***Original Research Article***

# Effect of boron on yield of different varieties of mustard (*Brassica juncea* L.)

**Abstract:**

The field experiment was conducted during *Rabi* 2022 at Crop Research Farm, Department ofAgronomy,SHUATS,Prayagraj(U.P).Thesoilofthe experimentalplotwassandy loamintexture,nearlyneutral in soil reaction (pH 7.2), low in organic carbon (0.22 %), available N (171.48 kg/ha), availableP (12.3 kg/ha) and available K (235.7 kg/ha). The experiment was laid out in Randomized BlockDesign with nine treatments and one control plot each replicated threebased on one-year experimentation.The results showed that treatment with the application of Laxmi + Boron at 20 kg/ha recorded a significantly higher number of Siliquae/plant (259.00), Number of seeds/siliquae (15.00), Test weight (6.12 g), Seedyield(2.05 t/ha) and Stoveryield (6.30t/ha).

***Keywords:****Boron;Mustard; Varieties; Yield.*

**Introduction:**

"Mustard (*Brassica juncea*L.) is one of several plant species in the genera Brassicaand Sinapis in the family Brassicaceae. Mustard seed is used as a spice. The seeds can also bepressed tomake mustard oil, and theedibleleavescan beeatenas mustard greens.Itisknown as rai, raya or lah. They are generally divided into four groups: Brown mustard,Sarson,ToriaandTaramira.Intradesarson,toriaandtaramiraareknownasrapeseed.**Indiais one**of the largestvegetable oil economies in the world next only to the USA, China andBrazil. Brassicaceae occupies about 23% of the area and 14.6% of production in India. In terms of rapeseed-mustard production, India ranks third in the world, trailing only Canada and China. Its seed contains 37-49% oil"**(Singh *et al.* 2014)**. "Mustard has a primary center of origin in central Asia withsecondarycentersincentralandwesternChina,EasternIndia,BurmaandthroughIranto the Near East it has been cultivated for centuries in many parts of Eurasia. However, the principal growingcountries are Bangladesh, Central Africa, China, India, Japan, Nepal and Pakistan as well asSouthernRussiain the north of theCaspian Sea"**(KumarVineet*et al.*, 2016).**

"In India, mustard is the second most important edible oil seed after groundnut. In

India,mustard ispredominantlycultivatedinthe statesof Rajasthan,Uttar Pradesh,Haryana,Madhya Pradesh and Gujarat. Rajasthan ranks first in the area and production of rapeseed andmustard with a 2.50 million ha area and 3.71 million tonnesof production"**(Anonymous, 2017). "**Inour country, among the oil seed crops, rapeseed and mustard are the most important andhighlypromisinggroupsofcropsunderdifferentagro-climaticconditions.Amongthem,Indian mustard, alone accounts for about 80 percent of the 6.3 m ha area under rapeseed andmustardcrops in thecountry"**(Singh and Kumar,2015).**

"Boron is one of the essential micronutrients required for the normal growth of most plants. Boron plays an important role in cell differentiation and development by, regulatingmembrane permeability, tissue differentiation, carbohydrates and protein metabolism. It alsohelpsinthe translocationofphotosynthatesandgrowthregulatorsfromsourcetosinkandthe growth of pollen grains thereby increasingthe seedyield of crops. Functions of plants like cellwallformation,cellwallstrength,celldivision,fruitandseeddevelopmentandsugartransport are related to boron.The Availabilityof boron to plants is affectedby a variety of soilfactors including soil pH, texture, moisture, temperature, oxide content, carbonate content,organicmattercontentandclaymineralogy"**(Goldberg*etal.*,2000)**." UnderBorondeficiency, pollen viability and seed set of rape are greatly reduced and protein formation isalso restricted. Flowering and fruit development were restricted by a shortage of boron. It alsomakes upof the calcium deficiency to some extent. Reproductive growth, especially flowering,fruit and seed set is more sensitive to B deficiency than vegetative growth. Mustard as a Brassica crop is very responsive to B application. The B application produced the best quality seeds in respect of the proteincontent of mustard. Boron deficiency in mustard may cause sterilityi.e.,fewerpodsandfewerseedsperpod,resulting in lowseedyield"**(IslamandAnwar1994).**

**Material and Methods:**

The experiment conducted to know theEffect of boron on the yield of different varieties of mustard was carried out at the Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradeshin 2022. The experiment was laid out in an RBD (**Randomized Block Design**)consisting of Ten treatments including Control with 3 replications, with the treatment combinations T1 - Aravali +Boron10 kg/ha, T2 - Aravali +Boron15 kg/ha, T3 - Aravali +Boron20 kg/ha, T4 - Laxmi +Boron10 kg/ha, T5 - Laxmi +Boron15 kg/ha, T6 - Laxmi +Boron20 kg/ha, T7 - Vardan +Boron10 kg/ha, T8 - Vardan +Boron15 kg/ha, T9 - Vardan +Boron20 kg/ha, T10 - Control.Boron is essential for many growth functions in plants including nitrogen metabolism, enzyme activity and protein and oil synthesis. Boron is essential for many growth functions in plants including nitrogen metabolism, enzyme activity and protein and oil synthesis.

**Results and Discussion:**

**NumberofSiliquae/plants:**

"Thenumberofsiliquae per plantwassignificantlyinfluencedduedby differenttreatmentcombinations.The numberofsiliqua per plantwasrecordedsignificantlyhigher (259.00) in treatment with Laxmi + Boron 20 kg/ha, which was statistically atpar(258.12)with Laxmi + Boron 15 kg/ha and minimum was recorded in Control – RDF (80:40:40 kg/ha) (231.00). Boron enhances the primary and secondary branches which are silique-bearing organs asflowers are borne at the terminals of the branches. Therefore, with an increased number of branches,therewasan increasein thenumber of siliquaeper plant". **Mounika etal.(2021).**

**The numberofSeeds/siliquae:**

Thenumberofseedspersiliquaewassignificantlyinfluencedddueby differenttreatmentcombinations.The numberofseedspersiliquaewasrecordedsignificantlyhigher(15.00) in treatment with Laxmi + Boron 20 kg/ha, which was statistically atpar(14.28)with Laxmi + Boron 15 kg/ha and the minimum was recorded in Control – RDF (80:40:40 kg/ha) (10.12). "Boron promotes the pollen-producing capacity of anthers and hence might have produceda higher number of seeds per siliqua. It also had a positive effect on the photosynthetic performanceof plants by influencing the phosphorylation process, reducing the quantity of assimilates consumedbyrespirationtoobtain energyandaccelerating theremovalofproducts ofphotosynthesis".**Ranvir et al. (2017).**

**Testweight(g):**

ThedataonTestweightwassignificantlyinfluencedby differenttreatmentcombinations. However, a higher test weight (6.12 g) was recorded significantly higher intreatment with Laxmi + Boron 20 kg/ha, which was statistically at par (6.00 g)withLaxmi + Boron 15 kg/ha, and the minimum was recorded in Control – RDF (80:40:40 kg/ha) (4.01 g).

**Seedyield (t/ha):**

The seed yield was significantly influenced by different treatment combinations.Seed yield was recorded significantly higher (2.05 t/ha) in treatment withLaxmi + Boron 20 kg/ha, which was statistically at par with Laxmi + Boron 15 kg/ha(2.03 t/ha), and the minimum was recorded in treatment Control – RDF (80:40:40 kg/ha) (1.77 t/ha). "Theincrease in seed yield might be due to the significantpositive effect of B application on yield attributessuch as the number of siliqua plant -1, length of siliqua and the number of seeds siliqua -1. Stover yield,1000 seed weight and harvest index manifested a non-significant effect of B application. The maximumstover yield was recorded in T5 and the minimum inT1 (RDF)". [Dey and Nath (2015) and Jaiswal et al. (2015)].

**Stoveryield(t/ha):**

Thesignificantlyhigher(6.30t/ha)Stoveryieldwasobservedintreatmentwith Laxmi + Boron 20 kg/ha, the minimum was recorded in treatment Control – RDF (80:40:40 kg/ha) (6.02 t/ha) and there was no significant differencebetween the treatments. Applicationofboronenhancedtheuptakeofmajornutrientsresultingin greaterphotosyntheticactivitiesandledingtogreatervegetativegrowthin plants.Ultimatelythisaccelerated growth due to proper metabolic activities produced a higher stover yield in mustard.**Mounika*etal.* *(*2021).** Thefavorableeffectofphosphorusfertilizationonseed,Stover,oilyieldsandchlorophyll content in leaves might be due to its key role in energy transformation undervariousmetabolicprocesses**Faujdar*et al.* (2008)**

**Harvestindex(%):**

Asignificantlyhigher(24.54 %)harvest indexwasobservedintreatmentwith Laxmi + Boron 20 kg/ha, the minimum was recorded in treatment Control – RDF (80:40:40 kg/ha) (22.70 %) and there was no significant difference between the treatments.

**Conclusion:**

The study concluded that the application of Laxmi + Boron at 20 kg/ha (T6) performedbetter in growth and yield parameters andwas economically viable. Since the findings are based on one season, further trials are neededtoconfirm theresults.

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**Table 1:Effect of Boron and Varieties on growth of mustard.**

| Treatments | Plant Height | Number of branches per plant | Dry weight | No. of siliqua/plant | No. of seeds/siliqua | Test weight (g) |
|---|---|---|---|---|---|---|
| T1 | 168.50 | 15.33 | 31.00 | 237.00 | 11.32 | 4.10 |
| T2 | 171.60 | 16.00 | 32.00 | 241.30 | 12.41 | 4.51 |
| T3 | 172.00 | 16.67 | 32.29 | 245.79 | 13.00 | 4.79 |
| T4 | 172.40 | 17.00 | 33.07 | 247.56 | 13.27 | 5.08 |
| T5 | 176.30 | 18.00 | 34.40 | 258.12 | 14.28 | 6.00 |
| T6 | 177.00 | 18.33 | 35.12 | 259.00 | 15.00 | 6.12 |
| T7 | 169.70 | 16.00 | 31.56 | 239.61 | 12.00 | 4.27 |
| T8 | 172.90 | 17.00 | 33.56 | 249.46 | 13.56 | 5.34 |
| T9 | 173.10 | 18.00 | 34.00 | 255.09 | 14.19 | 5.76 |
| T10 (Control) | 167.20 | 15.33 | 30.50 | 231.00 | 10.12 | 4.01 |
| F– Test | S | S | S | S | S | S |
| S.Em(±) | 1.63 | 0.29 | 0.44 | 3.53 | 0.23 | 0.07 |
| CD(p=0.05) | 4.86 | 0.86 | 1.31 | 10.51 | 0.70 | 0.22 |

**Table 2:Effect of Boron and Varieties on yield attributes of mustard.**

| Treatments | Seed yield (t/ha) | Stover yield (t/ha) |
|---|---|---|
| T1 | 1.67 | 3.14 |
| T2 | 1.69 | 3.40 |
| T3 | 1.71 | 3.43 |
| T4 | 1.29 | 2.78 |
| T5 | 1.56 | 3.03 |
| T6 | 1.67 | 3.10 |
| T7 | 1.20 | 2.64 |
| T8 | 1.37 | 2.85 |
| T9 | 1.48 | 2.96 |
| T10 (Control) | 1.14 | 2.63 |
| F– Test | S | S |
| S.Em(±) | 0.02 | 0.04 |
| CD(P=0.05) | 0.08 | 0.12 |

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