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Response of Mustard to Boron Fertilization in Old Brahmaputra Floodplain Soil

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Abstract: Two identical field experiments were conducted, one in Phulpur, Mymensingh and the other in Netrokona during rabi season of 1999-2000 to evaluate the effect of boron on the growth and yield of mustard and to find the suitable dose of boron fertilizer for mustard in Old Brahmaputra Floodplain soil of Bangladesh. Four treatments such as T_0 – Control, T_1 – recommended package, T_2 – alternate package and T_3 – farmers' practice were applied Application of boron significantly influenced plant height, branches per plant, pods per plant, seeds per pot, 1000-seed weight, seed yield and stover yield of mustard. The highest seed yield was obtained with the application of 1.5 kg B ha^{-1} in association with site specific recommended doses of N, P, K, S and Zn fertilizers in both Phulpur and Netrokona locations.

Key words : Boron, seed yield, mustard, Phulpur, Netrokona

Introduction

Mustard is the major oil seed crop of Bangladesh. It covers 58.6% of the total oilseed area and produces 52.2% of the total oilseed production in the country (BBS, 1997). The average yield of mustard per unit area in Bangladesh is very low. During recent years micronutrient problem on many crops have been warranted due to intensive cropping with rice and other crops.The practice of intensive cropping with modern varieties causes a marked depletion of inherent nutrient reserves of some other nutrients such as S, Zn and B are being observed in many parts of the country (Jahiruddin *et al*., 1992,1995). In Phulpur and Netrokona under Mymensingh region organic matter and boron content of the soil is poor for which yield of mustard is also poor. This is mainly due to less pod as well as siliqua formation. Brassica crops in general have a high boron requirement (Mengel and Kirkby, 1987) and they are sensitive to low B supply, and severe deficiency may result in floral abortion and significant drop in seed production (Yang *et al* ., 1989). Boron increases the number of siliqua and yield of mustard (Singh, 1963). Chatterjee *et al*.(1985) reported that borax appliction at the rate of 10 kg B ha^{-1} in conjugation with gypsum application (20 kg S ha^{-1}) caused 42% increased seed yield of mustard. The present investigation was, therefore, undertaken to evaluate the effect of boron on the growth and yield performance of mustard and to findout the suitable boron fertilizer dose for mustard in Old Brahmaputra Floodplain soil.

Materials and Methods

The experiment was laid out in randomized complete block design with 5 replications and 4 treatments in each site viz. T_0 – Control (no fertilizer), T_1 – recommended package (NPKSZn + 1 kg B ha^{-1}), T_2 – alternate package (NPKSZn + 1.5 kg B ha^{-1}) and T_3 – farmers' practice (50-30-4-4 kg NPKS ha^{-1} + 5 t cowdung ha^{-1}). Initial soil samples were collected from both locations and analyzed for physical and chemical characteristics of soil (Table 1) following stantard methods (Page *et al*., 1982). NPKSZn fertilizer was applied for recommended and alternate package at the rate of 95-10-52-29-4 Kg/ha for Phulpur and 95-17-51-19-4 Kg/ha for Netrokona on the basis of soil test values with the help of Fertilizer Recommendation Guide (BARC, 1997). Boric acid was used as a source of boron. Full amount of PKSZnB and $^1/_2$ N were applied as basal. Rest $^1/_2$ N was applied as top dress at the time of flowering. Recommended seed rate (9 Kg/ha) was maintained (BARI, 1999). Seeds were sown in broadcast during November 10-14, 1999. Insecticide application and intercultural operation were done as and when required. The crop was harvested on January 27-30, 2000. Data on plant height, branches per plant, pods per plant, seeds per pod,1000 seed weight, seed and stover yield were recorded and were analyzed statistically using ANOVA technique. The difference among treatment means was evaluated by Duncan's New Multiple Range Test (DMRT) (Steel and Torries, 1960).

Table 1: Physico-chemical characteristics of Phulpur and Netrokona soils (0-15 cm)

Physical characteristics	Phulpur	Netrokuna
Partical size distribution		
% Sand	28	19
% Silt	61	59
% Clay	11	22
Textural class	Silt loam	Silt loam
EC (μS/cm)	114.00	270.00
Chemical characteristics		
pH	5.65	5.20
Organic matter (%)	1.58	1.22
Total N (%)	0.084	0.084
Available P (ppm)	22.00	15.70
Exchangeable K (me/100gm soil)	0.064	0.074
Available S (ppm)	8.25	15.20
Available Zn (ppm)	1.34	1.29
Available B (ppm)	0.18	0.20

Results and Discussion

Yield components: The yield components of mustard as influenced by boron application in Phulpur and Netrokona have been presented in Table 2. It is evident that all the yield contributing characters of mustard, were increased significantly due to boron application. Plant height of the crop responded significantly to boron application in both Phulpur and Netrokona locations. Between two locations, the plants were taller at Netrokona than at Phulpur site. In both locations the highest plant heights were obtained with T_2 treatment, receiving site specific recommended doses of NPKSZn and 1.5 kg B ha^{-1} and the lowest values were found with control. Regarding the branches per plant, in both locations the highest number was found in case of T_2 which was statistically similar to T_1 receiving site specific recommended doses of NPKSZn and 1 kg B ha^{-1} at Phulpur while T_1 and T_3 (farmers' practice having no B) at Netrokona and the lowest values were observed in control. It was noted that the number of branches per plant was slightly higher at Phulpur than at Netrokona irrespective of treatments. The number of total pods per plant was significantly influenced by boron application in both Phulpur and Netrokona locations. In both sites the highest number of total pods per

Table 2: Effect of different doses of boron fertilizer on the yield components of mustard at Phulpur and Netrokona locations during rabi season of 1999-2000

Treatment	Plant height (cm)		Branches plant^{-1} (No.)		Pods plant^{-1} (No.)		Seeds pot^{-1}		1000-seed wt. (g)	
	Phulpur	Netro-kona	Phulpur	Netro-kona	*Phulpur	Netro-kona	Phulpur	Netro-kona	Phulpur	Netro-kona
T_0 (Control)	47.4b	48.2c	2.2b	2.1b	16.0c	12.9c	6.6c	6.1c	2.01d	1.98c
T_1 (Recommended package)	55.6a	60.0b	3.0a	2.9a	25.9ab	25.7ab	11.4a	10.9a	2.60b	2.44ab
T_2 (Alternate package)	57.4a	66.7a	3.1a	3.0a	28.1a	26.6a	12.2a	11.7a	2.86a	2.66a
T_3 (Farmers' practice)	50.9b	50.6c	2.4b	2.2ab	23.2b	20.4b	9.2b	9.0b	2.38c	2.30b
SE (±)	1.03	0.65	9.89	0.25	1.04	1.34	0.34	0.25	0.04	0.05
CV%	4.36	2.57	0.12	21.77	10.0	13.93	7.62	5.94	3.19	4.87

Figures in column having common letter (s) do not differ at 1% level of probability, *5% level of probability.

Table 3: Effect of different doses of boron fertilizer on seed and stover yields of mustard at Phulpur and Netrokona locations during rabi season of 1999-2000

Treatment	Seed yield (kg ha^{-1})		Stover yield (kg ha^{-1})	
	Phulpur	Netrokona	Phulpur	Netrokona
T_0(Control)	325.0c	242.0d	745.0c	625.0c
T_1 (Recommendedpackage)	710.0a	522.0b	1180.0ab	1150.0a
T_2(Alternate package)	760.0a	618.0a	1260.0a	1240.0a
T_3(Farmers'practice)	560.0b	382.0c	1030.0b	800.0b
SE (±)	27.0	21.90	44.08	39.77
CV%	10.26	11.11	9.35	9.37

Figures in column having common letter (s) do not differ significantly at 1% level of probability.

plant was produced by T_2 which was statistically identical with T_1 and the lowest value was given by T_0 treatment. The results of present study are in agreement with Islam and Sarker (1993) who found significant effect of boron on pod set in mustard. Considering seeds per pod the results were found a little bit higher at Phulpur than at Netrokona location irrespective of treatments. The trend of the results was at par with pods per plant. In case of 1000-seed weight the highest values were recorded from T_2 in both locations followed by T_1 and T_3 treatments, while the lowest values were recorded from control.

Seed yield: Seed yield of mustard was markedly influenced by boron application in both locations (Table 3). In Phulpur the highest seed yield of 760 kg ha^{-1} was obtained with application of 1.5 kg B ha^{-1} (T_2) followed by the yield of 710 kg ha^{-1} obtained with application of 1 kg B ha^{-1} (T_1)and the lowest value of 325 kg ha^{-1}was obtained with control. Although T_2 gave higher seed yield than T_1, they were statistically similar. In case of Netrokona T_2 gave the highest seed yield of 618 kg ha^{-1}which was 18.39% higher than that of T_1 (382 kg ha^{-1}). The lowest value of 242 kg ha^{-1} was found in control. The highest plant height, branches per plant, pods per plant, seeds per pod and 1000-seed weight contributed to the highest seed yield in the treatment T_2 and farmer's practice (T_3) showed third highest yield at both locations. The yield difference between the T_2 and T_3 was 200 Kg ha^{-1} (35.71%) in Phulpur and 236 Kg ha^{-1} (61.78%) in Netrokona location. These results are in agreement with Dixit and Shukla (1984) and Sinha *et al.* (1991) who found that application of boron significantly increased the yield of mustard and 1.6 kg B ha^{-1} appeared to be the optimum B level for mustard.
Comparing the location effect, seed yield in Phulpur site was higher than that in Netrokona. This difference in yield resulted from the difference in pods per plant, seeds per pot and 1000-seed weight between Phulpur and Netrokona locations.

Stover yield: The effect of boron on the stover yield of mustard was highly significant in both Phulpur and Netrokona locations (Table 3). The highest stover yield was obtained with the application of 1.5 kg B ha^{-1} (T_2) which was statistically at par with T_1 (1 kg B ha^{-1}). The treatment T_3 ranked the next position in stover yield. The lowest stover yield was found in control at both locations. The results of the present study support the findings of Sinha *et al.* (1991), who found that the stover yield of mustard crop was increased significantly by boron application.
The overall results indicate that, for obtaining satisfactory yield of mustard both Phulpur and Netrokona sites of Old Brahmaputra Floodplain, soil need to be fertilized with 1.5 kg B ha^{-1}with site specific recommended rates of N, P, K, S and Zn. Further, the experiment can be repeated with different varieties of mustard to examine the varietal response to the added B for making final recommendation.

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