INTEGRATED NUTRIENT MANAGEMENT FOR BORO-T.AMAN RICE CROPPING PATTERN IN THE LEVEL BARIND TRACT AREA (AEZ-25)

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ABSTRACT

The experiment was conducted at Joypurhat MLT Site, Bogra (AEZ-25) during 2001-03 to find out a different nutrient management packages for Boro-T.Aman rice cropping pattern. The experiment was laid out following RCBD with six treatments including one farmers' practice and one fertilizer control in six dispersed replications. The other four treatments were soil test based (STB) fertilizer dose for moderate yield goal (MYG) and high yield goal (HYG), STB based fertilizer dose for HYG plus cowdung (5 t/ha) and fertilizer dose as per country's Fertilizer Recommendation Guide (FRG '97). For the average result of three consecutive years it was indicated that the highest grain yield of Boro (5.487 t/ha) and T.aman (4.75 t/ha) were obtained from IPNS. The highest average gross margin was Tk.33556 /ha and MBCR (1.65) in Boro rice over control. The highest gross margin (Tk. 31276 /ha) and MBCR (1.93) of T.aman rice were also obtained from IPNS over control. So the IPNS was economically and agronomically profitable dose of fertilizer for the level Barind Tract area (AEZ-25).

Key words: High yield goal, Moderate yield goal, Boro, T.aman, Level Barind Tract, yield

INTRODUCTION

Soil fertility declining day by day is a major reason for lower crop yield in Bangladesh. Intensive cropping use of modern varieties, imbalanced use of fertilizer and higher decomposition of organic matter are the principal factors for soil fertility depletion in the country. A crop production system with high yield targets cannot be sustainable unless balanced nutrient inputs are supplied to soil against nutrient removal by crops (Bhuiyan *et al*. 1991). Available data indicate that the soil fertility in Bangladesh is in declining trend (Karim *et al*. 1994; Ali *et al*. 1997) which is responsible for declining crop yields (Anon. 1996; Cassman *et al*. 1995). Rice is the main crop of this region. T.Aman rice using rain water, Boro-T.aman rice cropping pattern is one of the major dominant cropping pattern in the greater Bogra district. Neither organic manure nor chemical fertilizer alone can increase satisfactory yield under intensive farming. The use of chemical fertilizer as supplemental source of nutrients has been increasing steadily in Bangladesh. However most of the farmers' usually do not apply fertilizer in balanced proportion (Anon. 1997). The present system of fertilizer replication is mostly based on the nutrient requirement of individual crops ignoring the carry –over effect of the manure or fertilizer applied to the preceding crop. Organic sources of nutrients applied to preceding crop can benefit the succeeding crop to a great extent (Singh *et al*. 1996; Hedge, 1998) through integrated use of organic and inorganic sources of nutrients (Singh and Yadav, 1992). Therefore, a judicious integration of chemical fertilizer along with organic manure may help to maintained soil fertility as well as increase crop productivity. In this reason, the present study was carried out to find out a cropping system based fertilizer dose of organic and inorganic sources of nutrients and to determine the economic dose of nutrients for Boro-T.aman rice cropping pattern for the Level Barind Tract at greater Bogra under AEZ-25.

MATERIALS AND METHODS

The experiment was conducted at MLT site Joypurhat under Bogra during 2001, 2002 and 2003 in AEZ-25. Before starting the experiment, one dominant cropping pattern Boro–T.aman was selected. It was done following discussion with local farmers, DAE personnel and available secondary information. The experimental site was medium high land and it belongs to the agro ecological zone Level Barind Tract (AEZ-25). Annual rainfall of the site was irregular and varied from 1400-2400 mm. Average maximum temperature was 31.5^{o}c and average minimum temperature was 21.15^{o}c. Before conducting the experiment soil samples were collected from farmers' field and then sent to the laboratory for chemical analysis. The chemical properties of the soil are presented in Table 1. The experiment was laid out following RCBD with six treatments in six dispersed replications. The unit plot size was 10m X 10 m constant for the whole cropping pattern. After getting the results of soil analysis value fertilizer doses were estimated with the help of soil analysis value as per treatment concerned. The estimated fertilizer doses for Boro and T.aman rice were presented in the Table 2. Six different fertilizer packages were tested and the details of the treatments were as follows:

T_1 (ED_1) = Estimated inorganic fertilizer dose for moderate yield (MYG)
T_2 (ED_2) = Estimated inorganic fertilizer dose for high yield (HYG)
T_3 (IPNS) = Integrated nutrient management for high yield goal (cowdung was used)

T_4 (FRG'97) = Fertilizer does as per BARC Fertilizer on Recommendation Guide' 97.
T_5 (FP) = Local farmers practice (Average of 40 farmers data)
T_6 (control) = Absolute control.

Table 1. Soil analysis values of different samples collected from MLTs Joypurhat

Rep. No.	Analyzed results							
	PH	Total N (%)	P	K	S	B	Zn	OM (%)
			ppm	M.cq/100g soil	Microgram/g soil			
1	5.8	0.10	1.0	0.09	8.5	0.05		1.93
2	5.4	0.09	4.3	0.07	6.5	0.14		1.71
3	5.8	0.08	2.2	0.09	7.1	0.14		1.60
4	5.7	0.10	3.3	0.08	7.5	0.05		2.02
5	5.6	0.09	3.1	0.07	6.1	0.03		1.72
6	5.0	0.10	6.6	0.06	8.4	0.31		1.87
Average	5.55	0.093 L	3.42 VL	0.076 L	7.35 VL	0.12 VL		1.8

L= Low, VL= Very Low, OM=Organic matter

Table 2. Different nutrient management packages used in Boro-T.aman rice cropping pattern during experimentation

Treatments	N	P	K	S	Zn	B	*CD
	Kg/ha						t/ha
Boro rice							
T1 (ED1)	97	25	60	17	1.5	-	-
T2 (ED2)	136	35	83	23	2.0	-	-
T3(IPNS)	121	30	68	23	2.0	-	5
T4(FRG,97)	110	25	65	15	1.0	-	-
T5(FP)	87	26	40	3	1.0	-	-
T6(Control)	0	0	0	0	0	0	0
T.aman rice							
T1 (ED1)	67	11	42	6	-	-	-
T2 (ED2)	91	14	54	8	-	-	-
T3(IPNS)	76	9	44	8	-	-	5
T4(FRG,97)	75	12	40	5	-	-	-
T5(FP)	71	10	23	-	-	-	-
T6(Control)	0	0	0	0	0	0	0

*CD=Cowdung

For Boro rice (variety BRRI dhan-29), the land was puddled well, 45-48 days old seedlings of Boro rice were transplanted on 24-26 January, 2001, 27-31 January, 2002 and 3-10 February, 2003, respectively in the three consecutive years. The seed rate was 50 kg/ha during three years. Furadan 15 kg/ha was used at rapid tillering stage. The crop was harvested on 14-17 May, 2001, 17-22 May, 2002 and 18-27 May, 2003, respectively.

For T.aman rice (variety BR-11), the land was puddled well. 30-35 days old seedling were transplanted on 25-28 July, 2001, 16-24 July, 2002 and 20-26 July, 2003 in the year of 2001,2002 and 2003 respectively. The seed rate was 50 kg/ha during those years. Furadan at the rate of 15 kg/ha was used at rapid tillering stage. The crop was harvested on 24-28 November, 2001, 14-20 November, 2002 and 18-24 November, 2003 in the three consecutive years. In both Boro and T.aman rice entire TSP, MP, Gypsum and 1/3rd urea were applied as basal. The second 1/3rd urea was applied at rapid tillering stage and the rest 1/3rd urea was applied before panicle initiation stage. In every year Boron and Zincsulphate were applied only in Boro rice in full dose during land preparation. Data on yield and yield contributing characters of Boro and T.aman rice were recorded and analyzed statistically. Statistical analysis for F-test was performed and means were compared by DMRT.

Cost and return analysis was done for net return and marginal benefit cost ratio for different treatments.

RESULTS AND DISCUSSION

Three years mean performance of different nutrient management packages on Boro and T.aman in Boro-T.aman rice cropping pattern are presented in Table 3.

Table 3. Mean performance of different nutrient management packages on Boro and T. Aman in Boro-T. Aman rice cropping pattern averaged over per year (Average of three years)

Treatments	Plant height (cm)	Tiller/hill (no)	Grain/Panicle (no)	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
			Boro			
T1 (ED1)	94.76 b	21.38 b	150.0 ab	21.95 b	4.673 b	7.825 c
T2 (ED2)	95.88 a	22.87 a	152.8 ab	22.37 a	5.422a	8.591b
T3(IPNS)	96.55 a	23.09 a	156.0 a	22.53 a	5.487a	8.808a
T4(FRG,97)	94.41 bc	21.47 b	144.8 bc	21.98 b	4.581b	7.673 c
T5(FP)	93.44 c	19.82 c	139.4 c	21.58 c	4.052c	7.136 d
T6(Control)	82.29 d	14.54 d	123.1 d	21.07 d	2.737d	5.202 e
LSD(0.05)	1.082	0.5735	8.244	0.244	0.113	0.1585
F-Test	*	*	*	*	*	*
CV (%)	1.75	4.21	8.6	1.68	3.77	3.17
			T. Aman			
T1 (ED1)	98.76 c	12.17 c	99.11 c	23.43 b	3.99c	7.37 d
T2 (ED2)	101.8 b	13.17 b	105.0 b	23.9 a	4.56 b	8.07 b
T3(IPNS)	104.6 a	13.86 a	108.6 a	24.03 a	4.75 a	8.57 a
T4(FRG,97)	97.2 d	12.09 c	99.64 c	23.51 b	4.07 c	7.69 c
T5(FP)	94.36 d	11.42 d	94.85 d	23.18 c	3.41 d	6.90 e
T6(Control)	80.42 e	6.61 e	67.29 e	22.76 d	2.14 e	4.75 f
LSD(0.05)	2.065	0.506	2.658	0.217	0.144	0.307
F-Test	*	*	*	*	*	*
CV (%)	3.23	6.6	4.18	1.39	5.66	6.43

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

In case of Boro rice, the higher and identical plant height was produced by IPNS (96.55 cm) and ED_2 (95.88 cm) which were closed to ED_1 (94.76 cm). FRG'97 (94.41 cm) produced similar to ED_1 and FP (93.44 cm). The higher and identical tiller per hill was produced by IPNS (23.09) and ED_2 (22.87) followed by statistically identical FRG'97 (21.47) and ED_1 (21.38). The higher number of grain per panicle was produced by IPNS (156) which was similar to ED_2 (152.8) and ED_1 (150). The higher and identical 1000 grain weight was produced by IPNS (22.53 g) and ED_2 (22.37 g) followed by statistically identical ED_1 (21.95 g) and FRG'97 (21.98 g). The higher and identical grain yield was produce by IPNS (5.487 t/ha) and ED_2 (5.422 t/ha) followed by statistically identical ED_1 (4.673 t/ha) and FRG'97 (4.58t/ha). The farmers' practices (FP) produced 4.052 t/ha yield. The higher straw yield was produced by IPNS (8.808 t/ha) followed by ED_2 (8.59 t/ha). The FRG'97 (7.73 t/ha) and ED_1 (7.825 t/ha) produced identical straw yield. The treatment T_6 (control) produced the lowest performance in all yield contributing characters and finally yield of grain (2.737 t/ha) and straw (5.202 t/ha). Ishaque *et a*l. (1994) reported that the addition of cowdung along with soil test based fertilizer dose for high yield goal (IPNS) did not increase grain yield as compared to soil test based fertilizer dose for high yield goal (ED_2) without manure. Ali *et al*., (2001) reported that 50% N as cowdung + 50% N as urea was superior to 100% N as urea or 100% N as cowdung.

In case of T.aman rice, the higher plant height was produced by IPNS (104.6 cm) followed by ED_2 (101.8 cm) and ED_1 (98.76 cm). The treatment IPNS (13.86) produced the higher tiller per hill followed by ED_2 (13.17). The treatment ED_1 (12.17) and FRG'97 (12.09) showed identical tiller per hill. The higher grain per panicle was produced by IPNS (108.6) followed by ED_2 (105.0). The treatment ED_1 (99.11) and FRG'97 (99.64) resulted identical in grain per panicle .The higher and identical 1000 grain weight was produced by IPNS (24.03 g) and ED_2 (23.9 g). The treatment ED_1 (23.43 g) and FRG'97 (23.51 g) were identical in 1000 grain weight. The treatment IPNS (4.75 t/ha) produced higher grain yield followed by ED_2 (4.56 t/ha). The treatment ED_1 (3.99 t/ha) and FRG'97 (4.07 t/ha) produced identical yield. The farmers practice produced 3.41 t/ha grain yield. The treatment IPNS (8.78 t/ha) produced higher straw yield followed by ED_2 (8.07 t/ha), ED_1 (7.37t/ha), FRG'97 (7.69 t/ha) and FP (6.90 t/ha). The control treatment produced the lowest performance in all yield contributing

characters including grain yield (2.14 t/ha) and straw yield (4.72 t/ha). Mannan *et al*. (2000) reported that manuring with cowdung upto 10 t/ha in addition to recommended inorganic fertilizers with late N application improved grain and straw yields and quality of T.aman rice over inorganic fertilizers alone. Kader *et al*. (1998) reported that a combination of inorganic fertilizers with organic fertilizer (cattle manure) or combination of inorganic fertilizers with bio-fertilizers gave the best yield and growth of transplanted rice.

Cost and return analysis

Average crop wise cost and return analysis of different fertilizer nutrient management packages in Boro-T.aman rice cropping pattern are presented in Table 4. Yield and yield contributing characters were presented here through combined analysis of three years data. Average three years yield of Boro rice indicated that the highest gross margin (Tk. 33556 /ha) and MBCR (1.65) were produced by IPNS. The treatment ED_2 were produced second highest gorss margin (Tk.32943/ ha) and MBCR (1.62), respectively. The farmers practice (FP) produced the lowest gross margin (Tk. 25925 /ha) and MBCR (1.27) over control. In case of T.aman rice the highest gross margin (Tk. 31276 /ha) and MBCR (1.93) were produced by IPNS. The farmers practice (FP) produced the lowest gross margin (Tk. 23647 /ha) and MBCR (1.45) over control.

Table 4. Average crop wise cost and return analysis of different fertilizer nutrient management packages in Boro –T.aman rice cropping pattern at MLT site Joypurhat under Bogra during 2001-03. (Average of three years)

Treatments	Grain yield (t/ha)	Straw yield (t/ha)	GR(Tk/ha)	VC* (Tk/ha)	GM (Tk/ha)	MBCR
Boro						
T1 (ED1)	4.673 b	7.825 c	34287	4747	29540	1.45
T2 (ED2)	5.422a	8.591b	39539	6596	32943	1.62
T3(IPNS)	5.487a	8.808a	40070	6514	33556	1.65
T4(FRG,97)	4.581b	7.73 c	33642	4856	28786	1.41
T5(FP)	4.052c	7.136 d	29906	3981	25925	1.27
T6(Control)	2.737d	5.202 e	20392	0	20392	--
			T. Aman			
T1 (ED1)	3.99c	7.37 d	29620	2508	27112	1.67
T2 (ED2)	4.56 b	8.07 b	33675	3277	30398	1.87
T3(IPNS)	4.75 a	8.57 a	35265	3289	31276	1.93
T4(FRG,97)	4.07 c	7.69 c	30300	2622	27678	1.70
T5(FP)	3.41 d	6.90 e	25615	1968	23647	1.45
T6(Control)	2.14 e	4.75 f	16270	0	16270	---

From the above discussion it was revealed that the highest average grain yield of Boro and T.aman rice were obtained from IPNS due to positive effect of organic recycling which improved nutrient uptaking system by the plants for a long period. Considering the yield and soil fertility for sustaining crop production, IPNS practice can be recommended for farmers' use in the Level Barind Tract area (AEZ-25).

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