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## Effect of levels of nitrogen and boron on growth and yield of mustard (*Brassica juncea* L.)

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### Abstract

A field experiment was conducted at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj, on the Mustard in *Rabi* 2019, with 10 treatments which were replicated thrice and laid out in Randomized Block Design. The experiment consisted of three levels of Nitrogen *viz.*, (N<sub>1</sub>: 60, N<sub>2</sub>: 70, N<sub>3</sub>: 80 Kg/ha) were applied at two split dosages and three levels Boron *viz.*, (B<sub>1</sub>: 1%, B<sub>2</sub>: 2%, B<sub>3</sub>: 3%) as foliar application at 20 & 40 DAS respectively. Among the treatments, 80 Kg/ha of Nitrogen along with foliar spray of boron *i.e.*, 1% was recorded higher in plant height (200.79cm), number of branches (10.87/plant), dry weight (113.30 g/plant), Crop growth rate (17.84 g/m<sup>2</sup>/day), number of siliqua/plant (173.00), number of seeds/siliqua (15.67), test weight (4.73g) were recorded higher in treatment combination 80Kg/ha Nitrogen + 2% Boron. Higher gross returns (₹114364.65/ha) and net returns (₹ 73609.65/ha) as well as benefit-cost ratio (1.81) were obtained with (80kg/ha Nitrogen + 2% Boron).

**Keywords:** Mustard, nitrogen, boron, growth, yield

### Introduction

Oilseeds are the second most important nutrients of the world after grains. Rapeseed is one of the most important oilseeds throughout the world. Brassicas play an important role in agriculture as oil seeds, vegetables, forage and fodder, green manure and condiments. In India 7.2 million metric tons Brassica oilseed is produced from 6.9 million ha area (2018-2019). In world India ranks 2<sup>nd</sup> and 3<sup>rd</sup> for area and production, respectively, with 26.5% and 16.6% of total hectareage and production of Rapeseed-Mustard, respectively. In India oilseed crop and Rapeseed-Mustard group of species accounts for 14.1 and 3% of gross cropped area, respectively. Among the seven annual edible oilseeds cultivated in India, rapeseed-mustard contributes nearly 30 percent in the total production of oilseeds. Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, and Gujarat cover more than 80% of acreage under mustard.

Nitrogen has an important role in seed protein and physiological functions of the plant. It is possible to increase the yield per unit area by adopting improved cultural practices, it is the most spectacular of all essential nutrients in its effect on plant growth and yield of this crop. The literature showed that nitrogen has significant effect on plant height, branches/plant, siliqua/plant and other growth factors and yield of mustard. However, Nitrogen requirements can differ very much according to soil type, climate, management practice, timing, source, and rate of Nitrogen application, cultivars, and so forth. Many studies have shown that both growth and yield of rapeseed are enhanced significantly by high doses of applied Nitrogen. (Siadat *et al.*, 2010)

Boron plays an important role in cell differentiation and development, regulating membrane permeability, tissue differentiation, carbohydrate and protein metabolism, translocation of photosynthates and growth regulators from source to sink and growth of pollen grains thereby marked increase in seed yield of crops. Cell wall formation, Cell wall strength, cell division, fruit and seed development and sugar transport are plant functions related to boron (B). Under Boron deficiency, pollen viability and seed set of rape is greatly reduced and protein formation is also restricted. Flowering and fruit development were restricted by shortage of boron. It also makes up the calcium deficiency to some extent. Reproductive growth, especially flowering, fruit and seed set is more sensitive to Boron deficiency than vegetative growth. (Khurana and Chatterjee, 2002).

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## Materials and Methods

The experiment was conducted during the *Rabi* season 2019, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.). The soil of the experiment plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.10), low in organic carbon (0.51%), available N (247 kg/ha), available P (15.22 kg/ha), available K (235 kg/ha). The experiment was laid out in Randomized Block Design with three replications with a plot size of 3 x 3 m. Mustard var., T-59 (Varuna) was grown with a spacing of 40 x 15 cm. The treatments consist of soil application of Nitrogen *viz.*, (N<sub>1</sub>: 60, N<sub>2</sub>: 70, N<sub>3</sub>: 80 Kg/ha) were applied at two split dosages and three levels Boron *viz.*, (B<sub>1</sub>: 1%, B<sub>2</sub>: 2%, B<sub>3</sub>: 3%) as foliar application at 20 & 40 DAS respectively.

## Results and Discussion

### Growth Parameters

Data presented in (Table. 1) shows effect of levels of nitrogen and boron on growth attributes of Mustard such as plant height, number of branches, plant dry weight, crop growth rate (CGR) and relative growth rate (RGR). Among different nitrogen and boron levels, the highest values were recorded with the application of N at 80 kg/ha along with B at 20 DAS

and 40DAS (2% foliar spray). The results revealed that the treatment T<sub>8</sub> (80Kg/ha Nitrogen + 2% Boron) recorded maximum plant height (200.79cm), number of branches per plant (10.87/plant), dry weight (113.30 g/plant) and Crop Growth rate (17.84 g/m<sup>2</sup>/day). The growth attributes like plant height and number of branches/plants increased significantly with every increasing in level of nitrogen up to 80 kg N/ha, (Reddy and Sinha 1987). Nitrogen has also increased for faster cell division and enlargement, which leads to higher growth rate, (Kumar *et al.* 2013) [4]. The nitrogen being the constituent of amino acids, proteins, chlorophyll and protoplast would directly influence the growth and yield attributing characteristics through better utilization of photosynthates and also reported increase in growth and yield attributes of rapeseed - mustard due to nitrogen application, (Singh and Kumar 2014). Boron levels significantly affected on plant height, number of branches per plant, number of siliquae, number of seed per siliqua, grain yield and bio-mass yield. It was observed that the number of siliqua/plant and seed/siliqua produced significant variations among the different levels of boron, (Gupta *et al.* 1980) [1]. Apart from major plant nutrients, B plays an important role in the production phenology of mustard and this crop responds to applied B, (Karthikeyan and Shukla 2008) [3].

**Table 1:** Effect of Nitrogen and Boron levels on growth parameter's of mustard

Treatment combinations	Plant height (cm) at 120 DAS	No. of branches/plant at 120 DAS	Dry weight (g) at 120 DAS	Crop growth rate (g/m <sup>2</sup> /day) at 80-100 DAS	Relative growth rate (g/g/day) at 80-100 DAS
1. 60 kg/ha Nitrogen + 1% Boron	186.21	10.47	77.73	16.36	0.07
2. 60 kg/ha Nitrogen + 2% Boron	187.57	10.60	101.57	16.10	0.06
3. 60 kg/ha Nitrogen + 3% Boron	186.80	10.70	91.03	10.50	0.04
4. 70 kg/ha Nitrogen + 1% Boron	185.47	10.30	97.20	10.80	0.04
5. 70 kg/ha Nitrogen + 2% Boron	187.69	10.07	95.10	10.34	0.03
6. 70 kg/ha Nitrogen + 3% Boron	190.58	10.37	100.03	12.58	0.04
7. 80 kg/ha Nitrogen + 1% Boron	194.51	10.47	93.23	13.01	0.05
8. 80 kg/ha Nitrogen + 2% Boron	200.79	10.87	113.30	17.84	0.06
9. 80 kg/ha Nitrogen + 3% Boron	198.90	10.50	109.17	15.17	0.04
10. Control RDF + 0% Boron	176.62	9.93	92.93	9.90	0.03
F- test	S	S	S	S	S
S.Em±	4.44	0.13	3.30	1.78	0.01
CD (P=0.05)	13.19	0.39	9.81	5.27	0.02

### Yield and yield attributes

Data presented in (Table. 2) shows that the combined effect nitrogen and boron significantly influenced all the yield parameters. Among different nitrogen and boron levels, the highest seed yield (1994.00 Kg/ha), number of siliqua per plant (173.00), number of seeds per siliqua (15.67), test weight (4.73g) was recorded with the application of nitrogen at 80 kg/ha along with boron at 20 DAS and 40DAS (2% foliar spray). reported that Nitrogen being a most important plant nutrient needed for growth and development of plant and is known to increase the yield of Brassica species, (Singh *et al.*, 2002). The increased seed yield was associated with an increase in all yield contributing characters *viz.* siliqua plant, length of siliqua, seed siliqua, and test weight. Adequate supply of nitrogen facilitated better growth and development of crop plant, enhanced nutrient content and resulted in a significant increase in yield attributes. Similar results have

also been reported by (Singh *et al.* 2008). Application of different level of nitrogen significantly influenced seed yield of rapeseed. Similar was reported, (Karamzadeh *et al.*, 2010) [10]. The number of siliqua per plants of mustard found higher in presence of available boron in the soil, (Chatterjee *et al.* 1985) [11]. Number of seeds siliqua increased with the increasing rate of boron application, (Islam and Sarker 1993) [12]. The 1000-seed weight was increased by boron application, (Subbaiah and Mitra 1996) [13]. Positive effect of supplementary nutrients on yield attributes of Indian mustard was observed, (Rana *et al.* 2005) [6]. The yield and yield contributing characters like number of siliqua per plants, number of seeds per siliqua, 1000-seed weight, seed yield, stover yield, biological yield and harvest index (%) significantly differed among the treatments (Hussain *et al.* 2012) [2].

**Table 2:** Effect of Nitrogen and Boron levels on yield and yield attributes of mustard

Treatment combinations	Seed yield (Kg/ha)	Siliqua/plant	Seeds/siliqua	Test weight (g)	Oil content (%)
1. 60 kg/ha Nitrogen + 1% Boron	1398.22	142.11	13.78	4.37	32.80
2. 60 kg/ha Nitrogen + 2% Boron	1549.89	96.00	12.89	4.51	34.47

3. 60 kg/ha Nitrogen + 3% Boron	1614.78	140.67	12.33	4.51	34.07
4. 70 kg/ha Nitrogen + 1% Boron	1410.44	123.67	11.44	4.44	34.73
5. 70 kg/ha Nitrogen + 2% Boron	1692.33	127.11	13.89	4.59	34.33
6. 70 kg/ha Nitrogen + 3% Boron	1790.56	117.22	12.22	4.55	35.03
7. 80 kg/ha Nitrogen + 1% Boron	1796.56	128.67	13.67	4.51	33.60
8. 80 kg/ha Nitrogen + 2% Boron	1994.00	173.00	15.67	4.73	37.43
9. 80 kg/ha Nitrogen + 3% Boron	1928.44	106.78	13.89	4.61	33.03
10. Control RDF + 0% Boron	1266.67	94.00	13.44	4.31	32.93
F- test	S	S	S	S	S
S.Em±	69.31	14.70	0.72	0.07	0.78
CD (P=0.05)	205.94	43.68	2.14	0.21	2.31

**Oil content (%):** Data presented in (Table. 2) shows that the combined effect nitrogen and boron significantly influenced all the quality parameters. Among different nitrogen and boron levels, the highest values were recorded with the application of Nitrogen at 80 kg/ha along with Boron at 20 DAS and 40DAS (2% foliar spray). The results revealed that the treatment T<sub>8</sub> (80Kg/ha Nitrogen + 2% Boron) recorded highest oil content (37.43%).

### Economics

Economic evaluation of the treatments was done on the basis of gross return, net return and benefit: cost ratio (Table 3). It was observed that the treatment receiving T<sub>8</sub> (80Kg/ha Nitrogen + 2% Boron) registered highest gross return (₹114364.65/ha), net return (73609.65/ha) and benefit cost ratio (1.81). This might be due to higher yield in this treatment compared to other treatments.

**Table 3:** Effect of Nitrogen and Boron levels on economics of mustard

Treatment combinations	Cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	Benefit cost ratio
1. 60 kg/ha Nitrogen + 1% Boron	37,055	81845.62	44790.62	1.21
2. 60 kg/ha Nitrogen + 2% Boron	40,555	89501.13	48946.13	1.21
3. 60 kg/ha Nitrogen + 3% Boron	44,055	92900.16	48845.16	1.11
4. 70 kg/ha Nitrogen + 1% Boron	37,155	81823.84	44668.84	1.20
5. 70 kg/ha Nitrogen + 2% Boron	40,655	98065.98	57410.98	1.41
6. 70 kg/ha Nitrogen + 3% Boron	44,155	103293.31	59138.31	1.34
7. 80 kg/ha Nitrogen + 1% Boron	37,255	103276.78	66021.78	1.77
8. 80 kg/ha Nitrogen + 2% Boron	40,755	114364.65	73609.65	1.81
9. 80 kg/ha Nitrogen + 3% Boron	44,255	110996.70	66741.70	1.51
10. Control RDF + 0% Boron	33,755	73539.73	39784.73	1.18
F- test	-	S	S	S
S.Em±	-	3833.91	3833.91	0.09
CD (P=0.05)	-	11391.12	11391.12	0.28

\*Data was not subjected to statistical analysis

### Conclusion

It is concluded that in the experiment on Mustard, the treatment number 8 in which Nitrogen was applied at 80kg/ha along with Boron at 20 DAS and 40DAS (2% foliar spray) recorded higher plant growth like plant height (200.79cm), number of branches per plant (10.87/plant), dry weight (113.30 g/plant) and Crop Growth rate (17.84 g/m<sup>2</sup>/day) and yield attributes namely seed yield (1994.00 Kg/ha), number of siliqua per plant (173.00), number of seeds per siliqua (15.67), test weight (4.73g) and oil content (37.43%) with highest Net Returns (73609.65/ha) and benefit cost ratio (1.81).

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