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EFFECT OF SOME SECONDARY AND MICRO NUTRIENTS ALONG WITH ORGANIC AMENDMENTS ON T. AMAN

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ABSTRACT

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A field experiment was conducted in the “Tista Meander Floodplain Soils” at BINA (Bangladesh Institute of Nuclear Agriculture) sub-station farm. Tajhat Rangpur, during Kharif 2002 with T. aman (cv. BRRI dhan 32)) grown with an objective of evaluating the direct renewed and residual effects of secondary nutrients (S & Mg), micro nutrients and organic amendments (PM and CD) on the growth, yields and nutrients uptake by crops. The surface soil was sandy loam texture, having pH, 6.30; organic matter, 1.24%; total N, 0.11% ; available P, 2.44 ppm; exchangeable K, 0.05 meq %; available S, 6.62 ppm; exchangeable Mg, 1.37 meq %; available Zn, 0.45ppm and available B, 0.17 ppm respectively. The experiments were designed with eight treatments laid out in a randomized complete block design with three replications. The eight treatments were viz. T_1: NPK (control), T_2: NPK + S, T_3: NPK + S + Mg, T_4: NPK + S + Mg + Zn, T_5: NPK + S + Mg + Zn + B, T_6: NPK + S + Mg + Zn + B + Mo, T_7: NPK + Poultry manure (PM) and T_8: NPK + Cowdung (CD). All plot received 80 kg N ha^{-1}, 20 kg P ha^{-1} and 30 kg K ha^{-1} both in the T. aman. The doses of secondary, micro nutrients, PM and CD were 30 kg S ha^{-1}, 15 kg Mg ha^{-1}, 5 kg Zn ha^{-1}, 2 kg B ha^{-1}, 1.5 kg Mo ha^{-1}, 5 ton PM ha^{-1} and 5 ton CD ha^{-1}. The grain and straw yields of T. aman rice significantly influenced due to application of secondary nutrients, micronutrients and organic amendments though the different treatments were not prominent on panicle length. Grain yields of T. aman rice varied from 3410 kg to 3937 kg ha^{-1}, with the highest yield recorded in the treatment T_7: N P K + (PM) & lowest in T_1: NPK (control). There were also significant effect of the treatments on N, P, K, S, Mg, Zn, B, and Mo contents and their uptake by the crop. In rice crop, the highest nutrients uptake by both grain and straw was obtained from T_7 treatment and lowest from control. Secondary nutrients and micronutrients along with NPK fertilizer showed less response than those of organic amendments plus NPK fertilizers. The overall results express that organic amendments with NPK is essential to obtain satisfactory yield of T. aman in the experiment soil.

Key words: *secondary nutrients, micro nutrients, organic amendments and T. aman*

INTRODUCTION

The major cropping sequence in Bangladesh agriculture is rice-wheat or mostly consisting of rice based cereal crops, rarely including legume or fibre crops. Rice is a staple food crops covering an area of 10.81 million hectare with producing 2.51 million tons of rice (*Oryza sativa*) annually (BBS, Pocked Book, 2002). The total production of rice in Bangladesh is not sufficient to feed her people.

The urgent need of the crop sector of Bangladesh Agriculture at this moment is to produce more food to feed the country’s ever growing population. To attain self-sufficiency in food, efforts must be made to enhance the yield per unit area and improve the quality of the produce. Targeting high yield with a higher cropping intensity is the most logical way to raise the total area from the total production from the limited land resource.

The practice of intensive cropping with modern improved variety is a major endeavour of crop production in Bangladesh. This in turn causes a marked depletion of inherent reserves in soils. Before 1980’s deficiency of NPK was a major problem but thereafter NPK, deficiency along with secondary and micronutrients (S and Zn) are frequently reported (Jahiruddin *et al*. 1981, Islam *et al.* 1990; Hoque and Jahiruddin, 1994; Islam and Hossain, 1993). Boron deficiency is also reported on some soils and crops (Islam *et al.* 1997). Sulphur deficiency has been recognized in many area of Bangladesh, which roughly covers 44% of the total cropped area (Hussain 1990).

Bangladesh soils are already depleted in many of essential nutrients mainly because of intensive cultivation having no return from organic recycling. Fertilizers are indispensable for the crop production systems of modern agriculture and inorganic fertilizers today hold the key to the success of the crop production systems of Bangladesh agriculture, being responsible for about 50% of the total production. But, it is also true that maintaining the sustainable crop production is difficult by using chemical fertilizers alone and similarly it is not possible to get higher crop yield by using organic manure only. The combined use of organic and inorganic fertilizers might be helpful for sustainable crop production and maintenance of soil fertility.

In the past, only three primary plant nutrients viz: N, P & K along with one secondary nutrient S were commonly used by the farmers of Bangladesh. The importance of the use of micronutrients was mostly ignored, although they could be the limiting factors, recently used micronutrients for crop production. The farmers of this country use only about 102 kg nutrients ha^{-1} (70 kg N, 24 kg P_20_5, 6 kg K_20, 2 kg S + Zn) annually, while the crop removal is nearly 200 kg ha^{-1}. The intensive cropping with modern varieties**,** nutrient leaching with monsoon rains and light textured soils are also favouring the emergence of micronutrient deficiency in this soil. Consequently, Zn and B deficiency are frequently reported on some soils and crops.

The soil fertility status are gradually declining or stagnating trend in the yield of major crops of the country is now becoming a very alarming issue for the scientists and policy makers. Cowdung a common manure in Bangladesh, can play a vital role in soil fertility improvement as well as in supplying most of the secondary and micronutrients. In the recent years poultry farms of the different sizes have been established all over the country.

Poultry farm holders use concentrated feeds to feed their poultry birds. As a result the poultry excreta are rich in nutrients. As the poultry excreta are not used as fuel these can be the good source of nutrients for field crops. Poultry manure contains high amount of secondary and micronutrients.

The farmers of Bangladesh are so poor and illiterate. So it is rigid that they don't know how to use properly secondary and micro nutrients adding from organic and inorganic sources. The intensive cropping with modern varieties, nutrients leaching with monsoon rains and light textured soil favorer emergence of secondary and micronutrient deficiency in those soils limiting secondary and micronutrients in properly blanched fertilization and organic amendments programmed should be taken into sequentially sustainable agricultural practices considerations keeping the above points in view, an experiment was conducted in BINA substation, Rangpur to investigate the effect of secondary nutrients, micronutrients and organic amendments on Tista Meander Floodplain Soils in achieving yield of T. aman for following objectives:

1. To study some physiological parameters which effect on growth and yield of rice,
2. To study the effect of secondary nutrients (S & Mg) micronutrients (B, Zn & Mo) and organic amendments (Poultry Manure & Cowdung) on the yield and yield contributing characters of T. aman rice,
3. To predict the effective doses of inorganic and organic fertilizers in rice at Tista Meander Floodplain Soils.

MATERIALS AND METHODS

The experiment was carried out at the BINA (Bangladesh Institute of Nuclear Agriculture) sub-station farm, Tajhat, Rangpur with T. aman (cv. BRRI dhan 32) under some selected treatments during the years 2002. The plots were situated on the North middle side of the sub-station fields. The physical and chemical characteristics of the initial soil are shown in Table 1.

Table 1. Physical and chemical properties of the soil

Particle size analysis	Results
AEZ-3	Tista Meander Floodplain soil (UNDP and FAO, 1988)
General soil type	Non-calcareous Brown Floodplain soil
Soil series	Gangachara
Sand (%) (2.0-0.02 mm)	58.24
Silt (%) (0.02 0.002 mm)	22.60
Clay (%) (<0.002 mm)	19.16
Soil textural type	Sandy loam
Organic matter content (%)	1.62
P^H	6.5
Total N (%)	0.11
Available P (ppm)	24.4
Available S (ppm)	6.62
Exchangeable K (me/100 g soil)	0.05
Available B(ppm)	0.17
Available Zn (ppm)	0.45
Exchangeable Mg (me/100 g soil)	1.37
Available Fe (ppm)	31.92
Available Mn (ppm)	5.13

The experiments were laid out in a randomized complete block design with three replications. There were eight treatments viz. T_1 = NPK (Control); T_2 = NPK + S; T_3 = NPK + Mg + S; T_4 = NPK + Mg + S + Zn; T_5 = NPK + Mg + S + Zn + B; T_6 = NPK + Mg + S + Zn + B + Mo; T_7 = NPK + PM (Poultry Manure); T_8 = NPK + CD (Cow dung). The total numbers of plots were 24. The unit plot size was 4m x 3m. The distance between two unit plots was 0.3m and between blocks 0.7 m. The treatments were randomized to the plots in each block. All the treatments contained recommended doses of N, P, K, S, Mg, Zn, B and Mo but sources were different. The sources of N, P, K, S, Mg, Zn, B and Mo, were urea, TSP, MP, gypsum, magnesium oxide, zinc oxide, borax and ammonium molybdate, respectively. Cow dung (CD) and Poultry manure (PM) were applied at the rate of 5 t/ha (dry weight basis). The full dose of (both crop) Triple super phosphate (TSP), Muriate of potash (MP), gypsum, magnesium oxide, zinc oxide, borax, Ammonium molybdate and 1/3 urea were applied at the time of final land preparation. In first crop rice rest of urea was applied in two equal installments at maximum tillering stage and at booting i.e. panicle initiation stage of crop growth. The total amount of cowdung and poultry manure was applied in both crops (T. aman rice) at 15 days before planting. The full amount of each TSP and MP was added as broadcast during final land preparation. Twenty-five days old seedlings were transplanted in the experimental plots on 9 August 2002. A distance of 20 cm from row to row and 15 cm from hill to hill was maintained. Three seedlings were used in each hill. Intercultural operations were done to ensure normal growth of the crop. There was no infestation of insects, pests and diseases in the field, therefore, no control measures were requires for insects, pests and diseases. The crop was harvested on 19th November 2002 and the crop of each plot was bundled separately and brought threshing floor. Yield and yield contributing data were taken when the crop attained maturity. The yield contributing parameters such as plant height, panicle length and 1000-grains weight (g) were collected from 10 (ten) randomly selected plants taken from each plot. Grain and straw yields were recorded plot-wise on sun dry basis. Grain yield was expressed on 12-14 % moisture basis. Grain and straw samples were collected, dried and ground for chemical analysis to calculate the nutrient content and uptake by the plant. The analysis of variance for every crop characters, for the nutrient content and nutrient uptake by the plant was done following the principle of F-statistics and the mean results in case of significant F-value were adjusted by the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The data on yield components of the crop as affected by different fertilizer treatments are presented in Table 2 results are discussed below:

Plant height

The plant height of T. aman rice (BRRI dhan-32) was unaffected due to the application of different treatment combinations (Table 2). The plant height ranged from 120 cm to 125 cm. The highest plant height of BRRI dhan-32 was 125cm in T_7 (PM) treatment and the lowest plant height was 120 cm in T_1 (control). However, the values for plant height of all the treatments were higher than that of the control. A similar effect of FYM with N, P and K was reported by several researchers (Maskina *et al.* 1985).

Table 2. Effect of secondary nutrients, micronutrients and organic amendments on yield and yield components of T. aman rice (BRRI dhan 32)

Treatment	Plant height (cm)	Tillers per hill (no.)	Panicle length (cm)	1000 grain weight (g)	Grain yield Kg/ha	Straw yield Kg/ha
T_1 NPK (control)	120.00 c	8.80 d	22.98 a	20.11 d	3410.00 b	3926.00 d
T_2 NPK+S	120.90 bc	9.33 cd	23.20 a	21.53 cd	3451.00 b	4054.00b cd
T_3 NPK+S+Mg	121.10 bc	9.47 cd	23.36 a	20.70 abc	3529.00 b	4009.00 cd
T_4 NPK+S+Mg+Zn	121.40 bc	9.67 bc	23.42 a	21.73 c	3421.00 b	3981.00 d
T_5 NPK+S+Mg+Zn+B	122.46 abc	9.90 abc	24.10 a	22.33 bc	3565.00 b	4248.00 b
T_6 NPK+S+Mg+Zn+B+Mo	123.47 ab	10.00 abc	24.50 a	22.81 abc	3540.00 b	4088.00b cd
T_7NPK+Poultry manure(PM)	125.00 a	10.57 ab	24.57 a	24.00 a	3937.00 a	4482.00 a
T_8 NPK+Cow dung(CD)	123.10 abc	10.30 a	23.30 a	23.50 ab	3607.00 b	4190.00 ab
CV(%)	1.64	4.30	7.74	3.88	4.03	4.28
S.E.(±)	1.42	0.34	1.50	0.71	116.93	86.33

Table 3. Effect of secondary nutrients, micronutrients and organic amendments on N, P and K content grain and straw of T. aman rice (BRRI dhan 32)

Treatment	Grain			Straw		
	N(%)	P(%)	K(%)	N(%)	P(%)	K(%)
T_1 NPK(control)	0.740 c	0.310 abc	0.600 ab	0.384 f	0.180 abc	1.900 a
T_2 NPK+S	0.760 c	0.293 c	0.540 c	0.420 e	0.179 abc	1.83 ab
T_3 NPK+S+Mg	0.890 ab	0.313 ab	0.617 ab	0.521 d	0.169 bcd	1.75 bc
T_4 NPK+S+Mg+Zn	0.905 a	0.300 bc	0.580 bc	0.534 cd	0.164 cd	1.83 ab
T_5 NPK+S+Mg+Zn+B	0.836 b	0.309 abc	0.540 c	0.540 c	0.190 a	1.650 c
T_6 NPK+S+Mg+Zn+B+Mo	0.919 a	0.315 ab	0.610 ab	0.561 b	0.158 d	1.690 c
T_7 NPK+Poultry manure(PM)	0.945 a	0.327 a	0.660 a	0.617 a	0.198 a	1.880 a
T_8 NPK+ Cow dung(CD)	0.919 a	0.316 ab	0.620 ab	0.578 b	0.187 ab	1.00 d
CV (%)	3.490	6.260	6.170	2.930	11.00	3.260
S.E.(±)	0.0258	0.0082	0.026	0.008	0.008	0.044

The figures having common letter in a column are not significantly at 5% level by DMRT
S.E. (M) = Standard error of mean
CV = Co-efficient of Variation

Tillers/hill

There was a significant effect of the treatments on tillering of T. aman rice (Table 2). The highest number of tillers/hill (10.57) was observed when poultry manure was applied (T_7), which was statistically identical with T_8 (CD), T_6 & T_5 treatments. The lowest numbers of tillers/hill (8.80) was noted in control (T_1) treatment. Ahmed and Rahman (1991) reported similar result of organic manure (PM & CD) on Tillers/hill. Aptosol (1989) also reported that organic and inorganic fertilizers increased the number of effective tillers/hill.

Panicle length

Panicle length of BRRI dhan-32 was not significantly influenced due to different treatments (Table 2). The panicle length varied from 22 cm in T_1 (control) treatment to 24.57 cm in T_7 (PM) treatment. However, the panicle length of all the treatments was higher than that of the control.

1000-grain weight

The 1000-grain weight of BRRI dhan-32 was significantly affected due to the application of different treatment combinations and ranged from 20.11 g to 24.0g (Table 2). The highest value of 1000-grain weight of T. aman rice was recorded 24.0 g in T_7 (PM) treatment and the lowest was 20.11g in T_1 (control) treatment.

Grain Yield

Grain yield of T. aman rice (var. BRRI dhan 32) responded significantly to the application of different treatment combinations of secondary nutrients, micronutrients and organic amendments (Table 2). All the treatment combinations gave significantly higher grain yield over the control. The grain yield varied from 3410 to 3937 kg/ha. The highest grain yield of 3937 kg/ha, recorded with the treatment T_7 (PM) which yields increment over control. The second highest grain yield of 3607.00 kg/ha was observed in T_8 (CD) the treatment comprising all secondary and micro nutrients and which was statistically identical with T_5 treatment. In producing grain yield, the treatments may be ranked in order of $T_7 > T_8 > T_5 > T_6 > T_3 > T_2 > T_4 > T_1$. Incase of individual effect of secondary (Mg) and micronutrients (Zn, B and Mo). The B missing treatment (T_4) recorded lower grain yield compared to Zn missing treatments (T_3). This result was expected as the Mg (exchangeable) and Zn (available) status of the initial soil was 1.37 meq% and 0.45 ppm, which indicates a low status of Mg and Zn in soil. The results agree well with the findings of Islam *et al.* (1997), Karim (2001). The present results thus clearly indicate a yield advantage with the application of 5 t/ha poultry manure with the recommended rate of NPK (T_8) in achieving high yield goal in T. aman rice. Budhar *et al.* (1991) found that grain yield of rice was highest with application of poultry manure.

Straw Yield

Straw yield of T. aman rice (var. BRRI dhan-32) was also significantly influenced by the different treatment combinations of secondary nutrients, micronutrients and organic amendment treatments (Table 2). The straw yield of T. aman rice (var. BIRRI dhan-32) varied from 3926.00 kg/ha to 4482 kg/ha as noted in T_1 (control) and T_7 (PM). The highest straw yield (4482 kg/ha) was recorded in poultry manure treatment (T_7) that was significantly different from all other treatments. The second highest straw yield was obtained in T_5 treatment, which was statistically similar to T_8 (CD) and significantly higher than the rest of treatments. In producing straw yield, the treatments may be ranked in order of $T_7 > T_5 > T_8 > T_6 > T_2 > T_3 > T_4 > T_1$. This result also indicated the significant contribution of poultry manure to straw yield of T. aman rice. It is clear that organic amendments in combination with inorganic fertilizer encouraged vegetative growth of plants and there by increasing straw yield. Ahmed and Rahman (1991) also reported that the application of organic manure (poultry manure, cowdung) and chemical fertilizers increased straw yield of rice.

Nutrient content and uptake by T-aman rice grain and straw

Rice straw and grain samples were analyzed for N, P, K, S, Mg, Zn and B contents as influenced by the application of inorganic fertilizer, cowdung, poultry manure, along with NPK fertilizers. These data have been presented in Tables 3-7.

Nitrogen:

The N content in grain of T. aman rice ranged from 0.740 to 0.945 % and in straw of T. aman rice ranged from 0.384 to 0.617 % (Table 3). The poultry manure (T_7) treatment also recorded substantially highest N content (0.945 %). Kadu *et al.* (1991) reported that N uptake and its content in rice increased significantly with NPK + FYM application.

Phosphorus:

The P content in grain of T. aman rice ranged from 0.293 to 0.327 % and in straw of T. aman rice ranged from 0.158 to 0.198 % (Table 3). The grain P content was higher than that of straw P in all cases. Kadu *et al.* (1991) reported that grain P and K were the highest with NPK + FYM application.

Potassium:

The concentration of K in grain was significantly influenced by the treatment combination. The K content was ranged from 0.540 to 0.660 % in grain and 1.00 to 1.90 % in straw. Potassium content in straw was significantly influenced by the treatment combinations (Table 3). The T_1 treatment was statistically identical to T_2, T_4 and T_7 (PM) treatments. The straw K content was higher than that of grain K.

Secondary nutrient content and uptake in T. aman rice grain and straw

Sulphur:

The highest S (0.102 %) content in grain was recorded in T_7 (PM) and the lowest S (0.075%) content was noted in T_1 (0.075 %) treatment (Table 4). Hossain *et al.* (1989) reported that S concentration in rice straw increased considerably due to the addition of S applied as gypsum. Yoshida and Chowdhury (1979) and Islam *et al.* (1990) reported that application of sulphur increased the S content in straw of BR2 rice.

The S content in rice straw ranged from 0.099 % in T_1 (control) to 0.135 % in T_7 (PM) treatment (Table 4). The highest S content was observed in T_7, followed by T_6, T_8, T_3 & T_5 treatments. Similar results were also reported by Hoque and Eaqub (1984). The highest (4.02 kg/ha) S uptake was obtained by rice grain in T_7 (PM) treatment and lowest (2.56kg/ha) was found in T_1 (control) treatment. The straw S uptake ranged from 3.89 to 6.05 kg/ha. The total S uptake by rice straw and grain plus straw ranged from 6.45 to 10.07 kg/ha (Table 6). Islam *et al.* (1997) reported that application of S significantly increased S uptake by rice. This result correlated well with works of Xie and Mamaril (1992) who observed a significant S uptake by rice plant due to S application.

Addition of organic manure with NPK fertilizers further increased the S concentration in rice grain. Amongst the organic manures and inorganic fertilizer used, single effect poultry manure was found to be performed well than that of secondary nutrients, micronutrients and cowdung.

Table 4. Effect of secondary nutrients, micronutrients and organic amendments on S and Mg content in grain and straw of T. aman rice (BRRI dhan 32)

Treatment	Grain		Straw	
	S (%)	Mg (%)	S (%)	Mg (%)
T_1 NPK (control)	0.075 b	0.146 b	0.099 c	0.185 c
T_2 NPK+S	0.088 ab	0.160 b	0.111 bc	0.209 ab
T_3 NPK+S+Mg	0.0920 ab	0.154 b	0.122 ab	0.185 c
T_4 NPK+S+Mg+Zn	0.0950 a	0.158 b	0.116 abc	0.215 a
T_5 NPK+S+Mg+Zn+B	0.0890 ab	0.158 b	0.120 ab	0.204 abc
T_6 NPK+S+Mg+Zn+B+Mo	0.0920 ab	0.168 b	0.128 ab	0.209 ab
T_7 NPK+ Poultry manure(PM)	0.102 a	0.284 a	0.135 a	0.195 bc
T_8 NPK+ Cow dung (CD)	0.098 a	0.156 b	0.125 ab	0.190 bc
CV (%)	5.780	14.300	6.680	7.170
S. E.(±)	0.008	0.025	0.008	0.008

Table 5. Effect of secondary nutrients, micronutrients and organic amendments on Zn and B content grain and straw T. aman rice (BRRI dhan 32)

Treatment	Grain		Straw	
	Zn (ppm)	B (ppm)	Zn (ppm)	B (ppm)
T_1 NPK (control)	19.00 a	10.47 b	46.90 c	23.80 f
T_2 NPK+S	19.86 a	12.92 a b	67.80 a	47.45 bc
T_3 NPK+S+Mg	20.55 a	12.75 a b	70.50 a	38.00 d
T_4 NPK+S+Mg+ Zn	19.30 a	14.50 a	47.56 c	45.93 c
T_5 NPK+S+Mg+ Zn+B	20.80 a	13.71 a	70.10 a	30.50 e
T_6 NPK+S+Mg+ Zn+B+Mo	20.69 a	15.78 a	70.65 a	50.30 ab
T_7 NPK+ poultry manure(PM)	20.90 a	15.45 a	57.90 b	51.30 a
T_8 NPK+ cow dung(CD)	20.81 a	15.00 a	57.50 b	36.50 d
CV (%)	8.09	8.02	5.23	4.50
S. E. (±)	0.13	1.78	6.80	0.00

The figures having common letter in a column are not significantly at 5% level by dm DMRT
S. E. (M) = Standard error of mean
CV = Co-efficient of Variation

Magnesium:

Magnesium content in rice grain ranged from 0.146% to 0.284 % in T_1 (control) to 0.284 % in T_7 (PM) treatment. Mg content in rice straw ranged from 0.185 % in T_1 (control) to 0.215 % (Table 4). The highest Mg content was noted with the treatment T_7 (PM). The Mg uptake by grain varied from 4.98 to 11.18 kg/ha and by straw varied from 7.27 to 8.74 kg/ha. The total Mg uptake by grain plus straw ranged from 12.25 kg/ha to 19.92 kg/ha (Table 6). However, the Mg content of all the treatments was higher than that of the control treatments except T_3 treatment.

Micronutrient content and uptake in T. aman rice grain and straw

Zinc:

The Zn content in rice grain ranged from 19.00 ppm in T_1 (control) to 20.90 ppm in T_7 treatment and Zn content in rice straw ranged from 46.90 ppm in T_1 (control) to 70.65 ppm in T_6 treatment (Table 5). Hossain *et al.* (1989) also reported that Zn content in both grain and straw increased considerably due to Zn addition to soil. Maharana *et al.* (1993) reported that Zn concentration of rice grain and straw increased with applied $ZnSO_4$ and the concentration was more in straw than in grain. The Zn uptake by grain of T. aman rice varied from 0.064 to 0.082 kg/ha and by straw varied from 0.184 to 0.300 kg/ha. The total Zn uptake by grain plus straw ranged from 0.248 kg/ha to 0.373 kg ha^{-1} (Table 7). Zn uptake by the crop was closely associated with grain and straw yield.

Boron:

Boron content was found to vary from 10.47 ppm to 15.78 ppm in grain and in straw was 23.80 ppm in T_1 (control) treatment to 51.30 ppm in T_7 (PM), followed by T_6 treatment (Table 5). The B uptake by straw varied from 0.094 kg/ha in T_1 (control) treatment to 0.229 kg/ha in T_7 (PM) treatment and by grain of T. aman rice varied from 0.037 kg/ha in T_1 (control) treatment to 0.060 kg/ha in T_7 (PM) treatment. The total B uptake by grain plus straw ranged from 0.141kg/ha in T_1 (control) treatment to 0.289 kg/ha in T_7 (PM) treatment (Table 7). Hossain (1996) also reported similar findings in a field experiment on rice at BAU farm soil. Maharana *et al.* (1993) reported that in B deficient soil borax increased B concentration in rice grain and straw.

Table 6. Effect of secondary nutrients, micronutrients and organic amendments on S an Mg uptake by grain and straw of T. aman rice (BRRI dhan 32)

Treatment	Grain		Straw		Total	
	S kg/ha	Mg kg/ha	S kg/ha	Mg kg/ha	S kg/ha	Mg kg/ha
T_1 NPK(control)	2.56 c	4.98 c	3.89 d	7.27 c	6.45 e	12.25 b
T_2 NPK+S	3.04 bc	5.52 bc	4.50 cd	8.47 ab	7.54 d	13.99 b
T_3 NPK+S+Mg	3.25 b	5.43 bc	4.89 bc	7.42 c	8.14 b-d	12.85 b
T_4 NPK+S+Mg+Zn	3.25 b	5.41 bc	4.62 bc	8.69 ab	7.87 cd	14.10 b
T_5 NPK+S+Mg+Zn+B	3.17 b	5.63 bc	5.09 bc	8.67 ab	8.86 bc	14.30 b
T_6 NPK+S+Mg+Zn+B+Mo	3.26 b	5.95 b	5.23 b	8.54 ab	8.49 bc	14.49 b
T_7 NPK+ Poultry manure (PM)	4.02 a	11.18 a	6.05 a	8.74 a	10.07 a	19.92 a
T_8 NPK+ Cow dung(CD)	3.53 a b	5.62 bc	5.23 b	7.96 bc	8.76 b	13.58 b
CV (%)	9.39	5.49	7.16	4.79	4.31	8.48
S.E.(±)	0.25	0.28	0.29	0.32	0.29	1.00

Table 7. Effect of secondary nutrients, micronutrients and organic amendments on Zn and B uptake by grain and straw of T. aman rice (BRRI dhan 32)

Treatment	Grain	Straw	Total			
	Zn kg/ha	B kg/ha	Zn kg /ha	B kg/ha	Z kg /ha	B kg /ha
T_1 NPK(control)	0.064 b	0.037 b	0.184 c	0.094 f	0.248 d	0.141 f
T_2 NPK+S	0.068 ab	0.045 ab	0.274 ab	0.192 bc	0.342 b	0.237 c
T_3 NPK+S+Mg	0.073 ab	0.450 ab	0.283 ab	0.152 d	0.356 b	0.197 d
T_4 NPK+S+Mg+Zn	0.066 ab	0.049 ab	0.189 c	0.183 c	0.255 d	0.232 c
T_5 NPK+S+Mg+Zn+B	0.074 ab	0.047ab	0.297 a	0.129 e	0.371 a	0.166 e
T_6 NPK+S+Mg+Zn+B+Mo	0.073 b	0.056 a	0.300 a	0.206 b	0.373 a	0.262 b
T_7 NPK+ Poultry manure (PM)	0.082 a	0.060 a	0.259 ab	0.229 a	0.341 b	0.289 a
T_8 NPK+ Cow dung (CD)	0.075 ab	0.054 a	0.241 b	0.153 d	0.316 c	0.207 d
CV (%)	6.580	10.18	10.440	6.220	5.320	5.820
S.E.(±)	0.008	0.008	0.025	0.008	0.008	0.008

The figures having common letter in a column are not significantly at 5% level by DMRT
S. E. (M) = Standard error of mean
CV = Co- efficient of Variation

CONCLUSION

Based on the above result it may be concluded that to obtain satisfactory yield of T. aman application of recommended N, P and K containing fertilizers along with either CD or PM is needed for the "Tista Meander Floodplain Soil."

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