

RESPONSE OF CROPS GROWN IN POTATO-BORO-T.AMAN RICE CROPPING PATTERN UNDER LEVEL BARIND ENVIRONMENTS TO ADDED FERTILIZER NUTRIENTS

M. R. A. MOLLAH¹, M. R. KHATUN², M. A. AKTHER¹, M. Z. H. PRODHAN¹ and M. SHAHIDULLAH³

¹Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Bogra. ²Soil Science Division, BARI, Gazipur.

³Regional Agricultural Research station, BARI, Ishurdi, Pabna, Bangladesh.

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ABSTRACT

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An experiment was conducted at Joypurhat Multilocation Testing (MLT) site under Bogra during 2003-04 to 2005-06 to determine the optimum and economic dose of fertilizer nutrients. In every year the highest tuber yield was obtained from the level of N (134 kg ha⁻¹), P (22 kg ha⁻¹), K(252 kg ha⁻¹) and S(24 kg ha⁻¹), respectively. The highest grain yield of Boro was obtained from the level of N (134 kg ha⁻¹), P (18 kg ha⁻¹), K (114 kg ha⁻¹) and S (30 kg ha⁻¹). The highest grain yield of T.Aman rice was obtained from the level of N (88 kg ha⁻¹), P (16 kg ha⁻¹), K (72 kg ha⁻¹) and S (16 kg ha⁻¹) respectively. The lowest grain yield of Potato, Boro, T. Aman rice were found in treatment T₁₄ (control). But the economically optimum dose of potato were 125-22-150 and 15 kg ha⁻¹ of N, P, K and S, respectively. The economically optimum doses of Boro rice were 115-15-70 and 20 kg ha⁻¹ of N, P, K and S, respectively. Similarly, the economically optimum doses of T. Aman rice were 85-12-60 and 15 kg ha⁻¹ of N, P, K and S respectively.

Keywords: *Response of crops, Level Barind (AEZ-25), added fertilizer*

INTRODUCTION

Intensive cropping is being practiced in Bangladesh. Two to three crops are in a year in most of the Level Barind Tract soil and large portion of terrace areas removing a huge quantity of nutrients from the soil annually. As a result, the level of soil fertility is diminishing gradually reflecting the need of more fertilizer application in the soil for sustaining crop production. Long term soil fertility monitoring under a specific cropping system will be of great help in determining a better soil fertility management programme for sustained productivity at higher level. In the past, little attention was paid to soil fertility management for the cropping system as a whole rather than individual crop. To assess the fertilizer need for a cropping pattern the first thing is to know the kind of crops that have been included in the pattern and their nutrient requirements for a target yield.

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 fertilizer applied to the preceding crop. But it is known that some fertilizers have considerable residual effect on the succeeding crops, which may extend up to two/three crops. Organic or inorganic sources of nutrients applied to preceding crop can benefit the succeeding crop to a great extent (Singh *et al.*, 1998; Hedge, 1998) and the system productivity may become sustainable through integrated use of organic and inorganic sources of nutrients (Singh and Yadav, 1992). Hence, it is important to develop a cropping system based fertilizer dose for specific agro-ecological zones.

The development of appropriate nutrient management technologies for different cropping pattern of the country is the most important and should be the immediate goal of soil fertility research. Assessment of the nutrient requirement of different crops for desired yield levels in a cropping sequence is the first step in developing sound fertilizer management practices. Considering the above facts, the trial has been undertaken to determine the optimum and economic fertilizer dose for the cropping pattern of Potato- Boro-T.Aman rice for the Level Barind agro-ecological zone .

MATERIALS AND METHODS

The experiment was conducted in farmers' field at Multilocation Testing (MLT) site, Joypurhat, Bogra during 2003-04, 2004-05 and 2005-06 in irrigated Level Barind Tract (AEZ-25) area. Before starting the experiment, one of the dominant cropping pattern (Potato-Boro-T.Aman rice) was tested by 14 fertilizer combinations with four levels of N, P, K and S with a blanked dose (Average dose of 40 farmers) with six dispersed replications.

Before conducting the experiment, soil sample were collected from farmers' field and then sent to the laboratory for chemical analysis. The chemical analysis of soil is presented in Table 1.

The analyzed results indicated that the percent of total N, available K and S were very low and the available Zn was optimum. The available P was low. The selected land of each replication divided into three equal blocks and then one block was again divided into 14 unit plots for assigning 14 treatments and the rest two blocks were used for farmers' practices. Each unit plot size was 20 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 experiment was completed for three years cycle.

The estimated fertilizer doses for Potato, Boro and T. Aman are presented in Table 2. The experiment was laid out the following randomized complete block design. Potato tuber was sown in line on 3-10 December at the

¹ Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Bogra.

rate of 2000 kg/ha and the crop was harvested on 18-25 February during three years. The Boro rice seedling was transplanted in line on 23-28 February and the crop was harvested on 17-25 May during three years. The T. *Aman* rice seedling was transplanted in line on 1-5 August and the crop was harvested on 30 November – 2 December during three years. Entire quantity of P, K, S, B and Zn were applied as basal during final land preparation of potato. Half of N was applied as basal and remaining N was applied at the side row and covered with soil about 45 days after planting of Potato. Similarly the entire quantity of P, K and S were applied of Boro and T. *Aman* rice as basal during final land preparation. The N was applied in three equal split of Boro and T. *Aman* on 12 – 15 DAP, 5 – 30 DAP and 40 – 45 DAP in both the crop. Intercultural operation and plant protection measures were done as and when necessary. Data on yield and yield attributes were recorded and analyzed statistically following DMRT.

Table 1. Soil analysis values of different samples collected from Multilocation Testing site, Joypurhat

Replication	Analyzed Results						
	pH	Total N (%)	P	K	S	Zn	OC (%)
			PPM	m.eq/100g soil	microgram/g soil		
1	5.0	0.064	10.74	0.04	7.43	1.49	0.64
2	4.9	0.089	13.87	0.10	7.09	2.99	0.89
3	5.1	0.054	11.87	0.05	7.43	1.27	0.54
4	5.2	0.085	22.55	0.09	6.08	0.90	0.85
5	4.9	0.056	7.52	0.06	8.10	0.94	0.56
6	4.5	0.069	13.96	0.10	6.75	2.40	0.69
Average	4.93	0.0599 VL	13.41 L	0.073 VL	7.146 VL	1.665 Optimum	0.599

L= Low, VL = Very Low

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

Treatments	N-P-K-S-B-Zn	N-P-K-S	N-P-K-S
	Kg ha ⁻¹		
	Potato	Boro	T. <i>Aman</i>
T ₁	0-22-168-24-1-1.5	0-18-114-30	0-16-72-16
T ₂	68-22-168-24-1-1.5	67-18-114-30	44-16-72-16
T ₃	134-22-168-24-1-1.5	134-18-114-30	88-16-72-16
T ₄	201-22-168-24-1-1.5	201-18-114-30	132-16-72-16
T ₅	130-0-168-24-1-1.5	134-0-114-30	88-0-72-16
T ₆	134-11-168-24-1-1.5	134-9-114-30	88-8-72-16
T ₇	134-33-168-24-1-1.5	134-27-114-30	88-24-72-16
T ₈	134-22-0-24-1-1.5	134-18-0-30	88-16-0-16
T ₉	134-22-84-24-1-1.5	134-18-57-30	88-16-36-16
T ₁₀	134-22-252-24-1-1.5	134-18-171-30	88-16-108-16
T ₁₁	134-22-168-0-1-1.5	134-18-114-0	88-16-72-0
T ₁₂	134-22-168-12-1-1.5	134-18-114-15	88-16-72-8
T ₁₃	134-22-168-36-1-1.5	134-18-114-45	88-16-72-24
T ₁₄	0-0-0-0-0	0-0-0-0	0-0-0-0
T ₁₅ (FP)	147-65-130-0-0	87-26-40-3-1	71-10-23-0

RESULTS AND DISCUSSION

Potato: A considerable response of potato to added nitrogen was observed. Tuber yield increased appreciably with the increase of nitrogen up to 134 kg/ha of N. After that level tuber yield tended to decrease. Similarly, P and K showed a positive response towards the yield of potato. Tuber yield increased considerably up to 22 and 24 kg/ha of P and S. Regarding K yield increased appreciably up to 168 kg/ha of K and after that level yield also increased but the rate of increment was slow. The highest yield was found in highest level of K. Initial status of the soil showed that N, K and S were very low. The P was low. Therefore, a considerable response of potato to added nutrients was found.

Boro: Grain yield of Boro rice increased appreciably with the increase of N and the rate of increment was higher up to 67 kg/ha of nitrogen. However, grain yield gradually increased up to 134 kg/ha and then tended to decrease. But response to P, K and S was not very evident. Grain yield increased slowly up to 18, 114 and 30 kg/ha of P, K and S, respectively.

T. *Aman* rice: Response of T. *Aman* rice to added nitrogen was observed to some extent. Grain yield increased appreciably up to 44 kg/ha of N and after that slightly increased up to 88 kg/ha. But response to P, K and S was

not very sharp. However, grain yield increased up to 16, 72 and 16 kg/ha of P, K and S, respectively, but the rate of increment was very slow. More or less similar trend was found over the years.

Yun and Shin (1982) reported that the following cropping patterns: rice- barley, potato- rice, rice-rye and rice-fallow under NPK fertilizers, highest yield (7 t ha^{-1}) was obtained in the rice-fallow system with 200- 120- 180 kg NPKha⁻¹. Bache and Lopes (1983) carried out a field experiment by applying 0, 30, 60, 90 and 120 kg Nha⁻¹ in addition to 40 kg P₂O₅ ha⁻¹ and 60 kg P₂O₅ ha⁻¹ at sowing time and found that yield increased significantly with the increasing rate of nitrogen. Goose and Johnson (2001) reported that the grain yield response to P applied with the seed yield was typically 400 kg ha⁻¹. Subhendu *et al.* (2003) conducted a field experiment during Kharif season at Hyderabad, India. They found that the application of N (120 kg N ha⁻¹) as urea in equal splits during transplanting, tillering, panicle initiation and 50% of flowering resulted in the highest 1000-grain weight (22.57 g). Anonymous (2004) conducted an experiment in the farmers field at OFRD, BARI, Melandah, Jamalpur during 2002-03 under Potato-Jute-T. Aman rice cropping pattern. Response of potato to added nutrients was observed. Tuber yield increased markedly with the increase of nitrogen up to 130 kg ha⁻¹. After that level tuber yield tended to decrease. Similarly, P, K and S showed a positive response towards the yield of potato. Tuber yield increased up to 30, 100 and 10 kg ha⁻¹ of P, K and S, respectively. Fibre yield of Jute increased markedly with the increase of N. The highest yield was recorded from 100 kg ha⁻¹ of nitrogen and then trend to decrease. Almost similar trend was found in case of P, K and S. Fibre yield increased appreciably up to 12, 55 and 7 kg ha⁻¹ of P, K and S, respectively. Grain yield of T. Aman rice increased appreciably up to 90 kg N ha⁻¹ and then tended to decrease. Similarly, P, K and S showed a positive response towards the yield of T. Aman rice. Grain yield increased up to 10, 40 and 4 kg ha⁻¹ of P, K and S, respectively. Anonymous (2007) conducted an experiment in the farmer's field at OFRD, BARI, Rajshahi during 2003-04 to 2005-06 in High Ganges River Floodplain (AEZ-11) under Potato-Jute-T. Aman rice cropping pattern. Response of potato to added nutrients was observed. Tuber yield increased markedly with the increase of nitrogen up to 80 kg ha⁻¹ and after that level tuber yield also found increasing but a slower rate up to 160 kg ha⁻¹ of nitrogen. Similarly, P and K showed a positive response towards the yield of potato. Tuber yield increased up to 20 and 60 kg ha⁻¹ of P and K, respectively. But response of S was not very evident. Fibre yield of Jute increased markedly with the increase of N up to 50 kg ha⁻¹ and after that level yield slowly increased up to 100 kg ha⁻¹ of N. But response of Jute to P, K and S was not very evident. Grain yield of T. Aman rice increased appreciably up to 65 kg N ha⁻¹ and then the rate of increment was slowly but yield increased up to 130 kg N ha⁻¹. But response of T.Aman to P, K and S was not very evident. The soil of the experimental field was rich with nutrients. Except nitrogen other nutrients status were medium to high. Therefore, response of crops to added P, K and S was not evident.

Farmers showed their interest in Potato, Boro and T. Aman rice production by the use of optimum dose from different fertilizers. The new and neighboring farmers of the experimental area were also highly interested to know the optimum dose of fertilizer.

From three years experiment it was found that the tuber yield of potato was affected due to different levels N. Tuber yield of potato increased up to 134 kgha⁻¹ of N and there after yield was not increased with increasing rate of nitrogen. Tuber yield increased considerably up to 22 and 24 kgha⁻¹ of P and sulphur. Tuber yield increased appreciably up to 168 kgha⁻¹ of K and after that level also increased but the rate of increment was low. Grain yield of Boro gradually increased up to 134 kgha⁻¹ of N and then decreased. Grain yield increased slowly up to 18, 114 and 30 kgha⁻¹ of P, K and S respectively. Grain yield of T. Aman rice increased up to 88 kgha⁻¹ of N and then trend to decrease. Similarly grain yield increased up to 16, 72 and 16 kgha⁻¹ of P, K and S respectively. From the response curve was drawn and the optimum dose of Potato, Boro and T.Aman rice were calculated.

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ANNEXURE-1

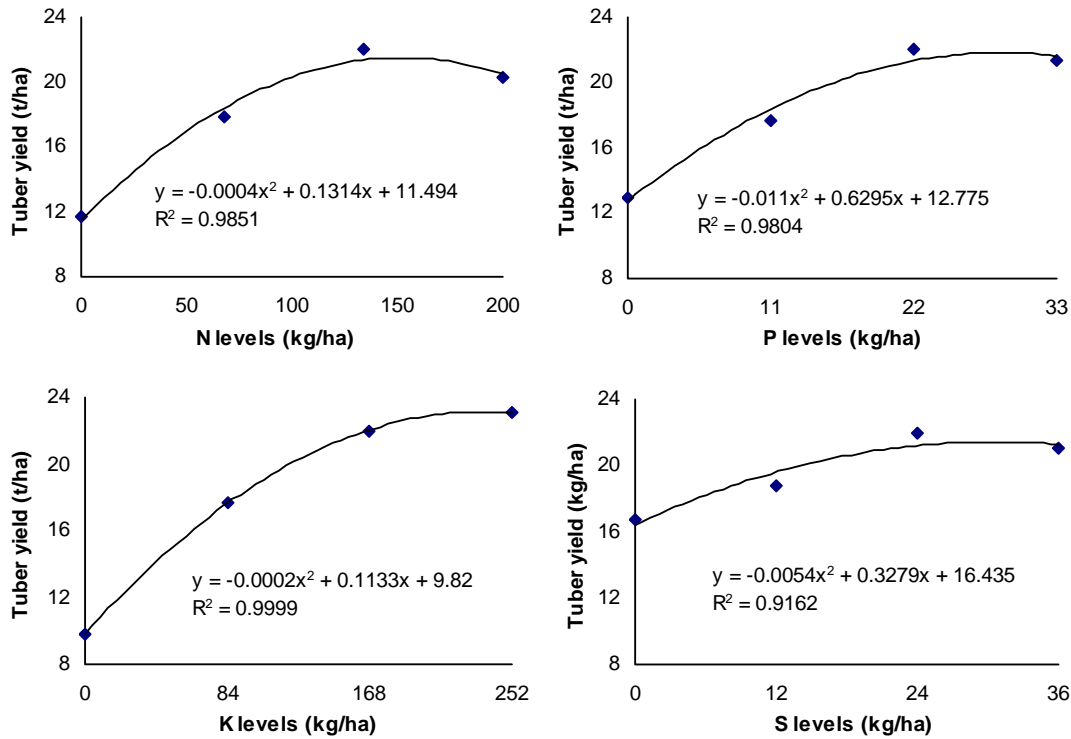


Figure 1. Response of Potato to added N, P, K & S in Potato-Boro-T.Aman rice cropping pattern

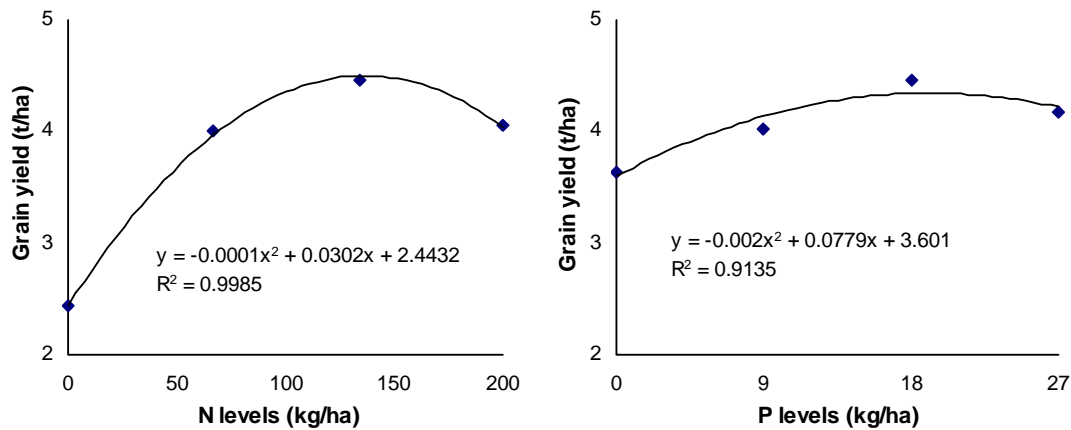


Figure 2. Response of Boro to added N & P in Potato-Boro - T.Aman rice cropping pattern

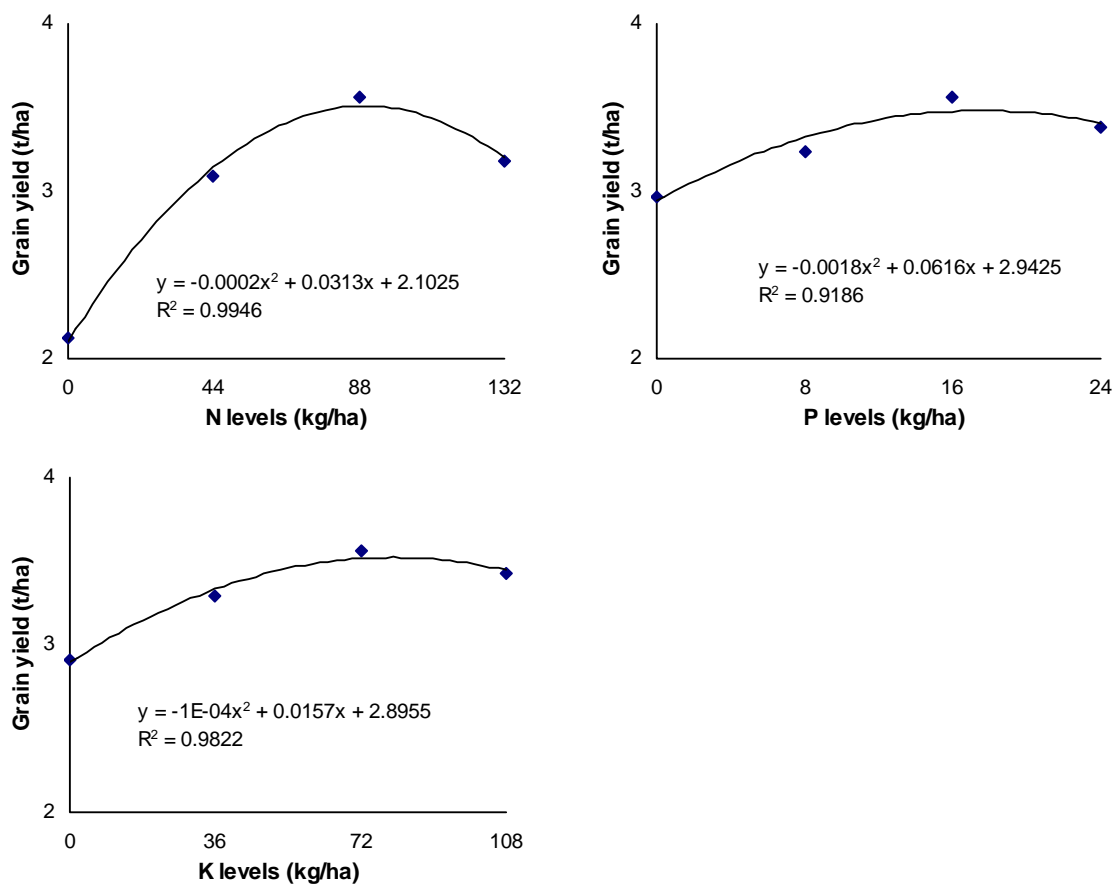


Figure 3. Response of T.Aman to added N, P & K in Potato-Boro-T. Aman rice cropping pattern

Table 3. Effect of different levels of fertilizer nutrients on the yield of Potato in Potato-Boro-T.Aman rice cropping pattern

Fertilizer levels (kg/ha)	Tuber yield (t/ha)			Mean
	2003-04	2004-05	2005-06	
N	0	12.2	11.2	11.5
	68	18.7	17.0	17.2
	134	23.1	21.0	20.8
	200	21.9	18.7	16.7
P	0	13.8	12.3	12.5
	11	17.5	18.0	17.4
	22	23.1	21.0	20.8
	33	22.9	19.9	17.6
K	0	10.4	9.2	9.5
	84	17.4	18.1	17.2
	168	23.1	21.0	20.8
	252	24.3	22.0	19.7
S	0	17.0	16.4	16.5
	12	18.9	18.7	18.2
	24	23.1	21.0	20.8
	36	21.7	20.4	17.8

Table 4. Effect of different levels of fertilizer nutrients on the yield of Boro in Potato-Boro T.Aman rice cropping pattern

Fertilizer levels (kg/ha)		Grain yield (t/ha)			
		2003-04	2004-05	2005-06	Mean
N	0	2.32	2.55	3.04	2.64
	67	3.98	4.05	3.40	3.81
	134	4.28	4.64	3.81	4.24
	200	3.94	4.18	3.57	3.90
P	0	3.72	3.56	2.91	3.40
	9	4.00	4.04	3.52	3.85
	18	4.28	4.64	3.81	4.24
	27	4.12	4.24	3.62	3.99
K	0	3.91	3.74	2.67	3.44
	57	4.18	4.27	3.70	4.05
	114	4.28	4.64	3.81	4.24
	170	4.22	4.33	3.47	4.01
S	0	4.10	4.02	3.45	3.86
	15	4.17	4.17	3.74	4.03
	30	4.28	4.64	3.81	4.24
	45	4.23	4.09	3.60	3.97

Table 5. Effect of different levels of fertilizer nutrients on the yield of T.aman in Potato-Boro T.Aman rice cropping pattern

Fertilizer levels (kg/ha)		Grain yield (t/ha)			
		2003-04	2004-05	2005-06	Mean
N	0	2.09	2.16	2.64	2.30
	44	3.05	3.13	3.10	3.09
	88	3.57	3.55	3.36	3.49
	132	3.29	3.07	3.03	3.13
P	0	3.02	2.91	2.80	2.91
	8	3.30	3.18	3.20	3.23
	16	3.57	3.55	3.36	3.49
	24	3.34	3.41	3.34	3.36
K	0	2.95	2.87	2.81	2.88
	36	3.37	3.21	3.18	3.25
	72	3.57	3.55	3.36	3.49
	108	3.57	3.29	3.23	3.36
S	0	3.26	3.08	3.15	3.16
	8	3.33	3.22	3.19	3.25
	16	3.57	3.55	3.36	3.49
	24	3.42	3.27	3.17	3.29