum along with 22-42-20 kg P, K and S /ha produced higher yield of lentil (822.5 kg/ha) followed by 30-22-42-20 kg N, P, K and S /ha (810.6 kg/ha). Inoculums instead of 30 kg N /ha gave only 12 kg higher yield of lentil. Application of only inoculums produced 735.2 kg lentil per hectare and farmers practice was 650.4 kg/ha. Among the yield contributing characters only pods/plant differed significantly and others were insignificant. The highest number of pods/plant was observed in inorganic fertilizer plus inoculum treatment.

Location: Bagherpara, Jessore

Plants/m^2, plant height, pods/plant, seed weight and seed yield were significantly affected by different fertilizer treatment (Table 5). Significantly the highest plant height was recorded from treatment T_3. Branches/plant, seeds/pod and stover yields were not significantly influenced by the treatment. Pods/plant was higher from T_3 but at par to T_2. Seed weight was similar to all treatments except T4 which showed the lowest weight. Higher seed yield was recorded from treatment T_3 where only inoculum used but at par to T_1 where all fertilizer (NPKS) is used.

Farmers reaction

Kushtia: Farmers expressed their satisfaction for higher yield potential without use of chemical fertilizer.

Pabna: Farmers of that location were pleased on bio-fertilizer and they opined that it should be available.

Table 1. Yield and yield components of lentil as affected by bio-fertilizer at Bheramara MLT site Kushtia during 2004-05

Treatments	Plants/m^2	Plant height (cm)	Pods/ plant	1000-seed wt. (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
T_1	66.5b	35.68	42.0	15.73	1508b	925.0a
T_2	85.7ab	35.60	56.8	15.93a	1580a	858.3a
T_3	82.2ab	35.50	42.0	15.72ab	1583a	893.3a
T_4	88.3a	35.38	44.0	15.20b	836.7c	636.7b
CV (%)	19.5	0.9	34.1	2.7	1.8	6.9
LSD	**	NS	NS	**	**	**

Table 2. Response of lentil to newly developed bio-fertilizer in the farmers field of Goyeshpur FSRD site, Pabna during 2004-05

Treatment	Plants pop./m^2	Plant height	No. of nodule plant^{-1}	No. of primary branches plant^{-1}	No. of pods plant^{-1}	No. of seed pod^{-1}	!000 Seed wt.(gm)	Yield of seed (t ha^{-1})	Yield of stover (t/ha^{-1})
T_1	139.8c	41.9	11.4c	4.2	77.5	1.60	15.58	1.56a	2.11c
T_2	125.2d	42.8	21.5b	4.1	79.6	1.57	15.33	1.37b	2.03d
T_3	162.7b	40.6	24.1a	4.2	91.4	1.55	15.58	1.59a	2.20b
T_4	173.7a	42.9	11.4c	3.9	73.7	1.55	15.42	1.56a	2.29a
CV (%)	5.63	8.95	2.35	13.67	22.52	4.80	3.74	2.19	1.65
LSD	10.42	NS	0.50	NS	NS	NS	NS	0.03	0.04

Table 3. Economic analysis of the response of lentil to newly developed bio-fertilizer, Goyeshpur 2004-05

Treatment	Gross Return Tk.	Cultivation cost	Net Return Tk/ha	BCR
T_1	47855	31885	15970	1.50
T_2	42115	31572.5	10542	1.33
T_3	48800	27172	21628	1.80
T_4	47945	30459.2	17485.8	1.57

Table 4. Effect of bio-fertilizer on the yield and yield attributes of lentil at Faridpur, 2004-05

Treatment	Plants/m^2 (No.)	Plant height (cm)	Pods/plant (No.)	1000 seed wt. (g)	Seed yield (kg/ha)
T_1	105.2	43.5	62.2	15.4	810.6
T_2	103.5	41.2	65.3	15.2	822.5
T_3	97.6	41.6	59.8	16.5	735.2
T_4	101.2	40.2	51.2	14.8	650.4
LSD (0.05)	NS	NS	10.5	NS	52.6

Table 5. Yield and yield attributes of lentil at FSR site, Bagherpara, Jessore during rabi 2004-05

Treatment	Plant Pop./m^2 (no.)	Plant height (cm)	Branch/ plant (no.)	Pods/ plant (no)	Seeds/ pod (no)	1000-grain weight (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
T_1	92.33ab	31.17b	10.67	47.25bc	1.62	15.32ab	682.17ab	1242
T_2	80.83b	31.83b	11.67	56.43ab	1.63	16.02a	640.00b	1410
T_3	81.33b	35.83a	10.83	64.18a	1.63	15.92a	740.50a	995
T_4	98.17a	32.00b	10.50	39.87c	1.65	15.18b	610.00b	1224
CV (%)	12.91	5.40	27.75	22.65	8.39	6.58	8.65	15.10
F-test	*	**	NS	*	NS	*	**	NS

On-farm verification of sulphur fertilization for Onion production

Abstract

An on-farm trial was conducted at MLT site Kashinathpur, Pabna and Faridpur during 2004-05 to find out optimum sulphur requirement for onion production. Higher bulb yield and benefit cost ratio was obtained from recommended fertilizer with 30 kg S ha^{-1} where Farmers dose gave lower value at Pabna where same trend yield was recorded at Faridpur.

Introduction

Onion is an important spice crop. It is used in almost all food preparation and is an integral part of Bangladesh diet (Hussain and Islam, 1994). It is grown more or less in all the districts of Bangladesh but the average yield is 4.17 t/ha, which is very low as compared to other onion producing countries of the world. The high demand of onion can only be meet up by increasing its per hectare yield. This crop is rainfed and grown with little or no application of fertilizers (specially sulphur). In addition to N, P and K nutrients, sulphur has been found to be very beneficial for onion. Onion needs sulphur in sufficient quantity for synthesis of protein volatile compounds and sulphate in inorganic forms. Sulphur is also essential for a good vegetative growth and bulb development in onion (Islam and Hoque, 1977). Sulphur can play a vital role in increasing the yield of onion and improving the quality especially pungency and flavors. Lack of its optimum supply in different plant parts may limit the crop growth at any stage resulting in yield reduction. Moreover, sulphur deficient onion plants had poor utilization of nitrogen, phosphorus and potash. The present study might be undertaken in the farmer's field to verify the effect of sulphur fertilization on the yield of onion.

Objectives

i) To find out sulphur requirement for onion production in the growing areas.
ii) To increase the income of farmers.

Materials and Methods

The experiment was conducted at MLT site, Kashinathpur, Pabna and Faridpur to observe the response of onion to sulphur during 2004-05 in High Ganges River Floodplain soil (AEZ-11). The experiment was laid out in RCB design with 4 replications. Three treatments were employed for the trial i.e, T_1= N_{120}-P_{40}-K_{75}-S_0- Zn_5 + CD 5 t ha^{-1}, T_2= N_{120}-P_{40}-K_{75}-S_{30}-Zn_5 + CD 5 t ha^{-1} and T_3= FP

(N_{40}-P_{30}-K_{78}). The unit plot size was 4 m × 5 m. Seedlings of onion (var. Taherpuri) were planted on 15 December at Pabna and 31 December at Faridpur 2004, respectively maintaining the spacing 30 cm × 15 cm. All P, K, S, Zn, cowdung and ⅓ urea (Treatment wise) were applied as basal and rest ⅔ urea were applied in two equal installments at 3rd and 5th week after planting. Two irrigations were provided at December 18, 2004 and February 22, 2005 at Pabna. Intercultural operation and other crop protection measures were taken as and when required. Necessary data were collected and analyzed statistically. The crop was harvested at 10 April 2005 at Faridpur.

Results and Discussion

Kashinathpur, Pabna: Yield and yield contributing characters were differed significantly among the treatments except bulb weight (Table 1). The highest bulb yield was obtained from T_2 treatment (with recommended S fertilizer) which was also supported by all yield contributing characters. The lowest bulb yield and yield parameter were found in T_3 (Farmers practice) treatment. From the economical point of view, T_2 treatment is more profitable than other treatments.

Faridpur: Application of sulphur at the rate of 30 kg per hectare produced higher onion yield (7.22 t/ha) followed by farmers practice (6.48 t/ha) and the lowest yield was recorded from control plots. Yield increase by application of 30 and 18 kg S/ha over control was 24 and 11%, respectively. Thirty kg S/ha also gave the highest single bulb weight. Others characters like number of plants/m^2, plant height, number of leaves per plant and diameter of bulb was not vary significantly.

Farmer's reaction

Pabna : Farmers of that location are surprised on the positive effect of S on onion production. They opined that in future they will use S fertilizer for onion production.

Faridpur : Farmers in this area usually use sulphur in their crops. However, recommended dose should be used.

Table 1. Yield and yield attributes of onion as affected by different treatments at MLT site Kashinathpur, Pabna during 2004-05

Treatment (S kg/ha)	Plant height(cm)	Leaves Plant^{-1}	Diameter bulb^{-1} (cm)	Weight bulb^{-1}	Bulb yield (t/ha)
T_1 = 0	50.6b	6.95b	4.73b	40.37	17.27b
T_2 = 30	54.1a	7.33a	5.14a	40.89	18.65a
T_3 = FP	38.8c	5.80c	3.77c	35.47	16.92b
CV (%)	2.59	1.52	2.37	15.58	1.41
LSD (0.05)	2.144	0.173	0.189	NS	0.4273

Table 2. Cost and return analysis of different treatments of sulpher fertilization for Onion production at MLT site Kashinathpur, Shathia Pabna during 2004-05

Treatment	Cultivation cost(Tk./ha)	Gross return (Tk./ha)	Net return (Tk./ha)	BCR
T_1	31,000	1,55,430	1,24,430	5.01
T_2	31,550	1,67,850	1,36,300	5.32
T_3	31048	1,52,280	121232	4.90

Table 3. Effect of sulpher on the yield and yield attributes of onion at Faridpur during 2004-05

Treatment (S kg/ha)	Plant pop./m^2	Plant height (cm)	No. of leaves/ plant	Diameter of single bulb (cm)	Single bulb weight (g)	Bulb yield (t/ha)	Yield increase (%)
T_1= 0	51.0	34.50	6.58	3.72	11.50	5.82	-
T_2= 30	56.5	36.08	7.20	4.03	14.18	7.22	24
T_3= 18 (FP)	50.0	34.50	6.78	3.82	13.94	6.48	11
LSD (0.05)	NS	NS	NS	NS	2.74	0.85	-

Effect of boron (Solubor) application on the Mustard production

Abstract

The experiment was conducted at Palima, Tangail during 2004-05 on rainfed condition. Among the application methods with various concentrations of solubor and boric acid showed difference in yield and yield contributing characters. The treatment $S_{0.5}$ (solubor in foliar spray) gave maximum yield (1.5 t/ha) of grain and biomass of mustard, which was significantly higher than other treatments. The lowest yield of grain (1.2 t/ha) and biomass (2.5 t/ha) were obtained the treatment without Boron.

Introduction

Recently B deficiency was clearly detected in the floodplain ridge soils in the Rangpur (AEZ-3), Tangail, Jamalpur (AEZ- 8) and Mymensingh (AEZ-9) regions through the soil analysis by OFRD and SRDI. Much study on soil boron application was done in 2001-02 in mustard at Palima, Tangail but foliar application of B is scantly. Therefore, a study is needed to find out the effect of Solubor B and compare with soil application on the yield of Mustard.

Materials and Methods

The trial was conducted at FSRD site, Palima, Tangail during rabi 2004-2005 in farmer's field. The design of the experiment was RCBD with three replications. The variety was BARI sharisha-9. The Plot size was 6 m×4 m. The experiment consist of following treatments i.e., B_o = Control (Without Boric acid), B_1 = Boric acid in soil (BSA), $S_{0.5}$ = Solubor in foliar application ($S_{0.5}$ FA) and $S_{0.25}$ = Solubor in foliar application ($S_{0.25}$ FA), respectively. Boric acid was applied in the soil at the time of final land preparation @ 15g/20m^2. Solubor was sprayed in two equal installments during the time of crop growth. One sprayed at the time of flowering and another at pod formation stage. The seed rate was 7 kg/ha. Seeds were sown on 13th November, 2004 with a spacing of 30cm×5cm. Fertilizer doses were 80 – 20 – 30 – 20 – 24 kg NPKSZn/ha. All fertilizers were applied as basal except urea. Urea was applied as top dress on 20 and 45 days after sowing (DAS), respectively. One weeding cum thinning operation was done 20 DAS. The crops were harvested on 29th January, 2005. The data on different plant characters and yield components were collected from 10 plants selected at random in each plot and yield was recorded plot wise. Data were analyzed statistically using MSTATC package.

Results and Discussions

The application method and concentration of Boron shown remarkable variation in yield and yield contributing characters which was presented in Table-1.Seed yield and yield attributes were significantly influenced by different treatments. Significantly highest plant/m^2 was obtained from Solubor in foliar application @ 0.5. Similar trend was followed in case of branches/plant, pods/plant, and seeds/pods & 1000 grain weight. Length of pod was similar in two doses (0.5 & 0.25). Yield attributes reflected to grain yield as a result highest grain yield was recorded from application of solubor @ 0.5. The same treatment also showed much higher yield than with and without Boron. Similar trend was observed in biomass yield.

From the year result showed that foliar application of solubor @ 0.5 gave higher yield as compared to soil application of boron @ 1 kg/ha.

Table 1. Effect of Boron (Solubor) on the yield and yield contributing characters of mustard (BARI Sharisa-9) Palima, Tangail, 2004-05

Treatment	Plant pop. /m^2	No. of branches/ plant	No. of pod/ plant	Length of pod	No. seeds /pod	1000 grain wt.(g)	Grain yield (t/ha)	Biomass yield (t/ha)
B_0	114.0d	4.867c	72.87d	4.42c	13.33d	3.00d	1.20d	2.50c
B_1	133.0c	5.267b	84.20c	4.53c	17.00c	3.10c	1.28c	2.77b
$S_{0.5}$	147.3a	5.800a	94.73a	5.30a	19.33a	3.37a	1.50a	3.23a
$S_{0.25}$	140.3b	5.467b	89.60b	4.99a	17.87b	3.23b	1.35b	2.93b
CV %	0.66	2.16	2.35	2.65	1.66	1.17	1.56	3.73

SFM

Effect of Boron (solubor) application on Wheat production

Abstract

Four boron doses viz. T1) $N_{100}P_{25}K_{40}S_{10}Zn_2$ kg/ha (Control), T2) $N_{100}P_{25}K_{40}S_{10}Zn_2B_1$ kg/ha (B-soil application), T3) $N_{100}P_{25}K_{40}S_{10}Zn_2B_{0.5}$ kg/ha (B-foliar spray) and T4) $N_{100}P_{25}K_{40}S_{10}Zn_2B_{0.25}$ kg/ha (B-foliar spray) were tested on wheat at the Multilocation Test Site (MLT), Melandah during the rabi season of 2004-05. Results obtained from the study indicated that none of the yield contributing characters except 1000 grain yield was influenced due to boron (solubor) treatment. But there was an increasing trend in all characters when boron was foliar sprayed. However, the highest grain yield was recorded from T_3 (3.52 t/ha) which was statistically similar to T_2 (3.17 (t/ha). The treatment T_1 produced significantly lowest yield (2.75 t/ha).

Introduction

Recently B deficiency was clearly detected in Jamalpur (AEZ 9) region through soil analysis by OFRD and SRDI. But the effect of solubor B on wheat as foliar as well as soil application for the farmers is not assessment. Considering the above mentioned situation the experiment was undertaken on wheat at the Multilocation Test Site, Melandah.

Materials and Methods

The experiment was conducted at the Multilocation Test Site (MLT), Melandah during the rabi season of 2004-05. Four boron doses viz. T1) $N_{100}P_{25}K_{40}S_{10}Zn_2$ kg/ha (Control), T2) $N_{100}P_{25}K_{40}S_{10}Zn_2B_1$ kg/ha (B-soil application), T3) $N_{100}P_{25}K_{40}S_{10}Zn_2B_{0.5}$ kg/ha (B-foliar spray) and T4) $N_{100}P_{25}K_{40}S_{10}Zn_2B_{0.25}$ kg/ha (B-foliar spray) were considered. The variety used was Shatabdi. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 5m x 4m. Two-third of urea and entire amount of all other fertilizers were applied at the time of final land preparation except the boron doses of treatment T_3 and T_4. Seeds were sown in lines 20 cm apart rows with seed rate 120 kg/ha on November 29, 2004. One hand weeding was provided before crown root (CRI) initiation stage with the top dressing of the rest quantity of Urea followed by an irrigation. Another irrigation was applied at primordia (60 DAS) stage of the crop. Solubor were sprayed two times, one at booting and another at anthesis stage of the crop. Finally the crop was harvested on March 21, 2005. Ten plants were collected prior to harvest from each plot after attaining maturity to collect data on yield attributes. Data on grain yield was recorded leaving three lines from each side of the unit plot. The collected data were analysed statistically and the means were separated as per DMRT.

Results and Discussion

Results obtained from the study indicated that none of the yield contributing characters except 1000-grain weight was influenced due to boron (solubor) treatment variation (Table 1). But there was an increasing trend in all characters when the treatment $N_{100}P_{25}K_{40}S_{10}Zn_2B_{0.5}$ (B-foliar spray) was applied on wheat. However, the weight of 1000 grains was found highest in T_3 which was statistically identical to T_2. The highest grain yield was recorded from T_3 (3.52 t/ha) but it was statistically similar to T_2 (3.17 (t/ha). The treatment T_4 produced the lowest yield (2.75 t/ha) but statistically identical to T_1 treatment. Higher straw yield was recorded from treatment T_1 followed by T_3. But with the decrease of boron as foliar resulted lower grain yield. Though statistically similar grain yield was recorded from boron application either soil or foliar application but higher doses of boron was needed for soil application (1 kg B/ha).

From the study it could be suggested that foliar application may be feasible depending upon farmers choice and circumstance.

Table 1. Yield and yield contributing characters of wheat as affected by boron (solubor) at MLT Site, Melandah during 2004-05

Treatment	Plant height (cm)	Plant/m^2 (no.)	Spike length (cm)	Spikelets/ spike (no.)	Grains/ spike (no.)	1000-grain wt (g)	Grain yield (t/ha)	Straw yield (t/ha)
T_1	93.9	318	9.77	16.9	29.3	40.2b	2.97c	6.07a
T_2	94.9	283	9.73	18.5	31.8	47.3ab	3.17ab	5.37b
T_3	92.1	331	9.79	18.9	33.4	48.6a	3.52a	5.68ab
T_4	94.9	343	9.67	18.1	30.7	43.6b	2.95bc	5.28b
F	NS	NS	NS	NS	NS	**	*	**
CV (%)	7.36	9.46	8.48	10.76	5.03	8.56	8.69	11.16

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

Effect of Fertilizer and Variety on the yield of sweet potato

Abstract

The experiment was conducted at the Multlocation Test Site, Melandah during the rabi season of 2004-05 to find out a suitable variety as well as to find out an economic dose for higher yield of sweet potato. The experiment was laid out in a split plot design assigning variety viz. i) BARI SP-5 and ii) BARI SP-7 in the main plot and fertilizer level viz. i) Estimated mineral fertilizer dose based on the soil test value for AYG; ii) IPNS basis fertilizer management with cow dung, iii) Recommended fertilizer based on FRG/97, iv) Farmers practice and v) Absolute control in the sub-plot. The result obtained from the study indicated that BARI SP-7 was found significantly higher yield (30.5 t/ha) than BARI SP-5. Significantly highest tuber yield was found in IPNS basis fertilizer dose (32.2 t/ha). From the it was observed from interaction that the highest tuber yield (33.9 t/ha) was obtained by the BARI SP-7 with IPNS basis fertilizer dose (33.9 t/ha). The lowest yield was obtained by BARI SP-5 with control treatment (11.3 t/ha). But the cost and return analysis showed that the highest benefit cost ratio (24.95) and marginal rate of return (1452) was found from FRG/97 treatment due to lower additional cost.

Introduction

Fertilizer is one of the most important factors of increasing the productivity of crops. In order to obtain good yield, modern varieties of different crops require relatively high quantity of fertilizer compared to the traditional cultivars. But, the economic condition of Bangladeshi farmers often does not support them to use required quantity of fertilizers due to its high cost. On the other hand, the organic matter content of most of the soils of Bangladesh is very low (0.8-1.8%) as compared to desired (2.5% and above) levels.

Sweet potato is one of the source of carbohydrate and carotene rich root crop. Farmers are using local variety which is low yielded and contain less carotene. Bangladesh Agricultural Research Institute (BARI) has already developed many sweet potato varieties which have high yield potential and also contain high amount of carotene. Keeping the views, the experiment was undertaken to fiend out the suitable variety with economic fertilizer dose (Sweet potato) at the MLT site Melandah, Jamalpur under AEZ 9.

Materials and Methods

The experiment was conducted in medium high land on loamy to clay loam soil at the Multilocation Test Site, Melandah during the rabi season of 2004-05. The experiment was laid out in a split plot design assigning variety viz. i) BARI SP-5 and ii) BARI SP-7 in the main plot and fertilizer level viz. i) Estimated mineral fertilizer dose based on the soil test value for AYG; ii) IPNS basis fertilizer management with cow dung, iii) Recommended fertilizer based on FRG/97, iv) Farmers practice and v) Absolute control in the sub-plot. The pH of the soil is 6.5, OM(%) 1.28, total N(%) 0.06, exchangeable cation meq (%) of K, Ca, Mg is 0.13, 1.25, 0.42 and P, S, Zn and B (PPP) is 3.4, 21.7, 0.56 and 1.3. The unit plot size was 4m x 5m. The trial was conducted in three dispersed replications.

Vines were planted on November 28, 2005 and were finally harvested from April 10-12, 2005. The collected data were analysed statistically and the means were separated as per LSD test.

Results and Discussion

Effect of variety: The yield and yield contributing characters of sweet potato varieties have been presented Table 1. The results revealed that all most all the yield and yield contributing characters were influenced due to variety. The variety BARI SP-7 gave significantly higher yield than BARI SP-5 due to higher yield attribute (Table 1).

Effect of fertilizer: The yield and yield contributing characters of sweet potato varieties were significantly influenced due to different fertilizer combination (Table 1). Lengths of vine found were statistically similar to all fertilizer doses except control plot. But the tuber/plant were found significantly highest in IPNS treatment. The length of tuber was found higher in IPNS basis fertilizer dose but it was statistically identical to all other treatments except control. The control plot had lowest length of tubers. The higher breadth of tuber was recorded from FRG/97 treatment and the lowest was from control plot. The tuber weight/plant was found higher in IPNS basis fertilizer trial but it was similar to FRG/97. However, significantly highest tuber yield was recorded from IPNS fertilizer trial (32.2 t/ha) due to higher tuber/plant, length of tuber & weight of tuber/plant and lowest from control plot.

Interaction: The interaction between variety & fertilizer dose was found significant in yield and yield attributes (Table 2). The variety BARI SP-5 with ED_1 showed higher vine length followed by IPNS & FP. But tuber/plant was higher in BARI SP-7 with IPNS followed by same variety of ED1 and BARI SP-5 with IPNS & FRG 197. Significantly highest breadth of tuber was recorded from BARI SP-7 with FSG 197 but tuber/plant was obtained from BARI SP-5 with FRG-97 followed by IPNS & BARI SP-7 with IPNS & FRG-97. Significantly highest tuber yield was obtained from BARI SP-7 with IPNS treatment due to higher tuber/plant & tuber weight/plant & lowest from control plot for both the variety.

Cost and return analysis: Cost and return analysis showed that the highest marginal benefit cost ratio (24.95) and marginal rate of return (1452) was found from FRG/97 treatment (Table 3). It had lower additional cost than the all other fertilizer treatment.

Table 1. Yield and yield contributing characters of sweet potato at Melandah during 2004-05

Treatment	Length of vine (cm)	Tuber/ plant (no.)	Length of tuber (cm)	Breath of tuber (cm)	Tuber wt./plant (gm)	Tuber yield (t/ha)
A. Variety						
BARI SP 5	106.9a	4.10b	10.8	2.92b	247.3b	24.4b
BARI SP 7	85.4 b	5.13a	9.8	3.87a	292.0a	30.5a
F	**	*	NS	*	*	**
CV (%)	5.04	3.98	11.03	9.56	14.39	7.08
B. Fertilizer level						
ED_1	103.7a	4.36b	10.6 ab	3.55ab	343.2b	25.5c
IPNS	100.8a	5.38a	11.1a	3.33b	293.3a	32.2a
FRG'97	102.4a	4.28b	9.8ab	3.76a	296.5a	28.0b
FP	102.6a	3.05c	10.6ab	3.42b	254.2b	15.8d
Control	71.4b	2.05d	9.3b	2.90c	191.3c	11.7e
F	**	**	*	**	**	**
CV(%)	10.65	11.24	9.86	5.92	13.92	6.69

Figures in column having similar/no letter(s) do not differ significantly

Table 2. Interaction effects of variety and fertilizer on the yield and yield components of sweet potato at MLT site, Melandah during 2004-05

Interaction (Variety x fertilizer dose)		Length of vine (cm)	Tuber/plant (no.)	Length of tuber (cm)	Breath of tuber (cm)	Tuber wt./ plant (gm)	Tuber yield (t/ha)
BARI SP 5	ED1	122.4a	4.10bc	10.6abc	2.93cd	247.33c	24.4c
	IPNS	115.4ab	5.13ab	11.8a	2.91cd	292.00a	30.5b
	FRG'97	102.9bc	4.33abc	10.5abc	3.03cd	305.33a	26.0c
	FP	116.1ab	3.01cd	11.5ab	3.04cd	260.00c	15.2d
	Control	78.0de	2.00d	9.3c	2.67d	189.33d	11.3e
BARI SP 7	ED1	85.0cd	4.60ab	10.5abc	4.16a	239.00c	26.7c
	IPNS	86.2cd	5.63a	10.4abc	3.75b	294.67a	33.9a
	FRG'97	101.9bc	4.23abc	9.1c	4.49a	287.67a	30.1b
	FP	89.1cd	3.09cd	9.8bc	3.79b	266.00b	16.4d
	Control	64.8e	2.13d	9.4c	3.13c	193.33d	12.2e
CV(%)		10.65	11.24	9.86	5.92	13.92	6.69

Figures in column having similar/no letter(s) do not differ significantly

Table 3. Cost and return analysis of sweet potato as affected by fertilizer levels at MLT site, Melandah during 2004-05

Treatment	Gross return (Tk/ha)	Variable cost (Tk/ha)	Gross margin (Tk/ha)	BCR	MRR (%)
ED1	89250	7938	81312	11.24	-
IPNS	112700	8944	103756	12.60	-
FRG'97	98000	3928	94072	24.95	1452
FP	55300	5518	49782	10.02	-
Control	40950	0	41120	-	-

Sweet potato (Tk/kg): 3.5

Response of chickpea varieties to Phosphorus and Molybdenum in Surma-Kusyiara Floodplain Soil

Abstract

The effect of molybdenum (Mo) and phosphorus (P) on the yield of three chickpea varieties was studied at FSRD site, Golapgonj, Sylhet during rabi 2003-2005. Five different fertilizer doses along with or without Mo and P, and three chickpea varieties (BARI Chola-2, BARI Chola-3 and BARI Chola-5) were used. Mo (0.5 kg/ha) and P (20 kg/ha) along with blanket doses of N, K, S and B gave the highest yield both in 2003-04 and 2004-05 but only P along with blanket doses had no significant effect. Among the varieties BARI Chola-3 gave the highest yield for both the year.

Introduction

Recently chickpea is performing well in the fallow area of Sylhet region. These soils are characterized by a low pH, with crops frequently showing nutrient deficiency symptoms. Inadequate nodulation of legumes on acid soils can be associated with low-plant available molybdenum (Barrow, 1973) and also phosphorus (Gupta and Singh, 1982). In that situation chickpea growth and yield will probably be hampered due to Mo deficiency. Therefore, an experiment was undertaken to investigate the effect of Mo on different chickpea varieties along with P.

Materials and Methods

Experiment was conducted under rainfed condition at FSRD site Golapgonj, Sylhet during rabi 2003-2004 and 2004-2005. A description of the initial physical and chemical properties of the experimental plots are presented in Table 1.

Table 1. Physical and chemical properties of the experimental soil profile used for chickpea

Properties	Depth of soil layers (cm)								
	0-15			15-30			30-45		
	*F_1	F_2	F_3	F_1	F_2	F_3	F_1	F_2	F_3
Soil P^H	5.9	5.4	5.1	6.1	-	-	6.2	-	-
N (Total N%)	0.10	0.10	0.09	0.11	-	-	0.08	-	-
P (ppm)	7.2	11.0	6.0	4.0	-	-	2.0	-	-
K (meq/100g soil)	0.14	0.12	0.09	0.15	-	-	0.11	-	-
S (meq/100g soil)	12.1	39.0	19	7.8	-	-	0.08	-	-
B (ppm)	0.27	0.22	0.18	-	-	-	-	-	-

*F- Farmer

Experiment was laid out in factorial RCB design with 3 dispersed replications. The unit plot size was 3m×4m. There were 5 fertilizer doses: (F_1- absolute control, F_2- blanket doses of fertilizers for N, K, S and B at the rate of 20, 20, 15 and 1 kg/ha, respectively, F_3- Mo (500g/ha) + F_2, F_4- Mo (500g/ha) + P_{20} (kg P/ha) + F_2, F5- P_{20} (kg P/ha) + F_2) and three varieties viz. V_1- BARI Chola-2, V_2- BARI Chola-3 and V_3- BARI Chola-5.

Molybdenum and Boron were used as a ammonium hepta molybdate tetrahydrate [$(NH_4)_6 Mo_7O_{24}.4H_2O$] and boric acid. N, K, S and B were applied at the time of final land preparation. Mo and P were applied in the furrow before sowing of seed. The seeds were sown on 29 November and 5 December, 2003 and 9 December 2004. Spacing was 40cm×10cm. The rainfall occurred during October 2003 was 238.1 mm and during crop growing period (November – March) was 54.6 mm (Fig1). Pod borer was minimized by spraying of insecticides and also by hand picking of larvae. The crop was harvested for 1st year last week of March, 2004 and 29 March 2005 for 2nd year.

Results and Discussion

The yield and yield attributes of chickpea were significantly influenced by Mo & P along with blanket fertilizer dose (Table 2). On an average, higher plan height was obtained from BARI chola 3 with Mo+F2 followed by BARI chola-2 with Mo+P+F2 treatment. Significantly highest pods/plant was recorded from BARI chola-3 with Mo+P+F2. Similar trend was followed in case of 100-seed weight but clearly follow by F5&F3 of same variety. Seed yield was not significantly influenced in 2003-04 but highest seed yield was recorded from BARI chola 3 with Mo+P+F2. Response of Mo & P along with blanket dose of fertilizer.

Table 2. Effect of molybdenum and phosphorus on pod/plant, 100-seed wt. and seed yield of chickpea varieties at FSRD site, Golapgonj, Sylhet during 2004-05

Fertilizer dose	Variety			
	BARI Chola-2	BARI Chola-3	BARI Chola-5	Mean
Plant height (cm)				
F_1= Absolute control	32.67	34.67	35.67	34.34
$F_2 = N_{20}K_{20}S_{15}B_1$	34.00	38.00	35.67	35.89
$F_3 = M_o + F_2$	38.00	39.67	36.00	37.89
$F_4 = M_o + P + F_2$	39.00	38.33	37.67	38.33
$F_5 = P + F_2$	33.67	34.33	36.33	34.78
Mean	35.47	37.00	36.07	
$LSD_{0.05}$	For variety- 2.12, for fertilizer dose- 2.76, for interaction- 4.78			
Branch/plant (No.)				
F_1= Absolute control	2.33	2.00	2.00	2.11
$F_2 = N_{20}K_{20}S_{15}B_1$	2.33	2.33	2.33	2.33
$F_3 = Mo + F_2$	2.33	2.33	2.33	2.33
$F_4 = Mo + P + F_2$	2.33	3.00	2.66	2.66
$F_5 = P + F_2$	2.00	2.33	2.00	2.11
Mean	2.26	2.40	2.26	
$LSD_{0.05}$	For variety- 0.24, for fertilizer dose- 0.469, for interaction- 0.692			
Pod/plant (No.)				
F_1= Absolute control	8.67	10.33	11.00	10.00
$F_2 = N_{20}K_{20}S_{15}B_1$	10.33	12.00	12.67	11.67
$F_3 = Mo + F_2$	10.33	13.00	13.00	12.11
$F_4 = Mo + P + F_2$	11.33	16.67	13.33	13.78
$F_5 = P + F_2$	9.33	11.00	10.33	10.22
Mean	10.00	12.60	12.07	
$LSD_{0.05}$	For variety- 3.32, for fertilizer dose- 1.66, for interaction- 2.88			
100 – Seed wt. (g)				
F_1= Absolute control	12.00	16.23	10.37	12.87
$F_2 = N_{20}K_{20}S_{15}B_1$	12.40	16.57	10.53	13.17
$F_3 = Mo + F_2$	12.53	16.83	10.80	13.39
$F_4 = Mo + P + F_2$	13.30	17.10	10.97	13.79
$F_5 = P + F_2$	13.03	16.95	10.73	13.57
Mean	12.67	16.74	10.68	
$LSD_{0.05}$	For variety- 0.44, for fertilizer dose- 0.2018, for interaction- 0.3			
Plant pop./m^2				
F_1= Absolute control	36	39	38	37.56
$F_2 = N_{20}K_{20}S_{15}B_1$	38	39	38	38.11
$F_3 = Mo + F_2$	43	44	39	41.89
$F_4 = Mo + P + F_2$	38	41	38	39.11
$F_5 = P + F_2$	39	38	43	40.11
Mean	39	40	39	
$LSD_{0.05}$	For variety- 9.97, for fertilizer dose- 5.77, for interaction- 9.99			

Fertilizer dose	Seed yield (kg/ha)					
	BARI chola-2		BARI chola-3		BARI chola-5	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
F_1	947	768	1180	1373	705	868
F_2	1024	1032	1276	1680	809	1005
F_3	1077	1081	1364	1804	940	1081
F_4	1269	1119	1554	2177	1082	1149
F_5	1195	952	1480	1431	1044	974
LSD(.05) for interaction	40.23 (2004-05),			NS (2003-04)		

Effect of split application of Compost on the performance of Okra

Abstract

An experiment was conducted at Agricultural research Station, Pabna during 2004 to see the effect of split application of compost on Okra. Treatment T_5 (compost used as 25% basal and 75% top dress at 20, 40 and 60 DAS) gave significant the highest yield where control treatment gave the lowest yield.

Introduction

Since time immemorial, agriculture was based on natural inputs and practices with indigenous varieties and species. Due to increasing population pressure use and decreasing land area, the natural system was broken down to an intensive and chemical based modern agriculture. The soil of arable land especially with high cropping intensity are declining in quality with poor OM and nutrient content, deteriorating physical condition. They receive very little organic replenishment while being dressed with increasingly higher rates of chemical fertilizers and pesticides. The crops are receiving high amounts of toxic chemicals causing serious threat to soil organisms, water and aerial environments and finally, the consumer's health. Food crops including those used directly as salads and fruits are the source of effective toxic chemicals endangering human and animal health.

On the other hand, an estimated amount of about 175 million tons of recyclable wastes are produced in the country every year. Major part of this waste is suitable for using as compost/manure to crop field and can help regenerating soil health and boosting crop production. Practical observation suggests that crop response was sharp just within 2-3 days of application of composts and crops were pale and showing nutrient deficiency at an interval of a period of 30-40 days. This indicated possibility of getting more benefit from splitting of compost.

Objectives

i) To find out the effect of split application of compost on Okra.
ii) To select best application method of compost for upland crop like Okra.

Materials and Methods

The experiment was conducted at Agricultural Research Station (ARS), Pabna in Gopalpur soil series under AEZ-11. The experiment was laid out in RCB design with four replications and unit plot size was 2.8 m x 2 m. Six different organic and inorganic fertilizer doses were tested against control. The treatments were:-

i. Control
ii. All compost as basal @ 10 ton dry matter/ha
iii. 75% basal 25% top dress at 40 days of transplanting @ 10 t/ha
iv. 50% basal 50% top dress at 40 and 60 days of transplanting @ 10 t/ha
v. 25% basal 75% top dress at 20, 40 and 60 days of transplanting @ 10 t/ha
vi. 0% basal 100% top dress at 10, 20,40 and 60 days of transplanting @ 10 t/ha
vii. 100% chemical fertilizer @ 100-20-60-20- kg of N-P-K-S/ha^{-1} using N at 4 equal splits at 10, 20, 40 and 60 days.

Active compost was the organic source which was made under semi aerobic condition with fresh poultry droppings 50%, chopped crop residues 50%. Urea, TSP & Gypsum @ 1%, 0.5% & 1%(of total organic mass) also used and effective micro organism (EM) solution as needed. Active compost contain 1.32% N (Appendix-1). Seeds of okra (BARI Dherosh-1) were sown on April 22, 2004 in line with spacing 50 cm × 40 cm. Fertilizer and compost were applied as per treatment (mentioned above). Neem oil was sprayed two times to control insect (Jassid) at June 14 and 23, 2004. Some plant leaves of chemical fertilized plot were came down yellowish but compost plots were fresh. The crop was harvested at June 3-5, 2004. Data on different parameters were collected and analyzed statistically.

Results and Discussion

Yield and yield contributing characters of okra were differed significantly among the treatments except days to flowering and 1st harvest. The highest plant height was found in T_7 treatment where the lowest found in control treatment. Higher number of fruits plant^{-1} was found in T_5 treatment which was statistically at par with T_4, T_6 and T_7 treatment. Fruits weight plant^{-1} was also higher in T_5 treatment which was statistically identical with T_6 treatment. The highest yield was obtained from T_5 treatment which was also supported by yield contributing characters, The results of other treatments indicated that there might have a deficiency of nutrient at an interval of a period of 30-40 days. The lowest yield was found in control treatment.

From the economical point of view, it was found that the highest gross margin and MBCR were obtained from T_7 treatment and it was mainly due to lower cost of fertilizer. Treatment T_5 showed second highest MBCR but gave the highest gross return. Treatment T_2 showed lower performance.

Conclusion

From the first years result, it was revealed that okra can be cultivated successfully by 100% compost with three split application. Though its cost is higher but safe for human and soil health. However, this is one years result, it should be continued at least for the next year for a concrete conclusion.

Table 1. Effect of different fertilizer management on yield and yield attributes of Okra at ARS, Pabna at 2004

Treatment	Days to flowering	Days to 1st harvest	Plant height at last harvest (cm)	Fruits plant^{-1} (no.)	Fruits weight plant^{-1} (g)	Yield (t ha^{-1})
T_1 = Control	33.50	43.00	160.75d	20.25d	177.89e	7.73e
T_2 = All compost basal	34.75	43.75	169.45c	34.05bc	279.75e	11.91d
T_3 = C. 75% basal + 25% TD	34.50	44.50	161.45d	33.55c	291.75d	12.71c
T_4 = C. 50% basal + 50% TD	34.50	44.25	173.20bc	36.20abc	315.00b	13.62b
T_5 = C. 25% basal + 75% TD	34.25	44.75	179.35b	37.85a	332.50a	14.45a
T_6 = C. 0% basal + 100% TD	35.00	44.75	172.08bc	35.90abc	329.25a	13.34bc
T_7 = 100% chemical fertilizer	33.50	43.75	194.50a	36.95ab	20175c	13.19bc
CV(%)	7.332	6.164	-	5.57	20.143	4.273
LSD (.05)	3.39	2.22	-	2.94	6.66	2.77

Table 2. Cost and Return analysis of different nutrient management in Okra at ARS, Pabna during 2004

Treatments	Gross return (Tk ha^{-1})	Variable cost (Fertilizer & applying cost) (Tk ha^{-1})	Gross margin (Tk ha^{-1})	MBCR (Over control)
T_1 = Control	23190	0	23190	-
T_2 = All compost basal	35730	13000	22730	0.96
T_3 = C. 75% basal + 25% TD	38130	13600	24530	1.10
T_4 = C. 50% basal + 50% TD	40860	14200	26660	1.24
T_5 = C. 25% basal + 75% TD	43350	14800	28550	1.36
T_6 = C. 0% basal + 100% TD	40020	15400	24620	1.09
T_7 = 100% chemical fertilizer	39570	7092	32478	2.30

Price of input

Urea	= 6.25	Tk kg^{-1}
TSP	= 14	Tk kg^{-1}
MP	= 14	T k kg^{-1}
Gypsum	= 03	T k kg^{-1}
Zn 0	= 40	T k kg^{-1}
Borax	= 40	T k kg^{-1}
Compost	= 1	Tk kg^{-1}

Price of output

Okra = 3 Tk kg^{-1}

Effect of different compost doses on the yield of papaya

Abstract

An experiment was conducted at Agricultural Research Station (ARS) Pabna during 2004 to see the possibility of producing organic Papaya. Only 40 t ha^{-1} compost treatment gave higher yield where 100% chemical treatment gave lower yield except control. MBCR was also higher in all compost treatment than 100% chemical treatment and the highest MBCR was observed from 15 t ha^{-1} compost treatment.

Introduction

Papaya is one of the most popular year round cheap fruit in Bangladesh. It is taken fresh as rich source of vitamins and minerals. It needs very high dose of chemical fertilizer to have a good yield of it. The taste of papaya including its sweetness, vary widely in seasons and management differences. It is the demand of the time to have an organic produce of it avoiding all sorts of chemicals used and with an expected better taste and yield.

Objectives

1. To find out possibility of producing organic papaya.
2. To select suitable compost dose for profitable papaya cultivation.

Materials and Methods

The experiment was conducted at Agricultural Research Station (ARS), Pabna during 2004 to find out the possibility of papaya production organically in Gopalpur soil series under high ganges river flood plain soil (AEZ). The experiment was laid out in RCB design with four replications and unit plot size was 4.5 m × 3.5 m. Three different doses of compost and one chemical treatment were tested against control treatment. The treatments were T_1= control, T_2= 15 t ha^{-1} of poultry compost (PC), T_3= 30 t ha $^{-1}$ of PC T_4= 40 t ha^{-1} of PC and T_5= 100% chemical (633, 276, 716, 312, 39, 4 kg N, P, K, S, Zn, B respectively ha^{-1}) . Poultry compost was made by fresh poultry droppings 50% and chopped crop residues 50% with urea 1% TSP 0.5%, Gypsum 1% and effective micro-organism (EM) solution as needed. Poultry compost contains 1.32% N (Appendix-1). Three seedlings of papaya (var. Shahi papaya) per pit were planted on April 4, 2004 maintaining the spacing of 1.5 m X 1.5 m. Fifty percent of compost was applied in pits (size 1 m x 1 m x 0.5 m) before 15 days of transplanting. The rest compost was applied as top dress at 30 and 60 DAT. Full of P, S, Zn, B and ½ K fertilizers was applied at 60 DAT and N fertilizer was applied at 10, 30 and 60 DAT in three equal split. Gap filling and irrigation was done on April 22, 2004. Most of the male plant and some female plant was up rooted on June 3, 2004, so that the field would contain 10 % male plant and other pit contain only female plant. Neem oil was sprayed four times on July 8, 14, 22 and 30, 2004 to protect the insect which might cause the plant virus infection. Papaya harvesting was started on September 27, 2004 but an unexpected storm and heavy rainfall hit the papaya field which caused the papaya likely damaged and as a result brix and panel test could not be done. However, data on different parameters were collected from the damaged plant and multiplying from the total number of papaya. The data were analysed statistically.

Results and Discussion

Yield and yield contributing parameters were differed significantly among the treatments except length and breadth of fruit (Table-1). Days to flowering and fruit setting were longer in 100% chemical treatment and shorter in 30 t ha^{-1} compost treatment. Plant height was higher in 40 t ha^{-1} compost treatment where lower plant height was found in control treatment. Length and breadth of fruit were higher in 15 t ha^{-1} compost treatment where higher fruits $plant^{-1}$ was found in 40 t ha^{-1} compost treatments which might be lead to highest yield of (22.5 t ha^{-1}) papaya. Yield was lowest in control treatment. The highest number of normal shaped and sized fruits were found in compost treated(40 t ha^{-1}) plot and lower in 100% chemical treated plot. Reverse trend was found incase of number of deformed fruits plant^{-1}. These results indicated that compost at active stage could be supplied the required amount of different nutrient sufficiently.

From the economical point of view, it was found that papaya production with compost always profitable and the highest MBCR was obtained from 15 t ha^{-1} compost treatment.

Conclusion

Storm and heavy rainfall were the great problem for papaya cultivation. However, early planting might be a chance to overcome it. Active compost where different nutrients especially N have an active stage might be promising for papaya cultivation. This is first year and incomplete result, so it should be continued for the next year for a concrete decision..

Table 1. Performance of papaya as affected by different compost doses and chemical treatments at ARS, Pabna during 2004

Treatment	Days to 50% flowering	Days to fruit initiation	Plant height (cm)	No. of fruits/ plant	Length of fruit	Breath of fruit	No. of normal fruits/plant	No. of deformed fruits/plant	Yield (t/ha)
Control	44.00b	59.00b	165.78b	11.75b	16.53	10.32	9.75c	1.75c	13.37c
15 ton/ha	40.50b	55.50b	183.60ab	19.75a	16.80	10.72	14.49abc	4.99bc	19.97ab
30ton/ha	39.25b	54.25b	202.29a	24.75a	15.59	10.53	16.73ab	7.96ab	20.10ab
40 ton/ha	39.75b	54.75b	202.52a	25.00a	16.13	10.54	17.83a	6.44b	22.51a
100% chemical	52.50a	66.50a	194.65a	23.25a	15.45	10.09	12.19bc	10.63a	14.76bc
CV %	8.93	5.79	8.45	20.41	6.52	6.42	21.62	40.32	20.29
LSD (.05)	5.95	5.177	24.70	6.573	NS	NS	4.729	3.946	5.671

Table 2. Cost and return analysis of different compost doses and chemical fertilizers of Papaya at ARS, Pabna during 2004

Treatments	Gross return (Tk ha^{-1})	Variable cost (Fertilizer & applying cost) (Tk ha^{-1})	Gross margin (Tk ha^{-1})	MBCR (Over control)
Control	106960	0	106960	-
15 t ha^{-1} compost	159760	20700	139060	2.55
30 t ha^{-1} compost	160800	40200	120600	1.34
40 t ha^{-1} compost	180080	53200	126880	1.37
100 % chemical	118080	52256	65824	0.21

Price of input

Urea = 6.25 Tk kg $^{-1}$
TSP = 14.00 Tk kg^{-1}
MP = 14.00 T k kg^{-1}
Gypsum = 03.00 T k kg^{-1}
Zn 0 = 40.00 T k kg^{-1}
Borax = 40.00 T k kg^{-1}
Compost = 1.30 Tk kg^{-1}

Price of output

Ripening Papaya = 8 Tk kg^{-1}

Screening green manuring crops for better adjustment and contribution to cropping pattern under organic farming

Abstract

The experiment was conducted at Agricultural Research Station (ARS), Pabna, during 2004-2005 to see the growth performance of organic manuring crop in summer season and its nutrient contribution to produce organic crop. Growth performance was found better in cowpea over the time and lower in blackgram. Nutrient contribution by cowpea to radish production was also higher, so, higher radish yield was obtained from cowpea plot.

Introduction

Green manure's (GM) are most important low cost impute of organic farming. They alone can contriute 50 percent or more nutrient requirement of crops. But not all species of GM are equally adjustable to all production environments. Thus, these should be screened out for the comparative performance against cropping patterns under organic farming system.

Objectives

1. To find out growth performance of GM crops sown in summer season
2. To select GM crop (s) for better growth and nutrient contribution to organic crop (Radish)

Materials and methods

The experiment was conducted at Agricultural Research Station (ARS) Pabna, during 2004-2005 in Gopalpur soil series under High Ganges River Flood Plain Soil (AEZ-11). Before starting the experiment a composite soil was collected for analysis to see the initial nutrient status. Five different GM crops (viz. Black gram, Sunhemp, Cowpea, local Sesbania and Mungbean) were selected for summer season and one control plot was maintained. The experiment was laid out in RCB design with three replications. The unit plot size was 6 m × 3 m during the GM crop and 2.75 m × 3 m during the radish. Seeds of GM crops were sown on August 21, 2004 maintaining the spacing 30cm × continuous. During the early stage of GM crop three times of unexpected heavy rainfall and storm disturbed the crop establishment, ie 1st September 13-16, 2004 (the crop was fully submerged for 4 days), 2nd September 27-29, 2004 (the crop was submerged for 2 day). The GM crops were incorporated after 2 months of sowing in October 21, 2004. Seeds of radish were sown on November 24, 2004 maintaining the spacing 40 cm × 30 cm @ 3 kg ha^{-1} seed rate. Before sowing the radish seed, each GM plot including control plot were divided into two portions and finally the plot size were 2.80 m × 3 m. One portion of each GM plot was fertilized with 50% compost another portion was fertilized with 75% compost according to recommended nutrient requirement 12 t ha^{-1} compost. Additional 50% compost was added in the plot due to lower plant population of GM crop as well as lower biomass which was caused by heavy rainfall. One of each control plot was fertilized with 100% chemical fertilizer (@ 161, 60, 122, 18.3 kg N, P, K, S, Zn, ha^{-1}) and another portion was absolutely control. Half of urea, ½ MP, ½ compost and other fertilizers applied as basal and rest ½ urea and ½ compost were applied in two equal splits at 21 and 35 DAS. Seeds of Radish were sown on November 24, 2004 maintaining the spacing 40 cm × 30 cm with seed rate 3 kg ha^{-1}. Thinning and gap filling were done 15 DAS. The crop was harvested on January 27, 2005. Next crop Mungbean is still in the field. Data on different parameters were collected and analysed statistically.

Results and Discussion

GM crop: Data on different parameters were collected at four different dates ie, September 23, October 04 October 14 and at the time of incorporation, October 20, 2004. Initial plant population was higher in sesbania and lower in mungbean. Plant height was higher at every date in sunhemp and lower in blackgram. Green biomass of 10 plants was higher at every date in cowpea and lower (in most cases) was in Black gram. Incase of dry biomass the same trend was also found. During the final incorporation the highest plant height was found in sunhemp but higher green biomass ha^{-1} and dry biomass ha^{-1} were obtained from cowpea.

Radish crop: Yield and yield attributes were differ significantly among the treatments (Table-3). All parameters results were higher in all plant height was found in 100% chemical (earlier control) treatment and the lowest was obtained in absolute control. Leaf length was higher in 100% chemical treatment and lower in sunhemp with 50% compost treatment. Marketable length, diameter, marketable weight and yield were obtained higher in cowpea with 75% compost treatment. It might be due to the succeeding effect and higher nutrient suppliment from higher amount of biomass added earlier. The lower value of all cases was found in absolute control treatment. Third crop (mungbean) is still in the field now.

Conclusion

Vegetable crops like Radish might be grown 100% organically, if summer green manuring crops like cowpea can grow successfully with few amounts of compost. In the presented year, the GM crop was hampared due to heavy rainfall and storm, so, the population of GM crop was low which caused lower biomass yield and for this reason a big amount of compost was needed to add. This is one year incomplete result, so, it is needed to be continued for the next year for a concrete conclusion.

Table 1. Growth performance of different GM crops at ARS, Pabna during 2004-05

Treatments	Initial plant pop. m^{-2}	Plant height (cm)			Green biomass of 10 plants (g)			Dry biomass of 10 plant		
		23/09/04	04/10/04	14/10/04	23/09/04	04/10/04	14/10/04	23/09/04	04/10/04	14/10/04
Blackgram	61.00b	20.52c	22.87b	27.26d	25.12b	35.70	62.97a	6.97b	7.8a	14.03a
Sunhemp	51.00b	32.06a	50.88a	103.62a	28.87b	69.67	164.2a	7.73b	19.7a	34.53a
Cowpea	61.33b	30.42ab	39.76ab	49.46c	75.07a	126.67	130.03a	14.73a	17.57a	27.40a
Sesbania	176.67a	23.67bc	36.27ab	63.40b	18.00b	40.73	99.73a	5.33ab	7.1a	14.83a
Mungbean	48.00b	23.56bc	30.34b	32.37d	31.667b	64.37	71.30a	7.90b	13.3a	22.00a
Control	-	-	-	-	-	-	-	-	-	-
CV (%)	70.56	13.92	27.33	7.45	32.56	25.68	54.36	24.84	52.87	49.73
LSD(.05)	105.70	6.83	18.53	7.74	21.92	32.60	108.10	3.99	13.04	21.13

Table 1. Contd.

Treatments	Initial plant pop. m^{-2}	Nodules Plant $^{-1}$ (No.)			Fresh weight of nodules plant^{-1} (no.)		
		23/09/04	04/10/04	14/10/04	23/09/04	04/10/04	14/10/04
Blackgram	61.00b	3.47B	16.4	15.50a	0.16b	0.43c	0.77c
Sunhemp	51.00b	3.17b	45.03	22.10a	0.15b	1.97ab	1.40bc
Cowpea	61.33b	8.30a	22.00	16.40a	0.83a	2.77a	2.97a
Sesbania	176.67a	6.03ab	15.77	23.40a	0.60ab	1.63abc	2.23ab
Mungbean	48.00b	4.20b	14.47	20.20a	0.13b	0.57bc	0.9c
Control	-	-	-	-	-	-	-
CV (%)	70.56	28.72	61.39	41.21	78.59	487.54	42.65
LSD(.05)	105.70	2.72	26.28	12.09	0.55	1.35	1.34

Table 2. Performance of different GM crops at incorporating stage at ARS, Pabna during 2004-05

Treatments	Plant height (cm)	Plant population m^{-2} (no.)	Green biomass (t ha^{-1})	Dry biomass (t ha^{-1})
Blackgram	33.73c	60.00ab	4.35c	0.86b
Sunhemp	98.10a	51.00b	8.05b	2.27a
Cowpea	65.01b	61.33b	16.63a	2.14a
Sesbania	80.00ab	163.33a	8.87b	2.11a
Mungbean	39.30c	47.00b	5.55bc	1.98a
Control	-	-	-	-
CV (%)	15.36	36.23	22.03	31.65
LSD	18.29	92.31	3.36	1.14

Table 3. Performance of Radish as affected by different fertilizer/ Compost treatment at ARS, Pabna during 2004-05

Treatment	Plant height (cm)	Marketable length (cm)	Diameter (cm)	Leaf length (cm)	Total weight plant^{-1} (g)	Marketable weight plant^{-1} (g)	Yield (t ha^{-1})
Blackgram (50% AC)	60bcd	27bcd	21abc	35b	915bcd	733bcd	65.2bc
Blackgram (75% AC)	64abcd	30ab	23ab	37ab	1041abc	842abc	74.5abc
Sunhemp (50% AC)	60bcd	26cd	21abc	26b	809cd	658cd	70.7bc
Sunhemp (75% AC)	59cd	25d	21bc	36ab	814cd	657cd	71.5bc
Cowpea (50% AC)	66abc	30abc	22abc	38ab	998abcd	812abcd	89.3ab
Cowpea (75% AC)	66ab	31a	24a	39ab	1129ab	1017a	97.3a
Local Sesbania (50% AC)	66abc	30abc	22abc	38ab	993abc	824abcd	74.3abc
Local Sesbania (75% AC)	61bcd	28abcd	21abc	34b	896bcd	760abcd	72.3abc
Mungbean (50% AC)	65abcd	30ab	24ab	37ab	1057abc	936ab	86.7ab
Mungbean (75% AC)	65abcd	30abc	24ab	37ab	1113abc	917abc	77.1ab
Control (Absolutecontrol)	58d	25d	19c	36ab	708d	577b	51.1c
Control (100% chemical)	70a	29abc	23ab	41a	1266a	940ab	82.9ab
CV (%)	5.65	7.00	7.50	7.43	15.89	16.39	16.80
LSD (.05)	6.35	3.53	2.94	9.89	276.7	234.3	22.74

Integrated approach to Farming Systems Research and Development, Faridpur

Abstract

The study was conducted at Farming System Research and Development (FSRD) Site, Ishan Gopalpur, Faridpur during June 2004 to May 2005 to determine the effect of integrated farming intervention on a farm family and to find out a module for resource specific technology integration. The households were selected previously involved in PETRRA project. The study was carried out on 03 landless, 03 marginal and 03 small households but data was recorded only eight farm families out of nine. Appropriate sets of technologies were intervened replacing the existing one. In the crop land, new crop varieties and management practices were given. Open homestead area, rooftop, trellis, tree support, fence, marshy land and pond bank were utilized for year round vegetable production. In livestock sub system, vaccination, deworming, chicken rearing for egg production, improved duck rearing, pigeon rearing and cattle fattening were adopted. Besides, mono and mixed culture of fish were introduced in the seasonal ponds. Some economically profitable off farm activities were practiced to increase the cash income. The gross margin from crop, livestock, fishery and homestead sector were higher than previous year. It was observed that after intervention of technologies, the average gross margin increased by 15, 73 and 69 percent in landless, marginal and small household, respectively. Vegetable consumption increased due to homestead gardening by 57 percent considering all farmer categories than before intervention. The family nutrition, resource use, knowledge, social status and work opportunity were improved considerably due to intervention.

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 marginal (0.2-0.5 ha) and small (0.5-1.0 ha) farmers together with the landless constitute more than 70% of the farm families. Due to high population pressure and fragmentation of land, small farmers are becoming marginal. Forty five percent of the farmers are poor with intake below 2122 kcal/capita/day while about 25% are hard core poor (below 1805 kcal/capita/day). The subsistence farming of Bangladesh is highly diversified with complex relationships between the various components of enterprises. Farmers grow crops and trees, raise poultry and cattle, culture fisheries and use their homestead for their livelihood. They also undertake non-farm and off-farm activities which are important to supplement their income. Most of the farmers have not adopted many of the technologies developed by different research institutes. Generally well to do farmers have been benefited from the modem agricultural technologies while the trends of landless and the economic hardships of the small and marginal farmers have continued to aggravate. Their major constraints are lack of technical know how, inputs and money. Their risks are market and natural calamities.

The farmers of the area, being mostly resource-poor are often malnourished and there is an urgent need for the development and home gardening practices for year round production of vegetables and quick growing fruits mainly for family consumption. The farmers of the area use mostly local breeds of livestock and poultry and share common problems of ill health (due malnutrition and diseases) resulting in poor draft output and milk/egg production.

However, there are many scopes and opportunities to increase the existing production systems using the technologies so far developed and carrying out problem based research activities in holistic approach with the active participation of the resource poor farm households, which ultimately will improve their existing livelihood. Considering the above circumstances, the present activities were undertaken at the existing FSRD site, Ishan Gopalpur, Faridpur with following objectives:

i) To determine the effect of integrated farming before and after technology intervention
ii) To utilize the available farm resources in a better way
iii) Interventions on overall development of a farm family

Methodology

The study was carried out at FSRD site Ishan Gopalpur, Sadar Upazila, Faridpur situated at 23^{0}29” and 23^{0}44” north latitude and 89^{0}34” and 89^{0}56” east longitude. The area is under Low Ganges River Floodplain (AEZ-12). In the study area the farmer’s category was 47% landless, 24% marginal, 16% small, 7% medium and 6% large. Major cropping pattern is Wheat-Jute-T.Aman, Pulse-Jute-T.Aman and Boro-T.Aman. The experiment was carried out during the period of June 2004 to May 2005 with nine farmers belonging to landless, marginal and small farm category. Socio-agro-economic data of each of the program activities of all the selected households were recorded but only the collected data from 2 landless, 3 marginal and 3 small households up to May 2005 were analyzed using simple statistical tools and their results have incorporated in this report. Different steps were considered before conducting the research activities, which are given below.

Step I: Selection of co-operator farmer

Cooperator farmers were selected on the basis of their own land i.e. landless <50 decimal, marginal 51-125 decimal and small 126-250 decimal.

Step II: Selection of technologies for intervention

The scope for improvement identified in the case study was discussed with the individual co-operator farmer. The site team considered several alternatives of technologies to each resource available to farm for intervention. Finally number of options for technological intervention was formulated in participation with farmers. In this step some motivational tools was used like demonstration of results so that farmers made evaluation of the costs, benefits, marketing and risk of the technologies.

Step III: Accounting of pre intervention status

A cause study was made of the selected farmers to assess their resources, assets, liabilities, potential for improvement, technology practiced, level of input used and output obtained, income and expenditure status.

Available technologies for intervention of the tested integrated farming system are as follows;

Resources			*Technologies for intervention*			
A. Homestead	01	Open field	Bed	Rabi	Kharif-1	Kharif-2
(Year round)			Bed-1	Cabbage	Lalshak	Gimakolmi
			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
	02	Trellis		BARI shim-1	Sponge gourd	
				BARI shim-1	Ribbed gourd	
				Bottle gourd	Cucumber	
				Bottle gourd	Snake gourd	
	03	Roof top		BARI shim-1	Sponge gourd	
				BARI shim-1	Ash gourd	
	04	Partial shade	Turmeric and Elephant foot			
	05	On support	Yam and Country bean			
	06	Marshy land	Taro (Latiraj)			
B. Field crops	01		High yielding variety and fertilizer management of different crops			
C. Trees	01		- Mango hopper control - Irrigation - Fertilization			
D. Pond	01		- Pond management for fish culture & vegetable production			

Resources		*Technologies for intervention*
E. Livestock	01	- Cattle fattening - Deworming of cattle - Vaccination of poultry - Vaccination of duck - Poultry rearing for egg production - Improve breed of duck rearing - Pigeon rearing
F. Off farm	01	- Ice cream making - Jhuri vaja - Embroidery (Khatha sewing) - Cooperative
G. Others		- Compost shed preparation - Seed preservation technique - Plantain plantation in homestead

Step IV: Implementation of intervention

The participating farmers were motivated through training, motivational tour and cross visit for adoption of proven technologies replacing the old practices in a fraction of land or production units. Continuous technical assistance by the multidiscipline team was done. Monitoring of performance, data recording and farmers reaction was taken into account in a regular interval.

Step V: Data recording

Nine farm households of landless, marginal and small farm categories were selected for this project but intensive data collection was done from nine farmers of which 2 farm households from landless category, 3 from marginal and 3 from small category farm households. The data were analyzed using simple statistical tools considering i) cost and benefits, ii) financial balances, iii) yield of crops and other enterprises, iv) net worth of the farmer from all components compared with previous years performance. The results were interpreted in terms of holistic considerations and environment.

Research Findings

A. Income enhancement

Among the 9 households, 8 households were studied in details. In this report the income of these 8 farmers from crops, homestead, livestock, fisheries, trees and off farm are presented in different Tables.

It was observed that the gross return and gross margin has increased considerably after the intervention of proven technologies to all farm categories. It was observed that over all farm categories gross margin increased by 5, 73 and 69 percent in land less, marginal and small group of farmers not considering the off farm activities (Table 4).

Table 1. Cost and return of different sub systems of intervened farmers (landless group) during the period of June/04 to May/05

Resource	Md. Rokon Mollah			Md. Rezaul Sheik			Average		
	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)
Crop	16637	7205	7432	14020	4265	5755	15328	6735	6593
Homestead	5385	478	4907	2937	405	2532	4161	441	3720
Livestock	13660	5400	6260	11540	3460	4080	12600	5430	5170
Fishery	1600	500	1100	3200	800	2400	2400	650	1750
Off-farm	21600	00	21600	23400	--	23400	22500	00	22500
Total	58882	13583	41299	55097	12930	38167	56989	13256	43733

Table 2. Cost and return of different sub systems of intervented farmers (marginal group) during the period of June/04 to May/05

Resource	Abdur Rahman			Mohsin Mandal			Malek Mirmalat			Average		
	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)
Crop	16095	8615	7480	2550	595	1955	22735	10549	12186	13793	6585	7207
Homestead	8150	2022	6128	7764	850	6914	2008	400	1608	5974	1091	4833
Livestock	11600	4940	6660	11750	4264	7486	9240	4340	4900	10863	4515	6349
Fishery	--	--	--	--	--	--	420	100	320	140	33	107
Off-farm	42500	22500	20000	6000	--	6000	18000	--	18000	22167	7500	14667
Total	78345	38077	40268	28064	5709	22355	52403	15389	37014	52937	19724	33163

Table 3. Cost and return of different sub systems of intervened farmers (small group) during the period of June/04 to May/05

Resource	Sohrab Mallik			Jainal Mallik			Samad Sadhu			Average		
	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)
Crop	25739	12575	13164	14800	6475	8325	25520	12630	12890	22020	10560	11460
Homestead	5225	450	4775	8560	960	7600	4564	569	3995	6116	660	5457
Livestock	8870	1220	7650	28800	10060	18740	11070	1450	9620	16247	4243	12003
Fishery	--	--	--	--	--	--	--	--	--	--	--	00
Off-farm	13500	--	13500	24500	--	24500	--	--	--	12667	--	12667
Total	53334	14245	39089	76660	17495	59165	41154	14649	26505	57050	15463	41587

Table 4. Comparative performance of cost and return from all subsystems of different farmers group during the period of June/01 to May/02 and June/04 to May/05

Farmers group	Before intervention (June, 01 to May, 02)			After intervention (June, 04 to May, 05			GM increased (%)
	GR (Tk.)	TVC (Tk.)	GM (Tk.)	GR (Tk.)	TVC (Tk.)	GM (Tk.)	
Landless	41653	3677	37971	56989	13256	43733	15
Marginal	29357	10173	19183	52937	19724	33163	73
Small	36405	11779	24626	57050	15463	41587	69

B. Homestead vegetable production and nutrition

After intervention of proven technologies the homestead vegetable production has increased significantly. The fallow and under utilized homestead area were utilized fully. Using of improved varieties and judicious fertilizer management in vegetable production increases the yield. Table-5 shows farmers wise and farm category wise total vegetable production, consumption and average consumption (g/day/person). It was observed that before intervention the yearly vegetable production in landless, marginal and small farm group was 498, 468 and 644 kg/household. This has increased to 746, 938 and 965 kg/household respectively. Similarly the vegetable consumption has also increased. Before intervention the average vegetable consumption rate was 110, 143 and 126 g/day/person in landless, marginal and small group farmers respectively. The consumption increased to 186, 209 and 197 g/day/person respectively. The increased rate of vegetable consumption was 57 percent.

Table 5. Comparative performance of homestead vegetable production and consumption of all farmers group during June/04 to May/05

Farmer	Before intervention			After intervention			Vegetable consumption increased (%)
	Total production (kg)	Total consumption (kg)	Av. consumption (g/day/person)	Total production (kg)	Total consumption (kg)	Av. consumption (g/day/person)	
Landless	498	200	110	746	338	186	69
Marginal	468	230	143	938	383	209	46
Small	644	272	126	965	361	197	56

C. Changes in dietary habits

The dietary habit has been changed specially in vegetable consumption among the resource poor farmers. In every day they are taking 57 g/person more vegetable than before. It has been possible due to year round vegetable production in homestead garden. While previously they used to have rice with green chili or a piece of onion. Most of the household members especially children are now taking egg, fish, milk regularly in their food menu. But earlier they do not take it within a month.

D. Changes in social status

All farmers responded that due technology intervention their income increased and hence their social status increased. All RPFs told that before intervention the village leaders and elites did not care them. Their neighbors and relatives also seldom came to them. But now, all of them look at different angle. Many neighbors and relatives came to them to see their crops and homestead gardens and took seeds of vegetables and new technology. Each intervened farmer could give names of more than five neighbors or relatives who took improved seeds and new knowledge from them.

E. Impacts

Sl. no.	Area of consideration	Impacts created
01.	Income	- Net income increased considerably - Build up new house - Mortgage in crop land - Use more area for cultivation/production
02.	Family nutrition	- Consumption of vegetables, fruits and fish increased - Pure drinking water ensured by sinking hand tube-well - Changed consumption habit - Reduced disease infestation - Purchased milch cow for milk
03.	Resource use pattern	- Introduction of new crops - Homestead area utilized properly - Used modern varieties
04.	Education and knowledge	- Increased knowledge of family member - Children's started to going school
05.	Refreshment	- Cost of refreshment increased - Purchase of new cloth increased - Purchase of radio
06.	Social status	- Social status increased - Improved mental strength - Increased acceptability to people
07.	Micro environment	- Household waste used for composting
08.	Others (Off farm & cooperative)	- More utilization of family labor - Improve the cattle health - Breakdown of unemployment - Female farmer playing vital role in decision making of the family

Homestead agricultural production possibility under organic system

Abstract

A study was undertaken at FSRD site, Goyeshpur, Pabna for testing possibility of growing homestead crop production under organic system. Due to lack of fund allocation from any source it was not possible to radymate compost supply to the farmers. Thus the conventional method of crop production under Goyeshpur model was carried out during 2004-2005. Cash income was highest in the medium farm group (Tk. 1522.49) and return was higher in the farm group (Tk. 2056.09). Out of the produce 86% was consumed by small group, 85% by marginal and 67% by medium farm group.

Introduction

There are money production technologies under way for organic farming with different types of crops including vegetables. A high efficiency composting method has been developed and no yield loss was experienced under organic condition, even with its lowest dose of 7.5 tons per hectare for modern rice and stem amaranth. The lands are gradually improved in quality and normally no risk involved with organic production systems. The demand and price of organic produce is always higher in world market including Bangladesh. But for getting a good price a market demand need to be created. Thus some organic produce must go to market and there should be a continuous supply in the market to create a persistent demand. On the other hand, since it needs about three years under consecutive organic cropping to get accreditation for acceptance to international markets as organic food. Local people should consume the produce of the interim period. Thus as a step for popularizing organic farming technologies and creating the market for its produce some production programme was essential. Now, homestead is the easiest environment with reach soil to start with organic. It also contains most of the common fruits and vegetable, which meet up most part of daily needs and are responsive to organic fertilizers. Therefore, a production programme with a total homestead production system under organic farming was under taken at FSRD site, Goyeshpur, Pabna.

Objectives

i. To evaluate possibility of conversion to organic system of currently chemical based homestead agriculture under local condition

ii. To popularize organic agriculture and create market opportunities

iii. To increase income and improve family nutrition

Materials and Methods

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 (moulobikachu)
		c.	Ginger
		d.	Perennial chilli

	Spaces		Cropping patterns
6.	Marshy land	a.	Panikachu
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)

Due to lack of fund, the organic fertilizer could not be supplied to farmers. So, the recommended production practices with conventional fertilization but biological pest control were followed for each crop. The cost of all the operations and inputs except seeds and seedlings was provided by farmers. Weekly monitoring was done and FSRD team members guided all operations.

Results and Discussion

Crop yield: The output of the model harvested during the period May'04 to April' 05 has been presented (Table 1). The amount harvested from open sunny land, creeper vegetables, shady and marshy area and fruit trees were 184, 168.13, 32.25, and 65.75 kg respectively per marginal farm group. It was 149.42, 60.66, 28.5, and 55.5 kg in small and 158.78, 229.14, 30.75 and 53.63 kg in medium farm group. The lower yields in small farm group because they have little space for cultivation.

Return in Taka: The return of the produce of the model in taka was dominated in medium farm group where bottle gourd and Saizna were the vital contributing crops (Table 1a, b, c) Small farm groups had the lowest return.

Consumption by family members: Highest consumption 86% of 294.08 kilogram total produce was in small farm group and lowest percent was in 67% of 472.3 kg in medium farm group. The marginal farm land group consumed 85% of total vegetable.

Cash income: Above the nutritional contribution the growers earned cash money of Taka 913 per family which as liquid cash in hand over the year had a good contribution towards mitigation of day to day family needs.

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 programme 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.

Problems encountered

1. Lack of fund forced growing crops under conventional method
2. Tidious, laborious and continuous work, needing skills in production techniques of huge number of crops. Need to one/two year of practice to start as a regular work by farmers.
3. Women farmers were not ready to cooperate spontaneously with the male scientific assistants in the implementation process.
4. Creeper crop got less emphasizes with lack in adequate amount of organic matter, size of pit, fertilization and other cares.
5. Long drought and water scarcity drastically reduced production of many crops like brinjal, okra, bitter gourd etc.
6. Lack in easy analytical tool to interpret data comfortably. (Needs a computer programming on analysis of results)

Conclusion

Due to total lack of fund allocation for the trial it could not be conducted with organic inputs. But the crops are now being grown with organic inputs from farmers own source. Provided the fund is available the programme will be continued in wider scale to achive its targeted objectives.

Recommendation

- The program is to be continued and expanded with adequate fund allotment, intensive cooperation, monitoring and awareness raising programmes on consumption practices.
- Emphasize should be on optimizing production from each crop and highest possible consumption by family members retaining food value for the edible parts.
- More participation by women members is to be ensured.

Table 1a. Performance of vegetable crops of marginal farm group under homestead production model at FSRD site, Goyeshpur during 2004-2005 (May 2004 to April 2005)

Crops	Performance						
	Harvest period	Amount harvested	Return in Tk.	Consumption/ day/person (g)	Amount distributed	Amount sold	Cash income (Tk./F)
A. Field crops							
Radish	35.2	38.4	54.4	88.4	8.0	17	27.75
Cabbage	29.4	53.2	110.6	166	11.45	15.7	30.5
Lady's finger	28.8	7.0	57.1	49.2	1.88	-	-
Indian Spinach	22.2	8.7	31.5	66.0	2	2	6.12
Tomato	47	35.9	161.2	68.8	7.54	13.63	53.66
Spinach	24.8	13.25	35.25	84.2	3.4	-	-
Stem amaranth	35	27.55	107.6	75	5	10.75	42
Total	222.4	184	563.05	597.6	39.27	59.08	160.03
Average	31.77	26.29	80.44	85.37	5.61	8.44	22.86
B. Creeper vegetables							
Bitter gourd	25	2.88	46.0	19.5	-	-	-
Bottle gourd #	56.33	40.0	214	52.66	2.25	7.5	126
Sweet gourd #	58	57.00	171.00	62.0	4.00	35.00	105.00
Sponge gourd	34	17.25	117.00	34	0.50	12.00	79.00
Country bean	47	51.00	198.0	58	5.50	29.00	96.00
Total	220.3	168.13	629	226.16	12.25	83.5	406
Average	44.07	33.63	125.8	45.23	2.45	16.7	81.2
C. Shady area crops							
Elephant foot yam	11	9.25	92.5	66.5	-	5.25	52.5
Leaf aroid	78	23.00	46.00	43	6.00	-	-
Total	89	32.25	138.5	109.5	6.00	5.25	52.5
Average	44..5	16.13	69.25	54.75	3.00	2.63	26.25
D. Fruit trees							
Papaya	124.5	37.25	150.5	42.5	3.5	21.0	73.00
Green Banana#	23	11.50	46.00	72	1.50	-	-
Saizna	25	17.00	350.0	64	4.00	5.00	100.00
Total	172.5	65.75	546.5	178.5	9	26	173
Average	57.5	21.92	182.17	59.5	3	8.67	57.67
Grand Total	177.89	450.13	1512.67	1111.76	57.33	173.83	791.5
Average	44.46	112.53	378.17	277.94	3.74	9.11	46.99

Table 1b. Performance of vegetable crops of small farm group under homestead production model at FSRD site, Goyeshpur during 2004-2005 (May 2004 to April 2005)

Crops	Performance						
	Harvest period	Amount harvested	Return in Tk.	Consumption/ day/ person(g)	Amount distributed	Amount sold	Cash income (Tk./F)
A. Field crops							
Radish	32.6	22.13	39.22	86.4	6.95	-	-
Cabbage	39.2	43.97	79.15	92.8	16.46	-	-
Lady's finger	28.5	5.46	48.88	64.75	-	-	-
Indian Spinach	28.4	8.0	22.7	51.2	4.0	-	-
Tomato	49.0	34.05	137.3	63.6	6.4	15	63.33
Spinach	23.2	12.51	28.84	66.4	1.6	-	-
Stem amaranth	35.2	23.3	103.5	74.2	9.08	10	45
Total	236.1	149.42	454.9	499.35	44.49	25	108.33
Average	33.73	21.35	65.65	71.34	6.36	7.14	15.48
B. Creeper vegetables							
Bitter gourd	30.4	3.14	49	17.6	-	-	-
Bottle gourd	44.0	44.0	188.66	79.66	6	13	116.5
Sponge gourd	-	-	-	-	-	-	-
Yard long bean	36	3.52	39.5	16	-	-	-
Potato Yam	17	10.00	100.00	94	2.00	-	-
Total	127.4	60.66	377.16	207.26	8	27	116.5
Average	31.85	15.17	94.29	51.82	2	6.75	29.13
C. Shady area crops							
Elephant foot yam	18.5	11.5	142	95.5	2.0	4	
Leaf aroid	69.5	17.0	34	31	6.0	-	
Total	80	28.5	176	126.5	8	4	
Average	40	14.25	88	63.25	4	2	
D. Fruit trees							
Papaya	85	18.5	74.0	24	-	-	-
Green Banana#	20	13.0	52.00	95	3.00	-	-
Saizna	27.67	24.0	304	57	3.5	10.0	200.00
Total	132.67	55.5	430	176	6.5	10.0	200.00
Average	44.22	18.5	143.33	58.67	2.17	3.33	66.66
Grand Total	576.17	294.08	1442.66	1009.11	66.99	62.0	424.83
Average	37.45	73.52	97.81	61.27	3.63	4.81	27.82

Table 1c. Performance of vegetable crops of medium farm group under homestead production model at FSRD site, Goyeshpur during 2004-2005 (May 2004 to April 2005)

Crops	Performance						
	Harvest period (Days)	Amount harvested(kg)	Return in Tk.	Consumption/ day/ person(g)	Amount distributed	Amount sold(kg)	Cash income (Tk./F)
A. Field crops							
Radish	42.8	34.7	54.65	72.6	8.9	25.0	50.00
Cabbage	37.8	50.63	107.05	151	13.9	38.5	47.0
Lady's finger	39.2	6.89	53.85	39.2	3.00	-	-
Indian Spinach	28.2	8.5	26.6	60.6	2.66	-	-
Tomato	51.8	32.04	156.4	74.4	7.9	12.33	50.33
Spinach	25.8	10.1	30.2	67	3	-	-
Stem amaranth	32.2	15.92	61.98	89.8	5.5	-	-
Total	257.8	158.78	409.56	554.6	44.86	75.83	147.33
Average	36.83	22.68	70.08	79.23	6.41	10.83	21.04
B. Creeper vegetables							
Bitter gourd	38	3.08	49	17.33	-	-	-
Bottle gourd	94	177.1	645.7	99.20	14.3	182.66	1160.16
Sponge gourd	41.66	38.66	173.33	46.66	6.66	35.0	175.00
Yard long bean	124	8.05	48.50	16	-	-	-
Potato Yam	13	2.25	15.00	34	-	-	-
Total	310.66	229.14	931.53	213.19	20.96	217.66	1335.16
Average	51.78	38.19	155.26	35.53	3.49	36.28	222.52
C. Shady area crops							
Elephant foot yam	16.5	13.5	135.0	101.5	2.0	4.0	40.00
Leaf aroid	92	17.25	34.5	34	3.5	-	-
Total	108.5	30.75	169.5	135.5	5.5	4.0	40.0
Average	54.25	15.38	84.75	67.75	2.75	2.0	20.0
D. Fruit trees							
Papaya	137	28.63	131.5	36.5	6.0	-	-
Green Banana#	11	6.00	24.0	72	2.0	-	-
Saizna	31	19.00	390.0	52	6.0	-	-
Total	179	53.63	545.50	160.5	14.0	-	-
Average	59.66	17.88	181.83	53.5	4.67	-	-
Grand Total	855.96	472.3	2056.09	1063.79	85.32	297.49	1522.49
Average	50.63	23.53	122.89	59.00	4.33	12.27	65.89

Table 2a: Average performance of vegetable crops of Medium farmers group under homestead production model at FSRD site, Goyeshpur during 2004-2005 (May '2004 to April '2005)

Crops	Performance					
	Harvest period	Amount harvested	Return in Tk.	Amount distributed	Amount sold	Cash income (Tk./F)
A. Field crops						
Total		158.78	409.56	44.86	75.80	147.33
Average	36.83			6.41	10.83	21.64
B. Creeper vegetables						
Total		229.14	931.53	20.96	10.83	1335.16
Average	51.78			3.44	217.66	222.52
C. Shady area crops						
Total		30.75	169.5	35.5	4.0	40.0
Average	54.25			2.75	2.0	20.0
D. Fruit trees						
Total		53.63	545.5	14.0	445-	955-
Average	59.66			4.67	148.33-	318-
Grand total		472.3	2056.09	85.32	297.44	1522.49
Grand average				4.33	12.27	65.89

Table 2b. Average performance of vegetable crops of Small farmers group under homestead production model at FSRD site, Goyeshpur during 2004-2005 (May 2004 to April 2005)

Crops	Performance					
	Harvest period	Amount harvested	Return in Tk.	Amount distributed	Amount sold	Cash income (Tk./F)
A. Field crops						
Total		149.42	459.59	44.49	25	108.33
Average	33.73			6.36	7.14	15.48
B. Creeper vegetables						
Total		60.66	377.16	8	27	116.5
Average	31.85			2	6.75	29.13
C. Shady area crops						
Total		28.5	176	8	4	42-
Average	40			4	2	42
D. Fruit trees						
Total		55.5	430	6.5	10	200
Average	44.22			2.17	3.33	66.66
Grand total		294.08	1442.75	66.99	62	424.83
Grand Ave.	37.45			3.63	4.81	27.82

Table 2c. Average performance of vegetable crops of Marginal farmers group under homestead production model at FSRD site, Goyeshpur during 2004-2005 (May 2004 to April 2005)

Crops	Performance					
	Harvest period	Amount harvested	Return in Tk.	Amount distributed	Amount sold	Cash income (Tk./F)
A. Field crops						
Total		184	563	39.27	59.08	160
Average	31.77			5.61	8.44	22.86
B. Creeper vegetables						
Total		168.13	629		83.5	406
Average	44.07			2.45	16.7	81.2
C. Shady area crops						
Total		32.25	138.5	6	5.25	52.5
Average	44.5			3	2.63	26.25
D. Fruit trees						
Total		65.75	182.17	9	26	173
Average	57.5		1512.67	3	8.67	57.67
Grand Total		450.13		57.33	173.85	791.5
Average	44.40			3.74	9.11	46.99

Table 3. Average harvest and consumption rates of vegetables by different farm categories under homestead production model at FSRD site, Goyeshpur, Pabna during 2004 to 2005 (May 2004 – April 2005)

Cost		Harvest period/ crop	#/ amount harvested	Return in Tk.	Consumption	Amount/# distributed	Amount sold	Cash income (Tk./F)
Marginal	Total		450.13	1512.67	85%	57.33(12.74)	173.83(38)	791.5
	Ave.*	44.46				3.71		46.99
Small	Total		294.08	1442.75	34%	66.99(22.71)	9.11	424.83
	Ave.	37.45			86%	3.63	62.0 (21%)	27.82
Medium	Total		472.3	2056.09	67%	85.32(18.06%)	297.49(62.98)	1522.49
	Ave.	50.63				4.33	12.27	65.89
Grand Total			1216.51	5011.51		209.64	533.12	2738.82
Grand Mean**		45.04	405.5Kg /day/family	1670.50	79.33(%)	(8.65%)	177.77(19.38)	913

* Per crop ** Av. of 3 groups

Crop-Fish-Livestock integrated farming in crop field of ganges tidal floodplain

Abstract

Two alternate modules of Crop-Fish-Livestock integrated farming was designed to test against farmers existing cropping pattern Mungbean-T.Aus–T.Aman in the crop field of Tidal Ganges Floodplain (AEZ-13) at FSRD site, Lebukhali, Patuakhali, during 2002. One alternate module called Gher module was tested for two consecutive years. Another alternate module called Modified Sorjon Module was tested from 2004. Total production, gross return and gross margin was higher in both alternate modules than that of farmers' practice. Though the operational cost was higher in alternate modules, Gher module and Modified Sorjon Module produced MBCRs of 4.71 and 3.63 respectively over farmers' practice. Crop diversification specially vegetables and fish production was an important benefit from alternate modules. The experiment should be continued for further detailed study.

Introduction

Farming of tidally flooded non-saline region of Patuakhali (AEZ-13) is mainly rice based. Transplant aus in Kharif-1 and transplant aman in Kharif-2 season are grown and yield level is potentially high for both local and modern varieties. Crop diversification in rabi season is less. Mungbean, Khesari, Cowpea, Chilli and Sweet potato are main rabi crops but area coverage is less than 25% of cultivable land. Improvement of existing cropping system is constrained by some of its special features as: (i) Inundation of crop field (up to 3 feet) twice daily by tidal water in monsoon season. (ii) Late harvest of T.aman rice delayed rabi crops. (iii) Rainfall and tidal innundation of crop field in late November delayed joy condition of soil which in turns limits rabi cultivation only for some selected crops like Mungbean, Khesari, Cowpea, Chilli etc. (iv)Short winter.

Improvement of cropping system in the existing context requires mainly control of entrance of tidal water into the field and diversification of crop production integrated with fishery and livestock production system. Rice-fish culture is being practiced by some farmers sporadically in the area. The present study is designed to integrate field and horticulture crops, fishery and livestock components to develop a module for maximum utilization of resources with high economic return.

Objectives

To develop a module(s) of integrated farming in the crop field for:

a) Maximum utilization of available resources.
b) Higher economic return.
c) Diversification of production system with sustainability.

Materials and Methods

It was designed to test two alternative modules of integrated farming along with the existing Mungbean- T.aus-T.aman cropping pattern. One alternate module named Gher Module was tested with existing cropping pattern during 2002 and 2003.During 2004, another alternate module named Modified Sorjon Module was tested with existing cropping pattern.

Description of Gher

An embankment surrounding the crop field was made digging a canal inside the embankment. In the middle, the crop field was kept as it was. Area distribution in the Gher was:

Embankment:	25%	i.e. 12.5 decimal
Bauckchar:	5%	i.e. 2.5 ”
Canal:	25%	i.e. 12.5 ”
Crop field:	45%	i.e. 22.5 ”
Total:	100%	i.e. 50 ”

The gher was completed within March 2002 with a cost of Tk 12,000/=

Integration of components in the Gher

a) Crop field: Mungbean (15 dec.)-T.Aus (MV)-T.Aman (MV) and
   Zero tillage potato (7 dec.)-T.Aus (MV)-T.Aman (MV)
b) Canal: Stocking / rearing of fish
c) Embankment top: Banana plantation + vegetables
d) Embankment slope: Creeper vegetables.

Description of Modified Sorjon

A Sorjon is an alternate ridges and furrows system to produce vegetables and fruits in low lying areas. The Sorjon system previously developed by OFRD, BARI, Patuakhali had only 1.5m wide furrows and 2.0m wide ridge beds. The Modified Sorjon was designed for much wider furrows (canal) and beds so that fish could be reared in furrows and water reserved in furrow could be used for vegetables grown in the beds. A total area of 80m X 27m was taken for the Modified Sorjon module in which area distribution was as follow:

Canal (Furrow) : 80m X 9m X1.83m.

Bed : 80m X 18m.

The Sorjon was completed within May 2004 at a cost of Tk. 16000 only. Then dhaincha as green manure was grown. Before vegetable cultivation, cow dung at a rate of 10t/ha was applied during land preparation.

Integration of components in the Sorjon

Canal : Stocking/rearing fish and creeper vegetables.

Bed : 1. Dhaincha- Lal Shak-Radish-Brinjal
2. Dhaincha- Lal Shak-Cabbage-Brinjal
3. Dhaincha- Lal Shak-Tomato-Ladies finger

All management practices for the crops in both alternate modules were given as per recommendation.

Results and Discussion

Despite the production of some vegetable in Sorjon module yet to be added, total production was increased remarkably in both alternate modules in compare to farmers' existing practice. Total variable cost was higher in alternate modules but gross margin was also higher enough to produce an MBCR 4.71 for Gher module and 3.63 for Modified Sorjon module over farmers' practice. It was noticeable that the total potential of the Gher and sorjon could not be exploited due to some unavoidable circumstances. Only 50% area of the embankment was cultivated to grow vegetables. Live-stock components in both modules and creeper vegetable in Sorjon module is yet to be tested.

Benefits derived from alternate modules were:

- More production.
- Diversified production especially fruits, vegetables and fish.
- More economic return.
- Income generation round the year.
- Maximum utilization of the resources.
- Better water management.

Shortfall

* Long-tern effect on soil fertility specially of embankment.
* Not yet fully utilized the resources for potential maximum production (creeper vegetables, livestock and fish).

Disadvantage

- More labour requirement.
- Requires intensive care, management and planning.
- Requires high initial cost.
- Requires higher operational cost.

Conclusion

The Modified Sorjon was carried out for one year only and it needs further details study. It was expected that both the alternate modules could be excellent technology to increase production and income of the farmers of the region sustainability.

Table 1. Production practices and production of different commodities in Modified Sorjon Modules and farmers' practices

Commodities	Total area (decimal)	Sowing/ transplanting date	Harvesting date	Production (kg)	Yield (T/ha.)
Modified Sorjon Module					
Red amaranth	35.8	20/9/04	30/10/04	1260	8.70
Radish	15	30/10/04	25/12/04	2405	40.00
Cabbage	10	5/11/04	10/1/05	1538	38.00
Tomato	10	7/11/04	3/3/05	1895	46.80
Brinjal	25	2/2/05	20/4/05----	---	---
Lady's finger	10	25/3/05	----	---	---
Fish in canal	17.9	3/7/04	5/5/05	165	0.92
Farmers' practices					
Mungbean	50	1/2/04	25/4/04	69	0.34
T.Aus	50	20/5/04	15/8/04	445	2.2
T.aman	50	1/904	28/12/04	605	2.99

Table 2. Cost and return of alternate modules and farmers' practice

Practices	Gross return	TVC	Gross margin	MBCR over FP
Modified Sorjon module	632300 Tk/ha	187600 (Tk/ha)	444700	3.63
Gher module	25500 (Tk/50dec)	8669 ((Tk/50dec)	16831 ((Tk/50dec)	4.71
Farmers' practice	40138 Tk/ha	24616 Tk/ha	15522 Tk/ha	

Input price:

Seeds of vegetables	: Supplied by OFRD
Fish finger ling	: Tk 1.00 per piece.
Banana sucker	: Tk 3.00 per piece.
Mungbean seed	: Tk 40.00 per kg.
T.Aus /T.Aman seed	: 15.00 per kg.
Potato seed	: Tk 14.00 per kg.

Output price:

Country bean	: Tk 5.00/kg
Yard long bean	: Tk 8.00/kg
Bottle gourd	: Tk 10.00/piece
Bitter gourd	: Tk 6.00/kg
Red amaranth	: Tk 4-5/kg
Radish	: Tk 3-4/kg
Fish	: Tk 30-40/kg
Potato	: Tk 5.00/kg
Mungbean	: Tk 25-30/kg
Rice	: Tk 6-7/kg

Utilization of fisheries Gher boundary through vegetable and fruit production in coastal area

Abstract

An experiment was initiated to find out suitable vegetable and fruit species for planting in the bund around fisheries gher at Bagerhat MLT Site. Four vegetable patterns were designed in this context. Four different crops within pattern were evaluated of which tomato performed better with high benefit cost ratio. Among those crops, tomato and sweet gourd were found feasible and profitable.

Introduction

The medium lowland and lower portion of medium high land occupies a considerable available area of the district. The dominant cropping pattern in such land types is fallow-T.Aman-Fallow. Because of low productivity from the land, farmers of the area are shifting over to fish production. A number of fisheries gher has cropped 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

Trials on different vegetables and fruit growing patterns at fisheries gher area round the year started at Bagerhat MLT Site during rabi 2004-05 with a view to find out suitable vegetable and fruit species and to utilize the unused under utilized places of gher. Four different patterns were included in the study. The pattern is as follows;

			Kharif	Rabi
Pattern - 1	:		Okra	Brinjal
	Edge	:	Papaya	
	Planting date	:	June'04	14 Dec'04
Pattern - 2	:		Indian spinach	Tomato
	Edge	:	Country bean	
	Planting date	:	June'04	03-16 Nov'04
Pattern - 3	:		Bottlegourd	
	Edge	:	Munkachu	Water Melon
	Planting date	:	June'05	08 Feb.'05
Pattern - 4	:		Bitter gourd	Sweet gourd
	Planting date	:	June'05	12-27 Nov.'05

The experiment was conducted in four farmer's field. The unit plot size was 6m 5 1.5m.
Recommended spacing and fertilizer dose were used. Data on yield, cost and returns were recorded.

Results and Discussion

Performance of vegetable patterns during rabi season has been presented in Table 1. From the partial results of pattern, tomato performed better than other patterns. Tomato performed better with higher benefit cost ratio. Although tomato involved higher cost of cultivation but due to its higher market price higher gross return was achieved. Water melon was damaged at February. From the above results it shown that tomato and sweet gourd could be grown at gher area. This is the 1st year result. It needs further details study.

Farmer's Reaction

Tomato should be planted within October to get better market. Farmer's prefer white big size Brinjal.

Table 1. Yield and return analysis of different vegetables patterns at Bagerhat MLT Site during Rabi 2004-05

Crop	Field duration (days)	Yield (t/ha)	Gross return (Tk/ha)	Total variable cost (Tk/ha)	Gross margin (Tk/ha)	BCR
Brinjal	130	2.50	12,500.00	98,000.00	(-)85,500.00	--
Tomato	110	49.10	2,94,600.00	1,05,000.00	1,89,600.00	2.80
Sweet gourd	125	35.00	1,42,000.00	68,600.00	73,400.00	2.06

Price: Brinjal = Tk 5.00/kg, Tomato = Tk 6.00/kg, Sweet gourd = Tk 4.00/kg,

✵ ✵ ✵

Jhum cultivation in hill district Bandarban: A socio economic overview

Abstract

A study was conducted on Jhum cultivation during 2005 at Bandarban sadar areas with view to identify the productivity, profitability and factors that are affecting on production of Jhum system. It revealed that per hectare total return was estimated as TK.7438 and total cost was Tk.13796. The net return was recorded negative –6358ha^{-1} while excluding guard salary the net return received at Tk. 1045ha^{-1} and BCR was only 1.16. It implies that the Jhum system was not an economically profitable practice. It was just subsistence farming for ethnic community.

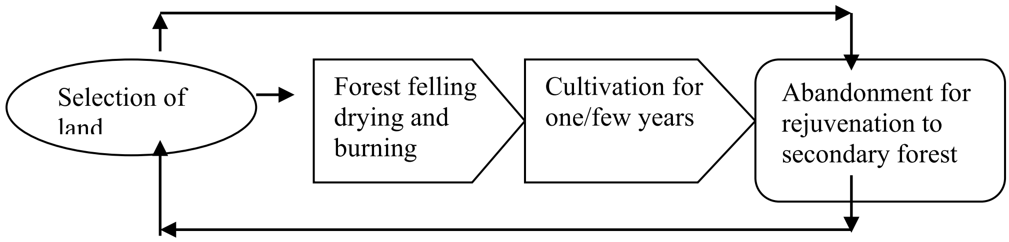
Background

Jhum means Shifting cultivation, Swidden Agriculture, slash-and-burn cultivation. The word is Barmese and used in large parts in South-east Asia. Jhum is a controversial hillside production system based on shifting cultivation. The contribution of Jhum to deforestation has probably been exaggerated. Legal and illegal commercial logging since the middle of the last century has probably been a much more important factor in the loss of most of the original forest.

Introduction

Jhum is the foundation of the economic structure in the ethnic community and is the principal source of livelihood. Jhum cultivation and forests are still central to the traditional societies as their primary source of food, shelter, medicine and other products and services (Ahmed and Gaby, 1996). The choice of crops depends on the food habit and requirements of the people and soil condition of the area. Rice is the major component, where Marfa, cucumber, Barbatti, beans, ladies finger, maize, sweet gourd, Kachu, pineapple, flowers etc also used to grow in Jhum cultivation. The basic elements of Jhum cultivation are: I) Forest felling, drying and burning, II) Cultivation for few (one to 4 years), III) Gradual or abrupt abandonment as the land reverts to secondary forest and IV) Initiation of another felling, drying and burning, this cycle ranges from three to 20 years (Nye & Greenland, 1960; Watters, 1971). The scenario of these basic elements of Jhuming system is sequentially presented in Fig-1.

Fig- 1: Basic elements of the Jhum cultivation



In last two decades continuous Jhum cultivation period in one piece of land never exceeds more than two years and restoration cycle shorten to 3-4 years. Reasons for shortening of Jhuming cycle have been reported by several scientists. Jhuming cycle is the time elapsed between leaving the first plot and returning to it. No major research focuses on the key issues of Jhum farming in CHT. Shoaib, et al. (1998) estimated about 32500 ha of land was used for Jhuming and about 1.5 M tons of topsoil was eroded each year. Indigenous knowledge related farm management, selection of lands, reasons for multiple cropping, planting methods and harvesting practice, cultural operations and the problems related to the issues are yet to be explored. Adequate input output data on the economical aspects of Jhuming are sadly lacking. So, the study will be helpful for researcher, extension workers and policy maker for identifying merits and demerits of Jhum cultivation.

Reasons behind Jhum Cultivation

Jhum cultivation has been always the most suitable practices by the tribal people for their physical and socioeconomic condition prevailing the hill tracts. Before 50 years all indigenous people depended on Jhum cultivation. Now about 80 percent tribal people are practicing Jhum. There are many reasons behind Jhum practices i,e., Social customs, economic, cultural thoughts by different ethnic groups and Religious believes etc. The main reasons for Jhum cultivation are stated below:

a. Social causes: The economy and society of Jhumiya groups has developed from a Jhum based. Jhum cultivation is deeply rooted in the hill people psyche, having evolved through the years and being rooted on social customs, beliefs and folklore. Traditional Jhum influences the hill people mindset. It influences the cultural ethos of its agrarian society and social fabric. It is established that Jhum is a well organized and regulated social system of cultivation in CHT. The intensive year round activities of Jhum have ensured its assimilation into the social structure of the hill tribes..

b. Economic causes: Jhum, it is a system well suited to the need of traditional subsistence farmers, with multiple intercropping of up to 60 different food crops in one field. Most village tribal people especially those in more remote areas and those who lost land, state they are much worse off than twenty years ago. Their livelihoods are still based on Jhum and forests.

c. Cultural causes by different Ethnic groups: Many ethnic groups prefer Jhum practices as their socio cultural heritage. It is a way of life of Jhumiya people and their livelihoods depend on it. Among the 13 ethnic groups on Bandarban, the *Bawm* is the smaller tribes who are live on hill tops where they still practice migratory Jhum. Twenty five percent *Chak* tribal depends on Jhum. *Khyang* tribes depend largely on Jhum cultivation. The *Lushai* tribes cultivate their Jhum intensively and make enclosures to keep any animal out.The also grow oranges and other fruit in the Sajek valley. *Marma* tribes are the majority in Bandarban. They are the most dominant ethnic group in that district. They do Jhum and valley agriculture as well as commercial cultivation of fruit and timber. The *Mro* tribes are most Jhum dependent of all tribes and stay mostly on hill tops. *Pankha* tribes feel worse of in social and economic terms than ten twenty years ago. They live in remote areas, lost access to land and are not helped by outsiders. So, they depend on Jhum and few have some upland agriculture. The *Tanchangyas* tribes valley agriculture and Jhum cultivation (80%, 5% owned). The *Tripura* tribes are the third largest tribe. They mainly practice Jhum and live in remote areas than Chakma and Marma.

In the past, life style of the indigenous people was very simple. They had no idea about modern agriculture. So, they are mainly dependent on Jhum cultivation because Jhum is a part and parcel of the tribal people's life.

The specific objectives are:

i. to find out basic reasons behind Jhum or Shifting cultivation practices;
ii. to know the socio-demographic characteristic of Jhumiya people;
iii. to estimate the cost and return of Jhum or Shifting cultivation;
iv. to know the productivity and factors affecting production of Jhum cultivation so, that policy could be make accordingly.

Methodology

A total of 30 sample Jhum farmers' were selected randomly from two villages i, e. Sheron para and laimee para in Bandarban sadar areas. Farmer's were selected keeping in view the concentration of Jhum cultivation. A pre-tested questionnaire was used for data collection by direct interviewing the selected farmer's. The period of study was May-Jun, 2005.To analyzes the key factors, Cobb-Douglas production model was chosen as because it was good fitted to the data and it was normally distributed. Multiple regression analysis was used to determine the individual effect of variable inputs on production. Seven explanatory variables were hypothesized to explain the Jhum production. The productivity was estimated by Marginal value product (MVP) divided Marginal factor cost (MFC).
The Cobb-Douglas production function was estimates as follows:

$$Y = a\, X_1 b^1 X_2 b^2 \ldots\ldots\ldots\ldots\ldots X_7 b^7 Ei$$

or $$\text{Log } Y = \text{Log}a + b_1\text{Log}X_1 + b_2\text{Log}X_2 + \ldots\ldots\ldots\ldots\ldots + b_7\text{Log}X_7$$

Where, Y = Gross income (TK/ha)

X_1 = Urea (Tk/ha)

X_2 = TSP (Tk/ha),

X_3 = MP (TK/ha)

X_4 = Weeding (TK/ha) ,

X_5 = Insecticide cost(Tk/ha),

X_6 = Seed cost (TK/ha),

X_7= Land preparation cost (Tk/ha)

bi= Production co-efficient to be estimated, i= 1,2,.....7. a= Intercept

Results and Discussion

Socio economic profile of Jhumiya people: The socio demographic characteristic was presented in Table1. It revealed that the average age of respondent was 42 years, education status was illiterate 27 percent, primary 67and secondary was 7 percent and family size was 5.00 where highest number of family size was found as highest and lowest income group. The average land holding was as hill 1.87ha and 0.207ha for plain land. It has been seen from table2 that the highest number 16.42 (35%) of agricultural equipment was available in highest income group and lowest 6.91 (14%) in lower income group of Jhumeya people.

Cost of Jhum cultivation: After selecting the Jhum field, at first they slashed the jungle and firing and lastly clearing the field for sowing the respective crops. It was observed during Jhum cultivation, the cost item was involved i,e. land preparation, seed purchase, sowing, fertilizer, insecticide use, weeding, harvesting and guard wages as variable inputs while land rent was considered as fixed cost. The cost item was estimated as together full cost and cash cost basis. The all cost item was converted into per hectare basis. It was estimated per hectare Jhum cultivation cost asTK.13796 (Table 3).

Return from Jhum cultivation: Jhum, is a farming system of tribal people where multiple crops were sowing at a time in one field. History say's that 60 multiple crops had been sown in one Jhum field as a mixed crop. During the study, it was observed that mainly the following crops had been sown in their Jhum field, i.e. Jhum paddy, Marfa, Sweet gourd, Barbatti, Cucumber, pineapple, Turmeric, Chilli and Kachu(Elphant foot). The return from individual crop was estimated by multiplying the farm gate price. The total return was estimated as TK. 7438 ha^{-1}. The net return was recorded negative as TK. –6358.00ha^{-1}.If the guard salary was excluded, the net return was stand by positive Tk. 1045ha^{-1} and BCR was 1.16(Table3) implying that not profitable of Jhum or Shifting cultivation practices but it was only subsistence farming or age old ethnic tradition.

Productivity analysis: Productivity can be measured marginal value product divided by marginal factor cost., implying that it's ratio would be greater than 2, the productivity has been increased. In this study it was found negative –1.702 (Table4).

Factors affecting production: The multiple regression analysis has been used for determining the factors that are affecting on production. The estimated values of co-efficient and related statistics of Cobb-Douglas production function are presented in Table 4.All the seven explanatory variables whose standard errors were higher than the corresponding estimated coefficients, were highly and linearly correlated with other variables under the crop, and they were dropped from the equations. The co-efficient of multiple determinations, R^2 was found 0.703 implying that all exhibits explanatory variable included in the model are explained 70 percent of total variation of production. The F- test of R^2 showed that 1% level of significance, implying that combined effects of explanatory variable in the model have been significantly contributing to the output in the study areas. The coefficient 'bi' of the independent variables of Cobb-Douglas production directly measure the elasticity of production with respect to the concerned inputs. The coefficient of Urea was found 0.716 implying that other factors remaining constant, output can be increased by 0.716 percent for a unit increase in Urea (X_1) and it was at 5% level of significance. The other positive coefficients may also be similarly interpreted. But the negative coefficient implies that to increase income, the respective input should be used rationally. Only two explanatory variable i,e. Urea and insecticide used was significantly influenced on output. Other five explanatory variables influenced on production insignificantly. The summation of elasticity of production Ebi was found 1.426 which was greater than one implies that the input used was fall in production stage I which indicate irrational use or less use of inputs. In order to get good return from Jhum cultivation, good combinations of the positive factors are required. But in real situation, the tribal people were not aware for taking decision for good combination of inputs. So, awareness should be developed through training program.

Conclusion

The finding of the study shows that net return of Jhum cultivation was negative and input use was not rational. So, old age Jhum cultivation was not a profitable cultivation practice for tribal people in Bandarban.

Table1. Socio demographic characteristics of Jhumeya people in Bandarban, 2005 (N=30).

Annual Income group of Jhumeya family's (Tk/family)	Unit distribution by income group				
	Age range (years)	Education of respondent (%)	Family size	Own hill land (ha.)	Own plain land (ha)
I. 10,000 -30,000 (14)	18-57	Illiterate- 36 Primary- 54 Secondary-10	6.00	1.85	0.347
II. 30,001 –50,000 (4)	28-51	Illiterate- 75 Primary- 18 Secondary- 7	3.00	2.02	0.102
III. 50,001 – 70,000 (1)	42	Illiterate- 0 Primary- 83 Secondary-17	5.00	2.02	-
IV. 70,001 – 90,000 (2)	29-51	Illiterate- 0 Primary- 64 Secondary-36	5.00	1.62	0.41
V. 90,001 – above (9)	32-61	Illiterate- 22 Primary- 50 Secondary-28	6.00	1.84	0.179
Average	41.63	Illiterate- 26.6 Primary - 66.6 Secondary- 6.8	5.00	1.87	0.207

Table 2. Asset position of agricultural equipment of Jhumya family's in Bandarban (N=30).

Income group of Jhumya family's (Tk/farmily)	Average number distribution of agricultural equipment						
	Spade	Belcha/ Trowel	Watering cane	Saw	Daa	Khonta	All
10,000 -30,000 (14)	3.14	1.21	0.50	0.42	1.43	0.21	6.91 (14%)
30,001 –50,000 (4)	2.75	0.75	0.21	-	3.25	0.11	7.07 (15%)
50,001 – 70,000 (1)	2.00	0.23	-	0.21	2.33	1.22	5.99 (13%)
70,001 – 90,000 (2)	4.00	0.00	0.14	1.00	4.00	1.50	10.64 (23%)
90,001 – above (9)	6.00	1.22	1.22	0.88	5.88	1.22	16.42 (35%)
Average	3.57	0.68	0.41	0.51	3.35	0.85	47.03 (100)

Table 3. Per hectare cost and return of Jhum or shifting cultivation in Bandarban, 2005.

A.	Crops Name	Cost items	Total Cost (TK/ha)	Crop yield (kg ha^{-1})	Price (Tk/kg)	Return (TK/ha)
1.	Jhum paddy	Land preparation (firing/clearing jungle)	1130	346	6	2076
2.	Marfa	Seed cost	1139	195	5	975
3.	Sweet gourd	Sowing cost	600	155	10	1550
4.	Barbatti	Fertilizer (Urea, TSP and MP)	250	82	4	328
5.	Cucumber	Fertilizer apply cost	472	27	8	216
6.	Pineapple	Insecticide used cost	278	240pc	7pc	1680
7.	Turmeric(dry)	Weeding cost	1472	4.8	60	288
8.	Chilli (dry)	Harvesting cost	911	3.43	90	309
9.	Kachu	Land rent	141	2	8	16
10.	-	Guard salary	7403	-	-	-
			Tk=13796 (A)			Tk= 7438 (B)
Net return(B-A)=-6358, Excluding guard salary, Net return=Tk1045, BCR=1.16						

Table 4. Factors affecting production of Jhum or shifting cultivation in Bandarban hill district (Cobb-Douglas production function estimates).

Explanatory variable	Co-efficient	Standard error	t- statistics	P- value	MVP/MFC
Intercept	1.206	2.130	0.566	0.576	
Urea = X_1	0.716	0.328	2.178	**0.040**	
TSP = X_2	0.207	0.339	0.611	0.547	
MP = X_3	- 0.142	0.086	-1.646	0.113	
Weeding=X_4	0.348	0.286	1.216	0.236	**- 1.702**
Insecticide=X_5	0.528	0.150	3.499	**0.002**	
Seed = X_6	- 0.155	0.158	-0.985	0.335	
Land preparation = X_7	- 0.076	0.202	-0.374	0.711	
Ebi = 1.426, R^2 = 0.703 F=7.44 at 1 % Level of Significance					

Production, potentiality, problems and policy issues of major crops in hill district Bandarban

Abstract

A study was conducted on major crop production over the year 1994 -95 to 2000-2001 in Bandarban hill district with view to know the exact crop production situation, growth rate of production, problems and potentialities of hill agriculture. It revealed that the growth rate of production of cereal and vegetable crops was positive 5% and 52% respectively. But negative growth rate was found in -7.8% for pulse crops,-4% for sugarcane, and –8% for cotton. It was also found 8% for spices and 7% for horticulture crops indicating that it was not satisfactory level. The growth rate of tobacco was estimated as 41% over the period implies that rapidly growth of tobacco production severely causing the loss of vegetables area in Bandarban. Government should take attention to the issues.

Introduction

Bandarban was originally a sub-division of Chittagong hill tracts district. It was up graded to a district in 1981. It lies between 21° 11' and 22° 30' north latitudes and between 92° 04’ and 92°41' east longitudes. The total area of the district is 4479.03 Sq.km of which 3.16 sq. km. is revering and 2,730.48 sq. km. is under forest which covers 60.96% of the total area of the district.(B.B.S,2000).

Bangladesh is not only an alluvial plain but about 12 percent of its territory is occupied by hills. Chittagong hill tracts represents a region of Bangladesh with high potential for agricultural development (M.Sabjal,2000). The region has an area of 13,237 sq.km.(Brammer,1997).Major agricultural activity in this area on unfavourable slopes is traditional rainfed farming popularly known as ' Jhum'. This type of farming commonly known as ' shifting cultivation' or slash and burn' farming system. About 1.0 million peoples in hilly areas of which 13 different ethnic groups are directly or indirectly depend on jhum. Important crops are included: rice, maize, sesame, cotton, beans, cucumber, chilly, yam, ginger, banana, turmeric etc. are commonly cultivated (mostly dibbled) before the onset of monsoon.(Sabjal, 2000). Most of the crops are grown under rainfed conditions due to lack of irrigation facilities. A limited area in velley floors near a river or 'charra' (a small water way or channel) may be irrigated, using indigenous methods.

Objectives

1. To examine the exact crop production situation i.e. area and production of major crops grown in Bandarban hill district;
2. To estimate the growth rate of major crops in Bandarban during 1994-95 to 2000-2001;
3. To see the prospect and potentialities of agriculture production in hilly areas;
4. To know the problems of agriculture production in hilly areas, so that research need will be clarified and policy intervention may be made accordingly and
5. To derive policy guide lines for the researchers, extension personnel, administrators and policy makers in order to improvement of hill agriculture production system.

Methodology

The study is mainly based on secondary information. In order to fulfil the first objective, the secondary information is collected from Year Book of Agricultural Statistic Bangladesh, BBS, 2001. Seven years data were accounted to examine the crop production situation where base year was assumed as 1994-95. Simple statistics i,e. mean, percentage were used for estimating area and production situation over the year 1994-95 to 2000-2001.Continous compound growth rate model was used to estimate the growth rate of major crops for different time periods. The simple linear model can not be appropriate for this type of growth. The compound growth model can be defined as $Z = a(1+b)^t$, where t= 0,1,2,.............n. The starting time periods is represented by 0 and n is the last time period.

The method of ordinary least squares can not be used to find out the values of a and b because the model is nonlinear. But a simple log transformation can transfer the model in to a linear one. Taking log we get,

$$\mathrm{Log}_e Z = \mathrm{Log}_e a + t.\ \mathrm{Log}_e (1+b)$$

$$\text{or } \mathrm{Log}_e Z = A+Bt \quad \text{where } A= \log_e a \text{ and } B= \mathrm{Log}_e(1+b)$$

Now the relationship between LogeZ and t is linear and the method of ordinary least square can be used to find out the values of A and B. Using the values of A and B then calculate the values of a and b as follows.

a = Anti logeA and b= AntilogeB-1

The compound growth rate in percent per time is bx100.

In order to fulfil others objectives, the necessary information were collected from secondary sources and Stackholder group (farmer, researcher, extension personnel, NGO worker and administrator (UNO) discussion meeting organized by deputy Commissioner in Ministry level, workshop meeting in Bandarban Zila Parishad and the secondary sources were collected from Asian Development Bank Report, BBS, Journals and Base line Survey Report in hilly areas conducted by BARI, Bandarban and the information was scrutinized as a form of report is presented.

Results and Discussion

Area and production of major crops in Bandarban

A wide variety of crops are grown in the hilly areas of Bandarban. Under rain-fed conditions, farmers generally prefer to grow local varieties, because of tolerance to drought, pests and diseases as well as unavailability of modern varieties and lack of knowledge of modern technology.

Seven years crop production situation i,e. area and production over the base year (1994-95) has been presented in table1.

It can be shown from table1 that all crops has been classified in to six groups i,e. Cereal crops, Pulse crops, Vegetables, Spices crops, Fruits and other crops. Among the all types of crops, total area increased by 12 percent where production was increased by 81 percent over the year from base year to 2000-2001.

Considering the Cereal crops, total area and production increased by 21 percent and 39 percent respectively. Area and production of pulse crops decreased by 63 percent and 66 percent respectively while in vegetables crops area and production increased by 43 percent and 40 percent respectively over the base year 1994-95. Considering the Spices crops area and production increased by 120 percent and 65 percent respectively, In Fruits crops total area and total production increased by 15 percent and 17 percent respectively. Others crops i,e. Sugarcane, Cotton, Tobacco total area increased by 12percent but total production decreased by 7 percent over the base year 1994-95 (Table1).

Growth rate of production of major crops in Bandarban

There are vast potential areas/resources of agricultural production in Bandarban. The growth rate of cereal crops was estimated 52%, pulse crops was negative, -78%, vegetables 52%, spices crops 8%, fruit crops 7% and other crops i.e. sugarcane, cotton and tobacco was 29% where sugarcane and cotton was negative growth rate –4% and –8% but the growth rate of tobacco was 41percent during the period 1994-95 to 2000-2001 (Table 2) indicating that the growth rate of major crop production over the period (7 years) was not satisfactory level except vegetable crops.

Prospect and Potentialities of Agricultural Production

Prospects of homestead agroforestry

There is a great opportunities and prospects for improvement of the existing traditionally managed homesteads. Majority of the homestead were found under utilized with limited fruit trees and vegetables. No scientific management practices have been identified to improve the homestead productivity. Replacement of the less productive trees/shrubs with a number of multipurpose tree species such as *mangifera indica, artocarpus heterophllus, cocos nucifera, psidium guajava, lichi chinensis, citrus spp*. etc. In the homesteads may fulfil the basic requirement of fuel, food/fruit, timber and fodder for the farmers. It can serve as a source of cash income. Similarly, planting of quick-growing nitrogen fixing tree species like *acacia nilotica, dalbergia sissoo*, etc. will help the farmers to overcome fuel wood and timber crisis and maintain the fertility and productivity of the homestead. Proper management practices such as pruning, pollarding, bending, etc. may enhance total dry matter, flower and fruit production.

Potential annual and perennial crops

In the following tables (3-4) a number of crops are listed on the basis of their suitability for (i) different slope classes and (ii) distance to market, in view of parishability of the produce and the need to avoid transporting high volume produce over long distances. Only those crops are listed which have a comparative advantage in the Bangladesh market or which have potential as an export crop (H. Mutsaers, 2000).

Potential crop which need further research

The following crops which need further research:

Jhum paddy: Upland paddy will remain an important crop for some time to come, mainly for subsistence needs. Practically no breeding has been done to improve jhum paddy varieties. Also, no information was found on major pess and diseases, although Stemborers and neckblast are likely to be important. An increase in yield due to improved genetic material in order of 10-20% may be expected under farmer's conditions. DAE of Bandarban has found that BR21, BR26 and BR27 perform well under jhum conditions. It has an opportunity to introduce HYV variety in Jhum field.

Pineapple: Fresh pineapple production could get a boost from the application of hormone treatment for the regulation of flowering, extending the fruiting period and reducing seasonally. The feasibility of promoting the technique for small scale producers needs further investigation. A large increase in production will require reliable processing facilities in that areas. Hormone treatment of pineapple for year around/off-season production as suggested by researcher of ARS, khagrachuri.

Lemon: The fluctuation of market prices of lemon is very large with the price going down to Tk.10/100 fruit at the top of the season. Profitability of the crop under the present conditions is therefore doubtful. Considering this, some experiment may be undertaken to induce flowering, which may extend the harvest period.

Maize: Now a day, it has a great demand due to rapid growing mini poultry and fish farm as well as tribal people more like for their food habit. More research should be needed on farmer's level.

Pointed gourd: Pointed gourd is new crop in hill district. Cultivation of pointed gourd in hill valleys could be more earning source and to be utilized of fallow hilly land. *On-farm* research with suitable varieties would be needed.

Pulses: In the plain land of bangladesh, production of pulses is practically limited to the rabi season and the hilly areas could capture a bonus from off-season production of pulses such as green gram, black gram and mungbean. *On-farm* trial of pulses should be needed due to negative growth rate of production.

Pomelo: Seasonally is less pronounced than with the other citrus species, because there exist significant varietal variation for flowering and fruiting time. A major problem is, however, the long juvenile period. Budding or grafting should be considered to shorten the juvenile period and some applied research will be needed in this area. According to report from ARS, Khagrachuri, early and late varieties of pomelo have very good prospects in the region.

Jackfruit: Off season jackfruit by contact grafting is possible and would be profitable for farmers (source: ARS, Khagrachuri).

Cardamom: Cardamom is an essential ingredient in the bangladesh kitchen, but all of it is imported from india. The conditions for growing the crop in the hilly areas appear excellent, especially under agroforestry conditions. Problems are the long period until first fruit (sowing, transplanting, juvenile period) up to 4 or 5 years and the processing. The crop should be definitely be a strong candidate for *on-farm* testing and eventually promotion.

Cinnamon: Cinnamon has been found by BARI to be suitable for Chittagong area and may be further tested under hill conditions.

Black pepper: Black pepper appears to be highly suitable for the hilly areas, with large trees serving as support for the vines. Testing under farmer conditions is needed.

Orange: Orange is a potential fruit in hill region in Bandarban. Two types of orange variety are found in Bandarban i.e. Ruma variety which shape is large and excellent colour but less sweet and another one is Chimbuk variety which shape is small and taste is sour. Farmers face several problems during orange cultivation. Among the problems, pre-harvest dropping is the major problem and farmers did not know modern technology for orange cultivation. Program should be undertaken for improving the sweetness of orange and introduce modern management package at farm levels. It would be helpful for increasing farmers' income.

Potential Crops for Export

* Pineapple (honey queen), baby corn, bamboo shoots;
* Novel products such as black pepper, cloves;
* Ornamentals: exotic varieties, palm and bamboo varieties;
* Orchids;
* Organic product

Problems of agricultural production in hilly areas

The following problems are synthesized from different Stakeholder group (a group researcher, extension personnel, development worker, administrator (UNO) and farmer) discussion:

Land related problem

1. Land ownership problem
2. Maximum land was strip slope
3. Land classification problem
4. Complexity of different law and orders of land

Production related problem

1. Low soil fertility
2. Rapid growth of weed and shrub in kharif season
3. Severe pest and disease infestation
4. Lack of technical know-how about modern ciltivation.
5. Due to shifting cultivation , soil fertility are declining and natural hazard are occurs
6. Lack of cash and credit facility
7. Lack of agricultural equipment/inputs
8. Unavailability and difficulties of getting loan from different sources
9. Lack of improved technology
10. Lack of irrigation facility during dry season

Marketing Problem

1. Lack of communication due to limited transportation and remoteness of production area
2. Lack of marketing center/point or co-operative marketing
3. Weak marketing channel/position
4. Inappropriate knowledge of post harvest technology
5. Lack of storage facility
6. Lack of agro-based industry

Social problem

1. Lack of awareness of modern technology
2. Adaptive problem of new technology due to different types of customs/ethnic group
3. Adicted to narcotizes of rural tribal poor people
4. Superstition and suspicion of rural poor people
5. Lack of linkage with different institutes/ organizations due to interior place

The above problem was gathered from different workshop/seminar hold on different time and places in Bandarban.

Policy implications and future thrust

1. Agricultural crop production can be increased taking the realistic plans and it is possible to create income generation activities, poverty alleviation, supply nutrition and it plays a vital role in the sustainable economic development.

2. An integration work plan on modern crop cultivation regarding research work should be taken and implemented by the government and private sectors.
3. Major portions of crop products are lost due to lack of storage facility and proper prices are not getting by the producer. So storage facility should be developed.
4. Proper planning and strengthening of research and extension work and execution of these policies is really needed so that the growth rate of crop production is increased satisfactory level after day by day.
5. Hill Development Board should be strengthened.

Conclusion

It might be concluded that the over all growth rate of production should be increased than existing one. It would be possible if proper plan and action work could be integrated and implemented for hill development.

Table 1. Total area and production of major crops grown in Bandarban hill district from 1994-99 to 2000-01

Area in acres and production in metric tons

Sl no.	Crops	1994-95		1995-96		1996-97		1997-98		1998-99		1999-2000		2000-2001	
		Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
A.	Cereal crops:														
1	Local Aus Rice	21670	9160	22020	10370	23510	11520	24250	11900	24000	11870	25330	12130	24400	13810
2	HYV Aus Rice	4450	4270	4470	4470	5760	5170	6370	5220	6250	5130	6280	5450	5780	4060
3	Local T.aman	1770	1050	1890	1370	1820	1240	1870	1430	1500	1330	1530	1100	2120	1570
4	HYV Aman	12390	13340	15080	15850	15710	16210	16320	16440	16490	17160	17720	16450	19230	22080
5	Boro	6870	6330	6220	7810	8560	8040	9330	8980	9260	9270	6920	7210	6190	6480
6	Maize	1065	525	980	515	985	520	330	180	355	210	295	145	380	205
	a. Sub total:	48215	34675	50598	40386	56346	42702	58470	44148	57858	44970	58075	42485	58100 (21%)	48205 (39%)
B.	Pulse crops:														
7	Lentil	80	20	100	25	110	25	120	30	125	30	55	10	45	10
8	Mung	25	10	25	10	25	10	20	10	25	10	20	10	20	5
9	Sesame (Til)	7890	2870	7940	2940	7960	2900	7965	2975	1285	485	1315	465	1330	475
10	Mustard	2480	1010	2990	1240	2960	1245	2960	1265	2845	1195	2735	1180	2645	920
11	Groundnut	750	380	150	85	150	90	155	100	110	75	85	50	85	55
	b. Sub total:	11225	4290	11205	4300	11205	4270	11220	4380	4390	4390	4210	1715	4125 (-63%)	1465 (-66%)
C.	Vegetables:														
12	Pumpkin	200	570	215	645	220	665	220	690	250	820	260	775	290	865
13	Brinjal	275	610	295	670	280	655	315	750	600	2530	625	1595	625	1600
14	Lady's finger	145	135	165	175	170	190	170	210	165	180	170	190	175	195
15	Bottle gourd (Karala)	270	450	260	455	265	475	275	505	285	525	275	485	265	495
16	Cucumber	230	410	235	420	240	430	245	440	240	435	260	475	255	465
17	Cow pea(Barbati)	250	380	225	355	230	375	135	265	150	225	235	345	240	410
18	Chalkumra	155	415	165	460	155	435	170	470	590	1650	585	1625	605	1570
19	Cauliflower	215	615	145	415	150	390	135	355	130	340	160	395	165	405
20	Cabbage	260	790	270	845	275	575	270	865	275	875	225	700	225	720
21	Tomato	295	1000	305	1040	310	1070	310	1075	300	1070	295	1080	305	930
22	Radish	615	2225	625	2280	640	2185	640	2240	640	2215	635	2110	660	1610
23	Potato(local)	575	3220	575	3260	580	3285	550	2895	1245	6365	1110	5515	1475	7155
24	Potato(HYV)	430	2180	445	2285	460	2350	475	2925	1080	6225	770	4255	325	1655
25	Sweet potato	320	1585	385	1950	395	2420	395	2095	385	1995	400	2190	425	2305
	c. Sub total:	303	1042	308	1090	312	1107	308	1127	453	1818	6005	21735	6035 (43%)	20380 (40%)

Table 1. Contd. Area in acres and production in metric tons

Sl no.	Crops	1994-95		1995-96		1996-97		1997-98		1998-99		1999-2000		2000-2001	
		Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
D.	Spices:														
26	Kharif Chillies	370	140	445	175	450	180	455	175	1365	510	1370	520	1375	530
27	Rabi Chillies	780	335	785	360	790	370	860	405	2540	1175	2555	1195	2565	1205
28	Turmeric	785	1000	840	1120	895	1240	920	1280	935	1395	905	1365	915	1410
29	Ginger	710	2290	730	2370	740	2220	785	2325	805	2330	795	2310	1035	3095
30	Coriander	65	15	70	15	70	15	80	15	80	15	80	15	75	15
	d. Sub total:	2710	3780	2870	4040	2945	4025	3100	4200	5725	5425	5705	5405	5965 (120%)	6255 (65%)
E.	Other crops:														
31	Sugarcane	205	2940	235	3400	230	3375	225	3255	235	3030	225	2910	225	2380
32	Cotton	8015	3180	8315	4035	8605	3830	4750	2690	9560	2665	7575	2330	7470	2380
33	Tobacco	250	100	315	135	375	170	645	310	740	365	1680	865	1795	995
	e. Sub total:	2823	2073	2955	2523	3070	2458	1873	2085	3512	2020	5040	2595	9490 (12%)	5755 (-7%)
F.	Fruits:														
34	Banana	3165	26230	3260	26730	3320	26715	3405	26245	2980	22360	2865	20375	3475	24255
35	Mango	945	830	965	850	980	865	1005	885	1015	900	1025	915	1035	920
36	Pineapple	1000	4955	1080	5380	1105	5525	1125	5610	1175	6000	1260	6635	1330	6675
37	Jack-fruit	955	3735	1060	4210	1090	4365	1095	4380	1100	4385	1105	4425	1115	4470
38	Papaya	310	1245	335	1300	360	1410	370	1485	420	1655	15	20	280	1380
39	Litchi	140	135	150	145	155	150	155	145	155	145	115	95	120	100
40	Guava	285	360	300	380	320	430	320	465	330	480	330	490	330	395
41	Orange	190	235	195	245	195	240	200	250	200	245	210	270	225	270
42	Pomelo	280	615	390	985	415	1070	420	1080	425	1070	420	1075	420	1075
43	Lemon	290	400	300	430	305	430	325	470	330	500	335	510	340	515
	f. Sub-total	756	3874	804	4066	825	4120	842	4102	515	3774	7680	34810	8670 (15%)	40055 (17%)
	Total (a+b+c+d+e+f)	82415	67420	-	-	-	-	-	-	-	-	-	-	92385 (12%)	122115 (81%)

Source: Year Book of Agricultural Statistics of Bangladesh, 2001, Published by June 2004

Table 2. Growth rate of major agricultural crops in Bandarban, Bangladesh from 1994-95 to 2000-01

Major crops	Growth rate (%)		
	GR (%)	t-values	P-values
A.Cereal crops:			
1. Local Aus	0.40	6.008	0.001
2. HYV Aus	0.00	0.359	0.733
3. Local Aman	0.03	1.131	0.309
4. HYV Aman	0.05	3.622	0.015
5. Boro	0.00	0.061	0.953
6. Maize	0.04	0.222	0.832
Sub total:	0.52	-	-
B. Pulse crops:			
1.Lentil	-0.13	-1.670	0.155
2. Sesame (Til)	-0.38	-3.833	0.012
3. Mustard	-0.02	-0.615	0.565
4. Groundnut	-0.25	-3.082	0.027
Sub total:	-0.78	-	-
C. Vegetables:			
1. Pumpkin	0.06	7.512	0.000
2.Brinjal	0.21	3.062	0.028
3. Lady's finger	0.04	1.983	0.104
4. Cucumber	0.02	5.658	0.002
5. Potato (local)	0.15	3.400	0.019
6. Potato (HYV)	0.05	0.546	0.608
7. Sweet potato	0.04	1.896	0.116

Major crops	Growth rate (%)		
	GR (%)	t-values	P-values
8.Radish	-0.03	-2.215	0.077
9. Tomato	-0.01	0.667	0.667
10. Cow pea (Barbatti)	-0.01	-0.270	0.797
Sub total:	0.52	-	-
D. Spices crops:			
1. Ginger	0.03	1.747	1.747
2. Turmeric	0.05	6.054	6.054
Sub total:	0.08	-	-
E. Fruit crops:			
1. Banana	-0.03	-2.183	0.081
2. Jackfruit	0.02	2.939	0.032
3. Pineapple	0.04	10.239	0.000
4. Papaya	-0.08	-0.912	0.403
5. Mango	0.02	15.963	0.000
6. Guava	0.03	1.547	0.182
7. Orange	0.02	4.272	0.007
8. Pomelo	0.07	2.113	0.088
9. Lemon	0.04	9.167	0.000
10. Litchi	-0.06	-2.256	0.073
Sub total:	0.07		
F. Other crops:			
1. Sugarcane	-0.04	-1.965	0.106
2. Cotton	-0.08	-3.136	0.025
3. Tobacco	0.41	12.530	0.000
Sub total:	0.29	-	-

Table 3. Potential herbaceous crops for promotion under hill farming conditions

Distance to market	**Slopes**		
	<5%*	5-20 %	20-40%
Close	Ginger, turmeric Summer gourds Melon, water melon Carrot, radish Yardlong beans	- Ginger, turmeric - Summer gourds - Aroids - groundnut - Brinjal(eggplant)	- Bananas - Fodder crops - Ginger, turmeric
Moderate	Spices Sesame Mung, black gram Lady's fingers	Fodder crops Spices Sesame	Fodder crops Ginger, turmeric
Remote	Dry chilli Garlic	- Fodder crops - Dry chilli	- Fodder crops

* excluding valley bottom land, Source: H. Mutsaers, 2000

Table 4. Potential perennial crops for promotion under hill farming conditions

Distance to market	**Slopes**		
	5-20%	20-40 %	>40 %
Close	Pineapple Tangerine Lychee	Pineapple Tamarind Pomelo Lychee	Tamarind Pomelo Indian olive
Moderate	Amluki Coffee	Tamarind Amluki Coffee	Indian olive (green) tea Tamarind Medicinal species
Remote	Black pepper Cloves Cardamom	Black pepper Cloves Cardamom Cinnamon	Black pepper Cloves Medicinal species (green) tea

Source: H. Mutsaers, 2000.

❋ ❋ ❋

A. PRODUCTION PROGRAM

Shibpur, Narsinghdi

Crop: Summer onion

Name of farmers	Plot size (m^2)	Date of sowing	Yield (t/ha)
1. Md. Ataur Rahman	320	12-02-05	18.0
2. Md. Mostafa Mia	360	20-02-05	18.5
3. Md. Sirajuddin	160	20-02-05	17.9
4. Md. Matiur Rahman	240	22-02-05	17.2
5. Md. Alauddin Bhuiyan	120	22-02-05	18.8
6. Md. Noru uddin Bhuiyan	1600	25-02-05	23.8
7. Md. Atikur Rahman	800	24-02-05	20.7
8. Md. Korshed Alam	480	26-02-05	15.7
9. Md. Kalachan Mia	480	27-01-05 (Broadcast)	9.30

Faridpur

Crops	Variety	Area (hectare)	Sowing date	Sowing method	Farmers involved (no.)	Yield (t/ha)
Wheat	Satabdi	2.0	23-11-04 to 26-11-04	Power tiller operated seeder	12	2.25
	Sourav	1.0	25-11-04 to 30-11-04	-Do-	8	2.08
Hybrid Maize	Pacific-11	16.0	24-10-04 to 12-12-04	Line sowing	112	7.54
Mustard	BARI Sharisha-9	1.0	24-10-04 to 6-11-04	Broadcast	5	1.325
	BARI Sharisha-11	1.0	24-10-04 to 6-11-04	Broadcast	7	1.950
Chickpea	BARI cholla-5	1.5	21-11-04 to 30-11-04	Broadcast	10	1.25
Lentil	BARI masur-4	4	1 st week, November,04	Broadcast	22	0.95
Sesame	BARI til-3	1.0	12-16 March, 05	Do	7	1.14

Kushtia

Crops	Variety	Area (hectare)	Sowing date	Sowing method	Farmers involved (no.)	Yield (t/ha)
Mustard	BARI Sarisha 11	1.0	20 October, 2004	Broadcast	5	2.0
Wheat	Shatabdi	4.5	26 Nov. 2004	do	16	2.99
Hybrid maize	Pacific 11	27	15 Nov. 15 Dec. 04	line	192	7.5
Lentil	Prime		7 Nov. 2004	Line		1.50
	Non prime					0.53

Barind

Yield of dhaincha seeds and fuel in T.Aman crop field during 2004-05

Dhaincha seed (kg/ha)		Mean yield (kg/ha)	Fuel /(kg/ha)		Mean yield (kg/ha)
FSRD site	MLT site		FSR site	MLT site	
150	110	130	650	490	570

Sylhet

Crops	Variety	Area (hectare)	Sowing date	Sowing method	Farmers involved (no.)	Yield (t/ha)
Chickpea	BARI Chola 3	-	25 Nov. to 4 Dec. '04	Broadcast	2	1.70
Gardenpea	BARI Motorshuti 3		28 Nov. to 4 Dec. '04	Line	6	7.3
Mustard	BARI Sarisha 11	0.5	-	Broadcast	5	1.79 (I) 1.382(R)
Onion	Summer onion	-	8 April 2004	Line	3	3.54

Jamalpur

Crops	Variety	Area (hectare)	Sowing date	Sowing method	Farmers involved (no.)	Yield (t/ha)
Hyacinth bean	BARI Seem 1	1.25	21-29 August 2004	Pit	20	12.15
Okra	BARI Dherosh 1	1.4	-	line	11	10.32

B. SEED EXCHANGE PROGRAM

Chabbishnagar, Barind, Rajshahi

Crops	Area (ha)	No. of Cooperator	Mean Yield (t/ha)	Supplied seed (kg)	Collected seed (kg)
Mustard (BARI sarisha-9)	5.30	18	1.16	40kg	30kg
Mustard (BARI sarisha-11)	0.66	2	1.50	5	5kg
Chickpea (Different variety)	7.00	65	1.055	328	100kg
Wheat (Different variety)	2.26	12	2.7	340	200
Linseed	1.50	2	8.00	24	-
Total	16.72	99	-	-	-
MLT site, Nachole,					
Mustard Chickpea	8	40	1.05	360	222

Faridpur

Crops	Variety	Area (hectare)	Yield (t/ha)	Farmers involved (no.)	Supplied seed (kg)	Collected seed (kg)
Wheat	Satabdi	6.0	2.05	46	800	800
	Sourav	2.0	1.98	8	260	260
	Protiva	2.0	1.88	6	260	260
Chickpea	BARI cholla-5	1.0	1.05	4	40	40

C. BARI TECHNOLOGY VILLAGE

Barind, Rajshahi, FSRD site

Crops	Varieties/ Lines	Area	Sowing time	Harvesting Time	Yield (t ha^{-1})
Wheat	Sourav	3m x 4m	8.12.04	25.3.05	2.32
	Protiva	"	8.12.04	25.3.05	2.48
	Kanchan	"	8.12.04	25.3.05	2.56
	Gourav	"	8.12.04	25.3.05	2.82
	Shatabdi	"	8.12.04	25.3.05	3.00
Chickpea	BARI chola-5	"	8.12.04	16.4.05	1.00
	BARI chola-3	"	8.12.04	16.4.05	0.90
	BARI chola-4	"	8.12.04	16.4.05	0.86
	BARI chola-2	"	8.12.04	16.4.05	0.85
	Nabin	"	8.12.04	16.04.05	0.77
Mustard	SS-75	"	8.12.04	16.4.05	0.83
	BARI Sarisha -4	"	8.12.04	16.4.05	0.96
	BARI Sarisha -6	"	8.12.04	16.4.05	0.90
	BARI Sarisha - 9	"	8.12.04	16.4.05	0.85
	BARI Sarisha -10	"	8.12.04	16.4.05	0.82
	BARI Sarisha-11	"	8.12.04	16.4.05	1.22
	BARI Sarisha-12	"	8.12.04	16.4.05	0.85
	Tori-7	"	8.12.04	16.4.05	0.86
China	Tushar	"	12.12.04	28.3.05	1.94
Guzi till	Shova	"	8.12.04	12.04.05	0.62
Tisi	Nila	"	12.12.04	8.04.05	0.48
Sunflower	Kironi	3m x 4m	8.12.04	23.4.05	0.75
Barley	BARI Barley-1	"	12.12.04	25.03.05	0.75
	BARI Barley-2	"	12.12.04	25.03.05	0.86
Maize	BARI Maize-2	"	8.12.04	20.04.05	6.90
	BARI Maize-3	"	8.12.04	24.04.05	8.50
	BARI Maize-7	"	8.12.04	24.04.05	7.60
Lentil		"	12.12.04	24.3.05	0.80
Coriander		"	12.12.04	20.3.05	450gm
Mathi		"	12.12.04	13.04.05	0.81
Soybean	G-2	3m x 4m	12.12.04	13.04.05	0.88
Radish	BARI Mula- 1	"	12.12.04	30.3.05	0.90
	BARI Mula- 2	"	12.12.04	30.3.05	0.75
	BARI Mula- 3	"	12.12.04	30.03.05	0.80
Garden pea	BARI Garden pea-1	"	08.12.04	25.03.05	0.45
	BARI Garden pea-2	"	08.12.04	24.03.05	0.85
Bush bean	BARI Bush bean- 1	"	12.12.04	16.03.05	0.80

Patuakhali

Name of crop	Name of variety	Date of sowing	Date of harvest	Yield (ton/ha)	Net return (Tk/ha)
Amaranth	BARI Data-1	5-04-04	20-5-04	25	77145
Indian spinach	BARI-1	5-4-04	25-5-04 to 30-6-04	45	98090
Gimakalmi	BARI-1	5-04-04	15-5-04 to 15-8-04	40	74600
Okra	BARI Derosh-1	5-04-04	28-5-04 to 30-8-04	13	67474
Tomato	BARI Tomato-2	25-11-04	19-2-05 to 10-3-05	82	173000
	BARI Tomato-3	25-11-04	22-2-05 to 20-3-05	80	165500
	BARI Tomato-9	25-11-04	22-2-05 to 20-3-05	78	161000
Red amaranth	BARI Data -1	10-11-04 to 15-11-04	15.12.04 to 20.12.04	10	4310
Radish	BARI Mula-1	10-11-04 to 15-11-04	25.12.04 to 30.12.04	50	51495
	BARI Mula-2	10-11-04 to 15-11-04	30.12.04 to 5.1.05	45	41495
	BARI Mula-3	10-11-04 to 15-11-04	25.12.04 to 30.12.04	35	21495
Bushbean	BARI Jharseem-1	10.11.04 to 15.11.04	25.12.04 to 30.12.04	10	14310
Mustard	BARI Sarisha-7	25-11-04 to 15-12-04	20.2.05 to 28.2.05	1.2	7365
	BARI Sarisha-8	25-11-04 to 15-12-04	20.2.05 to 28.2.05	1.3	9365
	BARI Sarisha -9	25-11-04 to 05-12-04	15.2.05 to 20.2.05	1.1	3165
	BARI Sarisha -11	25-11-04 to 15-12-04	22.2.05 to 28.2.05	1.8	19365
Brinjal	BARI Begun-4	2-12-04	22-2-05 to 30-4-05	56	240000
	BARI Begun-5	2-12-04	20-2-05 to 15-2-05	54	230000
Potato	Heera	30-11-04	26-2-05	24	76575
	Dheera	5-12-04	28-2-05	21	51075
	Diamont	5-12-04	28-2-05	24	76575
	TPS	7-12-04	25-2-05	29	72575
Wheat	Shatabdi	10-12-05	25-3-05	2.0	6900
Maize	Barnali	7-12-04	10-4-05	5 ton	10500
	Mohor	9-12-04	12-4-05	4.75	90000

Faridpur

Name of crop	Variety	Date of sowing/ transplanting	Yield (t/ha)
Radish	Tasaki	25.10.2004	54.00
	Druti	Do	50.40
	Pinki	Do	52.50
Pea	BARI motor-2	30.10.2004	16.20
Potato	Dheera	20.11.2004	29.00
	Diamant	Do	16.30
	Cardinal	Do	22.30
Tomato	Ratan	23.11.2004	56.00
	BARI tomato-3	23.11.2004	61.00
	BARI tomato-9	23.11.2004	66.00
Lentil	BARI mashur-4	02.11.2004	1.10
Mustard	Tori-7	27.10.2004	1.26
	BARI sarisha-8	Do	1.90
	BARI sarisha-9	Do	1.25
	BARI sarisha-11	Do	1.94
Linseed	Nila	02.11.2004	0.60
Wheat	Shatabdi	23.11.2004	2.40
	Shourav	Do	1.90
	Gourab	Do	1.98
	Protiva	Do	1.85
Barley	BARI barley-1	23.11.2004	2.11
	BARI barley-2	23.11.2004	2.02
Maize	BARI hybrid maize-2	02.11.2004	8.47
	BARI hybrid maize-7	02.11.2004	8.85

Jamalpur

Crop	Variety	Yield (t/ha)
Mustard	BARI Sarisha 10	1.35
	BARI Sarisha 11	1.21
	BJ-66	1.12
	Rai-5	0.98
	Daulat	1.02
Potato	BARI Potato 1 (Hira)	31.15
	BARI Potato 7 (Diamant)	32.32
Wheat	BARI Wheat 19 (Sourav)	4.35
	BARI Wheat 20 (Gourab)	4.17
	BARI Wheat 21 (Shatabdi)	4.23
	Protiva	3.96
Barley	BARI Barley 2	2.16
Maize	BARI Hybrid Maize 2	9.75
	BARI Hybrid Maize 3	9.01
	BARI Hybrid Maize 5	9.15
	Pacific 11	10.45
Tomato	BARI Tomato 2	69.00
	BARI Tomato 3	63.00
	BARI Tomato 9	68.00
Garden pea	BARI Motorshuti 2	7.31
Jharshim	BARI Jharshim 2	10.15
Radish	BARI Radish 2 (Pinki)	45.45
	BARI Radish 3 (Druti)	49.18
Groundnut	BARI Badam 1	1.75
	BARI Badam 6	1.65
Chickpea	BARI Chola 3	1.57
	BARI Chola 5	1.75
Kaon	BARI Kaon (Titash)	2.15

Faridpur

Name of crop	Variety	Date of sowing/ transplanting	Date of harvesting	Yield (t/ha)
Wheat	Satabdi	25.11.04	18.03.05	1.90
	Sourav	25.11.04	18.03.05	1.88
	Gourab	27.11.04	15.03.05	1.80
	Protiva	25.11.04	18.03.05	1.87
Coriander	BARI Dhonia-1	02.12.04	24.03.05	1.63
Mustard	Tori-7	20.10.04	16.01.05	1.20
	BARI sarisha-9	26.10.04	16.01.05	1.20
	BARI sarisha-11	25.10.04	31.01.05	2.00
Barley	BARI Barley-1	23.11.04	16.03.05	1.68
	BARI Barley-1	24.11.04	18.03.05	1.97
Maize	BARI Hybrid maize-2	05.11.04	04.04.05	7.98
	BARI Hybrid maize-7	05.11.04	04.04.05	8.29
Chickpea	BARI chola-5	25.11.04	22.03.05	0.93

Taratpara, Gazipur

Name of crop	Variety	Date of sowing	Date of harvest	Yield (t/ha)
Wheat	Shatabdi, Prativa, Sourab	28.11.04 to 14.12.04	16.3.05 to 24.4.05	2.9 to 3.3
Mustard	Tori-7	7.11.05 to 16.11.05	28.1.05 to 16.2.05	0.57 to 0.785
Potato	Heera, Deera, Diamond	26.11.04 to 2.12.04	27.2.05 to 7.3.05	11.25 to 27.6
Bottle gourd	BARI-1	15.11.04 to 16.11.04	1.03.05 to 14.3.05	9 to 27
Brinjal	BARI Begun-4	6.11.04 to 14.11.04	20.5.05 to 15.6.05	36 to 46.6
Tomato	BARI Tomato-3	15.11.04 to 23.11.04	1.03.05 to 10.03.05	38 to 41
Onion	BARI 1, OAF-5	28.1.05 to 25.04.05	30.3.05 to 17.05.05	3.8 to 7.4
Aroid	Latiraj	15.2.05 to 22.04.05	Continue	10.6.05 to 15.06.05
Sesame	BARI sesame-2 BARI sesame-3 BARI sesame-6	11.3.05	12.6.05	.96 to 1.15
Ladies finger	BARI Derosh-1	12.3.05 to 10.04.05	25.6.05 to continue	12.5 to 14.3
Amaranth	BARI Data 1	14.3.05 to 20.3.05	30.4.05 to 23.6.05	3.7 to 4.89
Maize	BARI Maize 5	3.4.05	20.6.05	1.2

Mango hopper control

No. of farmer	No. of trees	Fruit yield (kg)		Yield increase (%)	Cost/tree (Tk.)
		Prior to spray	After spray		
48	181	2819	7290	258.60	9.94

Lebukhali, Patuakhali

Title	Farmers involved (no.)	Yield (t/ha)
1. Bottle goard	3	35
2. Bean	3	16
3. Bitter goard	3	5
4. Raddish	3	35
5. Red amaranth	3	10
6.Cauliflower	3	15
7. Cabbage	3	40
8. Yard long bean	3	8.5
9. Tomato	3	40
10. Brinjal	3	40
B. Agrofishery-minipond		
1.Bottle goard	2	35
2. Bean	2	14
3. Bitter goard	2	5
4. Raddish	2	40
5. Red amaranth	2	11
6.Cauliflower	2	22
7. Cabbage	2	41
8. Tomato	2	58
9. Brinjal	2	44

Puspapara, Pabna

Variety	Date of sowing	Date of harvesting	Yield grain (t/ha)	Cultivation (cost/ha)	Net return per (t ha)	Remarks
Radish						
Tasakisan	15.11.04	10.01.05	62	23000	163000	Good
Pinky	15.11.04	20.01.05	52	23000	133000	Good
Druty	15.11.04	20.01.05	49	23000	124000 @ Tk 5	Good
Potato						
Hira	20.11.04	25.02.05	32	40000	120000@ 5 Tk	Good
Dhira	20.11.04	25.02.05	30	40000	110000@ 5 Tk	Good
Daimond	20.11.04	25.02.05	28	40000	10000@ 6 Tk	Excellent
BARI French						
BARI Jharseem-1	12.11.04	10.02.05 to 15.02.05	21	17000	128700@ 6 Tk	Excellent
BARI Jharseem-2	12.11.04	10.02.05 to 15.02.05	23	17000	132500@ 6 Tk	Excellent
Cowpea						
BARI Felon-2	12.11.04	05.01.05 to 15.01.05	17	15000	121000@ 8 Tk	Excellent
Red Amaranth	10.11.04	01.01.05 to 10.01.05	15	15000	50000@ 5 Tk	Good
BARI Lou -1	10.11.04	15.01.05 to 21.03.05	--	---	----	Excellent
BARI coriander -1	20.11.04	16.03.05	1.6	9040	22960@ 20 Tk	Good
BARI onion - 1	10.02.05		12	31875	58125@ 7.5 Tk	Good
BARI Masur-4	15.11.04	09.03.05	1.75		42812@ 30 Tk	Excellent
Mustard						
Tori -7	19.11.4	08.02.05	1.20		14325@ 20 Tk	Good
BARI Sarisha - 8	19.11.4	15.02.05	1.71		25035@ 20 Tk	Good
BARI Sarisha - 9	19.11.4	10.02.05	1.33		17055@ 20 Tk	Good
BARI Sarisha - 11	19.11.4	05.03.05	1.93		29655@ 20 Tk	Excellent
Wheat						
Gourab	30.11.04	17.03.05	2.65		22437@ 15 Tk	Line sowing with seeder
	05.12.04	24.03.05	3.25		29187@ 15 Tk	(Broadcast sowing)
Satabdi	2.12.04	22.03.05	2.85		25187@ 15 Tk	Line sowing with seeder
	05.12.04	24.03.05	3.30		29875@ 15 Tk	Broadcast sowing
Sourav	05.12.04	26.03.05	3.50		34125@ 15 Tk	Line sowing with seeder
	05.12.04	24.03.05	3.50		32625@ 15 Tk	Broadcast sowing
Protiva	04.12.04	23.03.05	2.75		23812@ 15 Tk	Line sowing with seeder
	05.12.04	24.03.05	3.00		25750@ 15 Tk	Broadcast sowing

Rangpur

Name of crop	Variety	Area (m^2)	Yield (t/ha)
Wheat	BARI Gom-18 (Protiva)	4040	3.77
	BARI Gom-19 (Sourav)	1520	3.60
	BARI Gom-20 (Gourav)	600	3.52
	BARI Gom-21 (Shatabdi)	1600	3.90
Mustard	BARI Sarisha-8	3300	2.00
	BARI Sarisha-9	3320	1.35
	BARI Sarisha-11	2400	1.65
	Tori-7	2120	1.05
Sesame	BARI Til-3	440	1.00
Groundnut	BARI Jhinga Badam	1920	-
Maize	BARI Hybrid Maize-3	920	-
Bush bean	BARI Bush bean-1	140	10.75
Bottle gourd	BARI Lau-1	80	20.00
Country bean	BARI Sim-1	80	18.00
Tomato	BARI Tomato-2 (Ratan)	110	65.00
	BARI Tomato-3	60	60.00
	BARI Tomato-4	30	65.00
Brinjal	BARI Begun-5 (Nayantara)	260	48.00
Potato	BARI Potato-7 (Diamont)	1800	26.00
	BARI Potato-11 (Dheera)	440	26.50
Garden pea	BARI Motorshuti-1	20	11.00
	BARI Motorshuti-2	70	10.50
Radish	BARI Mula-1 (Tasakisan)	40	70.00
	BARI Mula-2 (Pinky)	20	40.00
	BARI Mula-3 (Druti)	120	40.00
Okra	BARI Dherosh-1	280	12.50
Danta	BARI Danta-1 (Laboni)	40	31.00
Indian spinach	BARI Puishak-1	160	42.00
Lalshak	BARI Lalshak-1	200	13.00

D. TRAINING AND FIELD DAYS

Project: SFFP

Farmers' Training

Location	Date	No. of farmers
Narsingdi	28 November 2004	10
Joydebpur	07 December 2004	24
Barind	22 November 2004	18
Mymensingh	25 November 2004	24
Kishoreganj	27 November 2004	24
Khulna	29 November 2004	18
Faridpur	09 November 2004	15
Rangpur	21 November 2004	24
Tangail	30 November 2004	18
Jamalpur	13 December 2004	24
Pabna	29 November 2004	20
Rajshahi	27 November 2004	18
Comilla	06 December 2004	24
Sylhet	30 November 2004	12
Bogra	28 November 2004	24
Jessore	21 November 2004	24
Kushtia	30 November 2004	10
Dinajpur	09 November 2004	12
Noakhali	27 February 2005	24
Patuakhali	20 February 2005	21
Total		**388**

Field Day

Location	Date	No. of Participants				
		Farmer	BARI	DAE	NGO	Total
Mymensingh	02 February 2005	33	08	08	1	50
Kishoreganj	06 February 2005	32	07	09	2	50
Bogra	01 February 2005	32	07	09	2	50
Bogra	09 February 2005	30	08	10	2	50
Sylhet	13 March 2005	30	08	10	2	50
Kushtia	12 March 2005	28	10	10	2	50
Faridpur	09 March 2005	30	08	10	2	50
Munshiganj	24 February 2005	28	10	10	2	50
Munshiganj	28 February 2005	32	07	09	2	50
Jamalpur	27 February 2005	30	10	09	1	50
Jamalpur	10 March 2005	30	10	09	1	50
Tangail	07 February 2005	31	09	08	02	50

Project: CIMMYT

Farmer's training: Whole family maize production

A total of 1088 farm families (10488 x 4 = 4352 male and female, i.e. 50% male and 50% female) were trained on hybrid maize production through live samples, flip-chart and colored CD. Most of the venues were located into the rural areas (Table). For the training, OFRD local scientists were assisted by OFRD head quarter scientists. The training was conducted during September to October, 2004.

Location	No. of families	Total no. of farmers trained
Rangpur	320	1280
Pabna	240	960
Kushtia	192	768
Faridpur	112	448
Mymensingh	64	256
Tangail	64	256
Patuakhali	48	192
Kishoreganj	48	192
Total	1088	4352

Project: SUPPLEMENTARY FUND FROM BARC

Training on summer onion

Location	Date	Category of trainees	No. of participants
Joydebpur	14-06-05	30	DAE and BARI personnel
	16-06-05	50	DAE and BARI personnel
Joydebpur	27-06-05	25	DAE personnel
	28-06-05	30	BARI personnel
	29-06-05	30	DAE and BARI personnel
Joydebpur	22-06-05	17	Farmer
Shibpur, Narsingdi	23-06-05	15	Farmer
Bogra	-	10	Farmer
Patuakhali	-	20	Farmer
Faridpur	-	10	Farmer
Sylhet	-	10	Farmer
Noakhali	-	10	Farmer
Pabna	-	10	Farmer
Tangail	-	10	Farmer
Kishoreganj	-	10	Farmer
Total		287	

LIST OF FSRD AND MLT SITES

a. FSRD SITES

1. Kusumhat, Sherpur sadar, Sherpur
2. Jalalpur, Sylhet sadar, Sylhet
3. Elengga, Kalihati, Tangail
4. Lahirirhat, Rangpur
5. Pushpapara, Pabna sadar, Pabna
6. Hat Gobindapur, Faridpur sadar, Faridpur
7. Rajakhali, Kumki, Patuakhali
8. Hazirhat, Noakhali sadar, Noakhali
9. Kusum Shahor, 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
Rangpur	:	Domar-Nilphamari, Ulipur-Kurigram, Gobindaganj-Gaibandha
Bogra	:	Sherpur, Shibganj, Joypurhat, Gabtali
Rajbari, Dinajpur	:	Biral, Sadar

Region 2

Jamalpur	:	Tatultala-Jhenaigati, Islampur
Tangail	:	Gatail, Madhupur, Gobindadasi-Bhuyapur
Mymensingh	:	Trishal, Netrakona sadar, Mymensingh sadar
Kishoreganj	:	Karimganj, Pakundia, Sadar, Hossenpur

Region 3

Jessore	:	Myzpara-Narail, Shalikha-Magura, Kaliganj-Jhenaidah, Jikargacha-Jessore, Kuyadabazar-Monirampur
Khulna	:	Satkhira sadar, Gopinampur-Magura
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, Karna, Junglekhail-Patia, Jilonga-Cox's bazar
Noakhali	:	Dagonbhuiya-Selumia, Turapganj-Laxmipur sadar
Comilla	:	Sadar, Chadpur sadar, B. Baria sadar, Debidder, Borura, Choddagram
Sylhet	:	Sadar, Jahangirnagar-Sunamganj, Islampur-Moulvibazar
Bandarban	:	Lemujiri-Buhalong

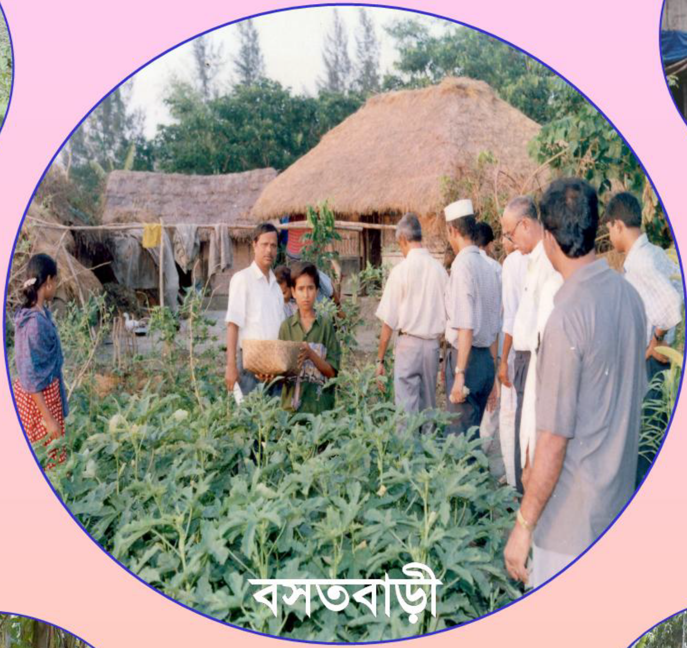
Region 5

Gazipur	:	Manikganj sadar, Munshiganj sadar, Gazipur sadar, Dirashram
Shibpur, Narsingdi	:	Shibpur, Narsingdi

THE END

NOTE

বসতবাড়ীতে নিবিড় সবজি উৎপাদন মডেল



স্থান	যে সব ফসল লাগানো যায়
১। উন্মুক্ত জমি	ঃ বেড-১ ঃ মুলা - ডাটাশাক - পুঁইশাক বেড-২ ঃ বাঁধাকপি - বেগুন - লালশাক বেড-৩ ঃ টমেটো - পালং শাক - ঢেঁড়স
২। ঘরের চাল	ঃ লাউ - চাল কুমড়া
৩। মাচায়	ঃ লাউ - মিষ্টি কুমড়া
৪। বেড়ায়	ঃ গজ করলা/বরবটি

স্থান	যে সব ফসল লাগানো যায়
৫। আংশিক ছায়াযুক্ত স্থান	ঃ মৌলভী কচু/আদা/হলুদ/মরিচ
৬। অফলা গাছ	ঃ চুপরি আলু/সীম/ধুন্দুল
৭। জলাশয়/স্যাঁতস্যাঁতে স্থান	ঃ পানিকচু
৮। বাড়ির পিছনে পরিত্যাক্ত স্থান	ঃ কাঁচাকলা/সজিনা
৯। বাড়ীর সীমানা	ঃ পেঁপে/পেয়ারা/লেবু

সরেজমিন গবেষণা বিভাগ
বাংলাদেশ কৃষি গবেষণা ইনস্টিটিউট