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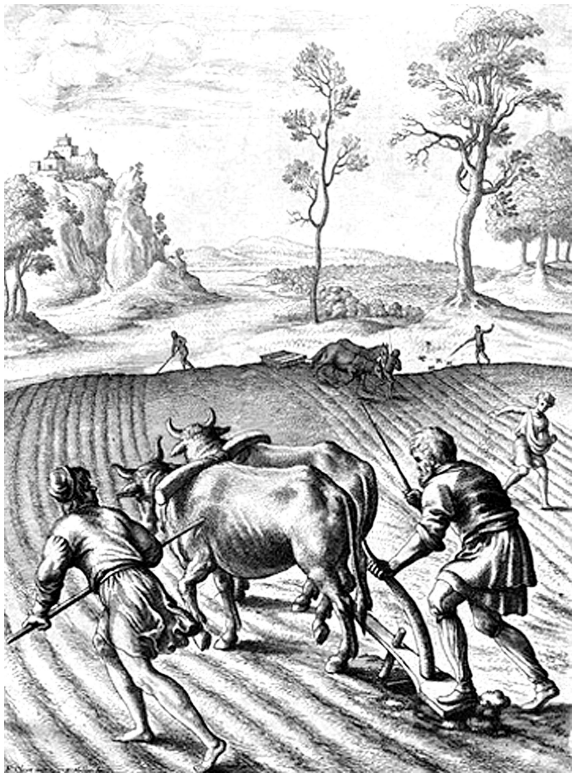

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Performance of Mustard Varieties with Boron Fertilization in Calcareous Brown Floodplain Soil of Bangladesh

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Abstract: A field experiment was carried out at Calcareous Brown Floodplain Soil of Regional Agricultural Research Station, Jessore during the two consecutive seasons of 2000-2002. The objectives were to evaluate the effect of boron on the yield of mustard and to screen out the suitable variety (s) tested against different boron levels for maximizing yield of mustard in the study area. Four varieties of mustard viz., BARI Sharisha-6, 7, 8 and 9 and 4 levels each of boron (0, 1.0, 1.5 and 2.0 kg ha^{-1}) along with a blanket dose of $N_{120}P_{35}K_{65}S_{20}Zn_5$ kg ha^{-1} and cowdung 5 t ha^{-1} were taken in the study. Results revealed that BARI Sharisha-6 integrated with 1.5 kg B ha^{-1} was found to be superior to all other treatment combinations. The highest mean seed yield (1.96 t ha^{-1}) was recorded with the said treatment by 25.64% yield increase. Among the 4 tested varieties of mustard, BARI Sharisha-7 showed a good performance and produced the highest mean yield (1.77 t ha^{-1}) as compared to other varieties used. On the other hand, boron at the rate of 1.5 kg ha^{-1} individually increased the highest seed yield by 58.83%, over boron control (Bo). However, from regression analysis, a positive but quadratic relationship was observed between seed yield and boron levels.

Key words: Mustard, boron, molybdenum, calcareous, brown

INTRODUCTION

Mustard (*Brassica campestris* L.) is the most popular and chief oleaginous crop of Bangladesh. In terms of area (812405 acres) and production (24908.0 MTS) in Bangladesh (BBS, 2002). It stands the first rank among oil producing crops. However, with the introduction of new modern varieties and their intensive cultivation through applying high analysis fertilizers have boosted the yields of many crops. Result of the reaping of essential nutrients from native soil cause the nutrient depletion of the soil. Consequently, deficient of some essential micronutrients are highly noticed in specific areas of the country. Micronutrients often play a key role in seed formation. Some crops like mustard, pulses, cole crops, maize, wheat, banana and papaya are very responsive to micronutrients. Specially boron is responsible for protein synthesis. Boron deficiency also may cause of floral abortion and sterility of seed (Islam *et al*., 1994) which ultimately affects the reduction of seed yields tremendously. Gupta *et al*. (1998) found similar findings in their study. It is reported that boron could increase the number of siliqua and filled grains in pods. Effect of boron and other micronutrients on seed yield of mustard have been stated by many researchers (Hu *et al*., 1996; Liu *et al*., 1995; Sen, 1996, Kushwah *et al*., 1996; Zhu *et al*., 1996). A judicious integration of macro and micronutrients along with organic manure not only increase. The crop yield but also maintain. The soil fertility and productivity for keeping the sustainability of agricultural production. Recently, BARI has developed some high yielding varieties of mustard in mitigating the demand of oil for penurious population. But their response to boron fertilizer has not been documented. Due to their genetic make up and yielding ability, it may vary among the varieties. To verity the test, the present study was therefore, designed to screen out the variety(s) and to find out the optimum requirement of boron for yield maximization of mustard in southern part of Bangladesh.

MATERIALS AND METHODS

The field experiments were conducted in Calcareous Brown Floodplain Soil (EPZ-11) at Regional Agricultural Research Station, Jessore during the rabi seasons of 2000-2001 and 2001-2002, respectively. The nutrient status of initial soil was presented in Table 1.

The experiment was laid out in randomized block design replicating thrice. It was a factorial experiment with 4 levels of B (0, 1.0, 1.5 and 2.0 kg ha^{-1}) and 4 varieties of mustard viz., BARI sharisha-6, BARI sharisha-7, BARI sharisha-8 and BARI sharisha-9 were tested in the study.

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Table 1: Chemical properties of the initial soil at the experimental field

			Ca	Mg	K		P	S	B	Mn	Zn
Location	pH	OM	Meq/100 g			Total N%	ug g^{-1}				
Jessore	7.2	0.85	11.40	2.36	0.31	0.12	30	15	0.2	5.0	2.0
Critical level	-	-	2.0	0.8	0.2	0.10	14	14	0.20	5.0	2.0

Source: Soil Science Laboratory, BARI

Sixteen different treatment combinations were constituted for verification. The unit plot size was 4×5 m and the seeds were sown in mid November for both the years by maintaining 30 cm row to row distance apart. Boric acid was used as a source of boron. Four levels each of B (0, 1.0, 1.5 and 2.0 kg ha^{-1}) along with a blanket dose of other chemical fertilizers ($N_{120}P_{35}K_{65}S_{20}Zn_5$ kg ha^{-1} and CD at the rate of 5 t ha^{-1}) were taken in the test. All P, K, S, Zn, B and CD and ½ of N were applied at the time of final land preparation and remaining ½ N was top dressed prior to flowering. Irrigation and other intercultural management practices were done as and when necessary. The crop was harvested on 15th March for both the seasons. The necessary data on different parameters wee recorded form 10 randomly selected plants. Then it was computed and analyzed statistically. The analyzed data was adjusted with Least Significant Difference (LSD) at 5% level.

RESULTS AND DISCUSSION

Interaction effects of variety and boron: The analyzed data revealed that different treatment combinations noticeably exerted significant influence of different treatment combinations on the yield and yield attributes of mustard (Table 2). The studied characters especially number of pods per plants and filled grains per pod were markedly increased by the interaction of variety and boron fertilization which greatly accelerated the yield of mustard. However, integration of variety and Boron up to the level of 2 kg B ha^{-1} significantly boomed the number of pods per plant and filled grains per pods except the 1000 seed weight which failed to contribute the seed yield of mustard. The highest pods per plant (154 and 145) and maximum filled grains per pod (33 and 31) were recorded in the varieties of BARI sharisha-6 and BARI sharisha-8, respectively with Boron at the rate of 1.5 kg ha^{-1} in both the years of 2000-2002. The said parameters differed their responses to the same boron level (1.5 kg B ha^{-1}) due to their genetic variances. Subbaiah and Mittra (1996) and Zhu *et al*. (1996), reported that application of B and Zn with recommended doses of $N_{80}P_{40}K_{20}$ kg ha^{-1} increased the seed yield of 26 and 18% in the first year and by 19 and 17% in second year over N P K alone. The seed yield was also noticeably increased up to 1.5 kg B ha and beyond that the increment of B level, the seed yield decreased steadily with irrespective of the varieties tested. However, BARI Sharisha-6 along with 1.5 kg B ha^{-1} was found to be superior among the treatments used and significantly highest seed yield (2.57 and 1.26 t ha^{-1}) was obtained in the same treatment in both the studied years of 2000-2001 and 2001-2002, respectively which was markedly differed over untreated B control (B_0) plants. The mean yield of the two successive years (1.96 t ha^{-1}) was also found higher by 25.64% yield increase. Similar findings were also reported by Rashid and Rafique (1992) and Grewal *et al*. (1998) in this study.

Effect of variety: The studied parameters like pods/plant, filled grains/pod and seed yield of tested varieties viz., BARI Sharisha-6, BARI Sharisha-7, BARI Sharisha-8 and BARI Sharisha-9 were highly influenced by applied boron levels (Table 3). All the studied characters except 1000 grain weight significantly contributed to the seed yield of mustard. Among the 4 varieties tested, BARI Sharisha-7 was found to be best in all respect. The maximum number of pods per plant (140.20 and 128.83) and filled grains (29.20 and 28.08) were recorded in the same variety which was significantly different over BARI Sharisha-8, BARI Sharisha-9 and BARI Sharisha-6 respectively. In the first year, all 4 varieties of mustard exhibited better performances than did in the second year. It might be the cause of management practices and the climatic effect as well. The highest seed yield (2.42 and 1.12 t ha^{-1}) was recorded by BARI Sharisha-7 followed by BARI Sharisha-8, BARI Sharisha-9 and BARI Sharisha-6, respectively for both the years of study. The yield difference was also noticed due to the effect of genetic variability of studied characters of the variety. The mean yield of two consecutive seasons also differed among the varieties and the highest average yield (1.77 t ha^{-1}) was observed in BARI Sharisha-7. Similar results were also found by Jena *et al* (1996) and Patil *et al*., 1996 in this study.

Effect of boron: Table 3 revealed that yield contributing characters like pods per plant and filled grains per pods significantly responded to the applied boron levels up to 1.5 kg B ha^{-1} and beyond that level the said parameters decreased gradually. The highest pods per plant (120.07 and 122.58) and maximum number of filled

Table 2: Interaction effect of variety and levels of boron on the yield and yield contributing characters of mustard at RARS, Jessore for two consecutive years of 2000-2001 and 2001-2002

Treatment		Pods/plant (No.)		Filled grains/pod		1000 seed weight (g)		Seed yield (t ha^{-1})		Mean yield (t ha^{-1})	% increase over control
Varieties	Boron levels (g)	2000-2001	2001-2002	2000-2001	2001-2002	2000-2001	2001-2002	2000-2001	2001-2002		
BARI Sharusga-6	B_0	96.00	105.00	26.00	28.00	3.12	3.01	2.06	1.06	1.56	-
	$B_{1.0}$	99.00	114.00	28.00	30.00	3.07	3.04	2.51	1.22	1.89	21.15
	$B_{1.5}$	101.00	121.00	33.00	31.00	3.10	3.07	2.57	1.26	1.96	25.64
	$B_{2.0}$	109.00	117.00	28.00	28.00	3.93	3.92	2.47	0.97	1.72	16.66
BARI Sharusga-7	B_0	119.00	108.00	24.00	24.00	2.86	2.87	1.94	0.96	1.45	-
	$B_{1.0}$	150.00	134.00	26.00	25.00	2.62	2.62	2.23	1.17	1.70	17.24
	$B_{1.5}$	154.00	145.00	28.00	27.00	2.74	2.72	2.26	1.24	1.75	20.69
	$B_{2.0}$	148.00	137.00	23.00	25.00	2.73	2.75	2.14	0.98	1.56	7.59
BARI Sharusga-8	B_0	96.00	99.00	28.00	26.00	2.88	2.87	1.95	1.04	1.50	-
	$B_{1.0}$	97.00	100.00	27.00	25.00	2.16	2.23	2.17	1.35	1.66	17.33
	$B_{1.5}$	102.00	106.00	28.00	28.00	2.88	2.87	2.25	1.15	1.77	11.33
	$B_{2.0}$	104.00	105.00	28.00	28.00	2.86	2.89	2.17	0.96	1.63	6.67
BARI Sharusga-9	B_0	109.00	127.00	18.00	20.00	2.62	2.61	2.07	1.06	1.57	-
	$B_{1.0}$	122.00	129.00	19.00	21.00	2.83	2.82	2.34	1.16	1.75	11.46
	$B_{1.5}$	129.00	133.00	18.00	18.00	2.81	2.82	2.49	1.07	1.77	12.74
	$B_{2.0}$	133.00	123.00	18.00	18.00	2.80	2.81	2.47	1.02	1.76	12.00
LSD (0.05)	-	1.80	1.73	0.84	0.87	NS	NS	0.19	0.20	-	-
CV (%)	-	10.12	7.20	9.62	6.60	6.70	7.12	10.20	6.68	-	-

Table 3: Mean effect of variety and levels of boron on the yield and yield contributing characters of mustard at RARS, Jessore for two consecutive years of 2000-2001 and 2001-2002

Treatment	Pods/plant (No)		Filled grains/pod		1000 seed weight (g)		Seed yield (t ha^{-1})		Mean yield (t ha^{-1})	% increase over control
Variety	2000-2001	2001-2002	2000-2001	2001-2002	2000-2001	2001-2002	2000-2001	2001-2002		
BARI Sharusga-6	131.31	114.32	27.82	27.25	3.02	3.62	2.02	1.03	1.52	-
BARI Sharusga-7	140.20	128.83	29.20	28.08	2.90	2.74	2.42	1.12	1.77	-
BARI Sharusga-8	127.26	126.58	28.18	26.67	2.94	2.72	2.33	1.06	1.70	-
BARI Sharusga-9	125.78	120.33	27.33	19.00	2.83	2.76	2.30	1.04	1.67	-
LSD (0.05)	12.52	1.78	1.28	0.87	NS	NS	0.20	0.20	-	-
Effect of Boron (B kg ha^{-1})										
B_0	110.96	110.17	24.30	24.33	2.93	2.84	1.36	1.03	1.20	-
$B_{1.0}$	114.00	116.92	25.42	25.17	2.86	2.68	2.17	1.11	1.64	36.67
$B_{1.5}$	120.07	122.58	27.27	25.88	2.83	2.87	2.46	1.27	1.87	58.83
$B_{2.0}$	120.31	115.50	26.73	24.07	2.90	3.09	2.35	1.16	1.76	46.67
LSD (0.05)	12.52	1.73	1.28	0.87	NS	NS	0.20	0.50	-	-

grains (27.27 and 25.88) were received by applying boron at the rate of 1.5 kg B ha^{-1} in both the years of 2000-2002 While 1000 seed weight did not respond positively to the boron levels. Seed yield of mustard was profusely increased with the increment of Boron level up to 1.5 kg ha^{-1} and beyond that dose the yield declined with similar trend. Boron can play a vital role in booming seed yields of oil crops especially for Brassica. Due to severe deficiency of B may restrict the normal flow of hormone. Resulting germination of pollen tube and receptivity of stigma sharply declined. However, the highest significant yield (2.46 and 1.27 t ha^{-1}) was obtained with 1.50 kg B ha^{-1} in two successive years of study. The highest mean yield (1.87 t ha^{-1}) was also recorded in same level of boron (1.5 kg B ha^{-1}) which was significantly higher over B control by 58.83%. This result is in conformity with the findings of Rashid and Rafique, 1992. From the mean data a positive but quadratic relationship was noticed between the seed yield and Boron levels (Fig. 1). It meant beyond that level of B there might be a risk of loosing yield.

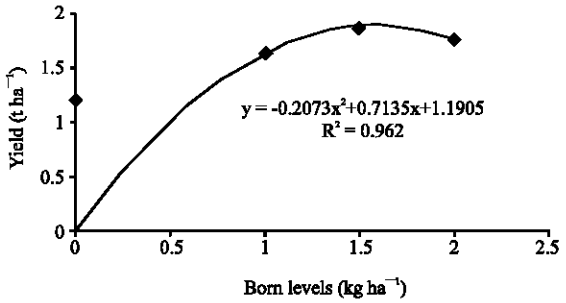

Fig. 1: Response of boron on the yield of mustard

CONCLUSIONS

It can be concluded from two years study that B at the rate of 1.5 kg ha^{-1} along with a blanket dose of $N_{120}P_{35}K_{65}S_{20}Zn_5$ and cowdung 5 t ha^{-1} was found to be the best combination for all the varieties tested in the study area of Calcareous Brown Floodplain soil of Jessore. So, the said package of combination may be recommended for sustainable yield of mustard in the study area.

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