COMBINED EFFECT OF SULPHUR AND BORON ON YIELD AND YIELD CONTRIBUTING CHARACTERS, NUTRIENT AND OIL CONTENT OF MUSTARD

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Abstract

This experiment was conducted in the experimental field of Sher-e-Bangla Agricultural University, Dhaka during 2014-2015 to know the combined effect of different levels of sulphur (S) and boron (B) on yield and yield contributing characters, nutrient and oil content of mustard and to find out the suitable combination of sulphur (S) and boron (B) for yield maximization of mustard. There were 16 treatment combinations comprising four levels each of S (S_0= 0, S_1=10, S_2= 20 and S_3= 30 kg S ha^{-1}) and B (B_0= 0, B_1= 1, B_2= 2 and B_3= 3 kg B ha^{-1}). It was replicated thrice in a randomized complete block design. Results showed that the combination of S and B (20 kg S ha^{-1} and 3 kg B ha^{-1}) contributed positively for better performance of yield contributing characters of mustard. The combination S_2B_3 (20 kg S ha^{-1} and 3 kg B ha^{-1}) produced the highest grain yield (2180 kg ha^{-1}) followed by S_3B_2 and S_3B_3 treatment combination. The highest protein and oil content of mustard were recorded from S_3B_3 (30 kg S ha^{-1} and 3 kg B ha^{-1}) treatment followed by S_2B_3 treatment combination. Therefore, the combination of S and B (20 kg S ha^{-1} and 3 kg B ha^{-1}) might be suitable dose for cultivation of mustard in tejgaon series soils under agro-ecological zone of 28 (Madhupur Tract) Bangladesh.

Keywords: Mustard, sulfur and boron, oil and nutrient content, yield.

Introduction

Mustard (*Brassica rapa*) is one of the important oilseed crops grown in Bangladesh, covers almost 60% of the total oil seed demand. The annual production of mustard is 3.34 lakh metric tons from the area of 3.52 lac hectares against the total oilseed production of 5.48 lakh tons (BBS, 2011). Local production of mustard oil meets nearly 25% oil requirement of Bangladesh. The average seed yield of mustard is very low in Bangladesh compared to other countries due to inheritance, environmental and poor fertilizer management. However, Bangladesh Agricultural Research Institute has developed high yielding mustard varieties viz., BARI Sharisha-8, BARI Sharisha-9 and BARI Sharisha-11. Hence, high yielding varieties with appropriate fertilizer management can be increased the productivity of mustard in Bangladesh. In

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general, mustard is considered as sulphur (S) loving crop and is highly susceptible to S deficiency and responds well to S fertilization (Haque, 2000). Sulphur is greatly influenced the synthesis of amino acids (cystine, cysteine and methionine), co-enzymes (biotin, coenzyme A, pyrophosphate, lipoic acid and thiamine) and some secondary metabolites (FRG, 2012). It also helps in chlorophyll formation and enhances the vegetative growth. Sulphur played a vital role for yield maximization and oil content of mustard. It also influenced the oil quality of mustard by increasing protein content and some fatty acids (Aulakh and Pasricha, 1997). Moreover, S contributes the uptake of nitrogen (N), phosphorous (P) and potassium (K). About 97% soils of Bangladesh are deficient in S due to use sulphur free fertilizer (Khan *et al.*, 2008). Boron deficiency is another problem for cultivation of oil seed crops. More than one million hectares of land showed B deficiency which are caused lower yield of oil seeds (Khan *et al.*, 2008; Islam *et al.*, 1999). Among micronutrients- boron has taken third place due to total B concentration in seed and stem of oilseed crops (Robinson, 1973). Boron helps the assimilation of N, P and K and rate of water adsorption and carbohydrate translocation in plant. It is extensively involved in the synthesis of protein and oil (Malewar *et al.*, 2001). Thus, B deficiency affects the equilibrium state of N, P and K. Boron application markedly increases pod number and seed set. Seed yield of mustard increased from 16 to 69% due to B application (Islam and Sarker, 1993).

Several researches have been carried out on the effect of N, P and K fertilizers on mustard and other oil seed crops. But a few research works have been done to know the effect of S and B on production of oil seed crops in Bangladesh. The above discussion suggests that the limiting nutrients need to be identified in order to increase the production and nutritional value of mustard. Keeping the above mentioned facts, the study was undertaken to compare the yield and yield contributing characters and quality performance of mustard by using different doses of S and B and to find out the optimum dose of S and B for achieving its maximum yield potential at Tejgaon series soil of Modhapur Tract.

Materials and Method

The experiment was conducted at the Central Farm of the Sher-e-Bangla Agricultural University, Dhaka during November 2014 to February 2015. Experimental site- Sher-e-Bangla Agricultural University, Dhaka (90.2^O N latitude and 23.5^0E altitude) lies at an elevation of 8.2 m above the sea level. The terrace soils of Dhaka belongs to Tejgaon series under the agro ecological zone Madhupur Tract and texture is silty loam. There were 16 treatment combinations comprising four levels each of S (S_0= 0, S_1=10, S_2= 20 and S_3= 30 kg S ha^{-1}) and B (B_0= 0, B_1= 1, B_2= 2 and B_3= 3 kg B ha^{-1}). The treatments were S_0B_0, S_0B_1, S_0B_2, S_0B_3, S_1B_0, S_1B_1, S_1B_2, S_1B_3, S_2B_0, S_2B_1, S_2B_2, S_2B_3, S_3B_0, S_3B_1, S_3B_2 and

S_3B_3. The blanket doses of 120 kg urea ha^{-1}, 145 kg TSP ha^{-1}, 45 kg MoP ha^{-1}and 5 kg Z_nSO_4 ha^{-1} were used. Soil samples (0-20 cm) before initiation of the experiment was analyzed for soil pH (Jackson, 1973), organic matter (Nelson and Sommers,1982), total N (Bremner and Mulvaney, 1982), exchangeable K (Pratt, 1965), available P (Olsen & Sommers, 1982), available S (Fox *et al*., 1964) and available B (Page *et al*., 1982). The results of the soil properties are shown in Table 1.

Table 1. Soil properties of the experimental field

Location	pH	OM (%)	K meq. 100 g^{-1}	Total N (%)	P	S	B
					μg g^{-1}		
SAU, Dhaka	5.8	0.78	0.10	0.038	17	20	0.16
Critical level (FRG, 2012)	-	-	0.12	0.12	10	10	0.2

The land was prepared thoroughly by country plough followed by laddering. The treatments were laid out in Randomized Complete Block Design (RCBD) with three replications. The unit plots size was 2 m x 2.5 m. Gypsum and boric acid were used as the sources of S and B, respectively. The whole amount of triple super phosphate (TSP), muriate of potash (MoP), zinc sulphate and 50% of urea were incorporated into soil at the time of final land preparation. Gypsum and boric acid were applied as per treatment. The remaining urea was applied at 25 days after seed germination. Seeds of mustard (BARI Sharisha-9) were sown on the 7 November, 2014. The seed rate was 6 kg ha^{-1}. Weeding was done at 20 and 35 days after sowing. Insecticide Sumithion 50EC at the rate of 2 ml L^{-1} water was sprayed for controlling pod borer. Crop was harvested after maturity. Data on yield contributing characters were collected from randomly selected five plants in each plot excluding border plants. Data on yields (kg ha^{-1}) were recorded from the whole plot technique. Harvest index (%) was calculated. Ground stover and seed samples were digested with di-acid mixture (HNO_3-$HClO_4$) (5: 1) as described by Piper (1966) for the determination- concentration of N (Micro-Kjeldahl method), P (spectrophotometer method), K (atomic absorption spectrophotometer method), S (turbidity method using $BaCl_2$ by spectrophotometer) and B (spectrophotometer following azomethine-H method). Oil content of seed was determined by Soxhlet method and expressed in percentage (%). Nitrogen content was determined by Kjeldahl method. Protein content was measured by estimating the N content and then multiplying the N value by 6.25. Collected data were analyzed statistically with MSTATC programme and the mean difference was adjusted by Duncan's Multiple Range Test (Gomez and Gomez, 1984) at 5% level of probability.

Results and Discussion

Yields and yield contributing characters of mustard

Combination of sulphur and boron were exhibited significant effect on yields and yield contributing characters of mustard (Table 2). The highest plant height (166.3 cm) was recorded from the treatment of S_2B_3 (20 kg S ha^{-1} and 3 kg B ha^{-1}), which was significantly different over others treatment combinations but statistically identical to S_3B_3 treatment. The lowest height (125 cm) was found in S_0B_1 (0 kg S ha^{-1} and 1 kg B ha^{-1}) treatment. Result is in agreement with the findings of some researchers such as Mohiuddin (2007) reported that the maximum height of mustard plants (93.0 cm) under combined application of N (80) + S (24) kg ha^{-1}. The shortest plant (72.0 cm) was noted under no application of N and S. Islam (2003) also observed that the highest plant height (74.23 cm) was recorded from the treatment of 30 kg S + 20 kg Mg ha^{-1} and the lowest (56.67 cm) was from control treatment. Number of branches per plant was ranged from 4.08-5.25. The highest number of brunches per plant (5.25) was recorded from the treatment S_2B_3 whish was significantly different over the other treatment but statistically identical to S_3B_1, S_3B_2, S_3B_3 and S_2B_2 and lowest (4.08) was in S_0B_0. In case of pod length and number of capsules per plant showed the similar trend of number of branches per plant (Table 2). These results are in agreement with the findings of Mohiuddin (2007) and Haq (2012).

The maximum number of seeds per capsule (15.9) was recorded from the combination of S_2B_2 (20 kg S ha^{-1} and 2 kg B ha^{-1}) which showed significantly variation with others treatment combinations but it was statistically similar to S_2B_3 (20 kg S ha^{-1} and 3 kg B ha^{-1}) treatment. Lowest number of seeds per capsule (9.29) was found in control plot. The above result is supported by the observation of Singh *et al.* (2007); Mohiuddin, (2007). Islam (2003) reported the highest number seeds pod^{-1} (17.6) was found in the treatment of 30 kg S + 20 kg Mg ha^{-1} and lowest (12.42) was in control treatment.

The 1000 seed weight due to different treatment combination varied from 8.0-15.4 g. The highest 1000 seed weight was obtained from the treatment S_2B_3 followed by S_3B_2 and S_3B_3 treatment. The lowest 1000 seed weight was recorded from S_0B_0 treatment. Karthikeyan and Shukla (2011) obtained the highest dry matter of mustard seed from $S_{60}B_2$ treatment. Mohiuddin (2007) observed the highest weight of 1000 seed (2.86 g) from the treatment combination N_2S_3 comprising of 80 kg N ha^{-1} + 24 kg S ha^{-1} and the lowest (1.60g) was recorded in N_0S_0 treatment. Islam (2003) reported the highest 1000-seed weight (2.75 g) from the treatment of 30kg S + 20kg Mg ha^{-1}.

The grain yield of mustard was varied from 1806-2180 kg ha^{-1} due to different treatment combinations. The highest grain yield was recorded from the treatment combination S_2B_3 (20 kg S ha^{-1} and 3 kg B ha^{-1}) which was showed significantly different among the treatments but statistically identical with S_3B_2, S_3B_0 and S_3B_3 treatments combination. The lowest yield was obtained from control (S_0B_0)

treatment (Table 2). Karthikeyan and Shukla (2011) reported that highest yield seed (20.6 g pot^{-1}) was obtained from the treatment $S_{60}B_2$ (60 g S kg^{-1} and 2 mg B kg^{-1}). Mohiuddin (2007) also found the highest yield (1738 kg ha^{-1}) from the treatment combination N_2S_3 comprising of 80 kg N/ha + 24 kg S/ha and the lowest (850 kg ha^{-1}) from N_0S_0. Similar observation occurred by Islam (2003). The highest stover yield (2800 kg ha^{-1}) found in treatment of S 30 kg ha^{-1} and Boron 1 kg ha^{-1} which was significantly different over the other treatment combinations and lowest (2726 kg ha^{-1}) in S_0B_0 treatment. The result is in agreement with the findings of Mohiuddin (2007).

Harvesting index was positively influenced by different combinations of S and B. The combined dose of 20 kg ha^{-1} S and 3 kg ha^{-1} B contributed significantly to get highest (40.3%) harvest index of mustard and lowest harvest index (39%) was calculated from the treatment of S_0B_1 (0 kg S ha^{-1} and 1 kg B ha^{-1}) (Table 2).

Table 2. Combined effect of sulphur and boron on yield and yield contributing characters and harvest index (%) of mustard

Treatment	Plant height (cm)	No. of branches plant^{-1}	Pod length (cm)	No. of capsules plant^{-1}	No. of seeds capsule^{-1}	1000-seed wt. (g)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
S_0B_0	126.1^g	4.08^d	3.66^d	228^f	9.29^d	8.0^f	1806^h	2726^e	39.1^e
S_0B_1	125.0^g	4.29^c	3.79^c	230.2^e	9.34^d	9.2^e	1842^{fg}	2748^d	39^f
S_0B_2	131.3^f	4.42^{bc}	3.85^{bc}	230.8^e	9.57^d	10.7^{cd}	1879^f	2762^c	39.6^{cd}
S_0B_3	132.1^{ef}	4.61^b	3.89^b	234.3^c	10.43^{cd}	11.5^c	2048^c	2772^{bc}	40^b
S_1B_0	132.6^{ef}	4.46^{bc}	3.95^b	228.9^f	9.38^d	10.8^{cd}	1925^e	2791^b	39.9^b
S_1B_1	138.5^e	4.51^b	4.04^{ab}	230.5^e	10.82^{cd}	9.3^e	1992^d	2745^d	39.5^d
S_1B_2	141.3^d	4.49^{bc}	4.12^{ab}	232.6^d	11.48^c	10^d	1984^d	2760^{cd}	39.8^{bc}
S_1B_3	139.4^e	4.56^b	4.16^a	235.5^c	11.48^c	10.4^d	2037^{cd}	2777^{bc}	39.8^{bc}
S_2B_0	138.9^e	4.43^{bc}	4.08^{ab}	237.4^b	10.43^{cd}	10.9^{cd}	1939de	2781^b	40.1^{ab}
S_2B_1	145.1^{cd}	4.6^b	4.15^a	238^b	12.32^{bc}	11.7^c	1925^e	2769^c	39.4^{de}
S_2B_2	154.5^b	5.01^{ab}	4.2^a	238.4^b	15.9^a	13.3^b	2050^c	2763^c	39.9^b
S_2B_3	166.3^a	5.25^a	4.19^a	241.3^a	15.75^a	15.4^a	2180^a	2747^d	40.3^a
S_3B_0	145.1^{cd}	5.11^{ab}	4.17^a	237^b	10.35^{cd}	12.8^{bc}	2170^a	2779^{bc}	40.1^{ab}
S_3B_1	147.9^c	5.21^a	4.16^a	239.8^{ab}	12.14^{bc}	13.6^b	2140^b	2800^a	39.7^c
S_3B_2	148.7^c	5.17^a	4.17^a	241^a	13.63^b	14^{ab}	2170^a	2752^{cd}	39.6^{cd}
S_3B_3	152.9^{ab}	5.08^{ab}	4.19^a	240^{ab}	13.5^b	14.5^a	2150^{ab}	2761^c	39.3^e
Level of significance	*	*	*	*	*	*	*	*	*

Mean value within the column with different superscripts are significantly different by DMRT.

S_0B_0= control; S_0B_1= 0 kg S and 1 kg B; S_0B_2= 0 kg S and 2 kg B; S_0B_3= 0 kg S and 3 kg B; S_1B_0= 10 kg S and 0 kg B; S_1B_1= 10 kg S and 1 kg B; S_1B_2= 10 kg S and 2 kg B; S_1B_3= 10 kg S and 3 kg B; S_2B_0= 20 kg S and 0 kg B; S_2B_1= 20 kg S and 1 kg B; S_2B_2= 20 kg S and 2 kg B; S_2B_3= 20 kg S and 3 kg B; S_3B_0= 30 kg S and 0 kg B; S_3B_1= 30 kg S and 1 kg B; S_3B_2= 30 kg S and 2 kg B; S_3B_3= 30 kg S and 3 kg B.

Nutrient content in stover and seed of mustard

Different combinations of sulphur and boron were influenced significantly the nutrient (N, P, K, S and B) contents in stover and seed of mustard (Table 3). A range of N content 1.2-1.51% and 3.41-3.69% respectively were observed in stover and seed. The highest N content was found in S_2B_3 treatment (20 kg S ha^{-1} and 3 kg B ha^{-1}) followed by S_2B_2, S_2B_3, S_3B_1, S_3B_2 & S_3B_3 and the lowest in control plot. In case of other nutrient content varied from 0.21-0.44% P, 2.41-2.68% K, 0.08-0.88% S and 42.11-46.89 ppm B in stover and it were ranged from 0.45-0.57% P, 1.09-1.38% K, 0.52-0.79% S and 47.67-59.89 ppm B in seed of mustard (Table 3). The content of P, K, S and B due to different combinations of sulphur and boron followed almost the same trend of N content (Table 3). The result is in agreement with the results of Karthikeyan and Shukla (2008); Ganesharmurthy (1996), Chand *et al.* (1997) and Sarker *et al.* (2002).

Table 3. Combined effect of sulphur and boron on nutrient contents in stover and seed of mustard

Treatment	Nitrogen (%)		Phosphorous (%)		Potassium (%)		Sulphur (%)		Boron(ppm)	
	Stover	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover	Seed
S_0B_0	1.20^d	3.41^{cd}	0.21^d	0.45^b	2.41^{cd}	1.09^c	0.08^d	0.52^{cd}	42.11^f	47.67^{fg}
S_0B_1	1.22^{cd}	3.43^{cd}	0.21^d	0.46^b	2.43^c	1.09^c	0.11^{cd}	0.57^c	42.38^{ef}	47.79^f
S_0B_2	1.26^{cd}	3.43^{cd}	0.24^{cd}	0.46^b	2.44^c	1.10^c	0.12^{cd}	0.57^c	42.67^e	47.99^f
S_0B_3	1.29^c	3.45^c	0.26^c	0.47^b	2.47^c	1.11^c	0.13^{cd}	0.61^{bc}	42.99^e	48.46^f
S_1B_0	1.23^{cd}	3.44^c	0.27^c	0.46^b	2.51^{bc}	1.10^c	0.14^c	0.63^{bc}	43.18^d	48.93^f
S_1B_1	1.31^c	3.48^c	0.29^c	0.46^b	2.51^{bc}	1.14^c	0.15^c	0.67^b	43.23^d	50.12^{de}
S_1B_2	1.34^b	3.53^b	0.36^{ab}	0.47^b	2.55^b	1.17^c	0.16^c	0.67^b	43.34^d	51.34^{de}
S_1B_3	1.37^b	3.55^b	0.37^{ab}	0.48^b	2.56^b	1.23^b	0.17^c	0.67^b	43.88^{cd}	52.67^d
S_2B_0	1.31^c	3.48^c	0.35^b	0.47^b	2.58^b	1.25^{ab}	0.18^c	0.68^b	43.97^{cd}	52.89^d
S_2B_1	1.41^{ab}	3.56^b	0.39^{ab}	0.52^{ab}	2.61^{ab}	1.29^{ab}	0.24^b	0.71^{ab}	44.89^c	54.62^c
S_2B_2	1.44^a	3.59^{ab}	0.41^a	0.55^a	2.63^{ab}	1.34^a	0.29^{ab}	0.72^{ab}	45.65^b	57.17^b
S_2B_3	1.51^a	3.69^a	0.44^a	0.57^a	2.68^a	1.38^a	0.38^a	0.79^a	46.89^a	59.89^a
S_3B_0	1.40^{ab}	3.63^{ab}	0.42^a	0.55^a	2.67^a	1.35^a	0.33^{ab}	0.76^a	46.46^{ab}	59.18^b
S_3B_1	1.45^a	3.63^{ab}	0.43^a	0.56^a	2.67^a	1.36^a	0.37^a	0.79^a	46.68^{ab}	59.33^{ab}
S_3B_2	1.46^a	3.65^a	0.43^a	0.55^a	2.68^a	1.37^a	0.36^a	0.78^a	46.78^a	59.92^a
S_3B_3	1.49^a	3.69^a	0.44^a	0.56^a	2.68^a	1.38^a	0.36^a	0.78^a	46.87^a	59.98^a

Mean value within the column with different superscripts are significantly different by DMRT.

S_0B_0= control; S_0B_1= 0 kg S and 1 kg B; S_0B_2= 0 kg S and 2 kg B; S_0B_3= 0 kg S and 3 kg B; S_1B_0= 10 kg S and 0 kg B; S_1B_1= 10 kg S and 1 kg B; S_1B_2= 10 kg S and 2 kg B; S_1B_3= 10 kg S and 3 kg B; S_2B_0= 20 kg S and 0 kg B; S_2B_1= 20 kg S and 1 kg B; S_2B_2= 20 kg S and 2 kg B; S_2B_3= 20 kg S and 3 kg B; S_3B_0= 30 kg S and 0 kg B; S_3B_1= 30 kg S and 1 kg B; S_3B_2= 30 kg S and 2 kg B; S_3B_3= 30 kg S and 3 kg B.

Combined effect of sulphur and boron on protein and oil content in mustard

Protein content in stover and seed of mustard was significantly affected by the treatment combination of S and B (Table 4). The highest protein content (9.44%)

in stover and (23.06%) in seed were found in S_2B_3 treatment (20 kg S ha^{-1} and 3 kg B ha^{-1}) which showed significant variation over the others treatment combination, but statistically similar to S_3B_3 in stover and S_3B_3 & S_3B_2 in seed. The lowest protein content (7.50% in stover and 21.31% in seed) was observed in control treatment. This result is in agreement with the observation of Brady (1996). Similar finding was also corroborated by Tomar *et al.* (1996) who recorded the highest amount of protein in increasing S fertilization. Verma *et al.* (2002) reported the higher amount of protein was obtained from the combination of S 60 kg ha^{-1} + B 1.0 kgha^{-1} followed by S 40 kg ha^{-1} + B 1.0 kg ha^{-1}.

Table 4. Combined effect of sulphur and boron on protein content in stover and seed & oil content in seed of mustard

Treatment	Protein (%)		Oil content (%)
	Stover	Seed	seed
S_0B_0	7.50[i]	21.31[g]	41.67[d]
S_0B_1	7.62[h]	21.44[f]	41.69[d]
S_0B_2	7.87[g]	21.44[f]	41.83[c]
S_0B_3	8.06[f]	21.56[ef]	41.88[c]
S_1B_0	7.69[h]	21.5[ef]	42.87[bc]
S_1B_1	8.19[de]	21.75[e]	42.88[bc]
S_1B_2	8.37[de]	22.06[d]	42.97[b]
S_1B_3	8.56[d]	22.19[cd]	43.01[b]
S_2B_0	8.19[de]	21.75[e]	43.73[b]
S_2B_1	8.81[c]	22.25[cd]	43.75[b]
S_2B_2	9.00[bc]	22.44[c]	43.78[b]
S_2B_3	9.44[a]	23.06[a]	43.80[b]
S_3B_0	8.75[d]	22.69[b]	44.90[a]
S_3B_1	9.06[b]	22.69[b]	44.93[a]
S_3B_2	9.12[b]	22.81[ab]	44.95[a]
S_3B_3	9.31[ab]	23.06[a]	44.98[a]

Mean value within the column with different superscripts are significantly different by DMRT.

S_0B_0= control; S_0B_1= 0 kg S and 1 kg B; S_0B_2= 0 kg S and 2 kg B; S_0B_3= 0 kg S and 3 kg B; S_1B_0= 10 kg S and 0 kg B; S_1B_1= 10 kg S and 1 kg B; S_1B_2= 10 kg S and 2 kg B; S_1B_3= 10 kg S and 3 kg B; S_2B_0= 20 kg S and 0 kg B; S_2B_1= 20 kg S and 1 kg B; S_2B_2= 20 kg S and 2 kg B; S_2B_3= 20 kg S and 3 kg B; S_3B_0= 30 kg S and 0 kg B; S_3B_1= 30 kg S and 1 kg B; S_3B_2= 30 kg S and 2 kg B; S_3B_3= 30 kg S and 3 kg B.

Combinations of S and B demonstrated positive effect on oil content of mustard (Table 4). The percent oil content due to different treatment combination was ranged from 41.67-44.98%. Percent oil content gradually increased with the increasing of combination of S and B. The highest oil content (44.98%) was recorded from the treatment S_3B_3 (30 kg S ha^{-1} and 3 kg B ha^{-1}) followed by S_3B_2, S_3B_1 and S_3B_0. The lowest oil amount (41.67%) was found in control treatment

(Table 4).This finding was supported by Havlin *et al.* (1999) and Babhulkar *et al.*(2000). In contrast, Khatik *et al.* (1992) observed that S appliaction decreased the oil content. But Malewar *et al.* (2001) and Noor *et al.* (1997) reported that oil is synthesised by B nutrient with combination of other nutrient.

Conclusion

The combination of S_2B_3 (20 kg S ha^{-1} and 3 kg B ha^{-1}) with blanket dose of 120 kg urea ha^{-1}, 145 kg TSP ha^{-1}, 45 kg MoP ha^{-1} and 5 kg ZnSO4 ha^{-1} gave higher grain yield of mustard. The treatment combination S_3B_3 (30 kg S ha^{-1} and 3 kg B ha^{-1}) contributed the highest protein and oil content in mustard seed. Thus, combined application of S and B at 20 and 3 kg ha^{-1} can be recommended for yield maximization and quality improvement of mustard in Tejgaon series soil of Madhupur Tract (AEZ 28).

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