

Short Communication

Yield and economic response of Indian mustard (*Brassica juncea* L.) to varying levels of nitrogen and boron

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<https://doi.org/10.56093/job.v17i2.19>

(Received: 20 June 2026; Revised: 04 July 2026; Accepted: 07 July 2026)

Abstract

A field experiment was conducted during the *rabi* season of 2024-25 at the Agronomy Instructional Farm, College of Agriculture, (MPUAT), Bhilwara, Rajasthan, to evaluate the effect of nitrogen and boron levels on yield and economics of Indian mustard (*Brassica juncea* L.). The experiment comprised of four nitrogen levels (0, 40, 80 and 120 kg N ha⁻¹) and four boron levels (0, 0.5, 1.0 and 1.5 kg B ha⁻¹) in a factorial randomized block design with three replications. Increasing nitrogen levels significantly improved the major yield attributes and yield of mustard. Application of 120 kg N ha⁻¹ recorded the highest seed yield (1759 kg ha⁻¹), stover yield (4456 kg ha⁻¹), biological yield (6215 kg ha⁻¹), net return (Rs. 54963 ha⁻¹) and B-C ratio (3.36). Similarly, application of 1.5 kg B ha⁻¹ recorded the highest seed yield (1756 kg ha⁻¹), stover yield (4329 kg ha⁻¹), biological yield (6085 kg ha⁻¹), net return (Rs. 54698 ha⁻¹) and B-C ratio (3.34). Thus, under the experimental conditions, application of 120 kg N ha⁻¹ and 1.5 kg B ha⁻¹ was effective in improving yield and economic returns of Indian mustard.

Keywords: Indian mustard, economics, nitrogen, boron, seed yield, stover yield

Introduction

Indian mustard (*Brassica juncea* L.), belonging to the family Brassicaceae, is one of the major *rabi* oilseed crop of India and an important source of edible oil. India is one of the leading producer of rapeseed-mustard globally, with the crop occupying 8.63 million ha and producing 12.61 million tonnes with an average productivity of 1461 kg ha⁻¹ during 2024-25. Rajasthan is the leading rapeseed-mustard producing state, accounting for about 37.44 lakh ha area and 56.67 lakh tonnes production with an average productivity of 1514 kg ha⁻¹ during 2024-25 (Anonymous, 2025). Despite its major contribution to the national oilseed economy, improvement in productivity remains essential for enhancing the efficiency of mustard production and strengthening edible-oil security.

Balanced nutrient management is crucial for achieving higher productivity in Indian mustard (Tripathi *et al.*, 2001). Nitrogen (N) plays a fundamental role in chlorophyll formation, photosynthesis, vegetative growth and yield formation, whereas boron (B) is essential for cell-wall development, pollen viability, reproductive growth, sugar translocation and seed formation. Inadequate or imbalanced supply of these nutrients can adversely affect crop productivity. Balanced application of nutrients

including boron has been reported to improve growth, yield and yield attributes of Indian mustard (Singh *et al.*, 2022). Therefore, the present study was undertaken to evaluate the effect of nitrogen and boron levels on yield and economics of Indian mustard (*Brassica juncea* L.).

Materials and Methods

The experiment was conducted during the *rabi* season of 2024-25 at the Agronomy Instructional Farm, College of Agriculture (MPUAT) Bhilwara, Rajasthan, situated at 24°24'22" N latitude and 74°40'2" E longitude with an elevation of about 432 m above mean sea level. The soil of the experimental field was clay loam, having pH 7.32, organic carbon 0.56%, available nitrogen 220.5 kg N ha⁻¹, available phosphorus 15.7 kg P ha⁻¹, available potassium 310.6 kg ha⁻¹ and available boron 0.62 ppm. The experiment comprised 16 treatment combinations involving four nitrogen levels, viz., N₀ = 0, N₁ = 40, N₂ = 80 and N₃ = 120 kg N ha⁻¹, and four boron levels, viz., B₀ = 0, B₁ = 0.5, B₂ = 1.0 and B₃ = 1.5 kg B ha⁻¹. The treatment combinations were arranged in a factorial randomized block design with three replications. Half of the required N dose, as per treatment, was applied through urea and DAP as basal application, while the remaining half N was supplied through urea in two equal splits during crop growth. Boron was applied as a foliar spray through borax at the

prescribed concentration and growth stage. The mustard variety RHB-761 was sown in rows 30 cm apart on 5 October 2024. Thinning was done 20 days after sowing to maintain a plant-to-plant distance of 15 cm. The crop was harvested on 7 February 2025. Data pertaining to yield attributes and yield were subjected to analysis of variance following Cochran and Cox (1959). Treatment means were compared using the critical difference (CD) at 5% probability level when the F-test was significant.

Results and Discussion

Yield attributes

Nitrogen application significantly influenced the yield attributes of Indian mustard (Table 1). The maximum number of siliquae plant⁻¹ (209), seeds siliqua⁻¹ (16.78), siliqua length (6.94 cm) and test weight (4.91 g) were recorded with N₃ (120 kg N ha⁻¹), whereas the minimum values of 138, 12.23, 5.09 cm and 4.22 g, respectively, were observed under N₀ (control). From N₀ to N₃, siliquae plant⁻¹, seeds siliqua⁻¹, siliqua length and test weight increased by 51.45, 37.03, 26.47 and 16.35%, respectively. The improvement in yield attributes with increasing nitrogen supply may be associated with enhanced vegetative growth and photosynthetic activity, which favour reproductive development and seed formation. Similar improvement in yield attributes of Indian mustard with increasing nitrogen supply has been reported by Reager *et al.* (2006). Boron application also favourably influenced the yield attributes of Indian mustard. The maximum number of siliquae plant⁻¹ (204), seeds siliqua⁻¹ (15.62) and siliqua length (6.78 cm) were recorded with B₃ (1.5 kg B ha⁻¹), followed by B₂ (1.0 kg B ha⁻¹), whereas the minimum values were recorded under B₀ (control). Test weight was highest with B₃ (4.73 g) and lowest under B₀ (4.44 g); however, the effect of boron on test weight was non-significant. Increasing boron application from B₀ to B₃ resulted in increases of 28.30% in siliquae plant⁻¹, 15.19% in seeds siliqua⁻¹ and 21.51% in siliqua length. This improvement may be attributed to the role of boron in reproductive development, pollen viability, fertilization and seed formation. Similar responses have been reported by Yadav *et al.* (2016) and Singh *et al.* (2024).

Yield

Nitrogen application significantly influenced seed yield, stover yield and biological yield of Indian mustard (Table 1 & Fig 1). The maximum seed (1759 kg ha⁻¹), stover (4456 kg ha⁻¹) and biological yield (6215 kg ha⁻¹) were recorded with N₃ (120 kg N ha⁻¹), whereas the corresponding minimum values were 1244, 3471 and 4715 kg ha⁻¹ under N₀ (control). Increasing nitrogen application from N₀ to N₃ resulted in increases of 41.48% in seed, 28.38% in

stover and 31.92% in biological yield. The improvement in yield with increasing nitrogen application may be attributed to enhanced vegetative growth, photosynthetic activity and better partitioning of assimilates towards reproductive organs. Similar improvement in seed and biological yield with increasing fertility levels in Indian mustard has been reported by Keerthi *et al.* (2026). Boron application also significantly improved seed, stover and biological yield of Indian mustard. The highest seed (1756 kg ha⁻¹), stover (4329 kg ha⁻¹) and biological yield (6085 kg ha⁻¹) were recorded with B₃ (1.5 kg B ha⁻¹), while the minimum values of 1364, 3644 and 5008 kg ha⁻¹, respectively, were recorded under B₀ (control). Application of B₃ over B₀ increased seed, stover and biological yield by 28.74, 18.80 and 21.52%, respectively. The favourable response to boron may be associated with its role in reproductive development, pollen viability, fertilization and seed formation. Similar positive effects of boron application on yield attributes and seed yield of Indian mustard have been reported by Yadav *et al.* (2016), while Singh *et al.* (2024) also reported improved yield and yield attributes with foliar boron application.

Economics

Economic returns increased progressively with increasing nitrogen levels (Table 1 & Fig 2). The maximum net return (Rs. 54963 ha⁻¹) and B-C ratio (3.36) were obtained with N₃, followed by N₂ (Rs. 51431 ha⁻¹ and 3.25), whereas the minimum net return (Rs. 35923 ha⁻¹) and B-C ratio (2.42) were recorded under N₀. The higher economic returns under N₃ were mainly associated with the higher seed and stover yields obtained with adequate nitrogen supply. Boron application also resulted in a progressive improvement in economic returns. The maximum net return (Rs. 54698 ha⁻¹) and B-C ratio (3.34) were recorded with B₃ (1.5 kg B ha⁻¹), followed by B₂ (Rs. 49112 ha⁻¹ and 3.10), whereas the minimum net return (Rs. 40656 ha⁻¹) and B-C ratio (2.74) were recorded under B₀. The higher net returns and B-C ratio under B₃ were primarily associated with the greater seed and stover yield obtained with boron application.

Conclusion

Indian mustard responded favorably to increasing levels of nitrogen and boron under the conditions of the present experiment. Application of 120 kg N ha⁻¹ recorded the highest yield and economic returns among the nitrogen levels, while 1.5 kg B ha⁻¹ recorded the highest yield and economic returns among the boron levels. Thus, 120 kg N ha⁻¹ and 1.5 kg B ha⁻¹ were effective for improving productivity and economic returns of Indian mustard under the experimental conditions.

Table 1: Effect of nitrogen and boron levels on yield attributes, yield and economics of mustard

Treatments	Siliquae plant ⁻¹ (no.)	Seed siliquae ⁻¹ (no.)	Siliquae length (cm)	Test weight (g)	Seed Yield (kg ha ⁻¹)	Stover Yield (kg ha ⁻¹)	Biological Yield (kg ha ⁻¹)	Net return (Rs. ha ⁻¹)	BCR
Nitrogen levels									
N ₀ - Control	138	12.23	5.09	4.22	1244	3471	4715	35923	2.42
N ₁ - 40 kg/ha	177	14.27	6.23	4.49	1535	3949	5484	46954	3.06
N ₂ - 80 kg/ha	198	15.09	6.77	4.73	1658	4257	5915	51431	3.25
N ₃ - 120 kg/ha	209	16.78	6.94	4.91	1759	4456	6215	54963	3.36
SEm(±)	3.12	0.39	0.04	0.05	28	40	44	-	-
LSD (P=0.05)	10.23	1.29	0.15	0.16	92	124	136	-	-
Boron levels									
B ₀ - Control	159	13.56	5.58	4.44	1364	3644	5008	40656	2.74
B ₁ - 0.5 kg/ha	174	14.08	6.13	4.54	1477	3964	5441	44757	2.92
B ₂ - 1.0 kg/ha	185	15.01	6.54	4.64	1599	4196	5795	49112	3.10
B ₃ - 1.5 kg/ha	204	15.62	6.78	4.73	1756	4329	6085	54698	3.34
SEm(±)	3.01	0.33	0.05	0.03	28	38	44	-	-
LSD (P=0.05)	9.36	1.09	0.17	NS	87	118	133	-	-

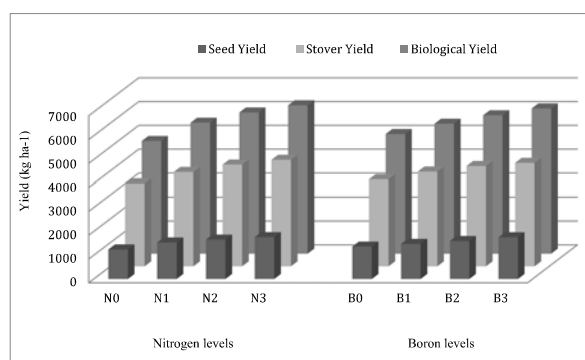


Fig.1: Effect of nitrogen and boron levels on yield of mustard

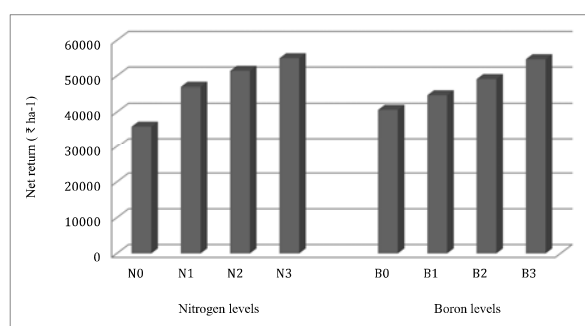


Fig. 2: Effect of nitrogen and boron levels on net return of mustard

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