DEVELOPMENT OF FERTILIZER RECOMMENDATION FOR FALLOW-T. AUS-T. AMAN CROPPING PATTERN UNDER SURMA-KUSHYARA FLOODPLAIN SOIL

M.O. KAISAR[1], M.. ASADUZZAMAN[2], A. K. CHOUDHURY[3] AND K. M. KHALEQUZZAMAN[1]

[1]Senior Scientific Officer, Regional Agricultural Research Station, BARI, Ishurdi, Pabna, Bangladesh, [2]Scientific Officer, Agricultural Research Station, BARI, Shibpur, Narshingdi, Bangladesh and [3]Senior Scientific Officer, On-Farm Research Division, BARI, Sylhet, Bangladesh.

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ABSTRACT

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The experiment was conducted at Golapgonj, Sylhet under Surma-Kushyara floodplain soil for three consecutive years (2001-2003) to find out the optimum fertilizer doses for Fallow-T. aus-T. aman cropping pattern. Six treatments including balanced inorganic fertilizer doses for moderate (ED_1) and high yield goal (ED_2), integrated nutrient management for high yield goal (INM), recommended fertilizer dose given in Fertilizer Recommendation Guide'97 (FRG'97), farmers' practice (FP) and absolute control were tested. Fertilizer doses were estimated as per treatment based on soil test values. The highest grain yield was obtained from ED_2 in both T. aus (5.23 t/ha) and T. aman (5.15 t/ha) crops, which were closely followed by INM (5.20 and 5.06 t/ha, respectively). Similar trend was observed in straw yield. Gross margin was highest in ED_2 (Tk. 76688.53/ha) followed by INM (Tk. 73797.90/ha). The highest marginal benefit cost ratio over control was recorded in ED_1 (7.34) indicating the most economically profitable dose.

Key words: High yield goal, Moderate yield goal, Fallow-T. aus-T. aman cropping pattern, Surma-Kushyara Floodplain Soil

INTRODUCTION

Fallow - T. aus - T. aman is the dominant cropping pattern in Sylhet region under rainfed medium highland and medium lowland areas of Surma-Kushyara floodplain. Now-a-days, high yielding varieties possess a large area under this cropping pattern. But the productivity of the cropping pattern is not satisfactory level under existing farmers' practice. The use of chemical fertilizers has been increasing steadily but usually they are not applied in balanced proportions (Anon., 1997). Farmers mostly use NPK fertilizer and do not apply sulphur or micronutrients. They apply fertilizers for high yield goal without considering the residual nutrients of the preceding crop. In soil plant system there must be a balance between input and output of nutrients for sustainable agriculture (Bhuiyan *et al.*, 1991). Organic or inorganic sources of nutrients applied to preceding crop can benefit the succeeding crop to a great extent (Hegde, 1998; Singh *et al*., 1998). Imbalance use of inorganic fertilizers, little or no addition of organic manure and poor attention to its improvement and maintenance made the situation difficult. As a result, the soil fertility in Bangladesh is in declining trend (Karim *et al.*, 1994; Ali *et al.*, 1997), which is responsible for declining crop yields (Cassman *et al.*, 1995; Anon., 1996). Hence, it is important to develop cropping pattern based fertilizer dose. The present study was undertaken to find out a cropping pattern based fertilizer recommendation and to determine the economically profitable dose of fertilizer for Fallow - T. aus - T. aman cropping pattern under Surma-Kushyara Floodplain soil.

MATERIALS AND METHODS

The experiment was conducted at farmers' field of Farming System Research and Development Site, Golapgonj, Sylhet with Fallow - T. aus - T. aman cropping pattern during three consecutive years (2001-2003). The site belonged to rainfed medium highland and medium lowland areas of Surma-Kushyara Floodplain (AEZ-20). Each crop was grown for three years in the same plot. Before starting the experiment, initial soil samples were collected from each farmer's field and analyzed. The soil was clay loam with low organic matter content (1.86%) and soil pH was 5. The status of N, P, K, S, B and Zn was low, very low, low, medium, optimum and optimum, respectively. The total rainfalls were 3474.2, 3635.9 and 3667.3 mm in 2001, 2002 and 2003, respectively. Average maximum temperature of three years was 30.32 and minimum was 20.71^0C. Initial soil status of different selected farmers' fields is presented in Table 1.

Table 1. Initial soil status of different selected farmers' fields

Sample no.	pH	OM (%)	Total N (%)	K (meq/100g soil)	P	S	B	Zn
					(µg/g soil)			
1	6.1	1.34	0.08	0.07	2	10	0.43	1.2
2	4.5	2.01	0.11	0.15	4	18	0.75	2.2
3	4.1	1.35	0.08	0.06	5	35	0.56	1.6
4	4.7	2.46	0.15	0.11	3	23	0.63	1.3
5	5.8	1.90	0.10	0.06	4	18	0.56	1.5
6	4.8	2.10	0.12	0.08	3	23	0.49	1.8
Average	5.0	1.86	0.11	0.09	3.5	21.17	0.57	1.6

The experiment was laid out following RCB design with six dispersed replications. The unit plot size was 10 m × 10 m. The treatments were - T_1: Estimated inorganic fertilizer dose for moderate yield goal (ED_1), T_2: Estimated inorganic fertilizer dose for high yield goal (ED_2), T_3: Integrated nutrient management for high yield goal (INM), T_4: Recommended fertilizer dose given in Fertilizer Recommendation Guide'97 (FRG'97), T_5: Farmers' practice (FP) and T_6: Absolute control. Fertilizer doses were estimated as per treatment with the help of FRG'97 based on soil test values. Treatments and fertilizer doses for the experiment are presented in Table 2.

Table 2. Treatments and fertilizer doses for the experiment

Treatment	Fertilizer level N-P-K-S-Zn (kg/ha)	
	T. aus	T. aman
ED1	68-17-41-4.8-0	68-9-41-2.4-0
ED2	93-21-53-6.4-0	93-11-53-3.2-0
INM	78-16-38-6.4-0+CD (5 t/ha)	93-11-53-3.2-0
FRG'97	40-8-20-4-1	40-4-20-2-0
FP	54-12-22-0-0	54-12-22-0-0
Control	0-0-0-0-0	0-0-0-0-0

Entire amount of P, K, S, Zn and one third of N were applied as basal. One third of urea was applied as rapid tillering stage and the remaining was applied before panicle initiation stage for both T. aus and T. aman. BR 26 and BRRI Dhan 32 were selected as the variety of T. aus and T. aman, respectively. Seed rate was 30 kg/ha for both the crops in all three consecutive years. Thirty two and 45 days old seedlings of T. aus and T. aman were transplanted in 3-10 June and 1st week of September of three years, respectively. Transplanting was done following the spacing of 25×15 cm. Weeding was done once at 26 DAT in T. aus and insecticide was sprayed for two times against rice hispa in T. aman. T. aus and T. aman were harvested in mid August and last week of November in three years, respectively. Data were recorded on both grain and straw yield in every year for both crops.

Statistical analyses for F-test were performed and means were compared by LSD following Gomez and Gomez (1984). Cost and return analysis was done for net return and marginal benefit cost ratio for different treatments.

RESULTS AND DISCUSSION

Performance of T. aus

The effect of different nutrient management packages on grain and straw yield of T. aus was significant in each year (Table 3). In 2001, the highest grain yield (5.40 t/ha) was obtained from ED_2 while INM produced second highest yield (5.30 t/ha). These two treatments increased 48 and 47% of grain yield over control and 30 and 29% over FP, respectively. FRG'97 gave 3.45 t/ha, which was higher than control but lower than FP. The reason for lower yield was due to that in FRG'97 fertilizer was recommended for this cropping pattern considering local improved variety of rice. In 2002, the highest yield was recorded from ED_2 (5.17 t/ha) followed by INM (5.15 t/ha). In these treatments, yield was increased 48.4 and 48.2% over control and 33.7 and 33.4% over FP, respectively. In 2003, the highest yield was recorded from INM (5.16 t/ha) which was followed by ED_2 (5.13

t/ha). INM showed increased performance over the year indicating the improvement of soil fertility by integrated nutrient management. In average of three years, the highest grain yield (5.23 t/ha) was obtained from ED_2 while INM produced second highest yield (5.20 t/ha). Effect of the treatments on straw yield was found similar trend.

Performance of T. aman

The nutrient management packages also showed significant effect on grain and straw yield of T. aman (Table 3). In 2001, the highest grain yield (4.85 t/ha) was obtained from ED_2 while INM gave second highest yield (4.60 t/ha). ED_2 and INM increased 60 and 58% of grain yield over control and 31 and 27% over FP, respectively. FRG'97 responded as in T. aus, which gave higher yield than control but lower than FP. In 2002, the highest yield was recorded from ED_2 (5.32 t/ha) followed by INM (5.30 t/ha). Here, yield was increased 48.1 and 47.9% over control and 30.6 and 30.4% over FP in these treatments, respectively. In 2003, the highest yield was recorded from INM (5.29 t/ha) followed by ED_2 (5.27 t/ha). INM in T. aman showed performance similar to T. aus crop. In average of three years, the highest grain yield (5.15 t/ha) was obtained from ED_2 while INM produced second highest yield (5.06 t/ha). Similar trend was observed in straw yield. This finding was almost in agreement with Ishaque *et al.* (1998) and Mollah *et al.* (2007).

Table 3: Effect of different fertilizer levels on yield of crops grown in Fallow-T. aus-T. aman cropping pattern at Golapgonj, Sylhet during 2001- 2003.

Treatment	2001		2002		2003		Mean	
	T. Aus	T. Aman	T. Aus	T. Aman	T. Aus	T. Aman	T. Aus	T. Aman
Grain yield (t/ha)								
ED1	5.08	4.35	4.81	4.98	4.75	4.94	4.88	4.76
ED2	5.40	4.85	5.17	5.32	5.13	5.27	5.23	5.15
INM	5.30	4.60	5.15	5.30	5.16	5.29	5.20	5.06
FRG'97	3.45	3.15	3.25	3.48	4.36	3.88	3.69	3.50
FP	3.76	3.34	3.43	3.69	4.17	4.02	3.78	3.68
Control	2.80	1.95	2.67	2.76	2.52	2.68	2.66	2.46
LSD (P≥0.05)	0.57	0.55	0.23	0.20	0.24	0.24	-	-
Straw yield (t/ha)								
ED1	6.15	5.48	5.87	6.23	5.76	6.16	5.93	5.96
ED2	6.64	6.16	6.31	6.81	6.25	6.74	6.41	6.58
INM	6.41	5.89	6.26	6.70	6.22	6.79	6.29	6.45
FRG'97	4.96	4.74	4.45	5.08	4.82	5.42	4.74	5.08
FP	5.49	4.79	4.82	5.24	5.14	5.59	5.15	5.21
Control	3.36	2.47	3.23	3.53	3.17	3.42	3.25	3.14
LSD (P≥0.05)	0.54	0.58	0.40	0.35	0.22	0.20	-	-

Cost and return analysis

Cost and return analysis of different treatments are presented in Table 4. Gross margin (Tk. 76688.53/ha) was found highest in ED_2 treatment and the lowest (Tk. 40874.00/ha) was in control plot. Mollah *et al.* (2007) also found maximum gross margin in ED_2. The second highest gross margin was with INM treatment (Tk. 73797.90/ha), which was followed by ED_1 treatment (Tk. 71992.27/ha). In spite of lower gross margin, ED_1 resulted in maximum marginal benefit cost ratio (7.34). It was due to that variable cost was Tk. 1431.24/ha less in ED_1 from ED_2. Variable cost was maximum in INM (Tk. 8136.10/ha) because of additional cost of cowdung for higher price and larger quantity. Consequently this treatment performed the lowest marginal benefit cost ratio (5.05).

Table 4. Cost and return analysis of different fertilizer levels in fallow-T. aus-T. aman cropping pattern at Golapgonj, Sylhet in 2001-2003 (Total of two crops in an average of three years)

Treatment	Gross return (Tk/ha)	*Variable cost (Tk/ha)	Gross margin (Tk/ha)	MBCR (over control)
ED1	76899.00	4906.73	71992.27	7.34
ED2	83026.50	6337.97	76688.53	6.65
INM	81934.00	8136.10	73797.90	5.05
FRG'97	58364.50	2824.84	55539.66	6.19
FP	60781.00	3532.64	57248.36	5.64
Control	40874.00	0.00	40874.00	-

*Variable cost = Cost involved in fertilizer purchase and application + additional labor cost for harvest of additional product

Price of inputs and outputs (Tk/kg):

Urea	: 5.50	Rice grain (BR 26)	: 6.25
TSP	: 11.40	Rice grain (BRRI Dhan 26)	: 7.00
MP	: 9.30	Rice straw	: 1.10
Gypsum	: 5.00		
Zinc sulphate	: 60.00		
Cowdung	: 0.50		
Labour (wage/day)	: 70.00		

Yield and economic return increased through increasing fertilizer inputs in balanced proportions based on soil tests. Inorganic fertilizer dose for high yield goal contributed the highest yield, which was very closed to IPNS based fertilizer. Maximum economic return was found from inorganic fertilizer dose for moderate yield goal. Therefore, these treatments may be recommended for Fallow - T. aus - T. aman cropping pattern in rainfed medium highland and medium lowland areas under Surma-Kushyara Floodplain soils.

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