

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-randomized Block-block Design-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 siliqua/plant (314.47), test weight (5.14g), number of seeds/siliqua (15.33), stover yield (4.61 t/ha), seed yield (2.48 t/ha), gross returns (124000.0INR/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.

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## 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.

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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~~ 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~~ fertilization is required for increasing crop yield and nutritional quality. There have been numerous reports on mustard's positive response to B ~~fertilisation~~ fertilization [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 yield~~ 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 siliquae 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 or 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 T1- Boron 1 kg/ha + Row spacing 20cm, T2- Boron 1 kg/ha + Row spacing 30cm, T3- Boron 1 kg/ha +

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Row spacing 40cm, T4- Boron 2 kg/ha + Row spacing 20cm, T5- Boron 2 kg/ha + Row spacing 30cm, T6- Boron 2 kg/ha + Row spacing 40cm, T7- Boron 3 kg/ha + Row spacing 20cm, T8- Boron 3 kg/ha + Row spacing 30cm, T9- 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<sub>8</sub> 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 [waswere](#) 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.](#)

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Significantly higher dry weight (36.95 g/plant), was observed in treatment T<sub>8</sub> 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<sub>8</sub> 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/siliqua (15.3) was observed in treatment T<sub>8</sub> 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<sub>8</sub> 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 [waswere](#) in line with those reported by Yadav *et al.* [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 siliqua filling period, and accelerating plant

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maturity Mendham *et al.* [????????] Significantly higher stover yield (4.61 t/ha) was observed in treatment T<sub>8</sub> 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                |
| <b>F test</b>               | S                 | S                    |
| <b>SEm(±)</b>               | 0.72              | 0.25                 |
| <b>CD (p=0.05)</b>          | 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 (gm) | 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             |
| <b>F test</b>               | S                         | S                         | S                | S                 | S                   | S                 |
| <b>SEm (±)</b>              | 1.51                      | 0.19                      | 0.06             | 0.03              | 0.03                | 0.29              |
| <b>CD (5%)</b>              | 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.

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