**Original research article**

# Effect of Boron levels and Row Spacing on Growth and Yield of Mustard (*Brassica juncea* L.)


## Abstract

The field experiment was entitled **"Effect of Boron levels and Row Spacing on growth and yield of Mustard (*Brassica juncea* L.)"** was conducted during *Rabi* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2). The experiment was laid out in Randomized Block Design with nine treatments which are replicated thrice. The treatments viz Boron 1 kg/ha + Row spacing 20cm, Boron 1 kg/ha + Row spacing 30cm, Boron 1 kg/ha + Row spacing 40cm, Boron 2 kg/ha + Row spacing 20cm, Boron 2 kg/ha + Row spacing 30cm, Boron 2 kg/ha + Row spacing 40cm, Boron 3 kg/ha + Row spacing 20cm, Boron 3 kg/ha + Row spacing 30cm, Boron 3 kg/ha + Row spacing 40cm. The results obtained that the application of Boron 3 kg/ha plus Row spacing 30cm (Treatment 8) recorded significantly maximum plant height (192.53 cm), plant dry weight (36.95 g/plant), number of siliquea/plant (314.47), test weight (5.14g), number of seeds/siliquea (15.33), stover yield (4.61 t/ha), seed yield (2.48 t/ha), gross returns (124000.0 INR/ha), net return (84370.0 INR/ha) and benefit cost ratio (2.13) as compared to other treatments.



***Key words: -*** *Boron, Row Spacing, yield, Mustard.*


.

## INTRODUCTION

Mustard (*Brassica juncea* L.) belongs to the family of "Cruciferae" and popularly used in Indian cooking. It has also been reported that mustard crop had cultivated in Channhu-daro of Harrapan ancient civilization during 2300-1750 BC. There is ambiguity in the history as the origin of B. juncea is concerned. It had been believed that center of origin for B. juncea is Middle-East, where putative parents i.e. B. nigra and B. rapa would have crossed with each other. Later on, it had been disseminated to other parts of the world such as Europe, Asia, and Africa etc. India is the third largest mustard producer in the world after China and Canada with 12% of world total production [15]. Mustard is the second most important and most prominent winter oilseed crop of India. It is grown mainly in the northern plains of India with some cultivated area in the eastern geography as well.

Boron is one of the essential micronutrient required for normal growth of most of the plants. It helps in the normal growth of plant and in adsorption of nitrogen (N) in soil and also makes up the calcium (Ca) deficiency to some extent. Boron plays an important role in cell differentiation, regulating membrane permeability, tissue differentiation, carbohydrates and protein metabolism. It also helps in translocation of photosynthesis and growth regulators from source to sink and growth of pollen grains thereby increase in seed yield of crops. Boron is involved in plant functions such as cell wall development, cell wall strength, cell division, fruit and seed production, and sugar transport are related to boron fertilization. B fertilisation is required for increasing crop yield and nutritional quality. There have been numerous reports on mustard's positive response to B fertilisation [6]. Brassicas have a greater boron need, and a severe deficit can lead to floral abortion and a reduction in seed yield [7]. Apart from essential plant nutrients, boron is vital in the phenology of mustard production, and this crop responds to boron application [8].

Row spacing is one of the very important practices for mustard production. Improved varieties of mustard are capable of higher yields when grown under optimum row spacing and fertility level. The major row spacing of mustard decrease seed yield through synchronization of siliquae filling period with high temperature, the decrease in assimilates production, drought stress occurrence, shortened silique filling period and acceleration of plant maturity [9]**.** Plant density is an important cultural practice that determines number of pods, number of siliquae and other growth attributes of Mustard. Spacing is dependent on variety, its growth habit and agro-climatic environment [13]. Light attenuation in row crops may be influenced by canopy architecture, which has to be defined in terms of the size, shape orientation of shoot components and row spacing [1]**.**

## MATERIALS AND METHODS:

The experiment was conducted during *Rabi* season of 2021-22. The experiment was conducted in Randomized Block Design consisting of nine treatment combinations with three replications and was laid out with the different treatments allocated randomly in each replication. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.22 %), available N (171.48 kg/ha), available P (12.3 kg/ha) and available K (235.7 kg/ha). The experiment was laid out in Randomized Block Design with nine treatments which are replicated thrice. The treatments viz $T_1$- Boron 1 kg/ha + Row spacing 20cm, $T_2$- Boron 1 kg/ha + Row spacing 30cm, $T_3$- Boron 1 kg/ha +

Row spacing 40cm, $T_4$- Boron 2 kg/ha + Row spacing 20cm, $T_5$- Boron 2 kg/ha + Row spacing 30cm, $T_6$- Boron 2 kg/ha + Row spacing 40cm, $T_7$- Boron 3 kg/ha + Row spacing 20cm, $T_8$- Boron 3 kg/ha + Row spacing 30cm, $T_9$- Boron 3 kg/ha + Row spacing 40cm. The observations were recorded on different growth parameters at harvest viz. plant height (cm), plant dry weight(g), Number of siliqua per plant, number of seeds per siliqua, test weight(g), seed yield(t/ha) and stover yield(t/ha).

**RESULTS AND DISCUSSION**

**A. Growth Attributes:**

Plant height and plant dry weight was significantly influenced by the application on boron and row spacing at different stages. Plant height, and dry weight were found significantly influenced due to different treatments are presented in Table1. At harvest significantly maximum plant height (192.53 cm) were observed in treatment $T_8$ with application of Boron 3 kg and Row Spacing 30cm and treatment with application of Boron 3 kg and Row Spacing 40cm was statistically at par. Increase in plant height might be due to application of boron which play a major role in cell elongation, photosynthesis and translocation of photosynthates. Similar results was observed by Simta *et al*, Yadav et al[12,15]. Greater spacing between plants provided more space, sunlight, nutrients, and soil moisture for improved photosynthesis, metabolic processes, and growth and development Sondhiya *et al*.

Significantly higher dry weight (36.95 g/plant), was observed in treatment $T_8$ with application of Boron 3 kg and Row Spacing 30cm and treatment with application of Boron 3 kg and Row Spacing 40cm and Boron 2kg and Row Spacing 30cm was statistically at par as compared to other treatments. In case of dry matter accumulation boron aids in the production of deep green colour due to the synthesis of chlorophyll, which in turn provides more area for photosynthesis. Simta *et al*.[12]

**B. Yield Attributes**

The observations regarding yield and yield attributes *viz.*, number of siliquae/plant, number of seeds/siliqua, seed yield, stover yield and harvest index was shown in Table 2. Significantly higher number of siliquae/plant (314.47) was observed in treatment $T_8$ with application of Boron 3 kg and Row Spacing 30cm and treatment with application of Boron 3 kg and Row Spacing 40cm was statistically at par. Significantly higher number of seeds/siliquea (15.3) was observed in treatment $T_8$ with application of Boron 3 kg and Row Spacing 30cm and treatment with application of Boron 3 kg and Row Spacing 40cm was statistically at par. Significantly higher seed yield (2.48 t/ha) was observed in treatment $T_8$ with application of Boron 3 kg and Row Spacing 30cm and treatment with application of Boron 3 kg and Row Spacing 40cm was statistically at par. The beneficial effect of B on yield attributes may be due to its role in flower development, pollen grain formation, pollen viability, pollen tube growth for proper pollination and seed development. The findings was in line with those reported by Yadav *et al.[15]*. Mustard's major row spacing reduces seed yield by synchronising the siliquae filling phase with high temperatures, lowering assimilate production, causing drought stress, shortening the silique filling period, and accelerating plant maturity Mendham *et al.* Significantly higher stover yield (4.61 t/ha) was observed in treatment $T_8$ with application of Boron 3 kg and Row Spacing 30cm and treatment with application of Boron 3 kg and Row Spacing 40cm was statistically at par. Boron supplementation increased main nutrient intake, resulting in increased photosynthetic activities and plant vegetative development. Finally, due to adequate metabolic activities, this rapid development resulted in a larger stover yield in mustard [7].

Fig 1 Sowing

Fig 3 picture with my advisor

Fig 2 measuring plant height

Fig 4 Crop harvesting

**Table.1 Effect of boron levels and row spacing on growth attributes of Mustard.**

| Treatments | Plant height (cm) | Plant dry weight (g) |
|---|---|---|
| Boron 1kg+ Row Spacing 20cm | 183.07 | 34.34 |
| Boron 1kg+ Row Spacing 30cm | 185.01 | 34.71 |
| Boron 1kg+ Row Spacing 40cm | 184.18 | 34.55 |
| Boron 2kg+ Row Spacing 20cm | 185.97 | 34.79 |
| Boron 2kg+ Row Spacing 30cm | 189.07 | 36.27 |
| Boron 2kg+ Row Spacing 40cm | 187.74 | 35.88 |
| Boron 3kg+ Row Spacing 20cm | 186.80 | 35.28 |
| Boron 3kg+ Row Spacing 30cm | 192.53 | 36.95 |
| Boron 3kg+ Row Spacing 40cm | 190.41 | 36.47 |
| **F test** | S | S |
| **SEm(±)** | 0.72 | 0.25 |
| **CD (p=0.05)** | 2.16 | 0.75 |

**Table.2 Effect of boron levels and row spacing on yield attributes and yield of Mustard.**

| Treatments | No. of Siliquae per plant | No. of seeds per Siliquae | Test weight (g) | Seed yield (t/ha) | Stover yield (t/ha) | Harvest index (%) |
|---|---|---|---|---|---|---|
| Boron 1kg+ Row Spacing 20cm | 295.67 | 13.33 | 4.41 | 1.82 | 3.82 | 32.25 |
| Boron 1kg+ Row Spacing 30cm | 302.20 | 13.73 | 4.72 | 2.04 | 4.05 | 33.48 |
| Boron 1kg+ Row Spacing 40cm | 298.13 | 13.60 | 4.59 | 1.94 | 3.91 | 33.20 |
| Boron 2kg+ Row Spacing 20cm | 306.67 | 13.87 | 4.75 | 2.10 | 4.14 | 33.62 |
| Boron 2kg+ Row Spacing 30cm | 309.33 | 14.60 | 4.99 | 2.27 | 4.45 | 33.79 |
| Boron 2kg+ Row Spacing 40cm | 308.93 | 14.73 | 4.93 | 2.25 | 4.36 | 34.03 |
| Boron 3kg+ Row Spacing 20cm | 306.93 | 14.00 | 4.81 | 2.17 | 4.27 | 33.66 |
| Boron 3kg+ Row Spacing 30cm | 314.47 | 15.33 | 5.14 | 2.48 | 4.61 | 34.96 |
| Boron 3kg+ Row Spacing 40cm | 312.93 | 14.87 | 5.04 | 2.43 | 4.55 | 34.14 |
| **F test** | S | S | S | S | S | S |
| **SEm (±)** | 1.51 | 0.19 | 0.06 | 0.03 | 0.03 | 0.29 |
| **CD (5%)** | 4.54 | 0.57 | 0.18 | 0.09 | 0.10 | 0.86 |

## CONCLUSION

From the above results, it was concluded that application Boron 3kg+ Row Spacing 30cm (T8) had performed better in growth and yield parameters and was economically viable.

The conclusions drawn are based on one season data only which requires further confirmation for recommendation.

## Reference.


1. Awan T.H., R.I. Ali, Z. Manzoor, M. Ahmad and M. Akhtar (2011). Effect of different nitrogen levels and row spacing on the performance of newly evolved medium grain rice variety, KSK-133. J. Anim. Plant Sci., **21**(2):231-234.
2. Devaram Aarthi Reddy, Rajesh Singh, Wasim khan and punnamchhetri(2020) Efficiency of sulphur and Row Spacing on Growth and Yield Attributes of Mustard (Brassica campestris). International Journal of Current Microbiology and Applied

Sciences ISSN: 2319-7706, **9**(12).

3. Erdal CACAN, Kagan KOKTEN (2017) The Effect of Different Row Spacing on the Yield and Quality of Forage Rape (*Brassica napus* L. ssp. oleifera Metzg) E. Cacan et al. / Eurasian Journal of Biology and Ecology, **2**(7-13).
4. Hassan F.U and Arif M. (2012) Response of white mustard (SINAPIS ALBA L) to spacing under rainfed conditions. The Journal of Animal & Plant Sciences, **22**(1): , Page: 137- 141 ISSN: 1018-7081.
5. Hemkalyan Verma and Joy Dawson .2018.Yield and Economics of Mustard (Brassica CompestrisL.) as Influenced by Sowing Methods and levels of sulphur and Boron. International Journal of Current Microbiology and applied Sciences 2319- 7706.
6. Hossain,M.A., Jahiruddin,M., and Khatun,F.,2011.Effect of boron on yield and mineral nutrition of Mustard (*Brassica napus*) .*Bangladesh J. Agril. Res.* **36**(1) : 63-73.
7. Jalapathi Mounika, Joy Dawson and DRMS Vidya Sagar.2021.Influence of boron and sulphur levels on growth and yield of yellow mustard (*Sinapis*alba).*ThePharma Innovation Journal* **10**(11):174-177.
8. Karthikeyan, K. and Shukla, L.M. (2008) Effect of boronsulphur interaction on their uptake and quality parameters of mustard (Brassica juncea L.) and sunflower (Helianthus annuus L.). Journal of the Indian Society of Soil Science 56, 225-230.
9. Mendham NJ, Salisbury PA (1995) Physiology: crop development, growth and yield. In ‘Brassica oilseeds. Production and utilization’. (Eds DS Kimber, DI McGregor) pp. 11–64. (CAB International: Wallingford, UK).
10. Parminder Singh Sandhu, Mahal S.S. and Virender Sardana.2012.Nitrogen and Spacing Requirements of Promising Hybrids of Indian Mustard (*Brassica juncea* L). Czern&Coss) Indian J. Ecol.**39**(1):108-111.
11. Ranvir singh, Yogesh Singh and Sarika Singh .2017.Yield, quality and nutrient uptake of Indian mustard (*Brassica juncea* L.) under sulphur and boron nutrition. Annual of plant and Soil Research**19**(2): 227 -231.
12. Simta Sharma, Shikha Chaudhray and Rupinder Singh.2020.Effect of boron and sulphur on growth, yield and nutrient uptake of mustard (*Brassica juncea* L.). International journal of chemical studies **8**(4): 1998-2001.
13. Sondhiya,R.,Pandey,R.,andNamdeo,K.N.,2019.Effect of plant spacing on growth, yield and quality of mustard (*Brassica juncea* L.) genotypes. *Annals of Plant and Soil Research*, **21**(2): 172-176.

14. Sarabdeepkour, Meenakshi Gupta, Dileep Kachroo and Rajeev Bharat.2017.Direct and Residual Effect of zinc and Boron on Productivity,Nutrient Uptake and Quality on Mustard (*Brassica juncea* L.) and Succeeding Maize (*Zea mays*) in Subtropical Inceptisols of Jammu*. Journal of the Indian Society of soil Science* **65**(3):334-340.
15. Yadav,S.N., Singh,S.K. and Omkar Kumar.2016.Effect of Boron on Yield Attributes, Seed Yield and Oil Content of Mustard (*Brassica juncea* L.) on an Inceptisol. *Journal of the Indian Society of Soil Science*, **64**(3), pp 291-296.