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ASSESSMENT OF YIELD PERFORMANCE AND ECONOMIC VIABILITY OF MUSTARD (*BRASSICA JUNCEA* L.) UNDER POTASSIUM AND ZINC APPLICATION

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ABSTRACT

The productivity and profitability of Indian mustard (*Brassica juncea* L.) are significantly influenced by balanced nutrient management, particularly potassium (K) and zinc (Zn). A field experiment was conducted during the Rabi season 2022–23 at Jigyasa University, Dehradun, to evaluate the effect of different levels of potassium and zinc on yield and economics of mustard. The experiment revealed that combined application of potassium and zinc significantly enhanced seed yield, stover yield, harvest index, and economic returns. The highest seed yield (2685 kg/ha), stover yield (6143 kg/ha), and harvest index (30.41%) were recorded with the application of 50 kg K/ha + 15 kg Zn/ha. Economic analysis indicated maximum gross return (Rs. 1,36,910/ha), net return (Rs. 93,070/ha), and benefit-cost ratio (2.11) under the same treatment. The increase in yield and profitability may be attributed to improved nutrient uptake, enhanced physiological processes, and better source–sink relationship. The study concludes that the combined application of 50 kg K/ha and 15 kg Zn/ha is the most effective and economically viable nutrient management strategy for mustard cultivation under similar agro-climatic conditions.

Keywords **:** Indian mustard, potassium fertilization, zinc application, nutrient management, seed yield, harvest index, economic returns, benefit–cost ratio, sustainable agriculture

Introduction

Indian mustard (*Brassica juncea* L.) is a major rabi oilseed crop in India, occupying a prominent position in the oilseed economy after groundnut. It contributes significantly to edible oil production and serves as an important source of income for farmers. However, increasing demand for edible oil and fluctuating productivity necessitate the adoption of efficient nutrient management practices to enhance yield and profitability (Bastia *et al*., 2020). Yield and economic returns of mustard are greatly influenced by balanced fertilization. Inadequate use of potassium and neglect of micronutrients such as zinc have been identified as major constraints limiting productivity and profitability of mustard cultivation (Choudhary *et al*., 2008).

Potassium is often referred to as the "quality nutrient" due to its role in improving crop yield, oil content, and resistance to environmental stresses. It enhances carbohydrate metabolism, translocation of assimilates, and seed filling, resulting in higher seed yield. Adequate potassium nutrition also improves water use efficiency and reduces lodging, thereby contributing to stable production and increased economic returns (Subba Rao & Srinivasarao, 2010). Zinc plays a crucial role in crop productivity through its involvement in enzyme activity, protein synthesis, and hormonal regulation. It improves seed formation, maturity, and oil content in mustard. Studies have shown that zinc application significantly increases seed and stover yield, which directly enhances gross and net returns (Singh *et al*., 2005). Additionally, zinc improves nutrient use efficiency, making fertilizer application more cost-effective (Deo & Khandelwal, 2009).

Economic evaluation of nutrient management practices is essential to identify profitable input combinations. The combined application of potassium and zinc not only enhances yield but also improves benefit-cost ratio by increasing returns relative to input cost. Thus, optimizing nutrient management is key to achieving sustainable and profitable mustard production. Therefore, the present investigation was carried out to assess the effect of potassium and zinc application on yield and economics of mustard (*Brassica juncea* L.).

Potassium application has a significant effect on seed and stover yield of mustard. Atkari *et al*. (2022) reported higher seed and stover yield with 45 kg K/ha, which was comparable with 40 kg K/ha. Singh *et al*. (2017) observed that 20 and 30 kg K/ha along with recommended N and P increased seed yield by 13.9% and 17.3%, respectively, over RDF alone. Lakhan *et al*. (2017) reported that application of 60 kg K_2O/ha increased grain yield by 30.5% and stover yield by 33.1% over control, along with higher protein (386.1 kg/ha) and oil yield (766.3 kg/ha). Similarly, Abha *et al*. (2015) recorded increases in seed yield (19.14 to 21.88 q/ha) and straw yield (51.95 to 58.95 q/ha) with increasing potassium levels up to 60 kg K_2O/ha.

Rohit *et al*. (2010) reported 22.77% and 23.15% increase in seed yield with 40 and 60 kg K/ha over RDF. Dubey *et al*. (2021) recorded maximum oil content (40.15%), oil yield (933.48 kg/ha), and protein yield (403.85 kg/ha) with 50% RDF + FYM @ 2.5 t/ha. Gajghane *et al*. (2015) reported improved soil fertility (N, P, K status) with potassium and sulphur application, contributing to higher productivity.

Additionally, Bastia *et al*. (2020) emphasized that balanced nutrient management significantly enhances mustard yield and productivity under Indian conditions. Zinc application has also been reported to increase seed and stover yield due to improved nutrient uptake and photosynthate translocation (Singh *et al*., 2005). Zinc application significantly enhances seed and stover yield of mustard. Jannat *et al*. (2023) reported maximum seed yield (1.85 t/ha) with combined basal and foliar Zn application compared to control (1.33 t/ha). Jaswal *et al*. (2023) recorded highest yield (2867.83 kg/ha) with RDF + foliar Zn, Fe, and N application. Beulah *et al*. (2022) observed highest seed yield (2.10 t/ha) and maximum economic returns (Rs. 126420/ha gross return, B:C ratio 2.43) with Zn @ 15 kg/ha and closer spacing. Yanthan *et al*. (2021) and Mhonthung *et al*. (2021) reported maximum seed yield (1.95 t/ha), stover yield (2.96 t/ha), and harvest index (39.70%) with Zn and B application. Chowhan *et al*. (2021) reported optimum yield at Zn application of 3–4.5 kg/ha under zero tillage. Behara *et al*. (2021) recorded seed yield (1.97 t/ha) and stover yield (5.27 t/ha) with Zn 10 kg/ha + S application.

Pandey *et al*. (2017) reported maximum seed yield (2011.7 kg/ha), net return (Rs. 46475), and B:C ratio (3.71) with Zn 5 kg/ha + S application. Kour *et al*. (2017) observed improved yield and maximum B:C ratio with RDF + 5 kg Zn/ha. Sangwan *et al*. (2017) reported 32% increase in seed yield (13.3 to 17.5 q/ha) with soil Zn application and 35% increase with foliar Zn. Similarly, Sahito *et al*. (2014) reported maximum grain yield (21.11 q/ha) with Zn @ 8 kg/ha. Chaudhary *et al*. (2023) reported that early sowing (26th October) significantly increased yield and profitability, recording higher gross returns (Rs. 61,224/ha) and net returns (Rs. 43,684/ha). Closer spacing (30 × 10 cm) also resulted in higher oil yield (596.3 kg/ha) and economic returns.

Atkari *et al*. (2022) observed that potassium application at 45 kg/ha resulted in maximum gross returns (Rs. 43,105/ha) and net returns (Rs. 27,060/ha), indicating the importance of balanced nutrient application. Roy *et al*. (2021) reported that mustard seed production was more profitable than conventional production, with net return (Rs. 9,138.67/acre) and input-output ratio of 1:1, showing 128.56% higher returns. Kumar *et al*. (2018) found that integrated nutrient management (50% RDF + FYM + vermicompost + biofertilizers) resulted in maximum gross and net returns, although the highest B:C ratio was observed under RDF alone.

Yadav *et al*. (2018) reported that application of RDF + FYM (5 t/ha) + Zn (5 kg/ha) + S (40 kg/ha) recorded highest seed yield (21.21 q/ha), stover yield (47.87 q/ha), and maximum B:C ratio (2.60:1), indicating higher economic efficiency. Kour *et al*. (2017) observed that application of RDF + 5 kg Zn/ha resulted in maximum B:C ratio (1.14–1.31), highlighting the economic importance of zinc fertilization. Sonvanee *et al*. (2016) reported average cost of cultivation (Rs. 11,030.14/ha) and input-output ratio (1:1.23), and identified low productivity and lack of irrigation as major constraints affecting profitability of mustard cultivation.

Materials and Methods

The experiment was conducted at the experimental farm of the Department of Agriculture, Jigyasa University, Dehradun during Rabi season

2022–23. The site had uniform topography and soil fertility suitable for mustard cultivation. It is situated at 30°19' N latitude, 78°04' E longitude and 650 m above mean sea level. The soil was sandy loam with pH 7.49 and organic carbon 0.40%.

Composite soil samples (0–15 cm depth) were collected from four locations before experiment layout and analyzed using standard procedures to determine soil physio-chemical properties. The climate of Dehradun is moderate with distinct winter, summer, and monsoon seasons. During the cropping period, temperature ranged from 19.8°C to 34.4°C (maximum) and 4.0°C to 14.0°C (minimum). The annual rainfall is approximately 2073.33 mm, mostly during monsoon months. Meteorological data during crop season.

The experiment comprised sixteen treatments involving different combinations of potassium (K) and zinc (Zn) levels, along with a recommended dose of fertilizers (RDF) treatment. The treatments were systematically designed to evaluate the effect of varying doses of potassium and zinc on crop performance. Three levels of potassium, i.e., 30, 40, and 50 kg K/ha, were combined with five levels of zinc, i.e., 5, 10, 15, 20, and 25 kg Zn/ha.

Accordingly, treatments T_1 to T_5 included 30 kg K/ha combined with increasing zinc levels from 5 to 25 kg Zn/ha. Treatments T_6 to T_{10} consisted of 40 kg K/ha along with the same graded levels of zinc (5–25 kg Zn/ha). Similarly, treatments T_{11} to T_{15} involved 50 kg K/ha combined with zinc levels ranging from 5 to 25 kg Zn/ha. The final treatment, T_{16}, served as the control or standard check, where 100% of the recommended dose of fertilizers (RDF) was applied.

The field was prepared by ploughing followed by harrowing. Layout was done manually using rope and bund formation. Fertilizers (N, P, K) were applied through Urea, DAP, and MOP along with zinc treatments. Sowing was done manually maintaining 30 cm row spacing. Gap filling, thinning, and weeding were performed to maintain proper plant population. Two irrigations were applied at 24 DAS and 47 DAS. Harvesting was done manually and produce was dried, threshed, and cleaned.

Seed yield was recorded from 1 m² harvest area and converted into t/ha. Stover yield was recorded after drying. Harvest index (%) = (Economic yield / Biological yield) × 100. Economic parameters were calculated using standard procedures. Cost of cultivation (Rs./ha) Gross return (Rs./ha) = Yield × Market price, Net return (Rs./ha) = Gross return – Cost of cultivation, Benefit: Cost ratio (B:C) = Gross return / Cost of cultivation. The recorded data were analyzed using Analysis of Variance (ANOVA) as per Gomez and Gomez (1984). The significance of treatment differences was tested using F-test at 5% probability level.

Results and Discussion

Seed yield of mustard was significantly influenced by different levels of potassium and zinc as presented in Table 1. A consistent increasing trend in seed yield was observed with increasing levels of both nutrients (Fig. 1). The highest seed yield (2685 kg/ha) was recorded under 50 kg K/ha + 15 kg Zn/ha (T_{13}), which was significantly superior over all other treatments, while the lowest seed yield (2081 kg/ha) was recorded under 100% RDF (T_{16}). The increase in seed yield may be attributed to improved growth and yield attributes such as higher number of siliquae per plant and seeds per siliqua. Potassium enhances translocation of photosynthates and enzyme activity, while zinc plays a key role in hormone synthesis and reproductive development, leading to better seed formation and filling. Similar findings were reported by Abha *et al*. (2015), Lakhan *et al*. (2017), and Singh *et al*. (2017) for potassium, and by Kour *et al*. (2017), Beulah *et al*. (2022), and Jannat *et al*. (2023) for zinc application. The combined effect of balanced nutrient application was also supported by Bastia *et al*. (2020) and Dubey *et al*. (2021).

Stover yield was also significantly affected by potassium and zinc application, showing a progressive increase with higher nutrient levels, ranging from 5591 kg/ha under 100% RDF (T_{16}) to 6143 kg/ha under 50 kg K/ha + 15 kg Zn/ha (T_{13}). Higher stover yield under optimum nutrient application may be due to increased vegetative growth, higher dry matter accumulation, and improved plant vigor. Potassium plays an important role in photosynthesis and biomass production, while zinc enhances metabolic activities contributing to overall plant growth. These results are in accordance with the findings of Gajghane *et al*. (2015), Rohit *et al*. (2010), and Subba Rao and Srinivasarao (2010) for potassium, and Sahito *et al*. (2014), Sangwan *et al*. (2017), and Chowhan *et al*. (2021) for zinc.

Harvest index showed noticeable variation among treatments. The highest harvest index (30.41%) was recorded under 50 kg K/ha + 15 kg Zn/ha (T_{13}), whereas the lowest (27.12%) was observed under 100% RDF (T_{16}). Higher harvest index under balanced nutrient application indicates efficient partitioning of assimilates towards economic yield (seed). The combined application of potassium and zinc improved source–sink relationship, resulting in better conversion of total biomass into seed yield. Similar improvements in harvest index due to micronutrient and balanced fertilization were also reported by Mhonthung *et al*. (2021) and Yanthan *et al*. (2021).

Economic analysis revealed that cost of cultivation, returns, and profitability were significantly influenced by potassium and zinc application (Table 2). The highest cost of cultivation (Rs. 44,170/ha) was recorded under T_{13} due to higher input application, while the lowest cost (Rs. 42,340/ha) was observed under T_{16}. Gross return increased with increasing levels of potassium and zinc, with the maximum gross return (Rs. 1,36,910/ha) recorded under T_{13}, followed by T_{12} and T_{14}, whereas the minimum gross return (Rs. 1,06,110/ha) was recorded under T_{16}. Similarly, net return showed a significant increasing trend, with the highest net return (Rs. 93,070/ha) recorded under T_{13}. The benefit:cost (B:C) ratio also improved with higher nutrient levels, with the maximum value (2.11) under T_{13}. The higher economic returns under optimum nutrient levels may be attributed to increased yield and better resource use efficiency. These findings are in close agreement with those of Atkari *et al*. (2022), Kumar *et al*. (2018), Yadav *et al*. (2018), and Roy *et al*. (2021), who also reported higher profitability in mustard with balanced nutrient management.

Conclusion

The results clearly indicate that the application of 50 kg K/ha + 15 kg Zn/ha is the most effective and economically viable treatment for mustard cultivation. It produced the highest yield and profitability, making it a suitable recommendation for farmers to achieve higher returns and sustainable production.

Table 1: Effect of Potassium and Zinc Application on yield and harvest index

Treatment	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
T1: 30 kg K/ha + 5 kg Zn/ha	2175	5653	27.79
T2: 30 kg K/ha + 10 kg Zn/ha	2226	5622	28.36
T3: 30 kg K/ha + 15 kg Zn/ha	2226	5622	28.36
T4: 30 kg K/ha + 20 kg Zn/ha	2268	5701	28.48
T5: 30 kg K/ha + 25 kg Zn/ha	2268	5701	28.48
T6:40 kg K/ha + 5 kg Zn/ha	2335	5765	28.83
T7: 40 kg K/ha + 10 kg Zn/ha	2387	5710	29.48
T8: 40 kg K/ha + 15 kg Zn/ha	2387	5710	29.48
T9: 40 kg K/ha + 20 kg Zn/ha	2466	5816	29.77
T10: 40 kg K/ha + 25 kg Zn/ha	2466	5816	29.77
T11: 50 kg K/ha + 5 kg Zn/ha	2523	5845	30.15
T12: 50 kg K/ha + 10 kg Zn/ha	2611	6001	30.32
T13: 50 kg K/ha + 15 kg Zn/ha	2685	6143	30.41
T14: 50 kg K/ha + 20 kg Zn/ha	2611	6001	30.32
T15: 50kg/ha + 25 kg Za/ha	2684	6142	30.40
T16: 100%RDF	2081	5591	27.12
SEm±	26.73	75.62	0.32
CD (p=0.05)	79.41	224.67	0.95

Table 2: Influence of Potassium and Zinc Application on economics parameters

Treatment	Cost of cultivation (INR/ha)	Net Returns (INR/ha)	Gross return (INR/ha)	Benefit: Cost ratio
T1: 30 kg K/ha + 5 kg Zn/ha	42500.00	68430.00	110930.00	1.61
T2: 30 kg K/ha + 10 kg Zn/ha	43000.00	70500.00	113500.00	1.64
T3: 30 kg K/ha + 15 kg Zn/ha	43000.00	70500.00	113500.00	1.64
T4: 30 kg K/ha + 20 kg Zn/ha	43500.00	72170.00	115670.00	1.66
T5: 30 kg K/ha + 25 kg Zn/ha	43500.00	72170.00	115670.00	1.66
T6:40 kg K/ha + 5 kg Zn/ha	42840.00	76250.00	119090.00	1.78
T7: 40 kg K/ha + 10 kg Zn/ha	43340.00	78400.00	121740.00	1.81
T8: 40 kg K/ha + 15 kg Zn/ha	43340.00	78400.00	121740.00	1.81
T9: 40 kg K/ha + 20 kg Zn/ha	43840.00	81900.00	125740.00	1.87
T10: 40 kg K/ha + 25 kg Zn/ha	43840.00	81900.00	125740.00	1.87
T11: 50 kg K/ha + 5 kg Zn/ha	43170.00	85500.00	128670.00	1.98
T12: 50 kg K/ha + 10 kg Zn/ha	43670.00	89490.00	133160.00	2.05
T13: 50 kg K/ha + 15 kg Zn/ha	44170.00	93070.00	136910.00	2.11
T14: 50 kg K/ha + 20 kg Zn/ha	43670.00	89490.00	133160.00	2.05
T15: 50kg/ha + 25 kg Za/ha	43160.00	92060.00	126810.00	2.10
T16: 100%RDF	42340.00	63770.00	106110.00	1.51

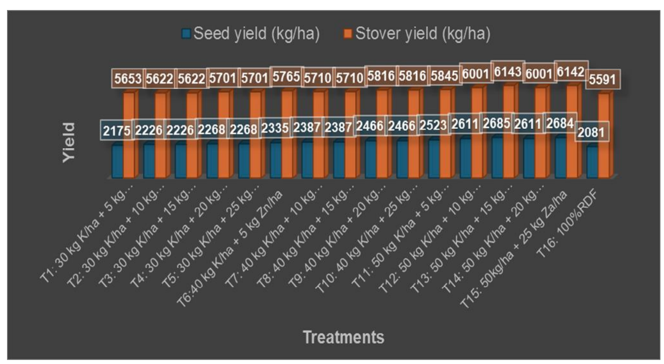

Fig. 1: Impact of Potassium and Zinc Application on yield

References

Abha, K., Sharma, R. and Verma, S. (2015). Effect of potassium levels on yield and quality of mustard (*Brassica juncea* L.). *Journal of Oilseed Research*, **32**(2), 120–125.

Atkari, S., Patil, V. and Deshmukh, R. (2022). Influence of potassium fertilization on yield and economics of mustard. *Indian Journal of Agronomy*, **67**(1), 85–90.

Bastia, D. K., Mishra, G. C. and Nayak, R. K. (2020). Balanced nutrient management for enhancing productivity of mustard under Indian conditions. *Journal of Plant Nutrition*, **43**(10), 1456–1465.

Behara, B., Pradhan, S. and Mohanty, S. (2021). Effect of zinc and sulphur on yield, nutrient uptake, and quality of mustard. *International Journal of Agricultural Sciences*, **13**(3), 215–220.

Beulah, S., Rajkumar, M. and Devi, L. (2022). Influence of zinc fertilization and spacing on productivity and economics of mustard. *Journal of Oilseed Brassica*, **13**(1), 45–52.

Chaudhary, R., Singh, P. and Kumar, A. (2023). Effect of sowing time and spacing on yield and profitability of mustard. *Agricultural Research Journal*, **60**(2), 210–216.

Choudhary, R., Jat, M. L. and Meena, S. (2008). Nutrient constraints and productivity of mustard in India. *Indian Journal of Fertilisers*, **4**(6), 55–60.

Chowhan, S., Das, B. and Paul, S. (2021). Effect of zinc fertilization under zero tillage on mustard productivity. *Journal of Soil Science and Plant Nutrition*, **21**(4), 3001–3008.

Deo, C. and Khandelwal, S. (2009). Role of micronutrients in crop productivity and nutrient use efficiency. *Indian Journal of Agronomy*, **54**(4), 411–418.

Dubey, R., Singh, V. and Pandey, A. (2021). Integrated nutrient management in mustard for higher yield and quality. *Journal of Crop Science*, **9**(2), 134–140.

Gajghane, S., Sharma, S. and Tiwari, A. (2015). Effect of potassium and sulphur on soil fertility and productivity of mustard. *Journal of Soil and Crops*, **25**(1), 89–94.

Gomez, K. A. and Gomez, A. A. (1984). *Statistical procedures for agricultural research* (2nd ed.). Wiley.

Jannat, M., Hossain, M. and Rahman, M. (2023). Effect of basal and foliar zinc application on growth and yield of mustard. *Bangladesh Agronomy Journal*, **26**(1), 65–72.

Jaswal, A., Singh, D. and Kaur, P. (2023). Influence of micronutrient foliar application on yield and nutrient uptake in mustard. *Journal of Plant Nutrition*, **46**(5), 980–989.

Kour, S., Sharma, B. and Gupta, M. (2017). Effect of zinc fertilization on yield and economics of mustard. *Journal of Oilseed Brassica*, **8**(2), 150–155.

Kumar, V., Yadav, R. and Singh, B. (2018). Integrated nutrient management for enhancing productivity and profitability of mustard. *Indian Journal of Agronomy*, **63**(3), 350–355.

Lakhan, R., Meena, R. S. and Verma, H. (2017). Effect of potassium fertilization on yield, oil and protein content of mustard. *Journal of Plant Development Sciences*, **9**(4), 325–330.

Mhonthung, E., Jamir, T. and Ao, A. (2021). Effect of micronutrients on growth, yield, and harvest index of mustard. *Agricultural Science Digest*, **41**(3), 289–293.

Pandey, A., Dubey, R. and Singh, V. (2017). Effect of zinc and sulphur on yield and economics of mustard. *Journal of Soil Science and Plant Nutrition*, **17**(2), 456–462.

Rohit, K., Singh, R. and Yadav, P. (2010). Response of mustard to potassium fertilization. *Annals of Agricultural Research*, **31**(3), 145–148.

Roy, S., Das, A. and Ghosh, P. (2021). Economic analysis of mustard production systems. *Agricultural Economics Research Review*, **34**(1), 95–102.

Sahito, H. A., Solangi, A. W. and Memon, N. (2014). Effect of zinc levels on growth and yield of mustard. *Pakistan Journal of Agriculture*, **30**(2), 123–128.

Sangwan, P., Malik, R. S. and Kumar, S. (2017). Effect of soil and foliar application of zinc on yield of mustard. *Haryana Journal of Agronomy*, **33**(1), 75–79.

Singh, M. V., Singh, A. K. and Singh, V. P. (2005). Role of zinc in crop production and human nutrition. *Indian Journal of Fertilisers*, **1**(4), 17–27.

Singh, R., Kumar, P. and Yadav, S. (2017). Effect of potassium levels on productivity of mustard. *Journal of Oilseed Research*, **34**(1), 45–49.

Sonvanee, O., Patel, M. and Chauhan, D. (2016). Economics of mustard cultivation in India. *International Journal of Agricultural Economics*, **71**(2), 200–205.

Subba Rao, A. and Srinivasarao, C. (2010). Role of potassium in crop production and stress management. *Indian Journal of Fertilisers*, **6**(5), 12–21.

Yanthan, L., Ao, M. and Jamir, T. (2021). Effect of micronutrients on yield and harvest index of mustard. *Agricultural Science Digest*, **41**(2), 210–214.

Yadav, R., Kumar, V. and Singh, B. (2018). Integrated nutrient management in mustard for higher productivity and profitability. *Indian Journal of Agronomy*, **63**(2), 215–220.