EFFECT OF DIFFERENT LEVELS OF BORON ON THE YIELD AND YIELD ATTRIBUTES OF MUSTARD IN SURMA-KUSHIARA FLOOD PLAIN SOIL (AEZ 20)

M. J. HUSSAIN[1], M.M.R SARKER[2], M. H. SARKER[2], M. ALI[2] AND M.M.R. SALIM[3]

[1]Senior Scientific Officer (A/C), OFRD, BARI, Sylhet, [2]Scientific Officer, OFRD, BARI, Sylhet and [3]Scientific officer, Agricultural Research Station, BARI, Thakurgaon, Bangladesh

Accepted for publication: October 24, 2008

ABSTRACT

Hussain M. J., Sarker M.M.R, Sarker M. H., Ali M. and Salim M.M.R. 2008. *Effect of Different Levels of Boron on the Yield and Yield Attributes of Mustard in Surma-Kushiara Flood Plain Soil (AEZ 20).* **J .Soil .Nature. 2(3)**: **06-09**

The experiment was conducted at Farming Systems Research and Development (FSRD) site Jalalpur, Sylhet during the two consecutive rabi seasons of 2005-06 and 2006-07 in Surma-Kushiara flood plain soil (AEZ-20) to show the effect of boron application on yield and yield attributes of different mustard varieties. The experiment involved five boron levels viz. 0, 0.5, 1.0, 1.5 and 2.0 kg B / ha and three mustard varieties viz. BARI sharisha-8, BARI sharisha-9 and BARI sharisha-11. The result from two years experiment revealed that 1-1.5 kg boron/ha should be applied along with recommended fertilizers produced higher seed yield. BARI sharisha-11 and BARI sharisha-8 performed better and highly response to boron than BARI sharisha-9. Highest seed yield (1.57 t/ha) was obtained from the combination of BARI Sharisha – 11 and boron level 1.0 kg / ha.

Key words: Mustard, boron, yield attributes and yield

INTRODUCTION

Mustard is the principal oilseed crop of Bangladesh, covers about 60% of the total oil seed area (BBS, 1998). Its production is 3.34 lac metric tons against a total oilseed production of 5.48 lac metric tons annually and it acreages is 3.52 lac hectare against a total oilseed area of 5.32 lac hectare (Krishi Dairy, 2008). At present, the local production of edible oil meets only 25% of the country requirement (Chowdhury and Uddin, 1990). The average yield of mustard is only 778 kg/ha (BBS, 2002), which is very low compared to other mustard growing countries of the world. Local production can meet up only one third of the requirement. Developing new high yielding varieties with a package of production technologies should increase the productivity of oilseed crops. On-farm research division has introduced BARI sharisha-8, BARI sharisha-9 and BARI sharisha-11. Farmers generally use local variety Tori-7 with their own fertilizer management, which yielded very low. Therefore, the scope to introduce high yielding varieties of mustard with proper fertilizer management can encourage the oilseed production in this area. This will help increase the present yield level of rapeseed and thus will reduce the gape between present production and requirement. Farmers generally apply lower amount of NPK and they did not use boron fertilizer in mustard. But, Sing (1963) reported that boron increased number of siliqua and yield of mustard. The seed yield of mustard plants is greatly influenced by boron particularly where soil is deficient in boron. Recently boron deficiency was clearly depicted in the light soil (AEZ- 20) of Sylhet region through a good number of soil analyses reports of OFRD and SRDI. The analysis report revealed that the soil of Sylhet area contains trace amount (0.2-0.3 µg/g soil) of boron. In preliminary study boron application effect was observed in mustard at Jalalpur Sylhet. Moreover, genotypic variability of mustard to boron application should be find out. Brassica group generally has a high boron requirement (Mengel and Kirkby, 1987). As observed by Dutta *et al*. (1984) and Islam and Sarker (1993), boron application markedly increased pod number and seed set. Mehortra *et al*. (1977) observed a seed yield increase ranging from16-69 % due to boron application. Therefore, a comprehensive study is needed to find out the effect of boron on mustard for extension and farmer's recommendation. Hence, the experiment was undertaken to investigate the influence of boron application on growth and yield of mustard and to observe if there is any genotypic response to boron application.

MATERIALS AND METHODS

The experiment was conducted at Farming System Research and Development (FSRD) site Jalalpur, Sylhet during the two consecutive rabi season of 2005-06 and 2006-07. The experiment field belongs to Goainghat soil series under the Agro-ecological region Surma-Kushiara Floodplain (AEZ- 20). Initial soil status of the experimental plot was presented in Table 1.

Table1. Initial soil status of the experimental plot at Jalalpur, Sylhet

Elements	pH	OM %	N %	P (ppm)	K(me/ 100gsoil)	S (ppm)	Zn (ppm)	B (ppm)
Ishaq Ali	4.7	1.19	0.09	4.6	0.13	8.5	0.95	0.30
Mobarak Ali	4.5	1.22	0.08	31.4	0.09	5.9	1.20	0.30
Rafiq Ali	5.1	1.32	0.08	2.4	0.04	13.3	0.90	0.30
Average	4.77	1.24	0.08	12.80	0.09	9.23	1.02	0.30
Status	Highly acidic	Low	Very low	Low	Very low	Low	Medium	Low

According to the analysis report, the soil of the experimental field was loamy clay in texture with P^H value 4.77 (highly acidic) and organic matter was 1.24% (low). The initial nutrients status of the soil was N=0.08% (very low), P=12.80 ug/g soil (low), K=0.09 meq/100 g soil (very low), S=9.23ug/g (low), Zn=1.02 ug/g (medium) and B=0.30 ug/g (low).

The trial consisted of five B levels viz. 0, 0.5, 1.0, 1.5 and 2.0 kg B/ha having three varieties such as BARI Sharisha 8, BARI Sharisha 9 and BARI Sharisha 11. The experiment was carried out through split plot design with three replications. The unit plot size was 8 X 5 m. According to soil test values, fertilizer doses for HYG of Mustard were selected followed by FRG, BARC, 2005). On the basis of soil analyses report fertilizers were applied as 120-23-57-28 NPKS kg/ha. Elements N, P, K, S and B were applied in the form of urea, triple super phosphate, muriate of potash, gypsum and boric acid, respectively. Half urea and other fertilizers were applied at during the final land preparation and the rest half of urea was top dressed at pre-flowering stage i.e. within 25 days after sowing. Seeds were sown on 29th November @ 9 kg/ha and harvesting started from 20th February and continued up to 8th February at maturity. Intercultural operations such as thinning and weeding were done as per requirement. Data on days to flowering and maturity were collected. At maturity, 10 randomly selected plants were collected to record the data on yield contributing characters such as number of branch, number of siliqua, and number of seed and 1000grain weight. Data were analyzed statistically and mean values were separated by DMRT followed by computer package MSTATC.

RESULTS AND DISCUSSIONS

The effect of variety

Significant differences were observed among the varieties in respect of plant height, number of branch/plant, number of siliqua/plant, 1000-grain weight and seed yield (Table 2). Among the varieties, BARI sharisha 11 showed highest plant height followed by BARI sharisha 8. Similarly number of branch/plant was higher in BARI sharisha-11 compared to other varieties. Number of siliqua/plant, number of seeds/siliqua and 1000 grain weight also varied significantly within varieties and BARI sharisha-8 and BARI sharisha -11 performed better compared to BARI sharisha-9. Significantly higher seed yield was recorded in BARI sharisha-11 (1.516 t/ha) which was statistically identical with BARI sharisha-8. Number of seeds/siliqua and 1000 grain weight mainly contributed to the seed yield. Regarding days to maturity shorter duration was recorded with BARI sharisha-9. But no significant effect was found among the varieties in biomass production.

Table 2. Main effect of different varieties of mustard on the growth, yield and yield parameters (Two years pooled data)

Variety	Plant height (cm)	No. of branch/ plant	No. of Siliqua/ plant	No. of seed/ siliqua	1000 grain wt. (g)	Days to maturity	Grain yield (kg/ha)	Bio-mass yield (t/ha)
BARI Sarisha 8	105.32b	3.48c	105.71b	19.56a	3.16b	93.59b	1.454a	2.88
BARI Sarisha 9	89.89c	4.58a	93.15c	14.74c	2.65c	83.69c	1.200b	3.28
BARI Sarisha 11	111.48a	4.22b	113.22a	15.63b	3.83 a	101.57a	1.516a	3.26
LSD(0.05)	1.409	0.1785	1.210	0.4361	0.1666	0.7620	0.1014	0.5912ns

Effects of Boron

Boron levels significantly effected on plant height, number of branch per plant, number of siliqua, number of seed per siliqua, grain yield and bio-mass yield (Table 3) .It was observed that the number of siliqua/plant and seed/siliqua produced significant variations among the different levels of boron. The highest plant height,

number of branch per plant, number of siliqua and number of seed per siliqua was obtained from 1 kg boron/ha, which was significantly different from all other treatments. Highest number of siliqua/plant (109.18) which was obtained with 1 kg boron/ha and it was supported to the findings of Gupta *et al.* (1980), who reported that application of boron increased siliqua formation of mustard. Similarly highest number of seed/siliqua (16.95) was obtained with 1.00 kg B /ha. Grain and biomass yield produced significant variations among different levels of boron. Highest seed yield 1.453 t/ha) was obtained with 1.0 kg B /ha which was statistically similar to 1.5 kg B/ha. This result was supported by the findings of Islam *et al.* (1998) as ported that the highest yield of mustard was recorded with the application of boron at the rate of 1.0 to 1.5 kg/ha. But Highest biomass yield (3.453 t/ha) was obtained with 1.0 kg B /ha which was significantly different from all other levels of boron. There was no significant effect was found in case of 1000-grain weight.

Table 3. Main effect of boron level and variety on the growth, yield and yield Parameters of mustard (Two years pooled data)

Boron Level (kg/ha)	Plant height (cm)	No. of Branch /Plant.	No. of Siliqua./ plant.	No. of seed/ siliqua	1000 grain wt. (g)	Days to maturity	Grain yield (t/ha)	Bio-mass yield (t/ha)
0.00	99.93c	3.93b	102.14c	16.47b	3.15	92.45b	1.342c	2.951c
0.50	101.28b	4.01b	102.67bc	16.58b	3.19	92.50b	1.368bc	3.047bc
1.00	105.51a	4.43a	109.18a	16.95a	3.33	94.69a	1.453a	3.453a
1.50	102.22b	4.07b	103.58b	16.64b	3.20	92.56b	1.400ab	3.164b
2.00	102.22b	4.02b	102.55bc	16.58b	3.19	9253b	1.388bc	3.083bc
LSD (0.05)	1.324	0.138	1.184	0.305	0.144ns	0.671	0.053	0.179

Interaction effect of variety and boron levels

The interaction effect of variety and different levels of boron was found significant for all characters except 1000-grain weight (Table 4). All the varieties performed better less than 1 kg B/ha. Highest plant height (115.353 cm) was obtained with BARI Sharisha –11 with 1.00 kg B /ha. Highest number of branch was found with the combination of BARI Sharisha-9 with 1.0 kg B/ha. Number of siliqua/plant was highest with BARI Sharisha 11 and 1.0 kg B/ha. Number of seed/siliqua was highest with the combination of BARI Sharisha -8 and B level 1.0 kg/ha which was statistically identical to all other levels of boron for this variety. A Significant interaction effect was observed in grain yield and biomass yield. From the interaction effect it was found that BARI Sharisha-1 and B level 1.00 kg/ha performed best among the varieties and B levels. Significantly higher seed yield was obtained from BARI sharisha-11 (1.571 t/ha) with 1.00 kg B/ha that is similar to BARI sharisha 8 with 1.0 kg B/ha and all other levels of boron with the variety BARI Sharisha–11. Almost similar results were found in case of biomass yield and the highest biomass yield (3.733 t/ha) was obtained from the combination BARI Sharisha–11 with 1.0 kg B/ha followed by BARI Sharisha–8 with 1.0 kg B/ha.

Based on the result of two years experiment it could be concluded that all variety and boron level 1.0-1.5 kg B/ha have positive effect on the yield performance of mustard. BARI sharisha 11 and BARI sharisha 8 performed better with high boron response than BARI sharisha–9. So, 1.0-1.5 kg boron per hectare is suggested to be applied as optimum dose, along with other fertilizers for mustard cultivation in Surma-Kushiara flood plain soil in Sylhet region (AEZ-20).

Table 4. Interaction effects of variety and boron level on the growth, yield and yield attributes of mustard (Two years pooled data)

Variety X B level	Plant height (cm)	No. of br./Pt.	No. of Siliq./pt	No. of seed /sili.	1000 grain wt. (g)	Days to maturity	Grain yield (t/ha)	Bio-mass yield (t/ha)
BARI-8								
0.0	103.100f	3.307f	103.303c	19.437a	3.120	93.077d	1.391c	2.673f
0.5	104.770ef	3.380f	103.600c	19.513a	3.153	93.167d	1.459bc	2.810ef
1.0	108.010cd	3.820e	113.257b	19.680a	3.177	95.267c	1.520ab	3.159b-e
1.5	105.890de	3.470f	104.723c	19.603a	3.180	93.230d	1.458bc	2.909d-f
2.0	104.837ef	3.420f	103.673c	19.557a	3.170	93.197d	1.444bc	2.824ef
BARI.-9								
0.0	87.490i	4.407bc	91.470e	14.487c	2.547	83.337f	1.162e	3.130b-e
0.5	88.507hi	4.487b	92.140e	14.587c	2.580	83.330f	1.140e	3.227b-d
1.0	93.157g	4.963a	97.400d	15.403b	2.950	85.047e	1.267d	3.468ab
1.5	89.390hi	4.557b	92.933e	14.640c	2.603	83.357f	1.224de	3.359bc
2.0	90.913gh	4.497b	91.793e	14.560c	2.577	83.353f	1.206de	3.232b-d
BARI-11								
0.0	109.197bc	4.077d	111.660b	15.497b	3.783	100.937b	1.472abc	3.051c-e
0.5	110.553b	4.167cd	112.293b	15.600b	3.827	101.007b	1.505ab	3.104c-e
1.0	115.353a	4.513b	116.870a	15.760b	3.870	103.763a	1.571a	3.733a
1.5	111.373b	4.180cd	113.073b	15.663b	3.830	101.083b	1.517ab	3.225b-d
2.0	110.897b	4.147d	112.180b	15.633b	3.827	101.037b	1.513ab	3.192b-d
LSD(0.05)	1.324	0.2383	2.051	0.5275	0.250ns	1.161	0.0923	0.3107

REFERENCES

Bangladesh Bureau of Statistics (BBS). 2002. Statistical Year Book of Bangladesh. 2002. Ministry of Planning, Govt. of Bangladesh Dhaka.

Bangladesh Bureau of Statistics (BBS).1998. Statistical Year Book of Bangladesh. 1998. Ministry of Planning, Govt. of Bangladesh Dhaka.

Chowdhury, M.A.Z. and M.J.Uddin.1990. Genetic parameters and character association in mustard. In extended synopsis of 15th Bangladesh Science Conference held in March 5-8, 1990 at Atomic Energy Research Establishment, Savar, Dhaka. Pp 87-90

Dutta, R.K., M. Uddin and L. Rahman. 1984. Productivity of mungbean, rice and mustard in relation to boron in Brahmaputra Floodplain soils. Bangladesh J. Soil Sci. 20: 77-83

FRG (Fertilizer Recommendation Guide). 2005. Bangladesh Agricultural Research Council (BARC), Farmgate, New airport Road, Dhaka-1215

Gupta I.C. 1980.Soil salinity and boron toxicity.Current Agril. 4(1-2):1-16

Haque, M.A. 2000. Effects of sulphur and boron on yield, oil content and nutrient uptake of mustard. M.S. Thesis. Dept. of Soil Science, BAU, Mymensingh.80p.

Islam, M. B. and M.A.Z. Sarker. 1993. Effect of different levels of boron on the yield of Mustard. Research Report 1992-93. BARI, Rangpur station pp1- 4

Islam M.B., D.A. Choudhury and M. Fazlul Haque. 1998. Response of crops to boron fertilization. In Proceedings of the National Workshop on Integrated Nutrient Management for crop production and soil Fertility held in March 24-25, 1998 at BARI, Joydebpur, Gazipur.pp.31-42

Krishi Dairy. 2008. Agriculture Information Service (AIS), Department of Agriculture Extension, Khamarbari, Dhaka-1215. Pp 34-35

Mehrotra, O.N., R.D.L. Srivastava and P.H. Misra. 1977. Effect of micronutrient on the growth, yield and quality of Indian mustard. Indian J. Agric. Chem. 10: 81-86

Mengel, K. and E.A.Kirkby. 1987. Principles of plant Nutrition. International Potash Institute, Switzerland.

Sing, S.I. 1963. Effect of foliar spray of micronutrients on growth and yield of *Brassica camprestris.* Indian Journal of Agricultural Science. 33:232-239