

CROPPING PATTERN BASED FERTILIZER RECOMMENDATION FOR MUSTARD -BORO-T. AMAN RICE CROPPING PATTERN UNDER AEZ-25 AT NANDIGRAM, BOGRA

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ABSTRACT

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An experiment was conducted at Nandigram Multilocation Testing (MLT) Site, Bogra (AEZ-25.) during 2003-04, 2004-2005 and 2005-06 to determine the optimum fertilizer dose for Mustard -Boro-T. aman rice cropping pattern which enhancing total production and profit. Six different doses of fertilizer were estimated from soil test value, BARC Fertilizer Recommendation Guide' 97 and Farmers practice. From the average of three years results it was found that the highest grain yield and gross margin were obtained from (T₂) soil test base (STB) fertilizer dose for high yield goal (HYG) in all crops and it was followed by IPNS (T₃). The lowest grain yield and gross margin from T₆ (Absolute control) in all crops. On the basis of yield and economic return, the soil test base fertilizer dose may be recommended for Mustard -Boro T. aman rice cropping pattern in the Level Barind Tract soil (AEZ-25) at Nandigram, Bogra. The application of organic manure (4-5 t/ha) once in a year could be suggested for sustaining soil fertility.

Key Words: High yield goal, Mustard, Boro,T.aman, Level Barind Tract soil, Yield

INTRODUCTION

Soil fertility is a dynamic property which varies with crops, cropping intensity and input use. More than 50% of our cultivated soil contains organic matter below the critical level (1.5%). Annual depletion of plant nutrients in the intensively cropped area ranges from 180 to more than 250 kg/ha. High and medium high land comprising 60% of total cultivated land which is in most cases deficient in essential nutrients such as nitrogen, phosphorus, potassium and Sulphur. The low organic matter content, higher cropping intensity, improper cropping sequence and faulty management practices are the major causes of depletion of soil fertility. Imbalance use of fertilizer is another serious problem for the country. Previous survey revealed that farmers in many areas in Bangladesh applied nitrogenous fertilizer higher than the recommended dose for some crops. They usually did not use any organic fertilizers. Scarcity of fuel led them to use cowdung and crop residues as domestic fuel. To maintain and improve soil fertility and organic matter content of the soil it felt necessary to use organic manures along with inorganic fertilizers as an integrated approach. Nutrients present in soil, added as inorganic and organic sources and the nutrient harvested by crops should be considered to develop a cropping pattern based fertilizer recommendation. Available data indicate that the soil fertility in Bangladesh is declining trend (Karim *et al*, 1994; Ali *et al*, 1997) which is responsible for declining crop yields (Anonymous, 1996; Cassman *et al*, 1995). However most of the farmers of Bangladesh usually do not apply fertilizer in balanced proportion (Anonymous, 1997).

The present system of fertilizer application is mostly based on the nutrient requirement of individual crops ignoring the carry- over effect of the organic or inorganic fertilizers applied to the preceding crop. Organic or inorganic sources of nutrients applied to preceding crop can benefit the succeeding crop to a great extent (Hegde, 1998). The system productivity may become sustainable through integrated use of organic and inorganic sources of nutrients (Singh and Yadav,1992) Therefore, the present study was carried out to find out a cropping pattern based fertilizer dose of organic and inorganic sources of nutrients for Mustard-Boro- T.Aman rice cropping system on the level Barind Tract area (AEZ-25) at Nandigram, Bogra.

MATERIALS AND METHODS

In On -Farm cropping pattern Mustard-Boro-T.aman trial was started at Multilocation Testing (MLT) Site, Nandigram, Bogra during rabi season of 2003-2004. The experiment was completed 3rd year cropping cycle. Before starting the experiment, one dominant cropping pattern (Mustard-Boro-T.aman) was selected. It was done following discussion with local farmers, DAE personnel and available secondary information. Before conducting the experiment, soil samples were collected from farmers' field and then sent to the chemical analysis. The chemical properties of the soil are presented in Table 1.

Table 1. Soil analysis values of different samples collected from MLT Site, Nandigram, Bogra

Sample No.	Analyzed results						
	PH	Total N (%)	K	P	S	ZN	OC (%)
			m.eq./100g soil	micro-gram/g soil			
1	4.7	0.110	0.07	18.26	8.44	1.42	1.10
2	4.8	0.126	0.06	8.59	12.83	1.78	1.26
3	5.0	0.097	0.06	5.37	9.11	0.60	0.97
4	5.9	0.122	0.10	8.23	13.16	2.71	1.22
5	4.4	0.134	0.11	8.23	15.53	1.74	1.34
6	4.8	0.110	0.08	7.16	11.81	1.36	1.10
Average	4.93	0.1165	0.08	9.306	11.81	1.60	1.165
Status		L	VL	L	L	OPT.	

L= Low V L= Very Low OPT = Optimum

The experiment was laid out following RCBD with six treatments and six dispersed replications. The unit plot size was 60 m². 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 Mustard, Boro and T.aman are presented in Table 2.

Table 2. Different fertilizer management packages used in Mustard-Boro- T.Aman rice cropping pattern during experimentation

Treatment	Mustard	Boro	T.aman
	N-P-K-S-ZN-B	N-P-K-S-ZN	N-P-K-S-ZN
T ₁	60-19-45-19-OPT.-1	87-17-79-13- OPT.	60-12-55-8- OPT.
T ₂	84-25-66-24- OPT.-1.5	122-25-111-19- OPT.	82-15-70-11- OPT.
T ₃	69-20-61-24- OPT.-1.5 (+5 T CD/HA)	107-20-96-19- OPT.	67-10-55-11- OPT.
T ₄	70-20-35-20- 1-0.5	100-15-60-8-0	75-12-40-5-0
T ₅	69-15-38-14-0-0	90-25-40-15-1	51-15-34-10-0.5
T ₆	0-0-0-0-0-0	0-0-0-0-0-0	0-0-0-0-0-0

Where

T₁= Estimated inorganic fertilizer dose for moderate yield goal (MYG)

T₂= Estimated inorganic fertilizer dose for high yield goal (HYG)

T₃= IPNS BASIS fertilizer management for high yield goal (Cow dung was used)

T₄= Recommended fertilizer dose on BARC Fertilizer Recommendation Guide'97 (FRG'97)

T₅= Farmers practice (Average of 40 farmers data) .

T₆= Absolute control.

The mustard variety Shati (Local variety) was sown on 25-30 November and harvested on 15-20 February during three years. One irrigation was supplied on 30-32 days after sowing. Entire amount of P, K, S, B and half N of different treatments were applied in different plots during final land preparation. Rest N was applied on 30-32 days after sowing. The Boro rice was transplanted on 20-25 February and harvested on 12-15 June during three years. Entire amount of P, K, S, Zn, CD and 1/3 N of different treatments were applied as basal during final land preparation. Rest N was applied in two equal split on 15-20 days after transplanting (DAP) and 35-40 days after transplanting (DAP). The T.aman rice was transplanted on 12-15 July and harvested on 20-28 November during three years. The 1/3 N and full doses of P, K, S and Zn were applied as basal. The rest N was applied on two equal split on 15-20 DAP and 30-35 DAP. Data on grain yield, yield contributing characters and straw yield of Mustard, Boro and T.aman were recorded and analyzed statistically following Duncan's New Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The effect of different treatments (Fertilizer doses) on grain yield and straw yield of Mustard, Boro and T. aman are presented in Table 3 and 4. The average of three years data showed that the highest seed yield (1.44 t/ha) of mustard was obtained with STB (soil test base) for HYG (T₂) closely seed yield (1.38 t/ha) followed by IPNS (T₃). The next higher yield (1.18 t/ha) was found in FRG'97 (T₄). Almost similar yield was recorded from STB for MYG (T₁) and farmers practice (T₅). The IPNS practice failed to show yield advantages over inorganic fertilizer of same level. The trend over the year is more or less same but yield was drastically reduced in 2003-04 due to cold injury. Because

BARI Sharisa-9 was very susceptible to cold. But the next tow years were sown the mustard variety shati (local variety). In Boro rice, grain yield did not vary appreciably, however the higher grain was recorded from T₂ (5.97 t/ha) and T₃ (5.52 t/ha). Almost similar yield was obtained with T₁ and T₄ which slightly higher than T₅ (4.93 t/ha). Significantly the higher yield was found in T₂ followed by T₃. Similarly in T. aman rice, higher yield was obtained from T₂ (5.33 t/ha) and T₃ (5.06 t/ha). More or less similar yields were recorded from T₁, T₄ and T₅. Over the years data showed that significantly higher yield was obtained from T₂ and T₃. Regarding straw yield almost similar trend was found in all the crops. Initial nutrient status of the soil showed that the soil of the experimental plot was deficit in NPKS and a considerable response of crops to higher doses of nutrients was observed to some extent. Ishaque *et al*, (1994) reported that the addition of cow dung 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 (HYG) without manure. Ali *et al*, (2001) reported that 50% N as cow dung + 50% N as Urea was superior to 100% N as urea or 100% N as cow dung. 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. Mollah *et al*, (2007) reported that three years average results of high yield goal (HYG) gave higher yield performance of crops compared to the other treatments. The mean yield performance of Mustared, Boro and T.Aman were 1.11, 5.59 and 3.39 t/ha, respectively.

Table 3. Grain yield of crops as influenced by fertilizer levels in the cropping pattern Mustard-Boro-T. aman rice at Nandigram, Bogra during 2003-04 to 2005-06 (Average of three years)

Treat	Seed/grain yield (t/ha)											
	2003-04			2004-05			2005-06			Average of three years		
	Mustard	Boro	T.aman	Mustard	Boro	T.aman	Mustard	Boro	T.aman	Mustard	Boro	T.aman
T ₁	0.57b	7.07ab	6.02ab	1.15b	5.17b	3.78ab	1.23c	3.73b	4.50ab	0.98	5.32	4.77
T ₂	0.78a	7.79a	6.68a	1.76a	5.59a	4.38a	1.77a	4.52a	4.93a	1.44	5.97	5.33
T ₃	0.71a	7.30ab	6.17a	1.71a	5.55a	4.21a	1.71a	3.71b	4.80a	1.38	5.52	5.06
T ₄	0.59b	7.27ab	5.95ab	1.45ab	5.09bc	3.65b	1.51b	3.43b	4.35ab	1.18	5.26	4.65
T ₅	0.51b	6.77b	5.62ab	1.11b	4.74c	3.64b	1.11c	3.28b	3.98b	0.91	4.93	4.41
T ₆	0.29c	3.19c	3.16c	0.25c	2.86d	2.25c	0.26d	2.24b	2.78c	0.27	2.76	2.73

In a column, similar letter do not differ significantly at 5% level of significance

Table 4. Straw yield of crops as influenced by fertilizer levels in the cropping pattern Mustard-Boro-T. aman rice at Nandigram, Bogra during 2003-04 to 2005-06

Treat	Straw yield (t/ha)											
	2003-04			2004-05			2005-06			Average of three years		
	Mustard	Boro	T.aman	Mustard	Boro	T.aman	Mustard	Boro	T.aman	Mustard	Boro	T.aman
T ₁	2.76b	7.52a	6.34a	2.83b	5.30b	4.64a	2.90a	3.73b	6.25ab	2.83	5.52	5.74
T ₂	3.02a	7.85a	6.88a	3.37a	5.85a	5.40a	3.29a	4.51a	6.70a	3.23	6.07	6.33
T ₃	3.20a	7.52a	6.52a	3.15a	5.75a	4.88a	3.19a	3.71b	6.00ab	3.18	5.66	5.80
T ₄	2.70b	7.54a	6.12ab	3.36a	5.12bc	5.00a	3.17a	3.43b	5.50ab	3.08	5.36	5.54
T ₅	2.59b	6.75ab	5.75b	3.31a	4.87c	4.50a	3.02a	3.28b	5.08b	2.97	4.97	5.11
T ₆	1.52c	3.88c	3.51c	1.16c	2.90d	3.50b	1.24b	2.24c	3.70c	1.31	3.01	3.57

In a column, similar letter do not differ significantly at 5% level of significance

Agro- Economic performance

Agro-economic performance of different treatments are Mustard-Boro-T.aman rice cropping patterns during 2003-04 to 2005-06 (average of three years) are presented in Table 5. Cost and return analysis (average of three years) showed that the highest gross return as well as gross margin was obtained from T₂ closely followed by T₃. But the fertilization cost was higher in T₂ and T₃ and therefore, the marginal benefit cost ratio was less in compared to T₄. MBCR was found higher in T₄ due to less fertilization cost.

Table 5. Cost and return analysis of different nutrient management packages in Mustard –Boro- T.Aman rice cropping pattern at Nandigram MLT Site, Bogra during 2003-04 to 2005-2006 (Average of three years)

Treat	Average yield of three years (t/ha)						Gross return (Tk/ha)	*Variable Cost (Tk/ha)	Gross margin (Tk/ha)	MBCR
	Mustard		Boro		T.aman					
	Seed	Straw	Grain	Straw	Grain	Straw				
T ₁	0.98	2.83	5.32	5.52	4.77	5.74	1,27,545	11,534	1,16,011	5.49
T ₂	1.44	3.23	5.97	6.07	5.33	6.33	1,49,615	16,068	1,33,547	5.31
T ₃	1.38	3.18	5.52	5.66	5.06	5.80	1,40,720	15,552	1,25,168	4.91
T ₄	1.18	3.08	5.26	5.36	4.65	5.54	1,29,690	10,732	1,18,958	6.10
T ₅	0.91	2.97	4.93	4.97	4.41	5.11	1,18,125	10,669	1,07,456	5.05
T ₆	0.27	1.31	2.76	3.01	2.73	3.57	64,245	0	64,245	-

*Fertilizer cost only

Inputs: (Tk./kg.): Urea = Tk. 6.00, TSP = Tk. 15.00, MP = Tk. 12.00, Gypsum = Tk. 3.0, Boric acid = Tk. 60.00 & CD = Tk. 0.15, Zinc sulphate = Tk. 65.00, Products = (Tk./kg.): Mustard seed = Tk. 20.00, Mustard straw = Tk. 0.50, Boro rice = Tk.10.00, T.aman rice = Tk.10.00, Rice straw = Tk.0.50

Farmers reaction

Farmers were very much impressed to have satisfactory grain yield with optimum dose of fertilizer which ultimately reduced the imbalance use of fertilizers and helps to the fertilizer recommendation for this area.

CONCLUSION

The three years results indicate that the treatment (T₂) soil test based (STB) fertilizer for HYG was found agronomically viable and economically profitable. On the bases of three years study, considering the yield and economic return the soil test base fertilizer dose may be recommended for Mustard – Boro – T.aman rice cropping pattern in the level Barind Tract area (AEZ-25) at Nandigram, Bogra. The application of organic manure (4-5 t/ha) once in a year could be suggested for sustaining soil fertility.

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