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Response of sulphur and boron on growth and yield characteristics of mustard (*Brassica juncea* L.) in central plain zone of Uttar Pradesh

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Abstract
A field experiment was conducted during *rabi* 2018-19 at Students' Instructional Farm of C.S. Azad University of Agriculture and Technology, Kanpur, U.P. to find out the Response of Sulphur and Boron on yield, nutrients uptake and quality of mustard (*Brassica juncea* L.) with nine treatments combination T_1: S_0B_0, T_2: S_0B_2, T_3: S_0B_4 T_4: $S_{30}B_0$, T_5: $S_{30}B_2$, T_6: $S_{30}B_4$, T_7: $S_{60}B_0$, T_8: $S_{60}B_2$ and T_9: $S_{60}B_4$ in randomized block design with three replications. The result showed highest seed yield of (20.53 q ha^{-1}) at 60 kg S ha^{-1} and (18.73 q ha^{-1}) at 2 kg B ha^{-1} and stover yield of (56.01 q ha^{-1}) at 60 kg S ha^{-1} and (53.98 q ha^{-1}) at 2 kg B ha^{-1}. The interaction response of sulphur and boron on seed yield was 20.90 q ha^{-1} and on stover yield was 57.10 q ha^{-1}. The highest combined effect of sulphur and boron on seed and stover yield was recorded at $S_{60}B_4$ i.e., 20.90 and 57.10 q ha^{-1}, respectively.

Keywords: Seed yield, stover yield, oil yield, protein, sulphur and boron

Introduction
Mustard (*Brassica juncea* L.) is the major Rabi oilseed crops of India and world and occupy a prominent place being next to groundnut both in area and production. It belongs to family cruciferae. It is popularly known as Rai, Raya or Laha in India and occupies considerably large acreage among the Brassica group of oilseed crops. It can be grown as pure crop or as intercrop. It is extensively grown traditionally as a pure crop as well as intercrop (mixed crop) in marginal and sub-marginal soils in the eastern, northern and north western states of India. Mustard/rape seed are being grown largely in states like Rajasthan, Uttar Pradesh, Punjab, Madhya Pradesh, Bihar, Orissa, West Bengal and Assam. Cool and moist climate of winter months is the major factor for growth and productivity of mustard in these states Singh *et al.*, (2017) [9].

In India, area, production and productivity of rapeseed mustard is 5.98 M ha, 6.87 M tonnes and 1239 kg ha^{-1}, respectively according to FAO-2020. It is mainly grown in the states of Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh. Based on area and production of 2019, these states accounted for 78.65% of acreage and 86.32% of production. Among the states, Rajasthan alone accounted for 46.21% of acreage and 50.23% of production and regard productivity, Haryana occupied first position with 18.43 kg ha^{-1}. Area and production decline in Uttar Pradesh over last 30 years. Share of Uttar Pradesh to total area and production was 57.13% and 53.09% in 2010 which declined to 14.25% and 14.98% respectively in 2019. Indian mustard is predominantly cultivated in Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh and Gujarat. Its cultivation extended to non traditional areas of southern states like Karnataka, Tamil Nadu and Andhra Pradesh Anonymous, (2021) [1].

Sulphur plays a very important role in chlorophyll formation. It is also important for oilseeds as the volatile di- and poly-sulphide compounds help to increase the pungency of the vegetable oils. Boron is a costly nutrient and its use efficiency by crops is also very low. Attempts should, therefore, be made to maximize the benefit out of B fertilization. Boron is very important in cell division and in pod and seed formation. Rate of water adsorption and carbohydrate transaction is restricted due to boron deficiency Kumar and Trivedi (2021) [5].

Materials and Methods
The experiment was conducted during *rabi* season of 2018-19 at Students' Instructional Farm, C. S. Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh. Soil of the experimental plot was slightly alkaline in nature having organic carbon 0.41%, total nitrogen 0

0.03%, available P_2O_5 16.0 Kg ha^{-1}, available K_2O 132.50 kg ha^{-1}, available S 9.0 kg ha^{-1}, available B 0.41 Mg kg^{-1}, pH 8.1, electrical conductivity 0.30 dS m^{-1}, permanent wilting point 6.3%, field capacity 18.4%, maximum water holding capacity 29.5%, bulk density 1.46 Mg m^{-3}, particle density 2.56 Mg m^{-3} and porosity 42.9%. The experiment was conducted in a randomized block design with 3 replications and 9 treatments *viz.* T_1: S_0B_0, T_2: S_0B_2, T_3: S_0B_4 T_4: $S_{30}B_0$, T_5: $S_{30}B_2$, T_6: $S_{30}B_4$, T_7: $S_{60}B_0$, T_8: $S_{60}B_2$ and T_9: $S_{60}B_4$. The fertilizer used were Urea, DAP, Muriate of potash and Sulphur and boron. Mustard cv Rohini was sown in rows 50 x 15 cm apart using 5 kg seed ha^{-1} on 23.10.2018. Available moisture at sowing time upto 100 cm soil profile was 282.5 mm whereas amount of rainfall received during the crop period was 8.6 mm against the average annual rainfall of about 800 mm. Recommended package of practices were applied in different treatments. Soil moisture was monitored gravimetrically using the sample collected from 0-25, 25-50, 50-75 and 75-100 cm soil depths at regular monthly intervals to quantify the soil moisture content and growth parameters by randomly selecting three plants for each plots till the harvest.

The oil content of the oven dried seeds was estimated by extracting oil using petroleum ether (60-80 ºC) as solvent and Soxhlet apparatus as given by Sadasivum and Manickam, (1992). The oil yield (kg ha^{-1}) was calculated using following formula:

Oil yield (kg ha^{-1}) = Seed oil content (%) x Seed yield (kg ha^{-1})

The data collected on growth and yield attributes were statistically analyzed (Fisher and Yates, 1958). Recommended package of practices and fertilizers doses were applied in different treatments.

Results and Discussion

Plant height (cm): Plant height of mustard crop increased with each successive doses of S and B upto their highest level. At 60 kg sulphur and 4 kg boron the plant height were 104.78 and 103.52 cm, respectively. However, significant increasing effect was observed only upto 30 kg sulphur and 2 kg boron, respectively. Highest plant height of mustard was noted 106.87 cm with con joint application of S and B at $S_{60}B_4$ which was 12.08 per cent higher to control.

The interaction effect of sulphur and boron was non significant. Similar results were reported by Ranjan *et al.*, (2018) [7].

Number of siliqua plant^{-1}: Number of siliqua plant^{-1} revealed that increasing levels of sulphur increased No. of siliqua plant^{-1} significantly upto its highest dose. The corresponding values due to different levels of sulphur as number of siliqua plant^{-1} were 211, 224 and 230. Application of boron also increased number of siliqua plant^{-1} upto highest levels of boron but significant effect was observed only upto 15 kg B ha^{-1}. The values due to boron application at 0, 2 and 4 kg ha^{-1} were 217, 223 and 224.66 respectively. At highest levels of S and B, numbers of siliqua increased by 9 and 3.5 per cent over control. The interaction of S and B could not qualify the levels of significance. Similar results were reported by Thaneshar *et al.*, (2017) [10].

Number of seed siliqua^{-1}: Number of seed siliquae^{-1} enhanced with the every incremental levels of S and B both. The levels of sulphur and boron both increased seeds/siliqua significantly upto 30 kg S ha^{-1} and 2 kg B ha^{-1}. The seed per siliqua produced at S_{30} (17.82) and at B_2 (18.03) which were 34.8 and 18.6 per cent higher over their respective control. The interaction effect of sulphur and boron was noted non significant. Similar results were reported by Vyas, (2015) [11].

Test Weight (g): Test weight of mustard increased due to different doses of sulphur upto highest level and significant response have been noticed only upto 30 kg S ha^{-1} after that non significant response was noticed. The highest test weight was reported at 60 kg sulphur i.e. 5.35 gm while lowest 4.60 gm in control in mustard. Significant response was also observed with boron only upto 4 kg B ha^{-1}. The mean test weight of mustard varies from 4.41 control and 5.48 B_4 kg ha^{-1}. Sulphur and boron interaction was observed as non significant. Similar results were reported by Banjara *et al.*, (2017) [3].

Seed and stover yield (q ha^{-1}): Seed and stover yields of mustard also showed linear increment due to different doses of sulphur and boron. The increase in seed and stover yields were upto their highest level of sulphur and boron both. Highest seed and stover yield at S_{60} were 20.53 and 56.01 q ha^{-1} and with B_4 the corresponding yield of mustard were 18.73 and 53.98 q ha^{-1}. Though both the yield increased upto highest levels of each nutrients applied, but significant response were noted at S_{30} and B_2 level. Whereas, seed and stover yields combined effect of S x B were noticed highest on $S_{60}B_4$. At this stage seed and stover yields were noted 20.90 and 57.10 q ha^{-1} which were increased by 41.2 and 22.80 per cent, respectively. Non significant responses were noticed due to S x B. Similar results were reported by Bamboriya *et al.*, (2017) [2].

Oil content (%): Oil content of mustard also increased with application of S and B upto their highest level but significant improvements were seen upto the 30 kg sulphur and 2 kg B ha^{-1}. The highest oil content was noted at S_{60} x B_4 when sulphur and boron were used jointly. Since, sulphur is a constituent of glucosinolate which play a vital role in synthesis of CoA and lipoic acid resulting in increased oil content. Oil content in mustard has been improved with increasing doses of S and B upto its highest level. The increase in oil content due to boron may be due to the positive influence on B on biosynthesis of oil and fatty acids Mallick and Raj, 2015 [6].

Oil yield (kg ha^{-1}): Oil yield of mustard increased significantly with the graded doses of S upto its highest level. At highest level of S, oil yield increased (819.00 kg ha^{-1}) as compared to control (567.76). Again boron also increased oil yield significantly upto its highest dose. The probable reason of increased in oil yield due to boron may be explained that boron alone increased the oil content per cent and oil yield (kg ha^{-1}) which culminated better oil yield in mustard. These findings on oil yield have also been reported by Kumar and Trivedi (2021) [5].

Protein content (%): The protein content of mustard increased significantly over control with application of S and B. The maximum protein content of 23.92 was recorded by 60 kg sulphur whereas minimum in control as we were

expecting. Sulphur is an integral part of amino acids *viz.*, cysteine, cystine and methionine, therefore its addition enhanced the amount of protein in mustard seed. This might be due to increased N-concentration in seed leading to higher protein. In the same way B-application also increased protein content. When Sulphur and boron applied conjointly the protein yield increased by 21.54 per cent (24.65%) over to their respective control (20.28%). Similar results were reported by Singh *et al.*, (2017) [9].

Table 1: Effect of sulphur & boron on plant height, No. of siliqua plant^{-1} and No. of seed siliqua^{-1} under different treatments in mustard crop.

Levels	Plant height at harvest (cm)				Levels	No. of siliqua plant^{-1}				LEVELS	No. of seed siliqua^{-1}			
	B_0	B_2	B_4	Mean		B_0	B_2	B_4	Mean		B_0	B_2	B_4	Mean
S_0	95.35	98.50	99.22	97.69	S_0	207.00	213.00	213.00	211.00	S_0	12.20	15.58	15.64	14.47
S_{30}	99.54	103.67	104.48	102.56	S_{30}	218.00	226.00	228.00	224.00	S_{30}	16.14	18.52	18.82	17.82
S_{60}	101.25	106.21	106.87	104.78	S_{60}	226.00	233.00	233.00	230.00	S_{60}	18.02	20.00	20.51	19.51
Mean	98.71	102.79	103.52	-	Mean	217.00	224.66	224.66	-	Mean	15.45	18.03	18.32	-
	S	B	S x B			S	B	S x B			S	B	S x B	
SE (m)	1.23	1.23	2.14		SE (m)	1.12	1.12	1.95		SE (m)	1.08	1.08	1.86	
CD at 5%	2.64	2.64	NS		CD at 5%	2.41	2.41	NS		CD at 5%	2.30	2.30	NS	

Table 2: Effect of sulphur & boron on Test weight, Seed yield and Stover yield under different treatments in mustard crop.

Levels	Test Weight (g)				Levels	Seed yield (q ha^{-1})				LEVELS	Stover yield (q ha^{-1})			
	B_0	B_2	B_4	Mean		B_0	B_2	B_4	Mean		B_0	B_2	B_4	Mean
S_0	4.10	4.75	4.95	4.60	S_0	14.80	16.00	16.30	15.70	S_0	46.50	49.00	49.70	48.40
S_{30}	4.50	5.45	5.65	5.20	S_{30}	17.40	18.50	19.00	18.30	S_{30}	52.65	54.50	55.15	54.10
S_{60}	4.65	5.55	5.85	5.35	S_{60}	20.10	20.60	20.90	20.53	S_{60}	54.30	56.60	57.10	56.01
Mean	4.41	5.25	5.48	-	Mean	17.43	18.36	18.73	-	Mean	51.15	53.36	53.01	-
	S	B	S x B			S	B	S x B			S	B	S x B	
SE (m)	0.08	0.08	0.13		SE (m)	0.49	0.49	0.34		SE (m)	1.03	1.03	1.78	
CD at 5%	0.16	0.16	NS		CD at 5%	1.05	1.05	NS		CD at 5%	2.20	2.20	NS	

Table 3: Effect of sulphur & boron on Oil content, Oil yield and Protein content under different treatments in mustard crop.

Levels	Oil Content (%)				Levels	Oil Yield (Kg ha^{-1})				LEVELS	Protein Content (%)			
	B_0	B_2	B_4	Mean		B_0	B_2	B_4	Mean		B_0	B_2	B_4	Mean
S_0	34.80	36.51	37.05	36.12	S_0	515.04	584.32	603.92	567.76	S_0	17.17	19.97	20.28	19.14
S_{30}	38.20	40.65	40.00	39.61	S_{30}	664.67	752.06	779.00	731.91	S_{30}	21.48	24.03	24.37	23.41
S_{60}	38.80	40.94	41.75	40.49	S_{60}	741.08	843.36	872.57	819.00	S_{60}	22.78	24.34	24.65	23.92
Mean	37.26	39.36	39.60	-	Mean	640.26	726.58	751.83	-	Mean	20.59	22.78	23.10	-
	S	B	S x B			S	B	S x B			S	B	S x B	
SE (m)	0.69	0.69	1.21		SE (m)	10.23	10.23	1.77		SE (m)	0.07	0.07	0.12	
CD at 5%	1.49	1.49	NS		CD at 5%	21.38	21.38	NS		CD at 5%	0.15	0.15	NS	

Conclusion

Therefore, it may be concluded from the above findings of present investigation that the application of S and B doses are very much essential to obtained maximum yield of mustard in soil having low sulphur and low boron content. In this study, it was found that S_{60} and B_4 resulted higher yields of mustard especially in this alluvial tract.

References

1. Anonymous. Ministry of Statistics and Programme Implementation. Agricultural statistics, India, 2021.
2. Bamboriya SD, Kaushik MK, Bamboriya SD, Jajoriya D, Kumawat A. Productivity and profitability of Indian mustard as influenced by weed-management practices under irrigated condition. Indian Journal of Agronomy. 2017;62(2):233-235.
3. Banjara TR, Pali GP, Kumar B, Kumar S. Tillage practices influence on growth, yield and economics of Toria under rainfed condition of Chhattisgarh. Journal of Oilseed Brassica. 2017;8(2):163-167.
4. Fichers RA, Yates YE. Report on coordination of fishers statistics in India. A Handbook of Agricultural statistics. 1958;17:47.
5. Kumar R, Trivedi SK. Effect of levels and sources of sulphur on yield, quality and nutrient uptake by mustard. Progressive Agriculture. 2021;12(1):69-73.
6. Mallick RB, Raj A. Influence of phosphorus, sulphur and boron on growth, yield, nutrient uptake and economics of rapeseed. International Journal of Plant, Animal and Environmental Sciences. 2015;5:22-27.
7. Ranjan R, Dimree S, Pathak RK, Awasthi UD, Verma Amar Kant. Productivity, Water Use Efficiency and Economics of Indian Mustard (*Brassica juncea* L.) as Influenced by Integrated Nutrient Management. International Journal of Current Microbiology and Applied Sciences. 2018;7(11):2027-2034.
8. Sadasivum SA, Manickam. Biochemical methods for Agricultural Sciences. Wiley Eastern Ltd., New Delhi India, 1992, 187-188.
9. Singh Y, Kumar S, Sharma DNL, Kumar V. Effect of different levels of NPK with combined use of FYM and sulphur on yield, quality and nutrients uptake in Indian mustard. International Journal of Chemical Studies. 2017;5(2):300-304.
10. Thaneshar SV, Prakash, Jai Kumar M, Kumar S, Singh RK. Effect of Integrated Nutrient Management on Growth and Yield of Mustard in Irrigated Condition of Upper Gangetic Plain Zone of India. International Journal

of Current Microbiology and Applied Sciences. 2017;6(1):922-932.
11. Vyas SP. Interactive Effects of Nitrogen and Biofertilizers on Indian Mustard. Annals of Arid Zone. 2015;44(2):47-50.