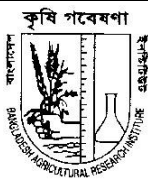


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Preface

This report presents the results of research conducted by the On-Farm Research Division at nine Farming Systems Research and Development Sites and eleven Multilocation Testing implementation units during the year 1998-99. Major thrust during this period has been on the improvement of existing farming systems through introduction of improved varieties and management practices. Component technology studies were also conducted to improve the existing cropping systems.

There has been a shift in the research approach for broadening the perspective of the cropping systems research towards a more comprehensive farming systems research by incorporating other farm components like homestead production systems, agroforestry and crop livestock interactions. However, these efforts were limited mainly to the understanding of the existing situations and constrained by the lack of adequately trained human resources.

Despite the delay in publication of this report, we hope it will be useful to the researchers and extension workers in the field.

Md. Fazlul Haq
Chief Scientific Officer

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Socio-economics of Farming Systems

Study on the existing livestock production and utilization systems

The survey was conducted at the FSRD sites of Pabna, Tangail, Barind and Noakhali during January to April 1999 to assess the livestock resources and to identify the constraints and potentials of livestock production systems. A pre-designed survey schedule was applied to stratified random samples of different farm categories. The data collected from the sample farmers were edited, summarized and presented in tabular form. The study revealed that large category farmers of Pabna (4.14/Farm) and Barind (4.50/Farm) owned higher number of cattle whereas in case of Tangail small farmers (1.54/Farm) have more cattle and the number decreased with the increase or decrease in farm size. But for Noakhali the situation was reverse than that of Tangail. In case of sheep and goat no trend followed over the locations Tangail got the least number of cattle and sheep/goat per farm and Noakhali got the highest number of cattle followed by Pabna. Highest number of goat/sheep was found with Barind followed by Pabna (Table 1). It was also observed from the study that feed crisis was the number one problem followed by disease infestation and lack of treatment facilities irrespective of locations (Table 2).

Table 1. Distribution pattern of cattle, sheep and goat at different FSRD sites

Farm category	No. of cattle/farm				No. of sheep and goat/farm			
	Tangail	Pabna	Barind	Noakhali	Tangail	Pabna	Barind	Noakhali
Landless	0.28	NA	1.50	4.30	0.97	NA	4.00	1.50
Marginal	0.91	NA	1.11	3.90	0.35	NA	1.16	1.11
Small	1.54	1.72	1.00	2.90	0.46	1.01	1.84	0.75
Medium	0.87	2.56	3.07	4.80	0.87	1.73	1.26	0.80
Large	0.75	4.13	4.50	4.00	0.75	1.65	2.05	0.30

Table 2. Constraints to livestock production at different FSRD site

Name of the problem	Ranking of the problems			
	Tangail	Pabna	Barisal	Noakhali
Housing	7	NR	NR	9
Feed crisis	1	1	1	1
Managerial	4	5	NR	8
Disease	2	2	2	2
Treatment	5	3	3	3
Improvement technology	6	4	5	4
Financial	3	6	4	6
Marketing	8	7	6	7
Illiteracy	9	NR	NR	5

NR = Not reported, 1= Most important, 9= Least important

Study on the existing poultry production and utilization systems at FSRD sites

The survey was conducted at the FSRD sites, Barind, Noakhali and Tangail during January to April 1999 to assess the poultry resources and to identify the constraints and prospects of poultry production. Data were collected from randomly selected farmers of different farm categories with the help of a pre-designed survey schedule. The

study revealed that number of poultry and duck increased with the increase in farm size (Table 3). The highest number of poultry and duck (21.98/farm) was found with Noakhali followed by Tangail (12.63/farm). Mean egg production of chicken was found higher in Barind (165/farm) than that of Tangail (115/farm) but egg production of duck was found lower in Barind (64/year) and that of Tangail (120/farm). Except the large farmers, egg production of chicken increased with the increase in farm size in both the locations (Table 4).

Table 3. Distribution of Poultry production by different farm categories at the FSRD sites during 1998-99

Farm category	Average no. of poultry and duck/farm		
	Noakhali	Barind	Tangail
Landless	6.4	9.75	-
Marginal	17.7	7.81	-
Small	27.5	11.14	-
Medium	4.4	11.52	-
Large	52.2	14.24	-
All	21.98	10.80	12.63

Table 4. Egg production of poultry by different category of farmers at two FSRD sites during 1998-99

Farm category	Egg production/year			
	Tangail		Barind	
	Chicken (no.)	Duck (no.)	Chicken (no.)	Duck (no.)
Landless	106.0	116	90.0	78.20
Marginal	107.0	120	137.8	49.27
Small	122.0	121	201.5	69.31
Medium	124.0	118	220.1	34.60
Large	118.2	126	177.5	87.20
All	115.0	120	165.0	64.00

Study on the existing fisheries resources at different FSRD sites

The survey was conducted at FSRD sites of Sylhet, Noakhali and Rajshahi during April and May 1999 to know the existing pond ownership pattern and to find out the existing fisheries production practices. All the available ponds of Noakhali and Sylhet FSRD sites and 50 randomly selected ponds of Barind FSRD

Table 5. Production of fish (kg/ha) by different farm category during 1998-99

Farm category	Sylhet	Noakhali	Rajshahi
Landless	41	-	1010
Marginal	66	-	375
Small	320	-	1507
Medium	444	-	1003
Large	472	-	1168
All	270	3870	1013

site were studied. The study revealed that per hectare fish production of ponds was very poor in Sylhet (270 gk/ha) but it was higher in Noakhali (3870 kg/ha). The ponds of Rajshahi FSRD site produce 1013 kg fish/ha (Table 5). The yield variation may be due to the variation in management practices and absence of modern fish culture practices.

Yield gap analysis of some selected crops in Patuakhali area

The study was conducted at the FSRD site, Lebukhali and MLT sites Kalapara and Borguna during 1998-99 to assess the extent of yield gap between farmers management and improved management in demonstration plot and to identify the factors responsible for the yield gap. Three crops viz. T.Aus, T.Aman rice and Mustard were selected for this study. A total of 20 farmers' plot for each crop was monitored and five-demonstration plot for each crop was also established with recommended packages for collection of necessary information (Table 6). The study disclosed that higher yield was obtained from the demonstration plots. The average yield of demonstration plots was 3900 kg/ha for T.Aus, 5125 kg/ha for T.Aman and 770 kg/ha for mustard but for the farmers plots the yield was 2800 kg/ha, 3500 kg/ha, and 540 kg/ha for T.Aus, T.Aman and Mustard respectively (Table 6). The yield gap was 1100 kg/ha for T.Aus, 1575 for T.Aman and 230 for Mustard respectively. This yield gap was due to lower plant population and reduced amount of fertilizer and insecticides used by the farmers.

Table 6. Production packages and yields obtained from Mustard-T.Aus-T.Aman in demonstration plots and farmers plot at Patuakhali area during 1998-99

Parameters	T.Aus		T.Aman		Mustard	
	Demo	FP	Demo	FP	Demo	FP
Plant population (m ²)	24	12	24	12	170	156
Fertilizer use (Tk./ha)	1325	346	1350	900	2800	700
Insecticides use (Tk./ha)	600	499	900	450	500	-
Labour (Tk./ha)	12040	12874	13200	12600	10500	10500
Yield (Tk./ha)	3900	2800	5125	3550	770	540
Yield gap (kg/ha)	1100		1575		230	

Demo= Demonstration plots, FP= Farmers' plot

Economics of Maize intercropping technologies practiced by the farmers

The survey was conducted at the MLT site, Fatikchari, Chittagong during January to March 1999 to identify the maize intercropping technologies practiced by the farmers and to evaluate the economics of intercropping with maize. A total of fifty farmers were interviewed by using a pre-designed schedule. The study revealed that 11 different maize intercroppings were practiced by the farmers (Table 7). Among the intercropping practices, maize + cucumber gave the highest gross margin (Tk. 113859/ha) followed by Maize + cucumber + yard long bean (Tk. 100862/ha). Destruction of maize by birds and animals, marketing of maize were identified as the major constraints of maize intercropping.

Table 7. Per hectare return and gross margin of different maize intercropping on the both full and cash cost basis in 1998

Crops name intercropped with maize	Total return (Tk.)	Gross margin (cash cost) (Tk.)	Gross margin (full cost)(Tk.)
Chilli	61981	42784	15850
Chillie + Yardlong bean	55472	37565	5702
Chilli + Potato	62759	39960	14947
Chilli + Potato+ Cucumber	97710	68579	55564
Chilli + Sweet gourd	69160	40987	31105
Chilli + Sweet gourd + Potato	61750	36494	6195
Cowpea	54340	36250	12317
Cucumber	16745	144518	113859
Yardlong bean + Cucumber	158080	133133	100862
Sweet gourd	39520	27145	12003
Sweet gourd + Tomato	50553	33361	5420

Improvement of Crops and Cropping Pattern

Performance of some alternative cropping patterns in the Old Brahmaputra Floodplain Soils

The experiment was conducted at FSRD site Narikeli, Jamalpur during 1998-99 to study the agro-economic performance of Potato-Jute-T.Aman rice, Mustard-Sesame-T.Aman, Lentil-Sesame-T.Aman rice and Sunflower-Jute-T.Aman rice cropping systems. Results revealed that agro-economic performance of Potato-Sesame-T.Aman rice was the best in terms of gross margin (Tk. 97700/ha) and BCR (3.10). Of course, all the other patterns gave gross margin more than Tk. 40,000/ha and BCR more than 2.53 (Table 1).

Table 1. Agro-economic performance of cropping patterns at FSRD site, Narikeli, Jamalpur (1997-98)

Cropping patterns	Yield and Economics				
	Yield (t/ha)	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)	BCR
Potato- Sesame- T.Aman	21.37 0.94 3.84				
Mustard- Sesame- T.Aman	0.96 0.83 3.80	144300 74500	46600 25800	97700 48700	3.10 2.89
Lentil- Sesame- T.Aman	0.72 0.78 3.91	69100	27300	41700	2.53
Sunflower- Jute- T.Aman	1.61 2.41 3.92	8130	30800	50500	2.64

Verification trial of promising technology on Boro-GM-T.Aman rice cropping pattern

The experiment was conducted at MLT sites Magura and Jhenaidha during 1997-98 to verify technology on Boro-GM-T.Aman rice cropping system. Fertilizer doses included i) T₁= 100-20-35-10-1.5, ii) T₂= 120-60-20-2 kg N-P₂O₅-K₂O-S-Zn/ha with iii) T₃= absolute control and iv) T₄= a farmers dose. Results revealed that at both the locations the highest grain yield of Boro and T.Aman rice was obtained from 120-60-20-2 kg N-P₂O₅-K₂O-S-Zn/ha, expect for T.Aman at Jhenaidha where the highest yield (4.88 t/ha) was obtained from farmer dose (Table 2). But from the economic point of view 100-20-35-10-1.5 kg N-P₂O₅-K₂O-S-Zn/ha gave the highest MRR of 698% and 467% at Magura and Jhenaidha respectively (Table 3).

Table 2. Performance of Boro-GM-T.Aman rice cropping pattern at Jessore (1997-1998)

Treatment N-P ₂ O ₅ -K ₂ O-S-Zn	Boro (t/ha)		T.Aman (t/ha)	
	Magura	Jhenaidha	Magura	Jhenaidha
T ₁ =100-20-35-10-1.5	4.73b	4.33b	5.01ab	3.76c

T ₂ =120-60-40-20-2	5.37a	5.08a	5.34a	4.56b
T ₃ =0-0-0-0-0	2.12c	2.74c	2.82c	2.35d
T ₄ =Farmers' dose	4.70b	5.13a	4.83b	4.88a
CV(%)	6.52	5.30	8.28	4.73

Farmers' dose

Magura : 108-60-28-16-6
 Jhenaidha : 122-48-32-20-3.8

Green manure (t/ha)

Magura : 19.8
 Jhenaidha : 10.5

Table 3. Partial budget analysis of Boro-GM-T.Aman rice cropping pattern

Treatment	TVC (Tk./ha)		Gross margin (Tk./ha)		MRR (%)	
	Magura	Jhenaidha	Magura	Jhenaidha	Magura	Jhenaidha
T ₁	30582	30182	42603	30618	698	467
T ₂	33532	33532	46903	38863	146	246
T ₃	26200	26200	10935	12025	-	-
T ₄	34370	34224	37180	40916	-	297

Effect of seed source and size on the performance of Yam

The experiment was conducted at RARS, Jessore during 1997-99 to find out a suitable seed yam size and its source. Seed source included a) Aerial tuber, b) Underground rhizome and seed yam size included i) 100-200 g, ii) 201-300 g, iii) 301-400 g, iv) 401-500 g, v) 501-600 g, vi) 601-700 g, vii) 701-800 g. Results revealed that size of seed yam nor its source could influence the yield. Yield level indicates that the management of the experiment was not effective. Thus final inference could not be made (Table 4).

Table 4. Effect of seed source and size on the yield of Yam at RARS, Jessore (1997-98)

Seed source	Seed size (g)	Total yield (Yam + Rhizome)/support (kg)		
		1998-99	1997-98	Mean
Aerial	100-200	1.00	0.87	0.94
	201-300	1.24	0.73	0.98
	301-400	1.31	1.14	1.23
	401-500	1.13	1.10	1.11
	501-600	1.32	1.01	1.16
	601-700	1.42	1.27	1.34
	701-800	1.49	1.38	1.43

Table 4. Contd.

Seed source	Seed size (g)	Total yield (Yam + Rhizome)/support (kg)		
		1998-99	1997-98	Mean
Rhizome	100-200	0.99	1.10	1.04
	201-300	0.98	1.05	1.01
	301-400	1.11	1.02	1.06

Seed source	Seed size (g)	Total yield (Yam + Rhizome)/support (kg)		
		1998-99	1997-98	Mean
	401-500	1.12	1.24	1.18
	501-600	1.34	1.08	1.21
	601-700	1.15	1.74	1.44
	701-800	1.53	2.27	1.90

Performance of Potato yam-Snake gourd on trellinet under different seeding rates

The experiment was conducted at RARS, Jessore during 1997-99 to find out optimum seeding rates of Potato yam and Snake gourd planted in sequence. Seeding rates included a) 1, 2, 3, 4 and plants of Snake gourd and 2, 4, 6, 8 seed yam planted on trellinet of 9m². Results revealed that yield of Snake gourd can be increased up to 35.16 t/ha planting 4 plant in a trellinet of 9m². Similarly yield of Potato yam can also be increased up to 38.32 t/ha by planting 8 seed yam in the same trellinet (Table 5).

Table 5. Effect of number of Seed yam and Sanke gourd plant grown on trellinet at RARS, Jessore (1997-99)

No. of plant/trellinet (9m ²)		Yield of Snake gourd (t/ha)			Yield (Bulbil+Rhizomes)/Trellinet (kg)		
Yam	Snake gourd	1996-97	1997-98	Mean (t/ha)	1997-98	1998-99	Mean (t/ha)
2	1	18.48c	11.95	16.91	6.37d	5.23d	7.87
4	2	26.48bc	9.04	19.73	13.66c	10.21c	16.87
6	3	35.61b	12.36	26.65		19.38b	28.51
8	4	48.68a	14.61	35.16		27.90a	38.32

Effect of staggered harvest on the performance of Potato yam

The experiment was conducted at RARS, Jessore during 1998-99 to find out a suitable harvest schedule of Potato yam. The schedule included 2, 3, 4, 5 and 6 harvest at 15 days interval with a final harvest at the end. Results revealed that harvesting could be staggered. Harvesting five times gave the highest yield (4.26 kg/support of 1 m diameter dish type bamboo support) (Table 6).

Table 6. Effect of staggered harvest on the yield of Yam at RARS, Jessore (1998-99)

Treatment	Weight of bulbil/ support (kg)	Weight of Rhizome /support (kg)	Total yield (Bulbil + Rhizome)	
			Kg/support	t/ha
6 harvest	3.07	0.27	3.34	14.84
5 harvest	3.93	0.33	4.26	18.88
4 harvest	3.38	0.26	3.64	16.17
3 harvest	2.17	0.28	2.99	13.28
2 harvest	0.88	0.21	1.08	04.80
1 harvest	2.45	0.20	2.65	11.78

Performance of Potato yam on different support arrangements

The experiment was conducted at RARS, Jessore during 1998-99 to find out a suitable support arrangement with intensification planting. Support arrangement included a) multistorey vertical wire support, b) dish type bamboo support with four planting intensification e.g. planting 1, 2, 3 and 4 seed yam on each support system. Results revealed that multistorey vertical wire support was better than dish type bamboo support and intensification of planting up to 4 seed yam produced the highest yield on both the support (28.2 t/ha and 16.24 t/ha on multistorey vertical wire support and dish type bamboo support respectively) (Table 7).

Table 7. Effect of support arrangement and planting system on the yield of Potato yam at Jessore (1998-99)

Planting density (Plant/support)	Yield of Bulbil (t/ha)	
	Multistorey wire support	Dish type bamboo support
One	3.43d	5.13d
Two	10.23c	9.53c
Three	21.26b	14.98b
Four	28.20a	16.24a

Performance of cropping pattern in the medium highland soil of Bil Dakatia

The experiment was conducted at Bil Dakatia of Khulna during 1998-99 to assess the performance of an alternative cropping pattern Sesame-T.Aman-Fallow against farmers' pattern

Fallow-T.Aman-Fallow. First year results revealed that gross margin and B.C. ratio of the alternative cropping pattern were Tk. 19087/ha and 3.06 respectively as compared to a gross margin of Tk. 11100/ha and B.C. ratio of 2.90 of the farmers pattern (Table 8).

Table 8. Agro-economic performance of Sesame-T.Aman rice – Fallow cropping pattern as compared to farmers’ pattern (1998-99)

Observation	Farmers’ pattern (Fallow-T.Aman-Fallow)	Farmers’ alternative pattern (Sesame-T.Aman-Fallow)		
	T.Aman (t/ha)	Sesame (t/ha)	T.Aman (t/ha)	Total (t/ha)
Grain yield (t/ha)	2.10	0.69	2.10	-
Biomass yield (t/ha)	0.45	12.13	4.50	-
Gross return (Tk./ha)	16950.00	11412.00	16950.00	28362.00
TVC (Tk./ha)	5850.00	3425.00	5850.00	9275.00
Gross margin (Tk./ha)	11100.00	7987.00	11100.00	19087.00
B/C ratio	2.90	3.33	2.90	3.06

Intercropping turmeric with vegetables

The experiment was conducted at ARS, Khulna during 1998-99 to identify a suitable intercrop of turmeric. The intercrop included were Red amaranth, Amaranth and Ghee Kanchan. Results revealed that intercropping reduced the yield of turmeric as compared to sole yield of 42.7 t/ha with amaranth. The lowest yield of turmeric was 37.85 t/ha. Economic analysis indicated that the total return was the highest with Ghee Kanchan (Tk. 231670/ha) followed by amaranths association (Tk. 223350/ha) and association of red amaranth (Tk. 221350/ha). Sole turmeric gave the lowest total return (Tk. 213000/ha) (Table 9).

Table 9. Yield and economics of intercropping turmeric with vegetables at ARS, Daulatpur, Khulna (1998-99)

Treatment	Yield (t/ha)		Gross return (Tk./ha)		Total return (Tk./ha)
	Turmeric	Vegetables	Turmeric	Vegetables	
Turmeric sole	42.70	-	213500	-	213500
Turmeric + Red amaranth	38.32	5.92	191600	29750	221350
Turmeric + Amaranth	37.85	8.50	189250	34000	223350
Turmeric + Ghee kanchan	38.27	6.27	191350	40320	231670

Screening of different rabi crops in saline area

The screening was conducted at MLT site, Dumuria during 1998-99 to find out a salt tolerant rabi crops. The crops included in the screening were Cabbage, Cauliflower, Tomato, Wheat, Triticale, Lentil, Blackgram, Mungbean, Grasspea, Chickpea, Cowpea, Radish and Chilli. Results revealed that only Cabbage, Cauliflower and Tomato survived and produced satisfactory yields of 55, 22.5 and 37.5 t/ha respectively (Table 10).

Table 10. Performance of different crops tested at Dumuria MLT site (1998-99)

Crops	Population/m ²	Seedlings mortality (%)	Yield (t/ha)
Cabbage	6	16.66	55.00
Cauliflower	6	33.33	22.50
Tomato	6	16.66	37.00
Wheat	109	100	-
Triticale	42	100	-
Lentil	-	-	-
Blackgram	122	100	-
Mungbean	95	100	-
Grasspea	132	100	-
Chickpea	-	-	-
Cowpea	28	100	-
Radish	50	100	-
Chilli	-	-	-

Performance of alternative cropping pattern Potato-Boro-T.Aman rice under irrigated condition at Tangail

The pattern trial was conducted at FSRD site, Tangail during 1998-99 to develop an alternative-cropping pattern for higher production and income. Alternative cropping pattern Potato-Boro-T.Aman rice was compared to a farmer's pattern Mustard –Boro-T.Aman. Results of the first crop revealed that gross margin of Potato were higher (Tk. 44986/ha) than that of Mustard (Tk. 6589/ha) but B.C. ratio of Mustard was higher (1.93) than that of Potato (1.28) (Table 11).

Table 11. Agro-economic performance of Potato – Boro - T.Aman rice cropping pattern as compared to farmers' pattern

Observation	Farmers' pattern Mustard-Boro-T.Aman	Alternative cropping pattern Potato-Boro-T.Aman
Variety	Tori-7	Diamont
Fertilizer: NPKS (kg/ha)	80-26-33-20	120-35-33-20
Yield (t/ha)	0.77	32.0
Byproduct yield (t/ha)	1.72	-
Gross return (Tk./ha)	13632	80000
TVC (Tk./ha)	7043	35014
Gross margin (Tk./ha)	6589	44986
B/C ratio	1.93	1.28

Performance of alternative cropping pattern Wheat-Sesame-T.Aman rice under rainfed condition at Tangail

The pattern was conducted at FSRD site Palima, Tangail during 1998-99 to study the agro-economic performance an alternative cropping pattern Wheat-Sesame-T.Aman rice against farmers' pattern Wheat-Jute-T.Aman rice. Results of the first crop revealed that gross margin of wheat in alternative pattern were higher (Tk. 6984/ha) than that of wheat in the farmers' patterns (Tk. 4578/ha). The B.C. ratio of the farmer was also higher (2.25) than that of the later (1.54) (Table 12).

Table 12. Agro-economic performance of Wheat-Sesame-T.Aman rice cropping pattern as compared to farmers' pattern (1998-99)

Observation	Farmers' pattern Wheat-Jute-T.Aman	Alternative cropping pattern Wheat-Sesame-T.Aman
	Wheat	Wheat
Variety	Kanchan	Kanchan
Fertilizer		
NPKSZnB (kg/ha)	80-43-24-20	100-26-50-20-3-1
Yield (t/ha)	1.51	1.85
Byproduct yield (t/ha)	1.74	1.92
Gross return (Tk./ha)	12950	15760
TVC (Tk./ha)	8382	8776
Gross margin (Tk./ha)	4578	6984
B/C ratio	1.54	2.25

Effect of sowing time on the performance of barley varieties in charland of Tangail

The trial was conducted at the charland of Nagarpur MLT site during 1997-99 to find out a suitable barley variety and its sowing time. Variety BARI barley 2 and a local check was sown on November 15, 25, December 5 and 15. Two years results revealed that BARI barley 2 produced higher grain yield than that of local check. Sowing time of December 5 and 15 produced higher grain yield than the other dates of sowing. Sowing time of local variety can be advanced up to November 25 (Table 13).

Table 13. Yield of Barley varieties under different date of sowing (1997-99)

Date of sowing	Yield of BARI Barley 2 (t/ha)			Yield of local variety (t/ha)		
	Gain		Mean	Gain		Mean
	97-98	98-99		97-98	98-99	
15 Nov.	2.11c	2.14c	2.13	1.88c	1.98c	1.93
25 Nov.	2.83b	2.98b	2.91	2.13abc	2.29abc	2.21
5 Dec.	3.43a	3.48a	3.46	2.55a	2.45a	2.50
15 Dec.	3.37ab	3.33ab	3.35	2.51ab	2.36ab	2.41

Study on the performance of Mustard varieties developed by BARI

The trial was conducted at FSRD site Tangail during 1998-99 to evaluate the performance of the newly released BARI mustard varieties. Mustard varieties Tori-7, BARI Sharisha 6, 7, 8, Sampad and Sonali Sharisha were included in the trial. Results revealed that BARI Sharisha 8 produced the highest grain yield (1.47 t/ha) and was identical with those of BARI Sharisha 6 and BARI Sharisha. This was followed by Sampad (1.08 t/ha). The lowest yield was produced by Tori 7 (0.76 t/ha) and was identical with that of Sonali Sharisha (0.87 t/ha). But as regards days to maturity Tori 7 matured in 74 days. BARI Sharisha 6, 7 & 8 took 91 days to mature. Sonali Sharisha was harvested in 96 days (Table 14).

Table 14. Performance of mustard varieties at FSRD site, Palima, Tangail (1998-99)

Variety	Grain yield (t/ha)	Biomass yield (t/ha)	Days to maturity
Tori 7	0.76d	2.10	74
BARI Sharisha 6	1.43a	2.59	91
BARI Sharisha 7	1.32ab	2.47	91
BARI Sharisha 8	1.47a	2.75	91
Sampad	1.08bc	2.25	83
Sonali Sharisha	0.87cd	2.11	96

Performance of newly released wheat varieties under rainfed condition

The experiment was conducted at FSRD site, Palima, Tangail during 1998-99 to assess the performance of newly released wheat varieties. Kanchan, Akbar, Aghrani and Protiva were used in the trial. Yield difference of the varieties was insignificant and yields ranged from 2.02 t/ha to 2.28 t/ha. Field duration ranged from 106 to 114 days (Table 15).

Table 15. Yield performance of BARI wheat varieties at FSRD site, Tangail (1998-99)

Variety	Crop duration (no.)	Grain yield (t/ha)
Kanchan	111	2.28
Akbar	106	2.12
Aghrani	107	2.02
Protiva	114	2.18

Screening of T.Aman rice varieties for succeeding rabi crop cultivation in the saline areas of FSRD site, Atkapalia, Noakhali

The experiment was conducted at FSRD site, Atkapalia, Noakhali during 1998-99 to find out a suitable rice variety(s) for succeeding rabi crop. Six modern and six local varieties were compared in the trial. All the local varieties were harvested by mid December while all the modern varieties were harvested by late November. Except BRRI Dhan 33 all the other modern varieties produced better yield than the local varieties (Table 16).

Table 16. Performance of different T.Aman rice varieties in saline area at FSRD site, Atkapalia, Noakhali (1998-99)

Variety	Grain yield (t/ha)	Harvest date	Net return (Tk./ha)
BRRi Dhan 30	4.31	Nov. 28	15777
BRRi Dhan 31	4.74	Nov. 26	20557
BRRi Dhan 32	5.20	Nov. 24	24537
BRRi Dhan 33	2.83	Nov. 10	4123
BRRi Dhan 34	3.93	Nov. 28	30797
Binashail	4.50	Dec. 3	27707
Katharijutha	3.12	Nov. 28	20067
Ghikuz	3.00	Dec. 16	18607
Kalijira	3.43	Dec. 16	24127
Katharichinigura	2.78	Dec. 3	15181
Katharijira	2.62	Dec. 16	13647
Kajalshail	3.11	Dec. 18	7377

Screening of different rabi crops in the saline area

The experiment was conducted at FSRD site, Atkapalia, Noakhali during 1998-99 to assess the performance of some rabi crops at saline area. Tomato, Chilli, Radish, Grasspea, Lentil, Chickpea, Cowpea, Mungbean, Wheat, Barley, Kaon were included in the screening trial. Monthly salinity and moisture data of the soil profile were obtained. Results revealed that salinity slightly increased by January with fall in soil moisture content (Table 17). Yield of Tomato (16.3 t/ha), Radish (22.13 t/ha), Chilli (0.66 t/ha), Grasspea (0.82 t/ha), Lentil (0.60 t/ha) and Wheat (2.04 t/ha) appeared to be satisfactory (Table 18).

Table 17. Month wise salinity and moisture level of the experimental area

Month	Depth wise salinity level (EC)			Depth wise moisture (%)		
	0-10 cm	10-20 cm	20-30 cm	0-10 cm	10-20 cm	20-30 cm
January	3.1	3.4	3.1	15.5	16.0	16.4
February	4.5	4.2	4.0	14.6	15.3	16.2

Table 18. Performance of different rabi crops in saline area, Atkapalia, Noakhali (1998-99)

Name of the crops	Crop yield (t/ha)	Net return (Tk./ha)
Tomato	16.30	38510
Radish	22.13	25060
Chilli	0.66	10296
Grasspea	0.82	2892
Lentil	0.60	NA
Chickpea	0.35	NA
Cowpea	0.58	NA
Mungbean	0.26	NA
Wheat	2.04	1912
Barley	0.83	NA
Kaon	0.37	1490

NA: Not available

Performance of cereal crops under minimum tillage at saline soils of Atkapalia, Noakhali

The experiment was conducted at FSRD site, Atkapalia, Noakhali during 1998-99 to select suitable cereal crop for Atkapalia area.

Wheat (Kanchan), Barley (BARI Barley 2) and Maize (Bornali) were used in the experiment. Yield performance revealed that Wheat (3.03 t/ha), Barley (2.53 t/ha) and Maize (3.93 t/ha) in highly droughts year appeared to be satisfactory (Table 19).

Table 19. Performance of cereal crops at saline area under minimum tillage (1998-99)

Crops	Grain yield (t/ha)
Wheat (Kanchan)	3.03
(BARI Barley 2)	2.53
Maize (Bornali)	3.93

On-Farm adaptability trial on late planting of tomato at the FSRD site, Atkapalia, Noakhali

The experiment was conducted at FSRD site, Atkapalia, Noakhali during 1998-99 to find out a suitable Tomato variety for the saline areas and a late planting data for economic yield. Two varieties of Tomato: Ratan and Roma VF along with six planting dates e.g. Dec. 15, 30, Jan. 15, 30, Feb. 15 and March 1 were included in the trial. Results revealed that Ratan yielded better than Roma VF. Both the varieties can be planted late up to 30 December (Table 20).

Table 20. Agro-economic performance of late planting tomato (1998-99)

Date of planting	Name of variety	Fruit yield (t/ha)	Net return (Tk./ha)
Dec. 15	Ratan	42.4	149702
	Roma VF	34.5	110252
Dec. 30	Ratan	29.8	116502
	Roma VF	23.0	75702
Jan. 15	Ratan	7.50	8452
	Roma VF	6.58	632
Jan. 30	Ratan	0.50	-
	Roma VF	0.33	-
Feb. 15	Ratan	0.33	-
	Roma VF	0.38	-
March 1	Ratan	-	-
	Roma VF	-	-

Performance of vegetables under different planting techniques in saline area

The experiment was conducted at FSRD site, Atkapalia, Noakhali during 1998-99 to examine the performance of different crops planted in furrows of different depths. Tomato, Brinjal and Chilli were planted in furrow of 5, 10 and 15 cm depth with a control of surface planting. Results revealed that the highest yields of Tomato (27.75 t/ha), Brinjal (17.38 t/a) and Chille (1.12 t/ha) were obtained from planting in furrows of 10cm depth (Table 21).

Table 21. Performance of vegetables transplanted in furrows of different depth at FSRD site, Atkapalia, Noakhali (1998-99)

Depth of furrows (cm)	Tomato (t/ha)	Brinjal (t/ha)	Chilli (t/ha)
0	0.05	5.15	0.74
5	14.12	12.43	0.58
10	27.75	17.38	1.12
15	18.68	15.10	0.72

Study on the performance of pulses and oilseeds at the FSRD site, Golapgonj, Sylhet

The experiment was conducted at FSRD site, Golapgonj, Sylhet during 1998-99 to assess the performance of Chickpea, Lentil and Mustard. Crop varieties included Tori-7, BARI Chola 3 and BARI Moshur 3. Yield level of the crops except chickpea appeared to be satisfactory in the context that those are the new crops at the area. Tori 7 produced a yield of 750 kg/ha in 78 days of field duration and lentil yield was 833 kg/ha in 115 days (Table 22).

Table 22. Performance of pulses and oilseeds at the FSRD site (1998-99)

Crops	Days to maturity (no.)	Yield (kg/ha)
Tori 7	78	750
BARI Chola 3	107	667
BARI Moshur 3	115	833

Screening winter vegetables under irrigated condition

The screening test under irrigated condition was conducted at FSRD site, Sunamganj, Sylhet during 1998-99 to select promising winter vegetables for the areas. Radish, Cabbage, Tomato, Cauliflower, Carrot, Red amaranth and Spinach were included in the trial. Performance of all the vegetables appeared satisfactory in both the locations but the crops produced better yields at Sunamganj than those at Golapgonj.

Table 23. Performance of winter vegetables at different locations in Sylhet (1998-99)

Crops	Yield (t/ha)	
	Golapgonj	Sunamganj
Radish	34.65	57.55
Cabbage	25.10	88.90
Tomato	24.05	27.50
Cauliflower	26.90	26.50
Carrot	6.00	20.10
Red amaranth	5.60	5.40
Spinach	5.15	5.45

On-Farm performance of promising groundnut varieties and different locations

The trial was conducted at FSRD site, Lebukhali and Kalapara during 1998-99 to evaluate the performance of Groundnut varieties. The trial included DG-2 (Basanti badam), BARI badam 6, Jhinga badam and Maizchar badam. Results revealed that days to maturity of all the varieties at Lebukhali was 150 while in Kalapara was 145 except Maizchar badam which was only 140 days. Basanti badam produced the highest pod yield (3.06 t/ha) at Lebukhali and was identical with that of BARI badam 6 (2.80 t/ha) and Jhinga badam (2.72 t/ha). Maizchar badam produced the inferior yield (1.05 t/ha). Yield of the varieties was almost the same at Kalapara (Table 24).

Table 24. Agronomic performance of groundnut varieties at Patuakhali (1998-99)

Varieties	Days to maturity		Pod yield (t/ha)	
	Lebukhali	Kalapara	Lebukhali	Kalapara
DG-2 (Basanti)	150	145	3.60a	3.10a
ICGS-55 (BARI badam 6)	150	145	2.80a	2.75b
Jhinga badam	150	145	2.72a	3.01a
Dhaka-1 (Maizchar)	150	140	1.05b	1.75c

On-Farm adaptability trial of promising sweet potato varieties developed by BARI

Two experiments were conducted at Faridpur and Borguna during 1998-99 to evaluate the sweet potato varieties. The varieties included BARI sweet potato 4 and 5, Daulatpuri and a local check. Results revealed that at Faridpur BARI sweet potato 5 produced the highest root yield (39 t/ha) followed by those of BARI sweet potato 4 (38 t/ha) and Daulatpuri (37 t/ha). The local variety produced lowest yield (28 t/ha). However, on the basis of taste, local and Daulatpuri were better than that of the other two varieties (Table 25).

Table 25. Performance of sweet potatoes at different locations of Faridpur and Patuakhali (1998-99)

Variety	Root yield (t/ha)		Taste	
	Faridpur	Borguna	Faridpur	Borguna
BARI sweet potato 4	38.0	11.94	Good	Good
BARI sweet potato 5	39.0	10.92	Good	Good
Daulatpuri	37.0	12.27	Very good	Very good
Local	28.0	09.44	Very good	Very good

Effect of seed soaking on emergence and yield of Mungbean

The experiment was conducted at FSRD site, Lebukhali, Patuakhali during 1998-99 to study the effect of pre-sowing soaking of Mungbean seeds on germination and yields. Seeds were soaked for 2, 4, 6 & 8 hours before sowing and were compared with a control of no soaking. Results revealed that soaking seeds for 4 and 6 hours improved emergence up to 51 and 48 plant/m² as compared to no soaking (38 plant/m²). Soaking for 2 and 8 hours gave lower emergence (44 and 35 plant/m² respectively). The highest grain yield was obtained from soaking seeds for 4 hours (1667 kg/ha). Soaking 8 hours produced the lowest yield (1067 kg/a) and was identical to that with control (1100 kg/ha) (Table 26).

Table 26. Agronomic performance of BARI Mung 5 at different level and pre-sowing water soaking at Lebukhali, Patuakhali (1998-99)

Treatments	Plant population/m ²	Grain yield
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(Pre-sowing in water soaking)	Emergence	Harvest	(kg/ha)
T ₁ (for 2 hours)	44	33	1473a
T ₂ (for 4 hours)	51	38	1667a
T ₃ (for 6 hours)	48	39	1663a
T ₄ (for 8 hours)	35	31	1067b
T ₅ (no soaking)	38	31	1100b

Effect of Straw kept at T.Aman rice harvest on the performance of relay Grasspea

The experiment was conducted at FSRD site, Kalapara, Patuakhali during 1998-99 to assess the effect of left over straw on the yield of Grasspea. Treatment included left over straw height of 15, 25, 35 cm with a control of no straw. The highest grain yield was found from the treatment no. 2 (1455 kg/ha). The later is again identical to that obtained from 25 cm straw height (1080 kg/ha) and the yield from control plot (1171 kg/ha) (Table 27).

Table 27. Agro-economic performance of grasspea at different level of rice straw cut a Kalapara, Patuakhali (1998-99)

Treatment: Straw height (cm)	Grain yield (kg/ha)	Gross return (Tk./ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)	BCR
0	1171b	15302	5160	10142	2.96
15	1455ab	17460	4660	12800	3.75
25	1080b	12960	4660	8300	2.78
35	1590a	19080	4660	14420	4.09

T.Aman rice cultivation with tiller separated as post flood option

The experiment was conducted at FSRD site, Lebukhali, Patuakhali during 1998-99 to study the effect of tiller separation from T.Aman rice hill on the production of rice. Treatments included a) Tiller separation plot, b) Plot transplanted with separated tillers and c) Monitoring farmers' undisturbed plot. Results revealed that grain yield of the plots did not vary much (ranged 2.55 to 2.67 t/ha). Gross margin (Tk. 8928/ha) and B/C ratio (1.72) were higher in the undisturbed plot than tiller separated plot (Tk. 8264/ha and 1.67 respectively) and re-transplanted plot (Tk. 8000/ha and 1.64 respectively) (Table 28).

Table 28. Agro-economic performance of T.Aman rice cultivation with tiller separates at Lebukhali, Patuakhali (1998)

Treatments	Grain yield (t/ha)	Gross return (Tk/ha)	Total variable cost (Tk./ha)	Gross margin (Tk./ha)	BCR
Re-transplanted plot	2.55	20400	12400	8000	1.64
Monitoring (F/P)	2.67	21328	12400	8928	1.72
Tiller separated plot	2.58	20664	12400	8264	1.67

Comparative performance of different flower varieties as commercial crops

The trial was conducted at FSRD site, Goyeshpur, Pabna during 1998-99 to assess the feasibility of growing flowers as commercial crops and to select suitable species for commercial values. Flower species included Gladiolus, Marigold and Tuberose (Single and double). Results revealed that 105263 Gladiolus and 1115790 Marigold flower could be harvested from one hectare of land. Return and B/C ratio from Marigold was higher (Tk. 348070 and 13.84 respectively) than those from Gladiolus (Tk. 210526/ha and 9.78 respectively). Tuberose yield was not recorded for consideration due to late harvest.

Table 29. Performance of flower species as commercial crops at ARS, Pabna (1998-99)

Species and varieties	No. harvested/ha	Return (Tk./ha)	Cost of cultivation (Tk./ha)	BCR	Remarks
Gladiolus	105263	210526	21528	9.78	One season crop. Seed bulb cost is very high
Marigold	1115790	348070	25087	13.84	High return, casual sale, but high demand
Tuberose:					
Single	-	-	-	-	Yet to flower as commercial scale
Double	-	-	-	-	Vegetative stage
Rose	-	-	-	-	Wild variety, needs to be grafted

Adaptability trial of newly released potato varieties

The trial was conducted at MLT site, Chandina, Comilla during 1998-99 to evaluate the performance of newly released potato varieties. Heera, Ailsa, Benela, Cardinal and Kufrisinduri varieties of potato were used in the trial. Results revealed that Heera (12.81 t/ha), Ailsa (12.65 t/ha) and Benela (11.57 t/ha) produced lower yield than those of the widely used varieties Cardinal (18.42 t/ha) and Kufrisinduri (17.75 t/ha). The lower yield of the former varieties was due to lower emergence than those of the later two (Table 30).

Table 30. Performance of newly released potato varieties at Chandina, Comilla (1998-99)

Variety	Seed germination (%)	No. of tuber/plant	Weight of tuber/plant (g)	Tuber yield (t/ha)
Heera	45	6	242	12.81
Ailsa	50	7	297	12.65
Benela	60	8	257	11.57
Cardinal	95	9	340	18.42
Kufrisinduri	85	11	318	17.93

Comparative performance of some promising lentil varieties

The experiment was conducted at FSRD site, Faridpur during 1998-99 to select lentil variety with high yield potential. Varieties included were BARI Moshur 2, BARI Moshur 3, BARI Moshur 4 and a local check. Results revealed that grain yield of the newly released varieties ranged from 0.83 to 0.87 t/ha and were much higher than the local variety (0.63 t/ha) (Table 31). Abnormal rainfall affected the crop performance.

Table 31. Performance of lentil developed by BARI at Faridpur (1998-99)

Variety	Population/ m ²	Grain yield (t/ha)
BARI Moshur 2	56.33	0.83
BARI Moshur 3	56.33	0.87
BARI Moshur 4	57.00	0.87
Local	56.83	0.63

Performance of wheat varieties under farmers' management

The experiment was conducted at FSRD site, Faridpur during 1998-99 to assess the yield performance of recent wheat varieties. Varieties included were Kanchan, Akbar, Aghrani and Protiva. Grain yield of the varieties did not differ much and ranged from 3.10 to 3.43 (Table 32).

Table 32. Performance of wheat varieties conducted at FSRD site, Ishan Gopalpur, Faridpur (1998-1999)

Variety	Grain yield (t/ha)	Straw yield (t/ha)
Kanchan	3.43	4.67
Akbar	3.10	4.37
Aghrani	3.43	4.33
Protiva	3.33	4.97

Comparative performance of different vegetables intercropped with sugarcane

The experiment was conducted at FSRD site, Faridpur to evaluate the performance of different vegetables crops intercropped with sugarcane. Intercrop vegetables included were Tomato, Red amaranth, Cabbage, Spinach and Turnip. Results revealed that the yields of cabbage (34.67 t/ha), Tomato (14.49 t/ha), Spinach (8.60 t/ha), Turnip (7.11 t/ha) and Red amaranth (6.75 t/ha) appeared satisfactory (Table 33).

Table 33. Performance of different vegetables as intercropped with sugarcane at FSRD site, Faridpur (1998-99)

Treatment	Yield (t/ha)	
	Sugarcane	Intercrop
Sugarcane (sole)	-	-
Sugarcane + Tomato	-	14.69
Sugarcane + Red amaranth	-	6.75
Sugarcane + Cabbage	-	34.67
Sugarcane + Spinach	-	8.60

Effect of seed priming on the yield and performance of different chickpea cultivars

The experiment was conducted at FSRD site, Chabbishnagar, Rajshahi during 1998-99 to study the effect of priming of seeds of chickpea varieties on the yield. Varieties included were BARI Chola 2, BARI Chola 3, BARI Chola 4, BARI Chola 5 and local check. Results revealed that yield of the varieties as well as prime and non-prime did not differ (Table 34).

Table 34. Effect of prime and non-prime seed treatment on the yield of chickpea at high Barind (1998-99)

Variety	Grain yield (t/ha)	
	Prime	Non-prime
Local	1.32	1.11
BARI Chola 2	1.32	1.20
BARI Chola 3	1.14	1.15
BARI Chola 4	1.19	1.38
BARI Chola 5	1.43	1.15
CV (%)	ns	Ns

Technique of growing Aman rice for successful rabi crop cultivation under rainfed condition

The experiment was conducted at FSRD site, Chabbishnagar, Rajshahi during 1998-99 to harvest T.Aman rice by mid October to accommodate early planting of rabi crops. Treatment included transplanting and direct sowing of BRRD Dhan 31, BRRD Dhan 32, BRRD Dhan 33 and a local check Sharna. Results revealed that direct seeding could reduce field duration of Sharna by 17 days, BRRD Dhan 31 by 20 days, BRRD Dhan 32 by 17 days and BRRD Dhan 33 by 25 days, offering scope for early sowing of rabi crops. Yield difference due to direct sowing and transplanting was negligible (Table 35).

Table 35. Effect of planting method and different variety on the yield of T.Aman rice at Barind (1998-99)

Variety	Days to maturity (no.)		Grain yield (t/ha)	
	Direct sowing	Transplanting	Direct sowing	Transplanting
Sharna	130	147	2.70ab	2.79a
BRRD Dhan 31	123	143	2.60a	2.18b
BRRD Dhan 32	118	135	2.42b	2.38b
BRRD Dhan 33	97	122	2.68b	2.77a

Effect of irrigation on the growth and yield of different Chickpea varieties in High Barind Soil

The experiment was conducted at MLT site, Nachole, Rajshahi during 1998-99 to study the effect of irrigation on the performance of chickpea. Two varieties of chickpea e.g. BARI Chola 2 and BARI Chola 3 with three irrigation schedule: a) irrigation at 20 days after emergence, b) irrigation at 40 days after emergence and c) irrigation at 20 and 40 days after emergence with a control of d) no irrigation were included in the experiment. Results revealed that BARI Chola 2 produced the inferior yield (1.32 t/ha) at two irrigation at 20 and at 20 and 40 days after emergence. The other treatments were identical within a yield range of 1.44 to 1.64 t/ha. BARI Chola 3 produced the highest grain yield (1.74 t/ha) with one irrigation at 20 days after emergence and was identical with that with one irrigation at 40 days after emergence (1.49 t/ha) (Table 36).

Table 36. Effect of varieties and irrigation on the yield of chickpea at Nochole (1998-99)

No. of irrigation	Grain yield (t/ha)	
	BARI Chola-2	BARI Chola-3
I ₀ (No irrigation)	1.44abc	1.36bc
I ₁ (20 days after emergence)	1.64ab	1.74a
I ₂ (40 days after emergence)	1.44abc	1.49abc
I ₃ (20 & 40 days after emergence)	1.32bc	1.19c

Effect of Leaf clipping of Sorghum on grain and fodder production for feeds and fodder

The experiment was conducted at MLT site, Nachole, Rajshahi during 1998-99 to study the effect of sorghum leaf clipping on grain and fodder yield of sorghum. Leaf clipping included a) before flowering, b) at flowering, c) before grain maturity with a control of d) no clipping. Results revealed that no clipping produced the superior grain yield (1.12 t/ha) and the inferior yield was obtained from leaf clipping at flowering (0.56 t/ha). The other two clipping produced intermediate yields and were identical. Fodder yield did not vary due to leaf clipping and ranged from 2.86 t/ha to 3.37 t/ha (Table 37).

Table 37. Effect of leaf clipping of Sorghum on grain and fodder production at Barind (1998-99)

Treatments (leaf cutting)	Weight of leaf (t/ha)	Grain weight (t/ha)
T ₁ (before flowering)	3.13a	0.98b
T ₂ (at flowering)	3.37a	0.56c
T ₃ (before grain maturity)	2.86a	1.02b
T ₄ (No cutting)	0.00	1.12a

Adaptive trial of BARI Mungbean varieties

The experiment was conducted at Rangpur during 1998-99 to examine the performance of BARI released Mung varieties. Varieties included were BARI Mung 2, BARI Mung 3, BARI

Mung 4 and BARI Mung 5. Results revealed that BARI Mung 4 produced the superior yield (1054 kg/ha) and the inferior yield was obtained from BARI mung 3 (545 kg/ha). The other two varieties produced intermediate yields and ranged from 824 to 831 kg/ha (Table 38).

Table 38. Performance of Mungbean varieties at Rangpur (1998-99)

Varieties	No. of pods/plant	No. of seeds/pod	Grain yield (kg/ha)
BARI Mung 2	20b	12b	831b
BARI Mung 3	18b	11b	545c
BARI Mung 4	24a	13a	1054a
BARI Mung 5	20b	11b	824b

Integrated approach to Onion seed production

The experiment was conducted at MLT site, Manikgonj during 1996-98 to find out appropriate management package to produce quality seeds of Onion. Management package involved seed bulb size (130, 70, 100/kg) two fertilizer dose (150-200-100-20-4-1 and 0-170-75-0-0-0 kg/ha, N-P₂O₅-K₂O-S-Zn-B) in five combination and spraying fungicide @ 0.01% each of Rovral and Ridomil mixed together at 15 days interval starting 40 days after emergence (Table 39a). Results revealed that seed bulb size of 70/kg with 150-20-100-20-4-1 kg/ha N-P₂O₅-K₂O-S-Zn-B with spraying of a mixture of Rovral and Ridomil @ 0.01% each at an interval of 15 days starting from 40 days after emergence gave the highest seed yield (552 kg/ha) and gross margin (Tk. 87898/ha) (Table 39b).

Table 39a. Treatment combinations

Treatments	Seed size (bulb/kg)	Fertilizer rate (kg/ha) N-P ₂ O ₅ -K ₂ O-S-Zn-B	Fungicide combination*
T ₁	130	150-200-100-20-4-1	Rovral + Ridomil @ 0.01% each
T ₂	70	150-200-100-20-4-1	Rovral + Ridomil @ 0.01% each
T ₃	70	150-200-100-20-4-1	00
T ₄	100 (FP)	0-170-75-0-0	Rovral + Ridomil @ 0.01% each
T ₅	100 (FP)	0-170-75-0-0	00

*Sprayed at 15 days interval starting 40 days after germination

Table 39b. Yield and economics of Onion seed production as affected by different treatment combinations at Manikgonj (1996-98)

Treatments	Seed yield (kg/ha)	Disease rating 0-5 m scale	Gross return (Tk./ha)	TVC (Tk./ha)	Gross margin (Tk./ha)	BCR
T ₁	436.4	1.64	338360	35762	302598	9.46

T ₂	552.0	1.51	542775	54877	487898	9.89
T ₃	226.4	3.33	264460	53877	210583	4.91
T ₄	431.1	1.88	446740	34839	411901	12.82
T ₅	254.9	3.18	218810	33839	184971	6.47

Integrated Soil Fertility and Fertilizer Management

Subproject: Cropping Pattern Based Fertilizer Management

Development of fertilizer recommendation for different cropping patterns under different environments

The experiment was conducted at different location of Bangladesh with 4 major cropping patterns to develop a cropping pattern based fertilizer recommendation and to determine the economic fertilizer dose for the cropping patterns during 1998-99. The experiment was laid out in RCB design with 6 dispersed replications. Six different fertilizer management packages were tested and the treatments were as follows-

T₁ = Estimated mineral fertilizer for moderate yield goal (ED₁)*

T₂ = Estimated mineral fertilizer for high yield goal (ED₂)

T₃ = Integrated nutrient management (INM)

T₄ = Recommended fertilizer dose based on BARC Fertilizer Recommendation Guide, 1997

T₅ = Farmers' practice (FP)

T₆ = Absolute control

* The treatment was omitted at Jamalpur

The experiment was conducted on the first crop of the first cycle of the following pattern at the corresponding locations.

Cropping pattern	Locations
Wheat-T.Aman	Godagari, Paba, Pabna
Mustard-Boro-T.Aman	Muktagacha, Jamalpur,
Wheat-Jute-T.Aman	Melandha
Potato-T.Aus - T.Aman	Jamalpur
	Chandina

Cropping pattern : Wheat-T.Aman

Location : FSR site, Chabbishnagar, Rajshahi

The following fertilizer treatments were used in the experiment:

T₁=105-30-21-13-1.5, T₂= 150-42-31-20-2-1, T₃= 140-36-21-20-2-1, T₄= 90-25-6-20-1.5, T₅= 35-50-25-10-0-0, T₆= 0-0-0-0-0-0 kg/ha of N-P-K-S-Zn B. In addition, treatment 3 contained cowdung @ 10 t/ha.

The fertilizer rates influenced the grain yield significantly. The yields were supported by yield contributing crop characters. The yield increased with the increase of fertilizer rates. The

highest yield 2.33 t/ha) was obtained from integrating organic and inorganic fertilizer (Table 1). This was similar to that obtained from the yield of high yield goal.

Table 1. Effect of different doses of fertilizer on the yield of wheat under Wheat – Fallow - T.Aman cropping pattern in 1998-99

Treatments N-P-K-S-Zn-B	Plant pop./ m ²	Grain /spike	1000 grain wt. (g)	Grain yield (t/ha)	% increase over control
T ₁ = 105-30-21-13-1.5-0.5	203ab	32.00ab	42.90ab	1.91ab	290
T ₂ = 150-42-31-20-2.0-1.0	213b	32.33ab	41.12bc	2.33a	376
T ₃ = 140-36-21-20-2.0-1.0+10 t/ha CD	192a	37.00a	44.70a	2.33a	376
T ₄ = 90-25-60-20-1.5-0.5	174ab	30.17b	41.8abc	1.45bc	196
T ₅ = 35-50-25-10-0-0-0 (FP)	132c	29.67b	42.18ab	1.09c	122
T ₆ = 0-0-0-0-0-0	96 d	22.33c	38.98c	0.49d	--
CV (%)	20.83	17.56	6.18	28.08	

FP = Farmer's practice, CD = Cowdung

Cropping pattern : Wheat-T.Aman

Location : Paba, Rajshahi

The fertilizer treatments used were as follows:

T₁= 89-17-43-15-10, T₂= 126-23-61-23-2, T₃= 116-17-51-23-2, T₄= 90-20-35-10-2 kg/ha of N-P-K-S-Zn and T₆= Absolute control. In addition, treatment 3 contained cowdung @ 10 t/ha. The experiment was sown during 4-13, Dec. 1998 and harvested during 22-30, March 1999.

The fertilizer treatments significantly influenced the grain yield. The yield was supported by the yield contributing crop character. Integrated application of organic and inorganic fertilizer gave the highest yield (3.3t/ha) (Table 2).

Table 2. Effect of different doses of fertilizer on the yield of wheat under Wheat-Fallow-T.Aman cropping pattern in 1998-99

Treatment N-P-K-S-Zn (kg/ha)	Spike/m ²	1000 seed wt. (g)	Grain/spike	Seed yield (t/ha)
T ₁ = 89-17-43-15-1.0	270.500b	39.367	31.050b	2.88bc
T ₂ = 126-23-61-23-2.0	287.000ab	38.933	33.617ab	3.22b
T ₃ = 116-17-51-23-2.0+10t/haCD	295.833ab	36.700	38.333a	3.97a
T ₄ = 90-20-35-10-2.0	318.500a	39.683	34.517ab	3.30b
T ₅ = 67-22-26 (FP)	287.833ab	39.000	24.790c	2.49c
T ₆ = Absolute Control	255.333b	38.483	18.933d	1.57d
CV%	12.15	12.70	14.59	14.31
LSD (0.05)	41.31	ns	5.237	49.31

Cropping pattern : Wheat - T.Aman

Location : Pabna

The experiment contained the following fertilized dose:

T₁= 125-80-47-67-1.66-2.7, T₂= 175-112-108-94, T₃= 132-51-78-94-2.3-3.8, T₄= 125-80-77-67-1.66-2.72, T₅= 170-105-47-31-1.25 kg/ha of Urea-TSP-MP-ZnO-Bo and T₆= Absolute control. The crop was sown on Dec. 3, 1998 and harvested during March 20-22, 1999, receiving only one irrigation at 21 DAS.

Table 3. Effect of different doses of fertilizer on Wheat crop under cropping pattern Wheat-Fallow-T.Aman rice at FSRD site, Goyeshpur, Pabna; Winter 1998-99

Treatment: Urea-TSP-MP-GYP-ZnO-B	Plant height (cm)	Spike/ m ²	Spikelet/ spike	Grain yield (t/ha)	Straw yield (t/ha)
T ₁ = 125-80-47-67-1.66-2.7	92.8a	241.8ab	19.7ab	1.86c	2.78c
T ₂ = 175-112-108-94-2.3-3.8	95.7a	247.5ab	20.2a	2.59a	3.42a
T ₃ = 142-51-78-94-2.3-3.8	87.8a	226.7b	18.7c	2.04b	3.06bc
T ₄ = 125-80-77-67-1.66-2.72	93.2a	256.5a	19.6abc	2.51a	3.33ab
T ₅ = 169.63-105-47-30.63-1.25-0	88.2a	245.7ab	19.0bc	1.82c	2.83c
T ₆ = 0-0-0-0-0	70.3b	179.8c	16.5d	0.97d	1.79d
CV(%)	8	8	3	6	8
T-Test	**	**	**	**	**

Cropping pattern : Mustard – Boro - T.Aman

Location : Muktagacha, Mymensingh

The experiment was initiated with Boro rice as the first crop. The treatments included: T₁=69-20-198-7, T₂= 96-29-25-9, T₃= 86-23-15-9, T₄=100-15-40-10, T₅= 120-23-30-21 kg/ha N-P-K-S and T₆= Absolute control. Variety Pajam was transplanted with 46 days old seedling on Feb.5, 1999 matured and harvested on May 18, 1999.

The fertilizer treatment significantly influenced the grain and straw yields. Superior grain yields (4.62-4.77 t/ha) was obtained with nitrogen dressing of 86-100 kg/ha. Higher dose of nitrogen tended to increase total dry matter but the conversion to grain was the lowest (Table 4).

Table 4. Yield and yield contributing characters of Boro rice under cropping pattern Mustard-Boro-T.Aman rice system at MLTs, Muktagacha, 1999

Treatment NPKS kg/ha	Effective tiller/hill	No. of grains/panicle	1000 grain wt. (gm)	Grain yield (t/ha)	Straw yield (t/ha)
T ₁ (69-20-18-7)	16.00	14.83	15.71	4.233b**	5.567b**
T ₂ (96-29-25-9)	15.00	16.67	16.77	4.617a	5.883ab
T ₃ (86-23-15-9)	17.33	16.55	16.89	4.767a	6.067a
T ₄ (100-15-40-10)	17.00	22.66	16.11	4.753a	6.217a
T ₅ (120-23-30-21) FP	14.67	17.11	15.62	4.283b	6.200a
T ₆ (0-0-0-0)	11.00	13.67	15.03	3.847c	4.950c
Sx	ns	ns	ns	0.068	0.102
CV%	31.87	11.13	8.49	2.68	3.02

Figures in column having letter(s) in common do not differ significantly but figure bearing dissimilar letter(s) differ significantly at** 1% level of probability.

Cropping pattern : Mustard-Boro-T.Aman

Location : FSR site Narikeli, Jamalpur

MLT site : Melandha

Treatment 1= Moderate yield goal was not used in the experiment. The treatments were rearranged at T₁= 77-14-28-14-1.4-0, T₂= 51.5-5.5-22.5-14-1.4-1.4, T₃= 55-10-20-10-1-1, T₄=30-25-0-0-1 kg/ha of N-P-KS-Zn-B with T₆=Absulte control. Treatment 2 received mustard oil cake @ 500 kg/ha. Seeds of mustard were sown during 25-30, Nov. 1998. The crop matured during 4-11 February 1999. Results revealed that integrated use of organic and inorganic fertilizer produced the highest seed yields (900 and 861 kg/ha) at both the locations (Table 5).

Table 5. Grain and staw yield of mustard in the pattern Mustard-Boro-T.Aman at FSRD site, Naeikeli and MLT Melandah of Jamalpur

Treatment (kg/ha)							Narikeli		Melandah	
N	P	K	S	Zn	B	MOC	Grain yield (kg/ha)	Straw yield (kg/ha)	Grain yield (kg/ha)	Straw yield (kg/ha)
77	14	28	14	1.4	0	-	750	2180	806	2253
51.5	-	22.5	14	1.4	1.4	500	900	2320	861	2300
55	10	20	10	1	1	0	680	2100	750	2133
30	25	20	0	0	1.1	0	580	1960	792	2133
0	0	0	0	0	0	0	230	1200	502	1697

Cropping pattern : Wheat-Jute-T.Aman

Location : FSR site, Jamalpur

The experiment did not contain T₁ (moderate yield), thus the treatments were rearranged. The flowing treatments were used in the experiment: T₁= 84-21-35-11.2-1, T₂= 58.8-12-29.5-11.2-1.4, T₃= 60-15-25-8-1, T₄= 30-36-20-0-0 kg/ha of N-P-KS-Zn with T₆= Absulte control.

Treatment 2 contained mustard oil cake @ 500 kg/ha. Wheat seeds were sown during 3-10 Dec. 1998 and the crop was harvested on 22nd March 1999. The crop received one irrigation during CRI stage.

Highest grain yield (2.75 t/ha) was obtained from the highest nitrogen rate but gave a very close yield (2.72 kg/ha) when organic fertilizer was integrated (Table 6).

Table 6. Grain yield of wheat in the pattern Wheat-Jute-T.Aman at FSRD site, Narikeli

Treatments						Grain yield (kg/ha)
N	P	K	S	Zn	MOC (kg/ha)	
84	21	35	11.2	1	1.4	2.75
58.5	12	29.5	11.2	1.4	500	2.72
60	15	25	8	1	0	2.61
30	36	20	0	0	0	2.46
0	0	0	0	0	0	1.86

Cropping pattern : Potato-T. aus-T. aman

Location : Chandina, Comilla

The experiment was sown on the first week of December 1998 and was harvested during second week of March 1999. The highest yield (25 t/ha) was obtained from the high yield goal plot but was similar to all the other treatments except absolute control, which produced the lowest yield of 11.2 t/ha (Table 7).

Table 7. Yield and yield attributes of Potato as influenced by different doses of fertilizer

Treatment	Shoots/plant	No. of Tuber/ plant (g)	Wt. of tuber/plant (g)	Haulm wt. (t/ha)	Yield (t/ha)
T ₁	2.8	5.64	252.2	3.68	19.954 ab
T ₂	3.2	6.32	344.0	5.05	24.585 a
T ₃	3.1	5.9	323.7	4.67	21.83 ab
T ₄	3.1	5.8	322.4	4.58	21.59 ab
T ₅	3.2	6.33	338.4	3.96	23.974 a
T ₆	1.8	4.6	146.2	1.42	11.156c

Development of fertilizer recommendation for Mustard-Boro-T.Aman rice cropping pattern under irrigated medium highland environment

The experiment was conducted on alternate cropping pattern Mustard – Boro -T.Aman rice developed against farmers pattern Boro-T.Aman rice under irrigated medium high land condition of Bangladesh Considering the residual effects of the mineral fertilizer to determine the profitable fertilizer dose and maximize the productivity with minimum mining of soil nutrients.

To achieve the objectives the following fertilizer treatments were selected for the pattern:

Treatment	Crops		
	Mustard (Tori 7)	Boro	T.Aman
T ₁	RF	RF	RF
T ₂	RF	N+1/2P+1/2K	Only N
T ₃	RF	N+P+K	Only N
T ₄	RF-Zn	N+P+K+Zn	Only N
T ₅	RF-Zn	N+P+K	N+Zn
T ₆	FP	FP	FP

Details of the recommended and farmers practices of fertilizer nutrients are as follows:

Location		Mustard	Boro	T.Aman
		N-P-K-S-Zn-B kg/ha)		
Polashbari	RF	80-26-33-20-3-1	100-26-33-20-4	96-16-33-20-4
	FP	54-19-27-5-0-0	105-16-25-7-0	86-16-32-10-0
Bogra	RF	80-26-33-20-3	80-26-33-10-2	70-26-33-10-3
	FP	120-44-54-0-0	100-22-50-0	86-30-35-0
		78-26-42-0	95-13-29-5	75-24-33-0
Hathazari	RF	-	95-10-30-5	55-18-18-0
		60-18-17-102	80-26-33-10-3	60-18-17-10-2
		70-20-25-0-0	100-26-17-0	75-26-17-0-0
Tangail	RF	100-26-33-20-2	100-35-50-20-4	70-26-33-10-3
	FP	66-17-23-0	116-25-27-5-0	55-13-3-4-0
Kendua	RF	30-26-17-30-3	100-35-50-20-4	70-3-33-10-3
	FP	35-17-26-0-0	80-15-13-0-0	63-13-11-0-0

RF = Recommended fertilizer for moderate yield goal (MYG)

FP = Farmer's practice

a. Polashbari, Rangpur

The experiment was conducted for three years from 1995-96 to 1997-98. Results from three years mean data revealed that seed yield of mustard within the designed fertilizer doses ranged from 1.20 to 1.29 t/ha. But these yields were much higher than those of the farmers practice (0.85 t/ha) Boro rice yields of the designed treatments also ranged from 4.21 to 4.48 t/ha. Farmers practice produced the lowest yield of 4.07 t/ha. T.Aman rice yield also followed the same trend (ranged from 4.19 to 4.35 t/ha). The farmers practice gave the lowest yield of 4.04 t/ha. Higher gross margin and benefit cost ratios were obtained from treatments having mustard with recommended fertilizer followed by Boro rice applied with full recommended nitrogen and either with full or half phosphorus and potassium and T.Aman dressed with only recommended nitrogen (Table 8).

Table 8. Development of fertilizer recommendation and cost and return analysis for Mustard-Boro-T.Aman rice cropping pattern at Palashbari, Rangpur during 1995-96 to 1997-98

Treatment			Grain yield (t/ha)			TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Mustard	Boro	T.Aman	Mustard	Boro	T.Aman			
RF	RF	RF	1.26	4.48	4.35	26558	55588	3.09
RF	N+1/2PK	N	1.28	4.33	4.19	22358	56654	3.53
RF-Zn	N+P+K	N	1.29	4.38	4.21	23400	56622	3.42
RF-Zn	N+P+K	N+Zn	1.20	4.21	4.19	23495	54187	3.31
FP	FP	FP	0.85	4.07	4.04	22635	48493	3.14

b. Kahalo, Bogra

Highest grain yields of all the three crops in the pattern Mustard (1.09 t/ha), Boro (4.90 t/ha) and T.Aman rice (4.41 t/ha) were obtained from the recommended fertilizer dose of the crops. As such the highest gross margin (Tk 58866/ha) and benefit cost ratio (2.84) were also obtained from the same fertilizer rates (Table 9).

Table 9. Effect of fertilizer treatment and cost and return analysis of Mustard-Boro-T.Aman rice cropping pattern during 1995-96 to 1997-98 at Kahaloo, Bogra

Treatment			Grain yield (t/ha)			TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Mustard	Boro	T.Aman	Mustard	Boro	T.Aman			
RF	RF	RF	1.09	4.90	4.41	27106	58860	2.84
RF	N+ ¹ / ₂ PK	N	1.02	4.36	3.41	24627	51661	2.73
RF	N+P+K	N	0.97	4.76	3.73	25752	53969	2.74
RF-Zn	N+P+K	N+Zn	0.90	4.52	3.80	25600	51833	2.68
RF-Zn	FP	FP	0.91	4.50	3.78	25752	52407	2.68
FP	FP	FP	0.93	4.68	4.31	26572	53256	2.74

c. Hathazari, Chittagong

Seed yield of mustard within the designed treatment did vary within the range of 0.48 to 0.54 t/ha but the farmer's practice with higher rates of NPK gave a higher yield of 0.73 t/ha. Grain yield of Boro and T.Aman rice was the highest with their recommended dose. In both the crops yield in other treatment varied within narrow limit. Gross margin (Tk 48848/ha) and BCR (2.67) of the treatments with recommended dose of Mustard followed by full nitrogen in boro along with full or half P and K and only full nitrogen in T.Aman rice were higher than the other treatments (Table 10).

Table 10. Effect of fertilizer treatment and cost and return analysis of Mustard-Boro-T.Aman rice cropping pattern at Hathazari during 1997-98

Treatment			Grain yield (t/ha)			TVC (tk/ha)	GM (Tk/ha)	BCR
Mustard	Boro	T.Aman	Mustard	Boro	T.Aman			

RF	RF	RF	0.48	4.77	4.56	31955	30776	1.96
RF	N+1/2PK	N	0.47	4.35	3.95	28075	48843	2.67
RF	N+P+K	N	0.54	4.35	3.88	29345	46658	2.59
RF-Zn	NPKSZn	N	0.48	4.59	3.91	29483	47045	2.60
RF-Zn	N+P+K	N-Zn	0.49	4.44	3.90	29067	42528	2.46
FP	FP	FP	0.73	4.19	3.93	33654	39618	2.18

d. FSRD site, Tangail, Kendua, Kishoregonj

In both the locations the pattern could complete two crops only. At Tangail seed yields of mustard in the designated doses were superior to that obtained from farmers' dose. The recommended dose was preferred. Same yield trend was also obtained from Boro crop that required a Zn, dressing. At Kendua, mustard produced the superior yield (1.05 t/ha) with recommended dose. Boro performed better in all the treatments than that of the farmers' dose (Table 11).

Table 11. Effect of different fertilizer doses on the yield of Mustard-Boro-T.Aman rice cropping pattern at Tangail and Kendua during 1997-98

Treatment			Tangail		Kendua	
Mustard	Boro	T.Aman	Mustard	Boro	Mustard	Boro
RF	RF	RF	0.82 a	4.55 a	1.05 a	6.37 a
RF	N+1/2PK	N	0.66 ab	4.41 a	0.98 ab	5.85 a
RF	N+P+K	N	0.69 a	4.35 a	0.84 bc	5.37 b
RF-Zn	NPKSZn	N	0.63 ab	4.44 a	0.71 cd	5.76 ab
RF-Zn	N+P+K	N-Zn	0.65 ab	4.27 ab	0.72 c	5.84 a
FP	FP	FP	0.48 b	3.86 b	0.55 d	5.20 b
CV(%)			14.65	4.64	9.56	5.99

Table 12. Effect of different fertilizers and cost and return analysis of Mustard –Boro-T.Aman rice cropping pattern at Tangail during 1997-98

Treatment			TVC (Tk/ha)		Gross margin (Tk/ha)		BCR	
Mustard	Boro	T.Aman	Tangail	Kendua*	Tangail	Kendua	Tangail	Kendua
RF	RF	RF	25984	9518	19451	48282	1.75	6.07
RF	N+1/2PK	N	23322	7018	18831	46727	1.81	7.66
RF	N+P+K	N	24737	8689	17400	40196	1.98	5.63
RF-Zn	NPKSZn	N	24754	8782	16919	40388	1.68	5.60
RF-Zn	N+P+K	N-Zn	24562	8397	16672	41153	1.68	5.90
FP	FP	FP	23270	4452	12635	38276	1.84	9.60

* TVC on the basis of Fertilizer cost only.

Integrated nutrient management for some cropping pattern

For maintaining good soil health and to determine the economic rate of nutrients for major cropping patterns the experiment was undertaken at the farmers' field at MLT site Paba,

Rajshahi from Rabi 1997 to Rabi 1998 and at MLT site Chandina, Comilla from Rabi 1996 to Rabi 1997. The major cropping patterns Wheat – Jute - Mashkalai of Paba and Potato-T.Aus - T.Aman of Comilla were considered for this study. The treatments on different nutrients management were taken on the basis of nutrient status of the soil before conducting the experiment.

Rabi	Kharif-I	Kharif-II
T ₁ = Absolute control	T ₁ = Absolute control	T ₁ = Absolute control
T ₂ = Nutrient rate for cropping pattern as per BARC F.R.G. for MYG	T ₂ = Nutrient rate for cropping pattern as per BARC F.R.G. for MYG	T ₂ = Nutrient rate for cropping pattern as per BARC F.R.G. for MYG
T ₃ = Soil test based nutrient rate for HYG	T _{3.1} =100% nutrient rate T _{3.2} =100% N+60% others T _{3.3} =100% N+33% other T _{3.4} =100% N+O	T _{3.1} =100% nutrient rate T _{3.2} =100% N+60% others T _{3.3} =100% N+33% other T _{3.4} =100% N+O
T ₄ = T ₃ +CD)t/ha0 for potato-10 t/ha	T _{4.1} =100% N+66% other or T _{4.2} =100% N+33% other	T _{4.1} =100% N+66% other or T _{4.2} =100% N+33% other
T ₅ = Farmers nutrient use	T ₅ =Farmers nutrient use	T ₅ =Farmers nutrient use

Cropping pattern : Potato-T.aus-T.aman rice

Location : Chandina, Comilla

Although fertilizer dose for high yield goal, with the integration of cowdung @ 10 t/ha and the farmers dose produced identical yield of potato but addition of cowdung increased the yield by 4 t/ha. In farmers practice application rates of fertilizer was too high (225-270-225 kg/ha of NPK). T.aus and T.Aman rice yield also improved when dressed with cowdung in the high yield goal plots. The same yield could be obtained both T.aus and T.Aman by applying 100% nitrogen and 66% of the other nutrients. Farmers dose was higher for all crops but are confined to NPK only (Table 13).

Table 13. Agro-economic performance of Potato-T.aus-T.aman cropping pattern with different fertilizer treatments 1997-98

Treatment	Fertilizer dose			Yield			Gross margin (Tk/ha)	TVC (Tk/ha)	BCR (Tk/ha)
	Potato	T.aus	T.Aman	Potato	T.Aus	T.Aman			
T ₁	0	0	0	7.71	2.1664	1.2256	-	-	-
T ₂	120-70-120-20-4	155-58-33	155-80-33	11.41	3.2156	4.15	65198	5860	12.13
T _{3.1}	333-89-251-56-0	200-133-67-56	200-133-67-56	13.92	4.3802	4.75	77184	10226	8.54
T _{3.2}	-	200-80-45-39	200-89-45-30	13.93	4.0126	4.48	75262	8991	10.41

Table 13 contd.

Treat	Fertilizer dose	Yield	Gross	TVC	BCR
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ment	Potato	T.aus	T.Aman	Potato	T.Aus	T.Aman	margin (Tk/ha)	(Tk/ha)	(Tk/ha)
T _{3.3}	-	200-44-22-18	200-44-22-18	13.64	3.7134	3.84	71496	7691	10.29
T _{3.4}	-	200-0-0-0	200-0-0-0	13.84	3.6162	3.4344	62782	6447	10.74
T _{4.1}	33-69-251-56-10t/ha	200-89-45-39	200-89-45-39	17.88	4.4194	5.0128	87140	13999	7.22
T _{4.2}	-	200-44-22-18	200-44-22-18	17.93	4.1922	4.580	84455	12691	7.65
T ₅	225-270-225	200-150-100	200-150-100	17.24	4.5492	4.63	86309	11237	8.68

Cropping pattern : Wheat – Jute - Blackgram

Location : Paba, Rajshahi

Results revealed that fertilizer dose give for high yield goal has superior yield of all the crops. In case of Wheat, treatment t₄ i.e. higher doses of fertilizer plus 10 t/ha cowdung gave the highest yield (3.99 t/ha). In case of Jute treatment T₃ gave the highest yield (2.84 t/ha) and for Mashkalai, the highest yield 946.67 kg/ha) was obtained from the treatment T_{3.2}= Application of cowdung could improve wheat yield but on the same level of significance Jute and Blackgram required 100% of recommended nitrogen+33% or 66% of the other fertilizer for significant yield improvement (Table 14). The highest gross margin (Tk 50733/ha) was obtained from the treatment T₄ i.e. higher doses of fertilizer+5 t/ha cowdung in 1st crop. Benefit cost ratio was also higher in treatment (T₄ (2.72) and treatment (3.3 (2.73).

Table 14. Cost benefit analysis of Wheat-Jute-Blackgram cropping pattern under different fertilizer management in 1997-98

Treatment N-P205-K20-S-(kg/ha)			Yield (t/ha)			TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Wheat	Jute	B.gram (kg/ha)	Wheat	Jute	B.gram (kg/ha)			
T ₁ =0-0-0-0-0	0-0-0-0	0-0-0-0	1.41	1.92	613.33	19125	26441	2.38
T ₂ =20-28-12-9	45-10-10-10-0	20-28-12-9	3.32	2.39	770.0	26127	44163	2.69
T _{3.1} =20-28-8-9	120-40-40-20-0	20-28-8-9	3.75	2.84	916.66	30176	48844	2.61
T _{3.2} =20-18-5-6	120-26-26-13-0	20-18-5-6	3.75	2.65	946.67	28860	48873	2.69
T _{3.3} =20-9-3-3	120-13-13-7-0	20-9-3-3	3.75	2.61	880.00	27767	48233	2.73
T _{3.4} =20-0-0-0	120-0-0-0	20-0-0-0	3.75	2.30	725.00	26560	43240	2.62
T ₄ = 20-18-5-6	120-26-26-13-0	20-18-5-6	3.99	2.68	746.66	29387	50733	2.72
T ₅ =0-0-0-0	34-26-13-0-0	0-0-0-0	1.93	2.37	676.67	22524	35409	2.57

Effect of rice straw on the performance of T.Aman rice in Boro-Fallow-T.Aman rice cropping system

The experiment was conducted at Bagherpara, Jessore and Feni, Noakhali during 1996-97 to improve the soil fertility and thereby the production of Boro-T.Aman rice system through incorporation of Boro rices straw in the soil. Boro rice was grown with recommended management. T.Aman rice was grown with 8 (eight) treatments with different fertilizers along with the previously incorporated boro rice and dhaincha as follows:

- T₁ = Dhaincha biomass incorporation + 20-40-20 kg/ha N-P₂O₅-K₂O
 T₂ = 1/3rd boro rice straw incorporation + 50-40-20 kg/ha N-P₂O₅-K₂O
 T₃ = 2/3rd boro rice straw incorporation + 50-40-20 kg/ha N-P₂O₅-K₂O
 T₄ = 1/3rd boro rice straw incorporation + 65-50-30-20-5 kg/ha N-P₂O₅-K₂O-S-Zn
 T₅ = 2/3rd boro rice straw incorporation + 50-40-20-20-5 kg/ha N-P₂O₅-K₂O-S-Zn
 T₆ = 70-60-40-10-3 kg/ha N-P₂O₅-K₂O-S-Zn
 T₇ = 50-40-20-20-0 kg/ha N-P₂O₅-K₂O-S-Zn
 T₈ = (Farmers practice) 105-53-36-21-4 kg/ha N-P₂O₅-K₂O-S-Zn

Results revealed that farmers practice can be profitably modified with two options in both the locations (Table 15 and 16)

- Incorporation of 1/3rd or 2/3rd of boro rice straw blended with 50-40-20 kg/ha of N-P₂O₅-K₂O at Bagherpara and 2/3rd of straw blended at Feni
- Application of 70-60-40-10-3 kg/ha of N-P₂O₅-K₂O-S-Zn at Bagherpara and 50-40-20 kg/ha N-P₂O₅-K₂O at Feni.

Table 15. Performance of T.Aman rice under Boro –T.Aman cropping pattern with different fertilizer treatment at Bagherpara, Jessore during 1996-98

Treatment	Grain yield (t/ha)				TVC (Tk/ha)	Gross margin (Tk/ha)	BCR (Tk/ha)
	1996	1997	1998	Mean			
T ₁	3.55bcd	2.93bc	3.77bc	3.42	31678	29372	1.93
T ₂	3.40cd	3.09ab	4.47ab	3.65	31865	31045	1.97
T ₃	3.17d	3.21a	4.71a	3.70	32657	30478	1.93
T ₄	3.81a-c	2.72de	3.87bc	3.47	33673	27887	1.83
T ₅	3.43cd	2.65de	3.66c	3.25	33428	26452	1.79
T ₆	4.17a	3.27a	4.37abc	3.94	33288	31717	1.95
T ₇	3.26cd	2.61e	4.47ab	3.45	31468	30057	1.96
T ₈	4.06ab	2.82cd	4.01abc	3.63	33823	28882	1.85

Table 16. Performance of T.Aman rice under Boro-T.Aman cropping pattern with different fertilizer management at Noakhali during 1996-98

Treatment	Grain yield (t/ha)				TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
	1996	1997	1998	Mean			
T ₁	2.39	1.63	1.98	2.00	6783	10627	2.57
T ₂	3.31	2.09	2.45	2.62	7033	14507	3.06
T ₃	3.43	2.46	2.87	2.92	7033	14507	3.06
T ₄	2.87	1.93	2.36	2.39	6300	14450	3.29
T ₅	2.75	2.14	2.83	2.57	8096	19614	3.09
T ₆	3.02	1.92	2.26	2.40	7294	12626	2.73
T ₇	2.67	2.50	3.10	2.76	6897	20463	3.97
T ₈	2.67	1.67	2.14	2.16	2900	15910	6.68
LSD _(0.05)	-	-	0.04	-	-	-	-

* TVC on the basis of fertilizer cost only.

Residual effect of phosphorus and sulphur on Boro-T.Aman/Mustard systems

The experiment was conducted at MLT site Melandah, Jamalpur during 1996-1998 to develop a economic fertilizer dose considering the residual effect of P, S and Zn. Three years mean data revealed that full dose of the three crops in the pattern produced the highest grain/seed yield. But the benefit cost ratio of the full dose treatments were lower than the other treatments. On the basis of gross margin and benefit cost ratio any of the dose except T₃ can be used for the cropping pattern (Table 17).

Table 17. Residual effect of phosphorous and sulphur on Mustard-Boro-T.Aman rice cropping pattern

Treatment (N-P ₂ O ₅ -K ₂ O-S-Zn kg/ha)	Grain yield (t/ha)			TVC (Tk/ha)	GM (Tk/ha)	BCR		
	Mustard	Boro	T.Aman					
T ₁ =80-60-40-20	100-8-60-15-4	70-60-40-10-3	0.65	6.99	5.35	33750	97620	3.26
T ₂ =60-40-30-10-2	80-60-40-10-2	50-40-20-0-0	0.57	6.76	4.91	30343	96025	3.40
T ₃ =60-40-30-10-2	80-60-40-0-2	0-0-0-0-0	0.42	6.41	4.32	28550	91906	3.28
T ₄ =60-40-30-10-2	80-60-40-0-2	25-0-0-0-0	0.46	6.34	4.86	28794	95331	3.48
T ₅ =60-40-30-10-2	80-0-40-0-2	25-0-0-0-0	0.45	6.25	4.65	28394	95473	3.36
T ₆ =60-40-30-10-2	80-30-40-0-2	25-0-0-0-0	0.43	6.35	4.80	28095	96489	3.46

Effect of organic and inorganic fertilizer on the performance of Mustard-Boro-T.Aman cropping pattern

The experiment was conducted at FSRD site, Narikeli, Jamalpur during 1995-96 to 1997-98 to determine a suitable organic and inorganic blending for economic productivity. Economic performance of the cropping pattern interms of gross margin and benefit cost ratio revealed

that organic and inorganic blending could not improve the performance of the cropping system. Mustard with 60-40-30-10-2, Boro with 80-60-10-2 and T.Aman rice with 50-40-20-0-0 kg/ha of N-P₂O₅-K₂O-S-Zn be recommended for cultivation in the cropping system (Table 18).

Table 18. Nutrient levels used in the cropping pattern Mustard-Boro-T.Aman

Treatment	Mustard (kg/ha)					Boro (kg/ha)							T.Aman (kg/ha)					
	N	P	K	S	Zn	N	P	K	S	Zn	MOC	CD	N	P	K	S	Zn	FYM
T ₁	80	60	40	20	2	100	80	60	15	4	0	0	70	60	40	10	3	0
T ₂	60	40	30	10	2	80	60	40	10	2	0	0	50	40	20	0	0	0
T ₃	60	40	30	10	0	80	30	20	0	0	400	0	50	0	0	0	3	0
T ₄	60	40	30	10	0	80	30	20	0	0	400	0	50	0	0	0	3	5000 BRS
T ₅	60	40	30	10	0	80	30	20	0	0	400	0	35	0	0	0	3	0

FP= Farmers' practice, MOC= Mustard Oil Cake, CD= Cowdung, FYM= Farm Yard Manure, BRS= Boro rice straw

Table 19. Cost and return analysis of Mustard-Boro-T.Aman rice cropping pattern as affected by different levels of organic and inorganic fertilizers at Narikeli FSRD site, Jamalpur during 1995-96 to 1997-98

Treatment	Grain yield (t/ha)			TV (Tk/ha)	Gross margin (Tk/ha)	BCR
	Mustard	Boro	T.Aman			
T ₁	0.71	6.11	3.68	33684	54358	2.61
T ₂	0.68	5.79	3.57	31110	54554	2.75
T ₃	0.65	5.90	3.56	31478	52322	2.66
T ₄	0.64	5.82	3.56	33258	49691	2.49
T ₅	0.63	5.87	3.54	33258	50078	2.51
T ₆	0.49	5.20	3.30	29028	44751	2.54

Development of fertilizer recommendation for Potato–Jute-Mungbean cropping pattern

The experiment was conducted at MLT site Paba, Rajshahi during 1995-96 and 1997-98 to develop a cropping pattern based fertilizer recommendation and to reduce fertilizer cost as well as make the pattern profitable. The treatment combination was given in Table 21. The result showed that all the six different sequences of fertilizer application produced significant differences in yield of potato. Only yield of mungbean failed to produce significant differences in first two years but in 3rd year yield of mungbean was significant. In all the three crops the highest yield was obtained from RF for HYV and lowest from farmers practice. In terms of productivity and economic analysis it is indicated that moderate yield goal rate of Potato (100-40-100-20-4 kg/ha of N-P₂O₅-K₂O-S-Zn), only recommended nitrogen (45 kg/ha) and only phosphorus (20 kg P₂O₅/ha) for Jute and Mungbean respectively may be recommended (Table 20).

Table 20. Treatment combination

Fertilizer dose (kg/ha) N-P ₂ O ₅ -K ₂ O-S	Potato	Jute	Mungbean
RF1	150-60-150-20-4	70-30-40-20-4	60-20-10-3
RF2	100-40-100-20-4	45-10-20-10-4	45-20-5-0
FP	160-50-200-0-0	34-36-23-0-0	0-0-0-0

Table 22. Cost and return analysis of crops under Potato-Jute-T.Aman cropping pattern at different fertilizer doses at Pabna MLT site, Rajshahi during 1995-96 to 1997-98

Treatment			Mean grain yield (t/ha)			TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Potato	Jute	Mungbean	Potato	Jute	Mungbean			
RF1	RF1	RF1	26.92	3.04	0.88	79714	153451	2.93
RF2	RF2	RF2	25.50	2.84	0.81	75279	144722	2.92
RF2	Only N	Only P	25.41	2.81	0.84	72697	147212	3.02
RF2	Only N	Only P	25.89	2.72	0.82	72037	142739	2.98
RF ₂ -20 kg N	Only P	25.16	25.16	2.64	0.79	72439	142434	2.97
FP	FP	FP	24.38	2.37	0.76	75155	131102	2.74

F1= Recommended fertilizer dose for HYG, RF2=Recommended fertilizer dose for MYG, FP=Farmers practice

Subproject: Crop Response to added Nutrients

Response of crops grown in different patterns and environment to added fertilizer nutrients

A predominant cropping pattern in irrigated high land environment of different locations was tested to determine optimum and economic dose of minerals nutrients for crop growth. Each of the crops of the pattern was tested by fourteen combinations with 4 levels of N, P₂O₅, K₂O and S. The design was RCB with 6 dispersed replication.

Cropping pattern : Wheat-Jute-T.Aman

Location : Jhenaidah, Natore and Kishoregonj

The experiment was conducted at Jhenaidah, Natore and Kishoregonj during 1996-97 to 1997-98. Results revealed that the average yield of the crops increased with increase in the rates of nitrogen application up to 150 kg for wheat, 90 kg for jute and 135 kg for T.Aman rice in all the location. Application of phosphorus up to 90 kg/ha of P₂O₅ could increase the yield of wheat at Natore and T.Aman rice at Natore and Kishoregonj. In all other places 60 kg P₂O₅ gave the highest yield of both the crops. Jute yield increased up to a rate of 45 kg P₂O₅ but at Jhenaidah yield of Jute was maximum @ 30 kg/ha P₂O₅, T.Aman gave the same yield @ 60 kg kg/ha of P₂O₅, Potassium, up to a rate of 150 kg/ha of K could increase the yield of

all the corps in all locations except at Jhenaidah where yield of all the crops were maximum at a rate of 100 kg/ha of K₂O. Yield increase by Sulphur beyond an application rate of 30 kg S/ha was not prominent rather decreased in yield of wheat in all the locations. From the point of gross margin and benefit cost ratio the following fertilizer dose may be recommended:

Location	Fertilizer dose (N-P205-K20-S-Zn kg/ha)		
	Wheat	Jute	T.Aman
Jhenaidah	100-30-100-15	90-15-40-10	135-30-20-10
Natore	100-30-50-15	90-15-20-10	100-30-30-10
Kishoregonj	100-30-50-15	90-15-20-20	100-30-30-10

Table 24. Effect of different fertilizer doses on the yield of different crops under Wheat-Jute-T.Aman cropping pattern at different locations during 1995-96 to 1997-98

Fertilizer dose (kg/ha)			Yield of crops (t/ha)								
			Wheat			Jute			T.Aman		
Wheat	Jute	T.Aman	Jhenaidah	Natore	Kishoregonj	Jhenaidah	Natore	Kishoregonj	Jhenaidah	Natore	Kishoregonj
N-levels											
0	0	0	1.08	1.79	0.74	2.34	1.52	1.79	3.16	3.54	3.36
50	30	45	1.68	2.68	1.30	2.56	2.04	2.04	3.79	5.01	3.70
100	60	90	2.31	3.25	1.88	2.67	2.19	2.19	3.93	6.33	3.92
150	90	135	2.47	3.90	1.91	2.88	2.32	2.32	4.48	6.95	3.90
P-levels											
0	0	0	1.97	3.11	1.80	2.58	3.05	2.08	3.76	6.61	3.82
30	15	30	2.06	3.12	1.71	2.73	3.30	2.17	3.85	6.82	3.97
60	30	60	2.31	3.25	1.88	2.80	3.52	2.19	3.93	6.95	3.92
90	45	90	2.19	3.63	1.78	2.79	3.81	2.25	3.85	7.41	4.02
K-levels											
0	0	0	1.98	3.56	1.61	2.62	3.00	2.05	3.86	3.72	
50	20	30	2.13	3.39	1.88	2.65	3.38	2.09	6.65	3.83	
100	40	60	2.31	3.25	1.91	2.80	3.56	2.19	6.70	3.92	
150	60	90	2.00	3.32	2.10	2.76	3.78	2.14	6.80	3.97	
S-levels											
0	0	0	2.03	3.25	1.66	2.58	3.06	2.02	3.81	5.84	3.91
15	10	10	2.18	3.41	1.72	2.80	3.11	2.11	3.93	6.33	3.94
30	20	20	2.31	3.50	1.88	1.88	3.31	2.17	4.05	6.55	3.92
45	30	40	2.22	3.45	1.77	1.77	3.53	2.15	4.11	6.57	3.95

Table 25. Cost and return analysis of different fertilizer doses of Wheat-Jute-T.Aman cropping pattern at different locations during 1995-96 to 1997-98

Fertilizer dose (kg/ha)			TVC (Tk/ha)			Gross margin (Tk/ha)			BCR (Tk/ha)		
Wheat	Jute	T.Aman	Jhenaidah	Natore	Kishoregonj	Jhenaidah	Natore	Kishoregonj	Jhenaidah	Natore	Kishoregonj
N-levels											
0	0	0	38722	33433		17693	42637	43738	1.46	2.27	
50	30	45	40348	35083		26507	73567	50559	1.66	3.10	
100	60	90	41980	36734		34288	96401	58483	1.82	3.62	
150	90	90	43322	38434		40563	119366	60381	1.94	4.11	
P-levels											
0	0	0	38230	31843		32600	109312	57188	1.85	4.43	
30	15	30	96633	34288		37162	111792	58302	1.38	4.26	
60	30	60	41980	36734		34288	96401	59342	1.82	3.62	
90	45	90	44328	39179		29537	129976	59824	1.67	4.32	
K-levels											
0	0	0	39708	34183		33497	114182	54811	1.76	4.34	
50	20	30	41436	36134		33119	117451	57930	1.88	4.25	
100	40	60	41980	36734		34288	96401	59545	1.82	3.62	
150	60	90	43708	38684		30187	119866	59787	1.83	4.10	
S-levels											
0	0	0	41145	35284		31155	111251	56371	1.76	4.15	
15	10	10	41727	36358		36778	112817	57708	1.88	4.10	
30	20	20	41980	36754		34288	96401	59869	1.82	3.62	
45	30	40	42895	38075		35595	109620	57867	1.83	3.88	

Cropping pattern : Potato-Jute-T.Aman

Location : Rangpur

The experiment was conducted at MLT site, Palashbari, Rangpur during 1996-97 and 1997-98 to determine optimum and economic dose of nutrients for Potato-Jute-T.Aman cropping system. Results revealed that the following fertilizer dose may be recommended for the pattern.

Potato=120-30-120-15 kg N-P₂O₅-K₂O-S

Jute = 30-15-40-10 kg N-P₂O₅-K₂O-S

T.Aman = 120-30-20-10 kg N-P₂O₅-K₂O-S

Table 26. Yield of Potato-Jute-T.Aman at Palashbari, Rangpur during 1997-98

Fertilizer dose (Kg/ha)			Yield (t/ha)					
			1997-98			1996-97		
Potato	Jute	T.Aman	Potato	Jute	T.Aman	Potato	Jute	T.Aman
N-Levels								
0	0	0	10.43	1.16b	1.33c	11.24f	1.33b	1.34c
60	30	45	23.11b	2.24a	4.07b	25.48c-e	2.21a	4.00b
120	60	90	29.40a	2.40a	5.36b	29.90ab	2.41a	4.97a
180	90	135	27.70a	2.37a	5.21a	26.38a-e	2.38a	4.86a
P-levels								
0	0	0	22.17b	2.23	4.96	24.34de	2.24a	4.36ab
30	15	30	28.46a	2.38	5.14	29.90ab	2.37a	4.77a
60	30	60	29.40a	2.40	5.36	29.24a-c	2.41a	4.94a
90	45	90	29.49a	2.35	5.17	29.18a-d	2.39a	4.80ab
K-levels								
0	0	0	20.82c	2.22a	5.01	26.22b-e	2.22a	4.58ab
60	20	30	26.15b	2.29a	5.36	27.18a-b	2.29a	4.97a
120	40	60	29.40ab	2.41a	5.12	29.90ab	2.41a	4.81a
180	60	90	31.00a	2.32a	5.15	30.53a	2.32a	4.84a
S-levels								
0	0	0	22.00b	2.25	4.99	24.26de	2.18a	4.47a
15	10	10	29.40a	2.40	5.16	29.90ab	2.41a	4.78a
30	20	20	29.10a	2.35	5.36	28.80a-c	2.35a	4.97a
45	30	40	28.14a	2.34	5.95	28.93a-c	2.30a	4.78a

Cropping pattern : Onion - T.Aus - T.Aman

Location : Kushtia

The experiment was conducted at MLT site, Kushtia during 1997-98 to determine optimum and economic dose of nutrient for Bulb Onion-T.Aus-T.Aman rice cropping system. Results revealed that the following fertilizer dose may be recommended on the basis of one year results.

Onion = 120-50-75-10

T.aus = 70-20-30-5 kg/ha N-P₂O₅-K₂O-S

T.Aman = 70-20-30-5 kg/ha N-P₂O₅-K₂O-S

Table 27. Cost and return analysis of Onion-T.Aus -T.Aman cropping pattern under different fertilizer doses at Kushtia MLT site during 1997-98

Fertilizer dose (kg/ha)			Bulb/grain yield (t/ha)			TVC (Th/ha)	Gross margin (Tk/ha)	BCR
Onion	T.Aus	T.Aman	Onion	T.Aus	T.Aman			
N-levels								
0	0	0	7.0d	2.00 c	2.13 c	9690	165570	18.08
60	35	35	9.21c	2.82 b	2.97 bc	11382	221758	20.48
120	70	70	12.2b	3.31 a	4.32 ab	13080	292478	23.36
180	105	105	13.2a	3.33 a	4.40 a	14840	317068	22.36
P-levels								
0	0	0	11.8b	3.33 a	4.15 b	7300	291518	40.93
50	20	20	12.0b	3.04 b	4.23 b	10155	291428	29.69
100	40	40	12.2b	3.31 a	4.32 b	13080	292478	23.36
150	60	60	13.0a	3.12 ab	4.75 a	16135	320808	20.88
K-levels								
0	0	0	9.7d	3.01 b	4.00	9939	243411	25.49
75	15	15	10.6c	3.24 ab	4.28	11514	265624	24.06
150	30	30	12.2 b	3.31 a	4.32	13080	292478	23.36
225	45	45	13.5 a	3.42 a	4.29	14155	322820	23.80
S-levels								
0	0	0	10.3	3.17	4.17 b	12411	256924	2170
10	5	5	12.5	3.22	4.38 a	12747	299878	24.52
20	10	10	12.2	12.2	4.32 ab	13080	292478	23.36
30	15	15	12.8	12.8	4.48 a	13749	307901	23.39
LSD _(0.05)			0.27					

Note : BCR is based on the fertilizer cost only

Cropping pattern : Potato-Jute

Location : Munshiganj

The experiment was conducted at Munshiganj MLT site during 1997-98 to know the response of fertilizer nutrients on the yield of Potato-Jute cropping pattern. The study reveals that (Table 28) among the nutrient elements only nitrogen could influence the yield of potato and jute to some extent while PK and S failed to produce any significant response in yield. This phenomenon could be explained that the farmers of Munshiganj traditionally apply about 4-5 times higher rates of fertilizers than the present recommendation. So the soil might be initially very rich in nutrient content and therefore no response was found. Highest gross margin was recorded from highest level of nitrogen (240 kg/ha) along with recommended dose of PK and S. The trial needs to be repeated for another 1-2 crop cycle to draw a complete recommendation for the pattern.

Table 28. Cost and return analysis of Potato-Jute cropping pattern under different fertilizer doses at Munshiganj MLT site during 1997-98

Fertilizer dose (kg/ha)		Tuber/fibre yield (t/ha)		TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Potato	Jute	Potato	Jute			
N-levels						
0	0	26.0 b	4.0 c	6006	111994	19.64
80	30	30.9 a	4.3 bc	7301	128599	
160	60	31.7 a	4.4 b	8394	130806	
240	90	31.8 a	4.6 a	9588	131712	
P-levels						
0	0	31.2	4.4	6408	130992	21.44
30	15	30.8	4.2	8056	126344	16.68
60	30	31.7	4.4	8394	130806	16.58
90	45	30.2	4.4	10047	124453	13.39
K-levels						
0	0	29.9	4.1	6069	124331	21.49
80	20	29.6	4.3	7592	124008	17.33
160	40	31.7	4.4	8394	130806	16.58
240	60	31.4	4.2	9996	125204	13.63
S-levels						
0	0	29.4	4.2	7506	122799	17.36
15	10	31.5	4.3	8183	131011	17.01
30	20	31.7	4.4	8394	130806	16.58
45	30	29.9	4.2	9072	122528	14.51

Cropping pattern : Boro-Mustard-Mustard

Location : Mymensingh

The trial was conducted at Muktagacha MLT site, Mymensingh during 1998-99 with Boro-Mustard-Mustard cropping pattern. Results of boro rice presented in Table 29 showed that application of N, P and Sulphur increased grain yield but no response to K was observed. After completion of at least one crop cycle a recommendation might be given.

Table 29. Yield and economics of boro rice under Boro-Mustard-Mustard cropping pattern at different fertilizer doses at Muktagacha MLT site during 1998-99

Fertilizer dose (kg/ha)	Grain yield (t/ha)	Straw yield (t/ha)	Gross margin (Tk/ha)
N-levels			
0	3.77 b	5.10 b	16018
80	4.38 a	5.42 ab	19911
113	4.48 a	5.67 a	20470
158	4.37 a	5.17 b	18527
P-levels			
0	4.28 b	5.30 ab	20856
18	4.32 b	5.12 b	19364
26	4.48 ab	5.67 a	20470
36	4.85 a	5.67 a	22364

Table 29. Contd.

Fertilizer dose (kg/ha)	Grain yield (t/ha)	Straw yield (t/ha)	Gross margin (Tk/ha)
K-levels			
0	4.22	5.18	18756
30	4.65	5.33	21607
42	4.48	5.67	20470
52	4.60	5.33	20842
S-levels			
0	4.30 b	5.07 b	18781
8	4.75 a	5.70 a	22591
15	4.48 ab	5.67 ab	20470
21	4.82 a	5.82 a	21618

Cropping pattern : Potato -T.Aus - T.Aman

Location : Comilla

The experiment was conducted at MLT site Chandina, Comilla during 1997-98 with Potato-T.Aus - T.Aman cropping pattern was initiated in 1996-97. Tuber yield increased significantly with application of NPK and S. Except potassium, the rates of other nutrient did not differ to influence in yield. In the succeeding rice crops (T. aus and T.Aman) no such response was observed (Table 30). From economic point of view highest gross margin and B/C ratio were calculated from the treatment receiving highest level of NPKS. The following dose may be recommended for Chandina.

Potato : 180-90-180-45 kg/ha N-P₂O₅-K₂O-S-Zn

T. aus : 135-90-60-15 kg/ha N-P₂O₅-K₂O-S-Zn

T.Aman: 135-90-60-15 kg/ha N-P₂O₅-K₂O-S-Zn

Table 30. Cost and return analysis of different fertilizer crops was affected by different fertilizer doses in Potato-T.Aus -T.Aman cropping pattern at Chandina, Comilla during 1997-98

Fertilizer dose (kg/ha)			Tuber/grain yield (t/ha)			TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Potato	T.Aus	T.Aman	Potato	T.Aus	T.Aman			
N-levels								
0	0	0	9.8 b	4.93	3.15	40940	28860	1.71
60	45	35	14.4 a	4.99	3.39	42774	42326	1.99
120	90	90	14.8 a	4.50	3.58	44424	40376	1.91
180	135	135	15.5 a	4.85	4.42	46074	46776	2.02
P-levels								
0	0	0	11.8 b	4.51	3.19	39754	34146	1.86
30	30	30	14.4 a	4.43	3.28	41764	39986	1.96
60	60	60	14.8 a	4.50	3.58	44424	40376	1.91
90	90	90	14.9 a	4.99	3.82	45784	42966	1.94

Table 30. Contd.

Fertilizer dose (kg/ha)			Tuber/grain yield (t/ha)			TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Potato	T.Aus	T.Aman	Potato	T.Aus	T.Aman			
K-levels								
0	0	0	9.9 c	4.92	3.37	40786	30364	1.74
60	20	20	14.0 b	4.29	3.96	42280	40970	1.97
120	40	40	14.8 ab	4.50	3.58	4424	40376	1.91
180	60	60	15.1 ab	5.22	4.04	45266	46334	2.02
S-levels								
0	0	0	13.9 b	4.91	3.54	42658	41292	1.97
15	5	5	16.1 a	4.12	3.65	43218	37932	1.88
30	10	10	14.8 ab	4.50	3.58	44424	40376	1.91
45	15	15	15.1 ab	4.79	3.96	44330	44720	2.01

Response of mustard to sulphur in the existing cropping system

The experiment was conducted at Gangni and Damurhuda MLT site, Kushtia during 1996-97 to 1998-99 to find out an optimum dose of sulphur for mustard. The variety BARI Sharisha 8 and Tori-7 were grown under irrigated and rainfed situation, respectively at both the locations with two fertilizer levels. Significantly higher seed yield of BARI Sharisha 8 was recorded from 40 kg/ha of sulphur at two locations compared to no sulphur (Table 33). Similar trend was observed in lower levels of fertilizers under rainfed situation. Tori-7 also showed positive response to sulphur at both the locations. But the response was more distinct at Gangni than Damurhuda. Considering the variable cost for fertilizer, higher gross margin and MRR was generated from application of S along with higher levels of fertilizers under both irrigated and rainfed situation. Therefore, sulphur @ 20-40 kg/ha for BARI Sharisha-8 under irrigation and 10-20 kg/ha for Tori-7 in rainfed condition might be recommended for Kushtia.

Table 31. Yield of mustard (BARI Sharisha 8) as affected by different doses of fertilizers under irrigated and rainfed condition at Gangni MLT site, Kushtia during 1996-97 to 1998-99

Treatment (N-P-K-S-Zn (kg/ha))	Grain yield of mustard (kg/ha)					
	Gangni			Damurhuda		
	1996-97	1997-98	1998-99	1996-97	1997-98	1998-99
120-35-50-40-4	1818 a	1792 a	1720 a	1673 a	2451 a	1721 a
120-35-50-0-4	1772 b	1612 ab	1550 b	1428 bc	2300 b	1706 a
100-28-42-20-2	1778 b	1450 b	1413 bc	1515 b	2351 ab	1683 b
100-28-42-0-2	1750 b	1364b	1404 bc	1358 c	2181 c	1668 b

Table 32. Yield of mustard (Tori-7) as affected by different doses of fertilizers under irrigated and rainfed condition at Damurhuda MLT site, Kushtia during 1996-97 to 1998-99

Treatment N-P-K-S-Zn (kg/ha)	Grain yield of mustard (kg/ha)					
	Gangni			Damurhuda		
	1996-97	1997-98	1998-99	1996-97	1997-98	1998-99
80-26-33-20-2	1258 a	1370 a	1436 a	800 a	1016 a	1032 a
80-26-33-0-2	1225 ab	1290 a	1152 b	659 bc	819 bc	1018 b
60-18-25-10-0	1215 ab	1278 a	1029 c	697 b	945 b	998 b
60-18-25-0-0	1178 bc	1164 b	908 d	619 cd	835 cd	992 bc

Table 33. Cost and return analysis of Mustard as effected by different rates of sulphur under irrigated and rainfed condition at Kushtia during 1996-97 to 1998-99

Treatment N-P-K-S-Zn (kg/ha)	Grain yield (t/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)	MRR (%)
Irrigated condition				
120-35-50-40-4	1863	6405	35393	586
120-35-50-0-4	1728	5745	31525	99
100-28-42-20-2	1675	4788	30573	423
100-28-42-0-2	1621	4458	29178	-
Rainfed condition				
80-26-33-20-2	1152	4281	21006	835
80-26-33-0-2	1051	3948	18226	12
60-18-25-10-0	1003	2748	18080	660
60-18-25-0-0	949	2580	16971	-

Subproject: BNF Technology

On-farm trial with rhizobium inoculants on different food legume crops

Crop : Lentil

Location : Pabna, Jessore and Noakhali

An on-farm trial on lentil was carried at FSRD sites Pabna, Jessore and Noakhali during rabi 1998-99 to evaluate the benefits of using BNF technology compared to urea and to investigate the effects of inoculum on soil fertility and productivity. From the trial it was observed that in Pabna the highest grain yield was obtained from the treatment by using PKS only. In Jessore and Noakhali the maximum yield was obtained by the treatment farmers practice and PKS + Inoculum respectively. But in respect of gross margin application of inoculum gave best results in Pabna and farmers practice at Jessore (Table 34).

Table 34. Effect of Rhizobium inoculants on the yield and consequent gross margin of lentil at different locations during 1997-98

Treatment (P-K-S kg/ha)	Grain yield (kg/ha)			Gross margin (Tk/ha)		
	Pabna	Jessore	Noakhali	Pabna	Jessore	Noakhali
T ₁ = Control	689	1300	1020	11745	28925	-
T ₂ = PKS	959	1380	1200	9375	29133	-
T ₃ = Inoculum	858	1350	1240	15225	29940	-
T ₄ = PKS+Inoculum	867	1600	1400	11383	34222	-
T ₅ = Farmers' practice	714	1620	1140	12060	35038	-

Fertilizer dose: 90-40-20 kg/ha PKS at Pabna Farmers' dose: 45-30-10 kg/ha PKS at Pabna
60-2-10 kg/ha PKS at Jessore
20-21-10 kg/ha PKS at Noakhali

Crop : Chickpea
Location : Kushtia and Faridpur

The trials were conducted at the FSRD site, Faridpur and MLT site Kushtia during 1998-99 with chickpea. Result showed that the treatment using inoculum only produced maximum grain yield with maximum gross margin in Kushtia however, in Faridpur the highest grain yield was reported by the treatment PKS + inoculum (Table 35).

Table 35. Effect of Rhizobium inoculants on the yield and consequent gross margin of chickpea at different locations during 1998-99

Treatment (P-K-S kg/ha)	Grain yield (kg/ha)		Gross return (Tk/ha)		Gross margin (Tk/ha)	
	Kushtia	Faridpur	Kushtia	Faridpur	Kushtia	Faridpur
T ₁ = Control	963	1590	23461	-	23461	-
T ₂ = PKS	1156	2020	27982	-	26554	-
T ₃ = Inoculum	1579	2250	37800	-	37400	-
T ₄ = PKS+Inoculum	1338	2750	32861	-	31033	-
T ₅ = Farmers' practice	1029	1610	25113	-	24228	-

Fertilizer dose: 12-15-10 kg/ha PKS at Kushtia Farmers' dose: 28-7 kg/ha NP at Kushtia
20-40-20 kg/ha PKS at Faridpur

Crop : Cowpea
Location : Chittagong, Noakhali and Patuakhali

The experiment was conducted on cowpea at Hathazari and Patiya during 1998-99. The treatment PKS+ Inoculum responded the best at both the locations in terms of yield as well as gross margin (Table 36).

Table 36. Effect of Rhizobium inoculants on the yield and consequent gross margin cowpea at Hathazari and Patiya MLT site during 1998-99

Treatment	Grain yield (kg/ha)				Gross margin (Tk/ha)			
	BARI Inoculum		BAU Inoculum		BARI Inoculum		BAU Inoculum	
	Hathazari	Patia	Hathazari	Patia	Hathazari	Patia	Hathazari	Patia
T ₁ = Control	567	561	487	503	5542	5419	4175	4463
T ₂ = PKS	642	649	665	660	4345	4436	4276	4636
T ₃ = Inoculum	614	639	582	611	6228	6902	5706	6190
T ₄ = PKS+inoculum	768	825	771	850	6397	7335	6422	7760

Fertilizer dose: 50-30-20 kg/ha or PKS

Crop : Cowpea

Location : Noakhali and Patuakhali

Effect of Rhizobium inoculants was studied on the yield of cowpea at 5 MLT sites during 1998-99. In the sites the treatment PKS+Inoculum yielded the best (Table 37).

Table 37. Effect of Rhizobium inoculants on the yield of cowpea at Noakhali and Patuakhali during 1998-99

Treatment	Grain yield (kg/ha)				
	Noakhali			Patuakhali	
	Atkapalia	Feni	Laxmipur	Lebukhali	Kalapara
T ₁ = Control	590	703	492	537	729
T ₂ = PKS	830	837	754	627	1021
T ₃ = Inoculum	770	949	768	562	1243
T ₄ = PKS + Inoculum	930	1054	957	684	1249
T ₅ = Farmers' practice	620	869	614	-	-

Fertilizer dose: 25-30-15 kg/ha at Patuakhali
20-21-10 kg/ha at Noakhali

Crop : Groundnut

Location : Mymensingh

The experiment was conducted at Mymensingh during 1997-98. The maximum yield of groundnut was found when PKS+Inoculum (BAU strain) was used. The treatment is also profitable due to the highest gross margin (Table 38) BARI strain required inorganic blending. However both strain could improve yield over control.

Table 38. Effect of Rhizobium inoculum on the yield and consequent gross margin of groundnut at Phulpur MLT site, Mymensingh during 1997-99

Treatment	Seed yield (kg/ha)		Gross return (Tk/ha)		Gross margin (Tk/ha)	
	BARI strain	BAU strain	BARI strain	BAU strain	BARI strain	BAU strain
NPKS	2821	3000	43741	4662	24073	26953
PKS	2431	2931	36790	47459	17403	28072
PKS + Inoculum	2476	3252	37345	50009	20906	33570
Inoculum	2204	2712	36532	44257	21027	28752
Control	1960	2579	2940	42718	14895	28213

Fertilizer dose: 20-80-80-20 kg/ha of NPKS

Crop : Groundnut

Location : Noakhali and Patuakhali

The effect of Rhizobium on the yield of groundnut was studied at Noakhali and Patuakhali during 1998-99. Except Lebukhali the use of inoculum with PKS have given the highest yield of groundnut (Table 39).

Table 39. Effect of Rhizobium inoculum on the yield of groundnut at Noakhali and Patuakhali during 1998-99

Treatment	Seed yield (kg/ha)				
	Noakhali			Patuakhali	
	Atkapalia	Feni	Laxmipur	Lebukhali	Kalapara
Control	1240	350	1420	1037	1600
Inoculum	1510	1180	1760	712	1670
PKS	1710	1070	1850	1050	1640
PKS + Inoculum	2080	1370	2410	850	1840
Farmers' practice	1300	1100	1550	-	-

Fertilizer dose: 22-21-10 kg/ha of PKS

30-55-25 kg/ha of PKS

Subproject: Verification of Fertilizer Management Practices

Study on nitrogen efficiency by using neem cake blended urea

The experiment was conducted at FSR site, Barind, Rajshahi during 1997-98 to increase the nitrogen use efficiency by using neem cake blended urea on boro rice under wet land condition. Three levels of nitrogen were in main plot and four levels of neem cake blended urea were in sub-plot in a split-plot design. Three years of experimentation results showed that grain yield was significantly influenced by neem cake blending. The highest nitrogen level (100 kg/ha) and neem cake @ 20% by weight of urea) combination gave the highest grain yield which did not significantly differed with N60 and N80 with same level of neem cake.

Table 40. Interaction effect of nitrogen level and neem cake on the yield of Boro rice during 1997-99

Neem cake rates	Grain yield (kg/ha)		
	N ₆₀	N ₈₀	N ₁₀₀
C ₀ = Without neem cake	4.09	5.10	5.45
C ₁₀ = Neem cake powder @ 10% by weight of urea	4.47	5.42	5.52
C ₂₀ = Neem cake powder @ 20% by weight of urea	5.29	5.56	5.77
C ₃₀ = Neem cake powder @ 30% by weight of urea	5.16	5.66	5.31

On-farm verification of fertilizer dose for different varieties of mustard under irrigated condition in the high Barind tract

The experiment was conducted at FSRD site, Barind, Rajshahi during 1996-97 to 1998-99 to find out an optimum fertilizer dose for a suitable variety of mustard for Mustard-T.aman cropping pattern. Five mustard varieties were tested against four different fertilizer doses along with a control. Results of three years experimentation showed that there was significant difference in seed yield of highest yield (1172 kg/ha) followed by Dhali irrespective of fertilizer dose. Seed yield of mustard varieties increased with the increase of fertilizer level and the highest level gave the highest yield (1190 kg/ha) irrespective of variety. Ishurdi local, Dhali or Tori-7 might be recommended for Barind with 100-80-50-30-4 kg/ha of N-P₂O₅-K₂O-S-Zn.

Table 41. Cost and return analysis of different Mustard variety as affected by different fertilizer doses FSRD site, Saroil, Barind, Rajshahi during 1996-97 to 1998-99

Treatment		Seed yield (kg/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
Variety	Fertilizer				
Daulat	F1	1130	13333	6442	1.18
	F2	1023	11966	5936	1.50
	F3	893	10577	5052	1.48
	F4	867	10506	4673	1.44
	F5	579	8000	2139	1.27
Mean	978				
3142	F1	1073	13333	5444	1.41
	F2	1018	11966	5849	1.49
	F3	865	10577	4560	1.43
	F4	750	10506	2619	1.25
	F5	446	8000	-191	.89
Mean	927				
Dhali	F1	1336	13333	10047	1.75
	F2	1128	11966	7774	1.65
	F3	971	10577	6424	1.61
	F4	825	10506	3940	1.38
	F5	511	8000	954	1.12
Mean	1065				
Tori-7	F1	1156	13333	6897	1.52
	F2	1078	11966	6899	1.58
	F3	939	10577	5855	1.55
	F4	868	10506	4684	1.45
	F5	506	8000	855	1.11
Mean	1010				
Ishurdi local	F1	1359	13333	10449	1.78
	F2	1227	11966	9506	1.79
	F3	1131	10577	9215	1.87
	F4	971	10506	6491	1.62
	F5	637	8000	3161	1.40
Mean	1172				

N-P₂O₅-K₂O-S-Zn kg/ha Note : Mean figure exclude data of absolute control

F₁=100-80-50-30-4, F₂=80-60-40-20-2, F₃=60-40-30-10-0, F₄=35-50-25-10-0, F₅=No fertilizer

Multilocation verification trial of Mustard-Boro-T.Aman rice cropping pattern

The trial was conducted at FSR site, Bogra during 1997-98 to verify the productivity and profitability of new fertilizer recommendation with current recommendation for Mustard-Boro-T.Aman rice cropping pattern. It reveals that highest grain yield of mustard and boro rice was recorded from current fertilizer recommendation, which is identical to new recommendation as well as farmers practice. In Boro and T.Aman rice the highest yield was obtained from new recommendation. From economic point of view, highest gross margin and BCR was also generated from new fertilizer recommendation.

Table 42. Yield and economics of Mustard-Boro-T.Aman rice cropping pattern as affected by different fertilizer recommendations at FSR site, Bogra during 1997-98

Treatment	N-P ₂ O ₅ -K ₂ O-S-Zn-B (Kg/ha)			Grain yield (t/ha)			TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
	Mustard	Boro	T.Aman	Mustard	Boro	T.Aman			
Current dose	70-46-42-20-10-1-5	100-34-72-8	50-18-48-3	0.89a	4.50b	4.79a	37726	49524	2.31
New dose	80-60-40-20	80-60-30	70-30-20-10	0.82a	4.55a	4.99a	36556	50644	2.39
Control	0-0-0-0	0-0-0	0-0-0-0	0.25b	1.94c	2.35c	26670	10633	1.40
Farmer practice	78-35-38	78-32-31-22	75-10-8	0.77a	4.13b	4.06b	33915	42505	2.25

Current dose = As per BARC cropping pattern based fertilizer recommendation guide 1997

New dose = OFRD, BARI cropping pattern based fertilizer recommendation

FP= Farmers practice

Multilocation verification trial of Boro-GM-T.Aman rice cropping pattern

The trial was conducted at FSR site Bogra during 1997-98 to verify the productivity and profitability of new fertilizer recommendation with current recommendation for Boro-GM-T.Aman rice cropping pattern. Highest grain yield of Boro and T.Aman rice was recorded from new fertilizer recommendation, which was identical to current recommendation. Regarding economics, highest gross margin and BCR was also calculated from same treatment.

Table 43. Yield and economics of Boro-GM-T.Aman rice cropping pattern as affected by different fertilizer recommendations at FSR site, Narhatta, Bogra during 1997-98

Treatment	N-P ₂ O ₅ -K ₂ O-S-Zn-B (Kg/ha)		Grain yield (t/ha)		TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
	Boro	T.aman	Boro	T.aman			
Current dose	110-57-78-15-1	75-28-48-5	5.0ab	4.6 ab	30574	38526	2.26
New dose	120-60-40-20-2	55-60-20-10-2	5.3a	4.8 a	30755	41745	2.36
Control	0-0-0-0	0-0-0-0	3.8c	3.6 c	26166	30484	2.01
Farmers practice	80-38-32-22	55-40-30-10	4.7b	4.3 b	27965	37585	2.34

Multilocation verification trial of Potato-Boro-T.Aman rice cropping pattern

The trial was conducted at Narhatta and Joypurhat MLT sites of Bogra during 1997-98 with a view to see the productivity and profitability of new fertilizer recommendation with current BARC recommendation for Potato-Boro-T.aman rice cropping pattern. Results showed that highest tuber and grain yield of all the three crops were obtained from new recommendation at Joypurhat which is insignificant with current recommendation. Similar results were also found at Narhatta.

Table 44. Yield of Potato-Boro-T.Aman rice cropping pattern as affected by different fertilizer recommendation at FSR site, Bogra during 1997-98

Treatment N-P ₂ O ₅ -K ₂ O-S-Zn-B (Kg/ha)	Grain yield at Joypurhat (t/ha)			Grain yield at Narhatta (t/ha)				
	Potato	Boro	T.aman	Potato	Boro	T.Aman		
100-57-108-15-10-1.5 (Current dose)	100-34-54-8	75-28-48-5	22.65	5.04	4.63	18.12	4.78	4.90
160-100-160 (New dose)	100-30-20-20	80-30-20-10-0-4	24.26	5.41	5.05	21.73	5.10	5.07
0-0-0 (control)	0-0-0	0-0-0	09.02	2.51	1.73	08.66	2.73	2.63
164-69-147 (FP)	73-9-0-9	58-16-18-9	23.21	4.77	4.44	20.44	4.67	4.70
LSD _(0.01)	-	-	02.45	0.33	0.71	2.43	0.53	0.47

Response of boron to Papaya

The experiment was conducted at ARS, Rangpur during 1998-99 to observe the response of papaya to boron. Papaya variety response 'Shahi' and CO-2 (local) were tested against different levels of boron under both soil and foliar application. The results showed that papaya responded positively to boron and the highest fruit yield was obtained from soil application of 3 kg B/ha and foliar application of 1.5 B/ha for both the varieties. The variety CO-2 out yielded the 'Shahi'.

Table 45. Effect of boron on yield of papaya at ARS, Rangpur during 1998-99

Boron (kg/ha)/variety	No. of fruits/plant	Fruit yield/plant(kg)	Fruit yield (t/ha)
Boron			
0	18.9 b	15.82 c	39.5 c
1	22.9 a	18.53 bc	46.3 bc
2	23.3 a	20.68 b	51.7 b
3	23.0 a	23.42 ab	58.5 ab
Foliage			
0	19.3 b	16.08 c	40.2 c
1	23.5 a	24.40 b	61.0 b
2	23.0 ab	25.75 ab	64.4 ab
3	24.8 a	28.26 a	70.6 a
Variety			
Shahi	20.5	18.04 a	45.1 a
CO-2	24.1	25.19 b	62.9 b

Nitrogen requirement in T.Aman rice

The experiment was conducted at Gangni MLT site, Kushtia during 1998-99 to verify the new fertilizer recommendation for T.aman rice grown after dhaincha with current recommendation. Significantly higher grain yield was recorded from new recommendation of 60-60-40-20 kg/ha of N-P₂O₅-K₂O-S compared to current BARC recommendation of 50-60-20-40 kg/ha of N-P₂O₅-K₂O-S. Straw yield of T.aman rice also followed the similar trend.

Table 46. Yield of T.aman rice grown after Dhaincah (GM) at Gangni, Kustia during 1998-99

Treatment N-P-K_S-Zn (kg/ha)	Grain yield (t/ha)	Straw yield (t/ha)
T ₁ = RP : 50-60-20-4-1	4.4b	5.2 b
T ₂ = AP : 60-60-40-20	4.8a	5.7 a
T ₃ = FP : 97-51-38-16-5	3.8c	5.4 ab
T ₄ = Absolute control	3.3d	4.2 c
CV (%)	5.3	6.9

Note : RP = Recommended package (Current recommendation)
 AP = Alternate package (new recommendation)
 FP = Farmers practice

Agroforestry Systems

Evaluation of agroforestry system of Guava and Potato Yam

The experiment was conducted at RARS Jessore during 1998-99 to examine the compatibility of growing Potato yam and Guava in association. Results revealed that Potato yam can be grown on Guava tree without affecting yield of the later. The yield of Yam could be increased up to 6.11 kg/tree by planting three Yam plant on a Guava tree. Associative affect of Guava tree and Potato yam was on Yam yield as compared to the yield of Yam on dish type bamboo support in the open sun under the same level of planting intensification (Table 1).

Table 1. Effect of support arrangement and planting intensification of Potato Yam on the yield of Guava and Yam during 1998-99 at RARS, Jessore

Planting intensification	Yam yield (kg/support)		Guava yield (kg/tree)
	Guava plant	Bamboo dish	
Control	-	-	53.00
One Yam/support	4.28	9.89	44.00
Two Yam/support	5.50	9.64	54.00
Three Yam/support	6.11	11.74	49.00

Evaluation of Agroforestry system of potato yam grown on different living and on living support materials along with turmeric

The experiment was conducted at RARS Jessore during 1998-99 in RCB design to assess the performance of Potato yam and turmeric in an agroforestry system. Treatment combinations included Sole Yam, Turmeric + Yam on Trailnet and Turmeric + Yam on Turmeric, Turmeric + Yam on Ziga, Turmeric + Yam on Shajna and Turmeric + Yam on Mander tree. Results revealed that yield of Yam was higher on trailnet in open sun (5.44 kg/9m² trailnet). Among the tree species Shajna supported the highest Yam yield (4.49 kg/tree). Turmeric yield was the highest (20.63 t/ha) under Ziga plant and the lowest on combination with Yam plant (17.45 t/ha). Biomass yield was the highest with Shajna plant (23.63 kg/tree) Table 2).

Table 2. Yield performance of potato yam and turmeric grown in an Agroforestry Systems during 1998-99 at RARS, Jessore

Treatment	Yield of Yam (kg/support)	Yield of turmeric (t/ha)	Biomass yield of tree above 1.5 m height (kg)
Sole Yam	0.96	-	-
Turmeric + Yam on trailnet	5.44	19.53	-
Turmeric + Yam on Turmeric	1.25	17.45	-
Turmeric + Yam on Ziga	2.99	20.63	10.44
Turmeric + Yam on Shajna	4.49	19.50	23.63
Turmeric + Yam on Mander	3.79	19.63	12.44

On-Farm trials with Advance lines and Technology

On-Farm trial of Rapeseed and Mustard line

The experiment was conducted at FSRD site, Faridpur and Pabna during rabi season of 1998-99 to evaluate promising rapeseed and mustard lines at farmers field. At Faridpur 11 varieties/lines were tested for one year and at Pabna 8 varieties/lines were tested for two years. Results revealed that except Tori-7 all the varieties produced similar yields ranging from 820 to 960 kg/ha at Faridpur. The lowest yield of 430 kg/ha was obtained from Tori-7. Along with the recommended varieties farmers of Faridpur were interested to grow the lines PT-303 and M-27 due to their yield potentialities. At Pabna, BARI Sharisha-8 produced the highest grain yield (1470 kg/ha) which is statistically similar to those obtained from BARI Sharisha-7 (1240 kg/ha), Jun-2592 (1150 kg/ha) and Daulat (1090 kg/ha) (Table 1).

Table 1. Yield obtained from different rapeseed and mustard varieties at FSRD sties Faridpur and Pabna

Variety/line	Yield (kg/ha)			
	Faridpur	Pabna		
	98-99	97-98	98-99	Mean
Tori-7	430	730e	1090cd	910
M-27	945	1040b	820e	930
PT-303	950	1020b	870de	950
BARI Sharisha-6	900	830bc	920de	1090
NAP-248	850	-	-	-
NAP-198	900	-	-	-
NAP-198	820	-	-	-
BARI Sharisha 8	940	1450a	1490a	1470
Jun-2592	910	900bc	1390ab	1150
Daulat	960	920bc	1250bc	1090
Punjab Rai	920	-	-	-
BARI Sharisha-7	-	1090b	1390ab	1240
CV (%)		1.32	9.6	

On-Farm trial of Chickpea variety

On-Farm performances of advance lines of chickpea were evaluated at the farmers field of FSRD site Faridpur during rabi 1998-99. Two advance lines viz. BCX 84012 and BCX 84021 and a local as check were tested under this trial. The advance line BCX 84012 produced the highest yield of 2.02 t/ha which was identical with the yield obtained from chickpea advance line BCx84021 (1.89 t/ha). Significantly the lowest yield was obtained from the local variety. Table 2. Yield performance of chickpea lines at FSRD site Faidpur 1998-99

Variety/line	Population/sq m. (no.)	Pods/plant (no.)	Seed/pod (no.)	1000 seed wt. (g)	Grain yield (t/ha)
BCX 84012	17.25	64.25	1.08	118.88	2.02
BCX 84021	16.75	66.00	1.07	118.43	1.89
Local	16.05	48.00	1.48	117.00	1.05
LSD _(0.05)	ns	ns	0.12	1.07	0.69
CV (%)	13.02	19.49	4.52	0.40	26.75

On-farm evaluation of Botrytis Grey Mould technology on chickpea

An experiment was conducted at FSRD site, Faridpur during 1998-99 to test and validate the suitability of a Botrytis Grey Mould (BGM) management options on chickpea in farmers field. A tolerant line ICCL-87322 with seed treatment and Bavistin spray was tested against a local with no chemical spray and seed treatment was used. No BGM infestation was observed in the tolerant line and the treatment produced significantly higher yield (2.13 t/ha) than the control (1.31 t/ha) (Table 3).

Table 3. Effect of Botrytis Grey Mould technology on chickpea at farmers field of FSRD site, Faridpur during 1998-99

Treatment	Population/sq m. (no.)	Pods/plant (no.)	1000 seed wt. (g)	Yield (t/ha)
T ₁ = Tolerant line + need based Bavistin spray + seed treatment	23	70	153	2.13
T ₂ = Local variety + no chemical spray	17	53	116	1.31
LSD _(0.05)	3.13	14.61	1.78	0.55
CV (%)	12.17	18.70	1.04	25.20

* Seed treatment with Vitavax-200 @ 2.5 gm/kg seed

**Foliar spray of Bavistin 0.1% suspension will be started at 50% flowering stage of the crop. Maximum three times spray is sufficient an interval of the spray will be 7-10 days.

Adaptive trial of summer Tomato at Noakhali

An On-farm adaptability trial was conducted to assess the yield performance of summer tomato and in saline area during rabi 1998-99. Four varieties of summer Tomato named BARI Tomato 4, BARI Tomato 5, Tomato 0825 and Tomato 0830 were tested under this trial. Establishment of the crop was severely affected due to heavy rainfall (2139 mm) and so average yield was comparatively poor. From the result it was revealed that BARI Tomato 4 has given the maximum yield of (12.0 t/ha) followed by BARI Tomato 5 (10.92) (Table 4). Due to high market price farmers were very much interested to grow this crop.

Table 4. Yield of summer tomato at Noakhali during 1998-99

Variety	Yield (t/ha)
BARI Tomato 4	12.01
BARI Tomato 5	10.91
Tomato 0825	9.05
Tomato 0830	7.60

Adaptive trial of new varieties of Potato at Noakhali

To find out a suitable variety for saline an on-farm adaptive trial on potato was conducted at Noakhali during rabi 1998-99. Four new varieties viz. Chamak, Ailsa, Dheera and Diamont were included in this trial. It was found that the new variety Dheera produced the superior yield of 17.30 t/ha and the yield obtained from other varieties were identical (Table 5). Poor yield may be overcome by advancing the planting time within early November.

Table 5. Yield obtained from some new varieties of potato at FSRD site, Noakhali during 1998-99

Varieties	Av. tuber yield (t/ha)	Range of yield (t/ha)
Chamak	10.00	5.72-23.07
Ailsa	11.10	7.6-24.35
Dheera	17.50	11-35.30
Diamont	10.14	5.5-19
LSD (0.05)	2.8	

On-Farm evaluation of Sweet Potato varieties

Performance of sweet potato varieties was evaluated at the farmers' field of FSRD site, Noakhali during 1998-99. Including local four varieties viz. Kamalasundari, BARI SP 4 and Daulatpuri were evaluated in the trial. Research revealed that tube yield obtained was significantly different by the varieties and all

Table 6. Yield of sweet potato varieties developed by BARI at FSRD site Noakhali during 1998-99

Varieties	Tuber yield (t/ha)	Net profit (Tk./ha)
Kamalasundari	29.03	50778
BARI SP 4	23.40	36703
Daulatpur	21.05	30828
Local	16.71	20978
LSD (0.05)	0.30	

the three varieties developed by BARI performed better than the local. Superior yield of 29.03 t/ha was obtained from Kamalasundari followed by BARI SP 4 (23.40 t/ha). The local variety yielded the lowest (16.71 t/ha) (Table 6).

Yield demonstration of wheat

Yield demonstration on different varieties/advance lines of wheat conducted at different FSRD and MLT sites during rabi season of 1998-99. Four varieties and seven advance lines were demonstrated under this trial to evaluate the yield performance at farmers' field of different AEZ. It was found from the results that yield performance of different varieties varied with the locations. On an average, all the varieties performed the best at Keshapur (4.27 t/ha) followed by Shyampur (3.68 t/ha) and Magura (3.65 t/ha). Among the new varieties Protiva yielded the best at Kishoregonj (3.35 t/ha) and Pabna (3.32 t/ha) Saurab at Nagarpur (3.75 t/ha) and Guarab at Shyampur (4.2 t/ha). The advance lines under trial were produced an average yield of more than 3 t/ha except in Kishoregonj (Table 7). At Shyampur the advance line BAW-923 produced the highest yield (3.94 t/ha) and BAW-989 at Keshabpur (5 t/ha) and BAW-936 at Magura (4.18 t/ha) (Table 7).

Table 7. Yield demonstrations of different varieties/lines of wheat at the farmers' field of different locations during the rabi season of 1998-99

Variety/ line	Yield (t/ha)							Mean
	Madhupur	Nagarpur	Kishoregonj	Pabna	Shyampur	Keshabpur	Magura	
Kanchan	2.06	2.75	3.90	2.87	3.74	4.00	3.48	3.11
Protiva	2.16	2.50	3.35	3.32	4.00	4.30	-	3.27
Sourab	2.31	3.75	2.40	-	3.80	-	-	3.07
Gourab	2.50	3.00	3.11	-	4.20	-	-	3.20
BAW-897	-	-	-	-	3.02	4.30	-	3.66
BAW-898	-	-	-	-	3.64	5.00	-	4.32
BAW-917	-	-	-	-	3.25	-	3.22	3.24
BAW-923	-	-	2.90	-	3.94	3.70	3.73	3.57
BAW-936	-	-	1.90	-	3.46	4.30	4.18	3.46
BAW-997	-	-	-	3.14	-	-	-	3.14
BAW-998	-	-	-	3.33	-	-	-	3.33
Mean	2.26	3.00	2.76	3.17	3.68	4.27	3.65	

Utilization of fisheries gher boundary through Agroforestry

The experiment was conducted at MLT site Dumuria during 1998-99 on the bund of fisheries gher (1.5 m wide). Saplings of Jujube, Koroi, Sissoo and Neem were planted during July 1996 at a planting distance of 5m. Vegetables like Okra, Brinjal, Snake gourd were also planted but were damaged due drought. Results revealed that among the four tree species Koroi and Sissoo performed better than the other two species in respect of height (3.20-3.92m) and diameter at breast height (1968 cm). Ribbed gourd yield ranged from 7.9 t/ha with Neem to 9.1 t/ha with Jujube (Table 3).

Table 3. Survival rate of tree species and effect of the species on the yield of ribbed gourd

Tree species planted	No. of Saplings	Plant survived after two year (no.)	Tree height attained after 2 year (m)	DBH after 2 years (cm)	Yield of ribbed gourd (t/ha)
Jujube	12	12	2.65	6.12	9.1
Koroi	12	10	3.20	19.68	8.6
Sissoo	12	11	3.92	19.63	8.0
Neem planted during 1997	12	8	2.50	8.18	7.9

Performance of potato yam grown on the existing homestead trees

The trial was conducted on the homestead trees of different MLT sites of Pabna, Faridpur, Mymensingh, Patuakhali, Khulna and Noakhali during 1998-99. Results that revealed among the locations Faridpur produced the highest yield of 4.18 kg yam/tree follow by Khulna (2.15 kg/tree) and Mymensingh (2.0 kg/tree). Among the tree species Drumstick (2.49 kg/tree) Ziga (2.35 kg/tree), Mander (2.39 kg/tree) and Pitraj (2.05 kg/tree) produced better yield than that of the other trees (Table 4.)

Table 4. Yield of potato yam on different supports over the locations

Yield of potato yam on different supports over the locations							
Support	Faridpur	Pabna	Mymensingh	Patuakhali	Khulna	Noakhali	Mean
Drumstick	3.92	1.5	2.23	-	2.30	-	2.49
Ziga	4.43	1.15	1.70	2.70	2.30	1.83	2.35
Mander	4.40	-	1.81	-	2.20	1.15	2.39
Pitraj	3.88	0.88	1.72	-	1.70	-	2.05
Jujube	-	-	-	-	-	1.50	1.50
Babla	-	-	-	1.40	-	-	1.40
Koroi	-	1.14	-	-	-	1.48	1.31
Vertical Bamboo	4.25	1.60	2.66	1.26	2.24	2.29	2.38
Mean	4.18	1.25	2.02	1.78	2.15	1.64	-

Feasibility of growing trees in the crop field

The experiment was conducted at Rangpur, Jessore and Mymensingh to study the performance of different tree species planted in crop fields. Results revealed that the end of 1st year all the sapling of Neem, Suktani and Koroi survived. At the end of 4th year survival of Sissoo was 83% and 56% at Jessore and Mymensingh respectively. Koroi survived better at Jessore (71%) than Mymensingh (17%). Survival of Mahogany was 61% at Mymensingh (Table 5).

Table 5. Survival of different tree species planted in the crop field over the locations

Tree species	Rangpur		Jessore		Mymensingh	
	Sapling planted (no.)	Survival 1 st year (no.)	Sapling planted (no.)	Survival 1 st year (no.)	Sapling planted (no.)	Survival 1 st year (no.)
Neem	2	2	-	-	-	-
Sissoo	8	5	18	83	18	56
Mehogoni	5	3	-	-	23	61
Suktani	9	9	-	-	-	-
Babla	-	-	16	63	-	-
Koroi	6	6	14	71	12	17

Table 6. Performance of tree species planted on the crop field at different locations

Tree species	Rangpur		Tangail		Jessore		Mymensingh	
	After 1 year		After 3 years		After 4 years		After 4 years	
	Pl. ht. (m)	DBH (cm)	Pl. ht. (m)	DBH (cm)	Pl.ht. (m)	DBH (cm)	Pl.ht. (m)	DBH (cm)
Neem	1.35	0.50	5.10	No	6.15	-	NA	-
Sissoo	2.18	1.30	3.57	-	6.15	8.90	-	39.27
Koroi	1.40	0.91	-	-	5.20	6.10	-	23.00
Mahogony	1.52	1.25	-	-	-	-	-	18.07
Suktani	3.30	-	-	-	-	-	-	-
Babla	-	-	4.75	-	6.30	8.30	-	-

DBH= Diameter at Breast Height

At Jessore and Mymensingh. Sissoo and Babla produced better plant during 4th year.

Pilot Production and Technology Transfer

Pilot production

Sl. no.	Title	Location	Area/ pits	No. of farmers	Yield/impact
1.	Pilot production of Radish (Tasakistan)	Hathazari Faridpur	731m ² 860m ²	3 5	24.00-70.00 t/ha. Farmers liked to grow this crop.
2.	Pilot production of Countrybean (BARI Sheem 1)	Hathazari Pabna Rangpur Faridpur	258m ² 43 pits 94 pits 200m ²	6 43 94 5	8.8-17.36 t/ha. Farmers liked it for early harvest.
3.	Pilot production of Tomato (Ratan)	Hathazari	350m ²	1	18.26 t/ha. Farmers liked to grow this crop.
4.	Pilot production of Tomato (Manik)	Hathazari	245m ²	1	22.24 t/ha. Farmers liked to grow this crop.
5.	Pilot production of Bottle gourd (BARI Lau-1)	Hathazari Tangail Mymensingh Pabna Faridpur Rangpur	19 pits 36 pits 11 pits 43 pits 230m ² -	6 36 11 43 5 102	34-37.7 t/ha. It was better in respect of yield. Colour is not attractive. Less interested to purchase. Less taste than local.
6.	Pilot production of Okra (BARI Dherosh-1)	Mymensingh Jamalpur Rangpur Faridpur	- 600m ² - 1200m ²	- 6 39 -	4.52-26.00 t/ha. It is a virus resistant variety.
7.	Pilot production of Chilli + Maize intercropping	Hathazari	1087m ²	3	173-360 kg/ha of Chilli and 212-409 kg/ha of Maize. Due to severe drought in reproductive stage. Yield was low. This intercropping is increasing day by day.
8.	Pilot production of Sweet gourd + Maize intercropping	Hathazari	1170m ²	3	Sweet gourd yield 23 t/ha & 394-577 t/ha of Maize. This intercropping is increasing day by day.
9.	Pilot production of Wheat (Kanchan)	Tangail	1.09 ha	8	1.98 t/ha. Higher yielder than other variety. Less disease susceptible.
10.	Pilot production of newly released Lentil variety (BARI Moshur-4)	Jessore Bogra	- 600- 1000m ²	6 6	1.45-1.52 t/ha.

Sl. no.	Title	Location	Area/ pits	No. of farmers	Yield/impact
11.	Pilot production of Mustard (BARI sharish-8)	Rangpur	-	155	1.4-1.8 kg/ha. Higher yielder than local ones. The variety was included in the Boro-T.Aman pattern. 93% farmers preserved seeds.
12.	Zero tillage Potato cultivation	Comilla	600m ²	5	18-22 t/ha. Farmers were interested for the technology.
13.	Evaluation of traditional Chula at farmers level	Jamalpur	-	10	Improved BARI Chula is more effective than traditional chula. It saves fuel and time.
14.	Pilot production of Mungbean (Kanti)	Paba	1000m ²	10	797 kg/ha.
Total		27	2.04 ha 246 pits	612	

Technology Transfer

a. Crops and Cropping pattern at FSRD sites

Technology	Location (no.)	Area (ha)	Farmers' involved (no.)	Yield/impact
BARI Lau-1	7	2.852	136	Vegetable yield ranged from 32 to 75 t/ha. Seed yield ranged from 22-185 kg/ha
		739 ^a	199	Number of Lau/homestead ranged from 15-53
BARI Sheem-1	6	3.973	126	Yield ranged from 6.25 to 8.2 t/ha. Seed yield ranged from 750-969 kg/ha.
		328 ^a	328	Vegetables yield: 17.36 t/ha. Seed yield: 858 kg/ha.
Country bean	1	0.02	5	Vegetables yield 8.2 t/ha.
Radish (Tasakistan)	5	6.811	44	Root yield: 10.93 to 70.00 t/ha Seed yield: 220-286 kg/ha.
Radish (Pinki)	2	0.205	3	Vegetables yield: 13.35 t/ha Seed yield: 7.5 t/ha.
BARI Pijaj-1	1	0.004	1	Bulb yield: 7.5 t/ha
Tomato (Ratan)	5	4.545	39	Yield: 13.44 to 28.32 t/ha Seed yield: 20-48 kg/ha.
BARI Tomato-5	4	0.462	19	Yield: 9.93-23.91 t/ha

Technology	Location (no.)	Area (ha)	Farmers' involved (no.)	Yield/impact
BARI Tomato-4	2	0.263	8	Yield: 14.33-21.3 t/h.
Tomato (Manik)	1	0.024	1	Yield: 22.24 t/ha.
BARI Dherosh-1	4	3.15	83	Yield: 22-22.65 t/ha.
TM-0825	1	0.023	5	Yield: 6.95 t/ha.
Brinjal (Khatkhatia)	1	0.16	1	Yield: 3.70 t/ha Seed yield: 120 kg/ha.
Brinjal (Uttara)	1	0.24	4	Yield: 32.66 t/ha Seed yield: 104 kg/ha.
Brinjaj (Islampuri)	1	0.16	3	Yield: 57.14 t/ha Seed yield: 493 kg/ha.

Technology	Location (no.)	Area (ha)	Farmers' involved (no.)	Yield/impact
Cauliflower	1	0.21	6	Yield: 9.88 t/ha Seed yield: 240 kg/ha.
Cauliflower (white contesa)	1	0.87	4	Yield: 45.0 t/ha
Spinach	1	0.005	1	Seed yield: 600 kg/ha
Chinashak	1	0.005	1	Seed yield: 600 kg/ha
Batishak	1	0.005	1	Seed yield: 600 kg/ha
Lalshak	1	0.005	1	Seed yield: 600 kg/ha
Cabbage (Provati)	1	0.16	3	Yield: 12.35 t/ha Seed yield: 37 kg/ha
Cabbage (KK cross)	1	0.96	3	Yield: 61 t/ha
Chickpea (Seed exchange)	1	30.5	150	Grain yield: 0.89 t/ha.
Chickpea (BARI Chola-4)	1	0.04	1	Yield: 1.2 t/ha
Wheat	1	25.5	155	Grain yield: 2.09-2.53 t/ha
Mustard	1	8.5	49	Grain yield: 0.59-0.79 t/ha
Sunflower	1	36	47	Grain yield: 1.02 t/ha
Papaya	1	2.0	18	Fruit yield: 34.76 t/ha.
Sesame (T6)	1	2.28	15	Grain yield: 1.15 t/ha
BARI Sharisha-6	1	0.48	4	Grain yield: 1.42 t/ha

Technology	Location (no.)	Area (ha)	Farmers' involved (no.)	Yield/impact
BARI Sharisha-7	1	4.40	66	Grain yield: 1.3 t/ha
BARI Sharisha-8	4	38.42	200	Grain yield: 0.79 to 1.80 t/ha
Pop corn	1	0.1	1	Grain yield: 2.1 t/ha
Wheat (Kanchan)	1	8.83	34	Grain yield: 2.53 t/ha
Foxtail millet	1	0.25	3	Grain yield: 0.75 t/ha
Zero tillage of maize after flood (Barnali)	1	0.2	3	Grain yield: 5.9 t/ha
Zero tillage of blackgram after flood	1	0.6	2	Grain yield: 4.67 t/ha
BRRRI Dhan-30	2	4.87	20	Grain yield: 4.03 t/ha
BRRRI Dhan-31	1	0.71	4	Grain yield: 4.27 t/ha
BRRRI Dhan-32	3	17.46	14	Grain yield: 3.58 to 5.45 t/ha
Potato (TPS)	1	0.25	NA	Tuber yield: 20.0 t/ha
Lentil (BARI Moshur-3)	1	0.20	3	Grain yield: 0.915 t/ha
BARI Moshur-4	2	0.52	9	Grain yield: 0.567-1.09 t/ha. Leaf rust and leaf blight was the cause of low yield.
BARI Chola-4	1	0.04	NA	Grain yield: 1.2 t/ha
Late Jute seed	1	0.032	3	Seed yield: 875 kg/ha
Mustard-Boro-T.Aman CP	1	0.4	2	Yield of Tori-7: 0.90 t/ha BRRRI Dhan-29: 5.80 t/ha
Wheat-Jute-T.Aman CP	1	0.72	6	Wheat yield: 3.07 t/ha
Wheat-GM-T.Aman CP	1	2.5	11	Tested pattern gave higher yield of wheat (3.04 t/ha) and T.Aman (3.65 t/ha) against 2.49 and 3.31 t/ha respectively in farmers pattern. Farmers are motivated to produce GM.
Wheat-Jute-T.Aman CP	1 1	1 1	8 10	Yield of Kanchan: 1.98 t/ha Wheat yield: 2.71 Rice yield: 3.59 t/ha Jute fibre yield: 1.85 t/ha
Mungbean-T.Aus-T.Aman CP	1	1.13	22	Mungbean: 800 kg/ha T.Aus: 3.50 t/ha T.Aman: 3.00 t/ha
Intercropping sugarcane	1	0.73	7	Lalshak: 118 kg/ha

Technology	Location (no.)	Area (ha)	Farmers' involved (no.)	Yield/impact
with different crops				Garlic: 955 kg/ha Mungbean: 650 kg/ha
Zero tillage potato	1	0.17	9	Heera: 32 t/ha Binola: 21 t/ha
Potato-Jute-T.Aman CP	1	4.83	29	Potato: 26.06 t/ha O-9897: 2.13 t/ha BRRD Dhan-32: 3.72 t/ha
Wheat-Jute-T.Aman CP	1	4.74	23	Kanchan: 2.62 t/ha O-9897: 2.04 t/ha BRRD Dhan-32: 3.69 t/ha
Mustard-Boro-T.Aman CP	1	4.96	24	BARI Sharisha-8: 1.68 t/ha BRRD Dhan-32: 3.8 t/ha
Wheat-GM-T.Aman CP	1	10	36	Wheat: 2.09 t/ha GM: 15.0 t/ha Rice: 2.90 t/ha
Chickpea-GM-T.Aman CP	1	10	19	Chickpea: 0.85 t/ha GM: 15.0 t/ha Rice: 2.87 t/ha
Intercropping T.Aman with Dhaincha	1	35	-	Fuel: 440 kg/ha Seed: 130 kg/ha
Production of Dhaincha seed and fuel	1	-	-	In wasteland, Seed: 923 kg/ha Fuel: 8.5 t/ha In pond bank, Seed: 833 kg/ha Fuel: 7.0 t/ha

b. Crops and cropping pattern under BARI-GKF, Rangpur

Technology	Area (ha)	Farmers' involved (no.)	Yield/impact
Cabbage (Provati)	8	77	Vegetable: 18.15 t/ha
Cauliflower (Agrahayani)	48.01	301	Vegetable: 16.58 t/ha
Spinach (Kapipalang)	0.81	13	Vegetable: 6.45 t/ha Seed: 1.63 t/ha
Indian spinach (Local improved)	0.27	7	Seed: 43.3 kg/ha
Kangkong (BARI)	0.31	8	Seed: 883 kg/ha
Red amaranth (Altapati)	4.63	34	Seed: 795 kg/ha
Amaranth (Bashpati)	0.40	4	Seed: 819 kg/ha

Technology	Area (ha)	Farmers' involved (no.)	Yield/impact
Batishak (BARO)	8.13	39	Seed: 514 kg/ha
Chinashak (BARI)	1.70	17	Seed: 568 kg/ha
Potato (Cardinal)	1.43	5	Seed: 21.72 t/ha
Tuberlet production from TPS	0.17	10	Seed: 26.32 t/ha
Red amaranth (Kharif)	3.22	29	Seed: 778 kg/ha
Snake gourd	0.93	15	Seed: 379 kg/ha
String bean (Kagornatki)	NA	NA	Vegetable: 2.77 t/ha Seed : 1.06 t/ha
Okra (BARI Dherosh-1)	9.88	62	Vegetable: 10.75 t/ha Seed: 1.08 t/ha
Cucumber (Baromashi)	0.48	4	Vegetable: 3.98 t/ha Seed: 127 kg/ha
Aroid (local)	119.7	590	Yield: 9.15 t/ha
Onion (local)	91.25	435	Bulb: 10.11 t/ha
Snake gourd (Zhoom long)	0.93	15	Vegetable 5.24 t/ha Seed: 379 kg/ha
Jute (O-9897)	1.31	19	Seed: 622 kg/ha
Maize (Hybrid)	81.5	436	Grain yield: 5.35 t/ha
Wheat (kanchan & provati)	71.9	427	Yield: 2.44 t/ha
Mustard (BARI Sharisha-8)	29.59	166	Yield: 1.58 t/ha
Mustard (Rai)	17	79	Yield: 1.29 t/ha
Mustard (Tori-7)	9	62	Yield: 0.89 t/ha
Boro rice (HYV)	388.4	1442	Yield: 4.62 t/ha
T.Aman rice (HYV)	196.4	1292	Yield: 3.61 t/ha

c. Plantation trees

Technology	Location (no.)	Number	Farmers' involved (no.)	Yield/impact
BARI Litchi-1	1	250	35	Age: 2 yr. yet to bear
BARI Litchi-2	2	57	57	Planted on May 1999
BARI Litchi-3	2	39	26	Bearing stage and some were planted on May 1999
Lemon (Improved kagogi)	2	170	30	Age: 2 yr. yet to bear

Technology	Location (no.)	Number	Farmers' involved (no.)	Yield/impact
BARI Lemon	2	48	48	Planted on May 1999
Seedless lemon	2	19	16	Bearing stage some were planted on May 1999
BARI Pomelo-1	1	50	50	Age: 2 yr. yet to bear
BARI Oranage-1	1	10	10	Age: 2 yr. yet to bear
BARI Guava-1	4	282	154	Bearing stage some were planted on May 1999
BARI Guava-2	2	16	8	Age: 1 year
Mango	3	509	184	Bearing stage some were planted in last year
BARI Sofeda	1	20	20	Growing stage
Passion fruit	1	20	20	Growing stage
Shahi papaya	1	15	15	Growing stage
Drumstick	1	-	-	Plantation completed
Budding of Jujube	2	25	15	Budding completed
Tree management	2	70	-	Middle age
Nursery establishment	1	-	-	Age: 1 year
Mango hopper and anthracnose control	6	2262	885	No sign of insect attack and diseases. Production increased manifold (5 times). Farmers are enthusiastic to adopt the technology.

d. Other improved technology

Technology	Location (no.)	Number	Farmers' involved (no.)	Yield/impact
Improved BARI Chula	2	60	60	Use of BARI Chula progressively increased

e. Livestock

Technology	Location (no.)	Animal/Bird (no.)	Farmers' involved (no.)	Yield/impact
Deworming of dairy cow	7	140	125	Animal health improved and milk production increased. Farmers were trained and motivated.
Beef fattening with UMS	7	58	58	Body weight gain ranged from 392-750 g/day/bull as against 90-155 g/day/bull. Farmers were motivated slowly. But some ones were hesitant. Farmers' need trained.
Chick rearing	3	190	6	Net profit ranged Tk. 9.92-10.80/bird. Cash support was needed for adoption.
			30	Improved training.
Poultry vaccination	5	3025	120	No mortality of the vaccinated birds. Farmers' were trained and motivated.
Layer bird (Fayoumi)	1	66	4	BCR: 1.3. Farmers' were motivated.
Broiler chick rearing	6	6025	30	One farmer succeeded up to 5 th batch in one year. After sixth week average body weight gain was 1750-2200 gm/bird by using protein concentrate, which was profitable. Farmers' were motivated.
Vaccination to cattle	2	201	60	No mortality of the vaccinated cattle. Farmers' were motivated.
Goat rearing by concentrate feeding	1	-	-	Highest body weight gained in 100% concentrate group. But highest net return was found in 50% concentrate group.
Preservation of wet straw in rainy season & feeding	1	6	6	Average growth rate of Bull & Heifer was increased by 386 & 288 g/day, respectively. Milk yield was increased by 10 ml/day.

f. Fishery

Technology	Location (no.)	No. of ponds/ rice field	Farmers' involved (no.)	Yield/impact
Monoculture of Rajpunti	3	10	10	Rajpunti weight gain ranged from 1.60 to 1.75 t/ha. Farmers were motivated to use balance feed.
Polyculture of fish (Rohu, Catla, Mrigal, Silver carp, Mirror carp & Grass carp)	1	2	2	Stocking density was 30/dec. Initial weight of fish ranged from 15.9g to 25.4g. After 9 months fish weight gain ranged from 100g to 2.0kg/pond.
Polyculture of fish (Rohu, Catla, Mrigal, Silver, Mirror & Grass carp)	2	0.084	4	After 6 months yield was 2.5 t/ha. Farmers were motivated.
		5	5	Final weight gain 95g/piece after 4 months as against 9 g/piece (initial).
Carp-Pangas polyculture system	1	6	6	Production: 3. t/ha.
Polyculture of fish (Silver carp, Rohu, Mrigal & Grass carp)	1	5	5	Stocking density of fish 35/dec. After 6 months average fish production is 2.05 t/ha. Net profit was Tk. 77419/ha.
Mixed culture of fish (Hybrid magur, GIFT & Rohu)	1	2	2	Stocking density of fish 80/dec. After 4 months average fish production is 2.5 to 3.0 t/ha. Net profit was Tk. 48968/ha.
Mixed culture of fish (GIFT & Mrigal)	1	1	1	Stocking density of fish 30/dec. After 4 months average fish production is 710 kg/ha. Net profit was Tk. 15561/ha.
Polyculture of fish (Rajpunti, Rohu, Catla & Mrigal)	1	3	3	Stocking density of fish 54/dec. After 6 months average fish production is 2.75 t/ha. Net profit was Tk. 13836/ha.
Polyculture of fish	1	6	6	Fingerlings were released in pond.
Rice + Fish culture	2	13	13	Farmers are motivated slowly. But some ones are not choosing the technology. Rajpunti & Common carp performed well.
Mixed culture of GIFT and Mrigal in the backyard ditches	1	1	1	Average yield was 701.48 kg/ha in 4 months.

Training and Field days

a. Training

Area of training	Location	No. of	Participants
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	(no.)	course	Category	Number
Computer skill and data collection	1	3	Scientists	
Farming System Research and Development	9	13	Farmer	588
Soil Fertility and Fertilizer management	10	15	Scientists SSA/SA Farmer	719

b. Field day

Area of training	Location (no.)	No. of course	Participants	
			Category	Number
Cropping pattern and component technology	9	23	Scientists, Extension officials, NGO and Farmers	1304
Soil Fertility and Fertilizer management	9	18	Scientists, Extension officials, NGO and Farmers	957
Vegetable seed production and technology transfer	1	5	Scientists, Extension officials, NGO and Farmers	400
Crop Museum	1	1	Scientists, Extension officials, NGO and Farmers	