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RESPONSE OF MUSTARD *(Brassica)* VARIETIES TO BORON APPLICATION

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Abstract

An experiment was conducted at the Regional Agricultural Research Station (RARS), Jessore (AEZ11, High Ganges River Floodplain) during 2003-2006 to evaluate the response of different varieties of mustard to boron application. Boron application was made at 0 and 1 kg/ha. The mustard varieties responded to B application. The response of the three *Brassica* species followed the order: *B. napus* > *B. campestris* > *B. juncea*. The varieties chosen from *B. campestris* were BARI Sarisha 6, BARI Sarisha 9, and BARI Sarisha 12. The *B. napus* varieties were BARI Sarisha 7, BARI Sarisha 8, and BARI Sarisha 13. Varieties BARI Sarisha 10 and BARI Sarisha 11 were from the *B. juncea* group. The seed yield was positively and significantly correlated with the yield contributing characters viz. pods/plant, seeds/pod, and 1000-seed weight, but not with plant height and pod length. This result showed that boron had positive influence on reproductive development, not on vegetative. The result suggests that BARI Sarisha 10 and BARI Sarisha 11 were the most B in-responsive (B efficient) varieties. So the farmers can grow these varieties in the moderately B deficient soils with a minimum dose (0.5 kg/ha) of B application.

Keywords: Mustard, boron, B in-responsive.

Introduction

Among the oilseed crops, mustard is the major oilseed crop, which covers about 60% of the oilseed production in Bangladesh (BBS, 2009). It is an important source of cooking oil in Bangladesh and it meets one third of the edible oil requirement of the country (Ahmed *et al.,* 1988). The average yield of the crop stands at 990 kg/ha (BBS, 2009), which is very low compared to the yield of many mustard growing countries of the world. There are several reasons that can explain this yield variation, which cover abiotic and biotic factors. Among the biotic and abiotic factors, unavailability of high yielding varieties (Akber *et al.,* 1994) and nutrient deficiency (Varma *et al.,* 2002) are responsible for lower productivity of mustard. The newly released high yielding potential varieties of mustard could not compensate the yield gap possibly due to B deficiency in soil. Mustard, a *Brassica* crop, is very responsive to B application (Mengel and Kirkby, 1987). Reproductive growth, especially flowering, fruit and seed set is

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more sensitive to B deficiency than vegetative growth (Dear and Lipsett, 1987). Boron requirement for root growth in B - in efficient rapeseed cultivars was higher than that in B efficient cultivars (Hu *et al.,* 1994; Xioug *et al.,* 1995).

Availability of B to plants is affected by a variety of soil factors including soil solution, pH, texture, moisture, temperature, oxide content, carbonate content, organic matter content, and clay mineralogy (Goldberg *et al.,* 2000). Boron is generally less available in high pH soil. Increasing pH favours its retention by soils or soil constituents (Mezuman and Karen, 1981; Bloesch *et al.,* 1987; Goldberg, 1997). Jessore is an extensively mustard growing area and the soil of this area is calcareous in nature. Mustard varieties may differ in its sensitivity to B deficiency. Keeping the above points in view, the present study was undertaken to evaluate the response of mustard varieties to B application.

Materials and Method

Eight varieties of mustard viz. BARI Sarisha 6, BARI Sarisha 7, BARI Sarisha 8, BARI Sarisha 9, BARI Sarisha 10, BARI Sarisha 11, BARI Sarisha 12, and BARI sarisha 13 were tested for their response to B application (0 and 1 kg B/ha). Of the eight varieties, three were from *Brassica campestries,* three from *Brassica napus* and two from *Brassica juncea.* Crop response to added B was evaluated in terms of yield and yield contributing characters. The experiment was conducted in the calcareous soil of Regional Agricultural Research Station (RARS) farm, Jessore, Bangladesh for 3 years from 2003-2004 to 2005-2006. The land belongs to High Ganges River Floodplain agroecological zone (11) and Gopalpur soil series (Soil taxonomy: Aquic Eutro-chrepts). The soil had high pH value (8.1) and with low B content of 0.18 mg/kg. The organic matter content of the soil was 1.65%, Olsen-P 10.1 mg/kg, exchangeable K 0.28 c mol/kg, Ca 19 c mol/kg, Mg 1.75 c mol/kg, $CaCl_2$-S 4.53 mg/kg and DTPA-Zn 0.89 mg/kg. Soil P^H was determined by glass electrode pH meter (1:2.5 soil-water ratio) and organic matter by wet oxidation method (Nelson and Sommers, 1982). The K, Ca, and Mg contents of soil were determined by 1M NH_4OAc (P^H 7.0) extraction method. The experiment was laid out in a randomized complete block design with three replications, each plot size being 4 x 3m. Boron was applied at 0 and 1 kg/ha. This layout was kept undisturbed for the second and third years of the study. Boron was supplied as H_3BO_3 (17% B). Every year, the mustard crop received 124 kg N, 30 kg P, 28 kg K, 35 kg S and 2 kg Zn per hectare (BARC, 2005). The sources of nutrients were urea, triple super phosphate (TSP), muriate of potash (MoP), gypsum, and zinc sulphate for N, P, K, S, and Z, respectively. Intercultural operations viz., weeding, irrigation, and insecticide spray were done as and when required. Every year, the mustard varieties were sown during first week of November and harvested in the second week of February. At maturity, data on the yield contributing characters were recorded from ten randomly

selected plants from each plot. The yield data were expressed as kg/ha on 12% moisture basis. The data were statistically analyzed following the principle of *F*-statistics and the mean values were separated by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984)

Results and Discussion

Yield components

Different mustard varieties significantly influenced on the number of pods/plant due to B application except BARI Sarisha 10. The number of pods/plant of *B. campestris* variety varied from 104.0 to 183.1, *B. napus* 133.3 to 139.9, and *B. juncea* 251.2 to 267.7 in the B treated plots against 80.56 to 143.0, 91.89 to 102.4, and 242.9 to 249.2 in the control plots of the respective three varieties. The highest number of pods/plant increased 45.1% in the BARI Sarisha 8 and the lowest 3.42% in BARI Sarisha 10 due to B application (Table 1). Except first year trial, BARI Sarisha 11 produced the highest number of pods/plant followed by BARI Sarisha 10. BARI Sarisha 7, BARI Sarisha 8, and BARI Sarisha 13 produced statistically similar number of pods/plant in the control plots. However, the effect of B on these three varieties was significantly higher than all other varieties. This result proved that *B. napus* is most responsive to B followed by *B. campestries. Brassica juncea* is merely responsive to B. On the basis of pods/plant, different varieties can be ranked as BARI Sarisha 11> BARI Sarisha 10> BARI Sarisha 12> BARI Sarisha 9> BARI Sarisha 7> BARI Sarisha 13> BARI Sarisha 8> BARI Sarisha 6. Shen *et al.* (1993) reported that B application markedly increased the number of pods/plant in with rape cv. Ningyou No. 8 and Ningyou No.7.

The number of seeds/pod also varied significantly among the varieties due to B application (Table 2). The average number of seeds/pod ranged from 12.00 to 20.67 and 13.22 to 27.44 in the B untreated and treated plots, respectively. The maximum average number of seeds/pod (27.44) was recorded in B treated BARI Sarisha 8, which was 32.8% higher than that where B was not added to the soil. The application of B failed to increase significantly the number of seeds/pod in BARI Sarisha 10. On the basis of number of seeds/pod, the *Brassica* groups can be ranked as *B. napus* > *B. campestris*> *B. juncea*. This finding corroborate with the findings of Shen *et al.,* 1993; Islam and Sarker (1993), and Hu *et al.,* 1994.

In the case of *B. campestris* group, 1000-seed weight varied from 3.12 to 3.76 g, *B. napus* group 3.76 to 3.89 g and *B. juncea* group 2.10 to 3.92 g due to B application, whereas it was 2.59 to 3.16 g in *B. campestris* group, 3.08 to 3.21g in *B. napus* group and 2.03 to 3.63g in *B. juncea* group in the B untreated plots. BARI Sarisha 8 of the *B. napus* variety, produced 24.0% higher 1000-seed

weight over B control plot; whereas, BARI Sarisha 10 increased only 3.45% due to B application (Table 3). BARI Sarisha 11 of *Brassica juncea* variety produced the highest weight of 1000 seeds (3.92 g) in the B treated plot, on the other hand, *B. juncea* variety BARI Sarisha 10 produced lowest 1000-seeds weight (2.10 g) in the B control plot.

Table 1. Number of pods/plant of different varieties of mustard due to boron application.

Group	Variety	Boron level (kg/ha)	Pods/plant (no.)				% increase over control
			2003-04	2004-05	2005-06	Average	
Brassica campestris	V_1	B_0	89.00g	85.00j	67.67h	80.56	-
		B_1	110.3f	112.0gh	92.00g	104.8	30.1
	V_2	B_0	132.3e	119.3g	99.33g	117.0	-
		B_1	162.0d	146.0f	130.3cde	146.1	24.9
	V_3	B_0	147.0de	167.0e	115.0ef	143.0	-
		B_1	191.0c	211.0d	147.3c	183.1	28.0
Brassica napus	V_4	B_0	109.3f	100.0hi	98.00g	102.4	-
		B_1	145.0e	138.7f	136.0cd	139.9	36.6
	V_5	B_0	97.33fg	92.00ij	86.33g	91.89	-
		B_1	135.0e	135.7f	129.3cde	133.3	45.1
	V_6	B_0	103.0fg	98.33hij	93.00g	98.1	-
		B_1	135.3e	137.0f	135.3cd	135.9	38.5
Brassica juncea	V_7	B_0	265.7a	238.7c	224.3b	242.9	-
		B_1	273.7a	248.0c	232.0b	251.2	3.42
	V_8	B_0	247.0b	272.0b	228.7b	249.2	-
		B_1	261.7a	293.3a	248.0a	267.7	7.42
		CV (%)	5.56	4.89	6.78	-	-

Values within the same column with a common letter do not differ significantly (p=0.05)

V_1 = BARI Sarisha 6, V_2 = BARI Sarisha 9, V_3 = BARI Sarisha 12, V_4 = BARI Sarisha 7, V_5 = BARI Sarisha 8, V_6 = BARI Sarisha 13, V_7 = BARI Sarisha 10, V_8 = BARI Sarisha 11

Pod length varied significantly among the varieties due to B application (Table 4). The maximum average pod length (8.31 cm) was recorded in BARI Sarisha 13, which was statistically identical to BARI Sarisha 8 (8.17 cm). In B control plots, highest pod length also observed in BARI Sarisha 13 (7.79 cm) being followed by BARI sarisha 8 (7.44 cm). The minimum pod length was recorded in B untreated BARI Sarisha 10 (4.11 cm) and BARI Sarisha 11 (4.11 cm).

The impact of B application on plant height of mustard was positive to some extent but not significant (Table 5). Boron application increased mean plant height from 2.48% in BARI Sarisha 10 to 8.17% in BARI Sarisha 13. The maximum average plant height (160.9 cm) was recorded in B added BARI Sarisha 11 variety, but it was only 100.3 cm in B untreated BARI Sarisha 7. Islam and Sarker (1993) reported that boron application significantly increased the number of pods/plant, seeds/pod and seed yield of mustard. Hu *et al.* (1994) reported that B application at the rate of 0.1 mg/kg soil was optimum at which plant height, branch number/plant, siliqua number/plant, seed number/siliqua, seed yield/plant, and oil yield/plant increased from 149.2 cm, 14.1, 302.3, 12.6, 14.51 g and 5.63 g in the control to 158.0 cm, 23.8, 400.2, 16.3, 20.93 g and 9.61 g, respectively.

Table 2. Number of seeds/pod of different varieties of mustard due to boron application.

Group	Variety	Boron level (kg/ha)	Seeds/pod (no.)				% increase over control
			2003-04	2004-05	2005-06	Average	
Brassica campestris	V_1	B_0	21.00e	20.67c	19.00c	20.22	-
		B_1	26.00b	25.67ab	24.33b	25.33	25.3
	V_2	B_0	14.33i	14.00gh	13.00e	13.78	-
		B_1	17.67gh	17.00f	15.67d	16.78	2.18
	V_3	B_0	16.33h	15.33g	15.67d	15.78	-
		B_1	19.00g	17.33ef	18.33c	18.22	15.5
Brassica napus	V_4	B_0	19.33f	18.67d	19.67c	19.22	-
		B_1	25.00bc	24.33b	24.33b	24.55	27.7
	V_5	B_0	23.33d	20.00cd	18.67e	20.67	-
		B_1	29.67a	26.33a	26.33a	27.44	32.8
	V_6	B_0	19.67df	19.33cd	19.00c	19.33	-
		B_1	24.33cd	25.67ab	24.67b	24.89	28.8
Brassica juncea	V_7	B_0	14.33i	12.67h	12.67e	13.22	-
		B_1	14.67i	13.33h	13.33e	13.78	4.25
	V_8	B_0	12.33j	12.67h	11.00f	12.0	-
		B_1	12.67j	14.00gh	13.00e	13.22	10.2
		CV (%)	4.29	4.40	4.76	-	-

Values within the same column with a common letter do not differ significantly (p=0.05)

V_1 = BARI Sarisha 6, V_2 = BARI Sarisha 9, V_3 = BARI Sarisha 12, V_4 = BARI Sarisha 7, V_5 = BARI Sarisha 8, V_6 = BARI Sarisha 13, V_7 = BARI Sarisha 10, V_8 = BARI Sarisha 11

Seed yield

Except BARI Sarisha 10, all the mustard varieties was significantly favoured by boron application with the ranking of *B. napus* > *B. campestris* > *B. juncea* (Table 6). The *B. campestris* varieties yielded 1671-1795 kg/ha (mean of 3 years), *B*

Table 3. Thousand seed weight of different varieties of mustard due to boron application.

Group	Variety	Boron level (kg/ha)	1000-seed weight (g)				% increase over control
			2003-04	2004-05	2005-06	Average	
Brassica campestris	V_1	B_0	3.34de	3.17f	2.97c	3.16	-
		B_1	3.84b	3.93ab	3.50b	3.76	19.0
	V_2	B_0	2.99g	2.29h	2.48d	2.59	-
		B_1	3.45cd	2.81g	3.11c	3.12	20.5
	V_3	B_0	3.06fg	3.07f	2.89c	3.01	-
		B_1	3.53c	3.47a	3.41b	3.47	15.3
Brassica napus	V_4	B_0	3.27e	3.19ef	2.96c	3.14	-
		B_1	3.94b	3.87b	3.46b	3.76	19.7
	V_5	B_0	3.08fg	3.24def	2.91c	3.08	-
		B_1	3.92b	3.93ab	3.62b	3.82	24.0
	V_6	B_0	3.20ef	3.43cd	3.00c	3.21	-
		B_1	4.01ab	4.12a	3.55b	3.89	21.3
Brassica juncea	V_7	B_0	2.07h	2.09i	1.94e	2.03	-
		B_1	2.13h	2.12hi	2.06e	2.10	3.45
	V_8	B_0	3.99ab	3.39cde	3.52b	3.63	-
		B_1	4.11a	3.75b	3.90a	3.92	7.99
CV (%)			2.58	3.56	4.34	-	-

Values within the same column with a common letter do not differ significantly (p=0.05)

V_1 = BARI Sarisha 6, V_2 = BARI Sarisha 9, V_3 = BARI Sarisha 12, V_4 = BARI Sarisha 7, V_5 = BARI Sarisha 8, V_6 = BARI Sarisha 13, V_7 = BARI Sarisha 10, V_8 = BARI Sarisha 11

napus 1917-2020 kg/ha and *B. juncea* gave 1763-2151 kg/ha yield due to B addition to soil. The corresponding yields from the control plots were 1359-1509, 1397-1544 and 1734-1971 kg/ha, respectively (Table 6). Considering percent yield increase over control (mean of 3 years) *Brassica napus* varieties showed a 25.62 to 30.83% yield increase, *Brassica campestris* had a 19.02 to 22.96% yield increase and *Brassica juncea* varieties exhibited a 1.67 to 9.17% yield increase over B control. BARI Sarisha 8 exhibited the highest B response and BARI Sarisha 10 did the lowest indicating that the former was highly sensitive and the latter was fairly tolerant to B deficiency. Nevertheless, the *Brassica juncea* varieties gave higher seed yield compared to the other groups particularly when boron was not applied.

Table 4. Pod length of different varieties of mustard due to boron application.

Group	Variety	Boron level (kg/ha)	Pod length (cm)				% increase over control
			2003-04	2004-05	2005-06	Average	
Brassica campestris	V_1	B_0	5.95e	5.97d	5.22g	5.71	-
		B_1	6.20d	6.23d	5.50f	5.98	4.27
	V_2	B_0	4.57h	4.70f	4.23j	4.50	-
		B_1	4.82g	4.94ef	4.59i	4.78	6.22
	V_3	B_0	5.65f	4.94ef	4.88h	5.16	-
		B_1	5.78ef	5.17e	5.15g	5.37	4.07
Brassica napus	V_4	B_0	6.42d	6.18d	5.95e	6.18	-
		B_1	6.73c	6.73c	6.34d	6.60	6.80
	V_5	B_0	7.67b	7.57b	7.09c	7.44	-
		B_1	8.28a	8.42a	7.80b	8.17	9.81
	V_6	B_0	7.82b	7.88b	7.68b	7.79	-
		B_1	8.32a	8.42a	8.20a	8.31	6.68
Brassica juncea	V_7	B_0	4.26i	4.04g	4.02j	4.11	-
		B_1	4.34hi	4.16g	4.08j	4.19	1.95
	V_8	B_0	4.12i	4.09g	4.11j	4.11	-
		B_1	4.24i	4.28g	4.29j	4.27	3.89
		CV (%)	2.47	2.84	2.80	-	-

Values within the same column with a common letter do not differ significantly (p=0.05)

V_1 = BARI Sarisha 6, V_2 = BARI Sarisha 9, V_3 = BARI Sarisha 12, V_4 = BARI Sarisha 7, V_5 = BARI Sarisha 8, V_6 = BARI Sarisha 13, V_7 = BARI Sarisha 10, V_8 = BARI Sarisha 11

Response of mustard yield to boron application has been reported by many researchers in the past (Banuelos *et al.,* 1993; Shen *et al.,* 1993; Bora and Hazarika, 1997; Lu *et al.,* 2000; Xue *et al.,* 1998). Rashid *et al*. (1994) reported the maximum seed yield increase for *Brassica napus* (43%) is at 1 kg/ha B application and for *Brassica juncea* (36%) at 1.5 kg B/ha rate. Xue *et al.* (1998) reported that the significant differences were found among the cultivars in leaf boron concentration. Contrary to current opinion, high quality oilseed rape cultivars were not all sensitive to low B supply nor were all conventional cultivars B efficient. There are significant differences between *Brassica napus* cultivars in their response to B deficiency (Hu *et al.,* 1991; James *et al.,* 2000a,b).

Table 5. Plant height of different varieties of mustard due to boron application.

Group	Variety	Boron level (kg/ha)	Plant height (cm)				% increase over control
			2003-04#	2004-05#	2005-06#	Average	
Brassica campestris	V_1	B_0	152.4	125.8	119.7	132.6	-
		B_1	154.5	130.5	126.6	137.2	3.47
	V_2	B_0	111.8	89.4	101.7	101.0	-
		B_1	119.4	96.1	109.8	108.4	7.33
	V_3	B_0	118.8	103.6	107.9	110.1	-
		B_1	123.5	110.5	114.5	116.2	5.54
Brassica napus	V_4	B_0	110.2	99.2	91.6	100.3	-
		B_1	115.2	101.0	98.9	105.0	4.69
	V_5	B_0	124.4	98.3	99.8	107.5	-
		B_1	133.6	106.1	107.2	115.6	7.53
	V_6	B_0	116.6	109.6	104.5	110.2	-
		B_1	124.2	121.2	112.3	119.2	8.17
Brassica juncea	V_7	B_0	156.1	141.0	126.3	141.1	-
		B_1	160.0	144.6	129.3	144.6	2.48
	V_8	B_0	167.7	155.3	138.9	154.0	-
		B_1	171.4	165.1	146.2	160.9	4.48
		CV (%)	5.95	6.36	6.53	-	-

Non= Non significant

V_1 = BARI Sarisha 6, V_2 = BARI Sarisha 9, V_3 = BARI Sarisha 12, V_4 = BARI Sarisha 7, V_5 = BARI Sarisha 8, V_6 = BARI Sarisha 13, V_7 = BARI Sarisha 10, V_8 = BARI Sarisha 11

Table 6. Seed yield of different varieties of mustard due to boron application.

Group	Variety	Boron level (kg/ha)	Seed yield (kg/ha)				% increase over control
			2002-03	2003-04	2004-05	Average	
Brassica campestris	V_1	B_0	1686c-f	1671d-g	1170h	1509	-
		B_1	1948b	1973ab	1467efg	1795	19.02
	V_2	B_0	1487fg	1311h	1280gh	1359	-
		B_1	1774bcd	1600 efg	1640de	1671	22.96
	V_3	B_0	1469g	1495g	1308gh	1424	-
		B_1	1756b-e	1783b-e	1547def	1695	19.03

Table 6 Cont'd.

Brassica napus	V_4	B_0	1450g	1565fg	1177h	1397	-
		B_1	1877bc	1939abc	1577def	1998	28.70
	V_5	B_0	1629d-g	1615efg	1389fg	1544	-
		B_1	2150a	2062a	1847bc	2020	30.83
	V_6	B_0	1549efg	1711def	1318gh	1526	-
		B_1	1944b	2109a	1698cd	1917	25.62
Brassica juncea	V_7	B_0	1827bcd	1762c-f	1612de	1734	-
		B_1	1896bcd	1742c-f	1652de	1763	1.67
	V_8	B_0	2152a	1854bcd	1906b	1971	-
		B_1	2257a	2080a	2115a	2151	9.17
		CV (%)	6.39	6.17	6.90	-	-

Values within the same column with a common letter do not differ significantly (p=0.05)

V_1 = BARI Sarisha 6, V_2 = BARI Sarisha 9, V_3 = BARIsarisha 12, V_4 = BARI Sarisha 7, V_5 = BARI Sarisha 8, V_6 = BARI Sarisha 13, V_7 = BARI Sarisha 10, V_8= BARI Sarisha 11

Table 7. Stover yield of different varieties of mustard due to boron application.

Group	Variety	Boron level (kg/ha)	Stover yield (kg/ha)				% increase over control
			2002-03 #	2003-04 #	2004-05 #	Average	
Brassica campestris	V_1	B_0	2993	2656	2456	2702	-
		B_1	3189	2704	2595	2829	4.07
	V_2	B_0	2372	2171	2129	2224	-
		B_1	2542	2301	2216	2353	5.80
	V_3	B_0	2366	2382	2179	2309	-
		B_1	2528	2592	2360	2493	8.25
Brassica napus	V_4	B_0	2614	3234	2703	2850	-
		B_1	2736	3246	2988	2990	4.91
	V_5	B_0	3055	3610	2933	3199	-
		B_1	3307	4077	3226	3537	10.57
	V_6	B_0	2600	3382	2807	2930	-
		B_1	2973	3579	2936	3163	7.95
Brassica juncea	V_7	B_0	3058	3191	2985	3080	-
		B_1	3269	3380	3069	3239	5.16
	V_8	B_0	3564	3849	3172	3528	-
		B_1	3622	4119	3300	3680	4.30
		CV (%)	5.70	6.50	6.14	-	-

= Non-significant

V_1 = BARI Sarisha 6, V_2 = BARI Sarisha 9, V_3 = BARI Sarisha 12, V_4 = BARI Sarisha 7, V_5 = BARI Sarisha 8, V_6 = BARI Sarisha 13, V_7 = BARI Sarisha 10, V_8= BARI Sarisha 11

Stover yield

Unlike seed yield, the stover yield remained unaffected by B treatments (Table 7). Apparently, BARI Sarisha 8 (*Brassica napus*) had the maximum response to B application, on the other hand, BARI Sarisha 11 (*Brassica juncea*) showed the minimum response. The mean yields of *B. campestris* varieties were 2224-2702 kg/ha, *B. napus* varieties were 2850-3199 kg/ha, and yields of *B. juncea* varieties were 3080-3528 kg/ha for the B control plots. The yields for the B added treatments were 2353-2829 kg/ha, 2990-3537 kg/ha and 3239-3680 kg/ha, respectively. Dear and Lipsett (1987) opined that reproductive growth is more sensitive to B deficiency than vegetative growth. Saha *et al.* (2003) reported that the use of B did not influence the stover yield of mustard.

Conclusion

Based on the information mentioned above, it may be concluded that BARI Sarisha 10 and BARI Sarisha 11 *(B. juncea)* were non-responsive to B application but are well suited to the Gopalpur series soil of Jessore to give appreciably higher yield of mustard without application of B fertilizer. BARI Sarisha 7, BARI Sarisha 8 and BARI Sarisha 13 (*B. napus*) were responsive to B application and can be grown in Gopalpur series soil by applying B @ 1.0 kg/ha, though the yield is low.

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