The Pharma Innovation Journal 2023; 12(10): 853-856

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 853-856

www.thepharmajournal.com
Received: 06-07-2023
Accepted: 10-08-2023

Nirdosh Goyal
M.Sc. (Ag.) Student, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Pradeep Rajput
Assistant Professor, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Kalpana Mishra
Assistant Professor, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Jai Dev Sharma
Professor, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Nawraj Chaudhary
M.Sc. (Ag.) Student, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Corresponding Author:
Pradeep Rajput
Assistant Professor, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Effect of integrated nutrient management on growth and yield of Indian mustard (*Brassica juncea* L.)

Nirdosh Goyal, Pradeep Rajput, Kalpana Mishra, Jai Dev Sharma and Nawraj Chaudhary

Abstract
The experiment was carried out at the Crop Research Centre (CRC), Department of Agronomy, School of Agriculture, ITM University, Gwalior, (M.P.), India, during the Rabi season of 2022–2023 to investigate the effect of integrated nutrient management on the growth, yield, and quality of Indian Mustard (*Brassica juncea* L.). In previous research, the combined effects of organic, inorganic, and biofertilizers were all carefully examined, and it was strongly recommended by all of them that for better quality and good grain and oil production in mustard, integrated nutrient management is noticeably superior to conventional farmer practises. Additionally, it leads to a high yield and a notable change in growth characteristics, which raises the mustard farmers' revenue. The experiment was laid out in a Randomized Block Design with three replications. Treatments *viz*., T_1 Control, T_2 100% RDF, T_3 100% RDF + Vermicompost @ 1 t ha^{-1} + Azotobacter, T_4 100% RDF + Vermicompost @ 1 t ha^{-1} + PSB, T_5 75% RDF + Vermicompost @ 2 t ha^{-1} + Azotobacter, T_6 75% RDF + Vermicompost @ 2 t ha^{-1} + PSB, T_7 75% RDF + Vermicompost @ 2 t ha^{-1} + FYM @ 3 t ha^{-1} + Azotobacter, T_8 75% RDF + FYM @ 6tha $^{-1}$ + PSB, T_9 75% RDF + FYM @ 6 t ha^{-1} + VAM, T_{10} VAM + Azotobacter + 75% RDF. Thus, a total of ten treatment combinations were replicated thrice.
The study examined the effects of integrated nutrient management (INM) on plant growth parameters. Plant population was consistent across treatments (6-7 plants/meter). INM significantly influenced plant height, with peak growth between 30-60 DAS, slowing after 90 DAS. Number of branches and leaves were significantly affected by INM at 60 and 90 DAS, with treatment T_7 showing highest values. Dry matter accumulation increased significantly, more so at 60 DAS. Treatment T_7 had the highest accumulation. INM affected days to flowering, but treatments were not significant. T_7 took longest (52 DAS), control shortest (46 DAS). Overall, INM impacted growth, especially height, branches, leaves, and dry matter accumulation. Integrated nutrient management (INM) significantly affects seed yield, stover yield, and biological yield, while not significantly impacting harvest index. Among treatments, T_7 (75% RDF + Vermicompost @ 2 t ha-1 + FYM @ 3 t ha-1 + Azotobacter) demonstrated the highest seed yield, stover yield, and biological yield. This treatment was comparable with T_3, T_4, and T_5. The harvest index was highest in T_4 (31.49%) and lowest in the control group.

Keywords: Mustard, integrated nutrient management, vermicompost, FYM, azotobacter, growth parameters; yield and economics

Introduction
With smaller centres in central and western China, eastern India, Burma, and across Iran to the near east, central Asia is the primary region of origin for mustard. Mustard has been grown for many millennia across most of Eurasia. Rapeseed mustard grows on 6.23 million hectares in India and produces 9.34 million metric tones and 1499 kg ha^{-1}, respectively. Rajasthan, Uttar Pradesh, and Haryana all have significant growth areas. The two states that produce the most mustard in our nation are Rajasthan and Uttar Pradesh. They make up nearly half of the entire production as a group. Rapeseed and mustard are two of the most widely produced crops in Uttar Pradesh, occupying 0.56 million hectares and producing 0.699 million metric tones and 1,248 kg ha^{-1}, respectively. (GOI, 2020-2021). INM is a comprehensive strategy that combines the use of organic and inorganic nutrient sources with other agronomic techniques to boost nutrient utilization efficiency and lessen environmental harm. Compared to using each component separately, combining chemical fertilizers and organic manures has been proven to be quite promising for maintaining both the productivity and health of the soil as well as stabilizing crop production. NPK fertilizers can be added to organically dense farmyard manure. Even though it costs more per nutrient than chemical fertilizer, the advantages it brings to the soil make up for the price difference.

By having a binding effect on the soil, it not only supplies the majority of the necessary nutrients but also enhances soil structure. (Kumawat *et al.*, 2018) [4]. Although soil condition is taken into account, main cropping systems show high production retention when organic manure (FYM @ 10-15 t ha^{-1}) with 100% prescribed NPK dose is applied. Farmyard manure (FYM), a variety of biofertilizers (Azotobacter, PSB), and the appropriate number of other fertilizers can be used effectively to promote lucrative and sustainable production while also improving the physical, chemical, and biological aspects of the soil. Singh *et al*., 2017) [12]. Similar findings were made by Meena *et al*. (2014) [18] who found that soil quality was improved by the application of organic manures such FYM, leaf compost, and vermicompost. Farmyard manure (FYM), vermicompost (VC), and bio-fertilizers like Azotobacter have been demonstrated to improve the physical, chemical, and biological aspects of soil when used judiciously in conjunction with fertilizers Singh *et al*., 2018a) [13] to boost the output of rapeseed mustard. The use of both organic and inorganic fertilisers at the same time ensures the availability of all essential plant nutrients, improves the chemical and biological characteristics of the soil, and increases crop output (Thakur *et al*., 2009) [19]. Utilizing organic and inorganic resources in the proper ratios is extremely beneficial in preserving the fertility and productivity of the soil. Therefore, maintaining soil fertility and production can be achieved through the careful use of organic and inorganic sources of nutrients. The different trends seen in mustard under the use of integrated nutrition management will be briefly summarized in this research.

Material and Methods

At the Crop Research Centre, Department of Agronomy, School of Agriculture, ITM University, Gwalior (M.P.), which is situated at 2608'51" north latitude and 75025' east latitude at an elevation of 213 m above mean sea level (MSL), the experiment was carried out during the Rabi season of 2022–2023. The soil in the experimental field has a sandy loam texture, a pH that is somewhat alkaline (7.76), low levels of organic carbon (0.432%), a high availability of potassium (28.6 kg/ha), a low availability of nitrogen (216.8 kg/ha), and a low availability of sulphur (11.84 kg/ha). Ten treatments, each duplicated three times, were used in the experiment's Randomized Block Design. Each treatment's plot was 3.15 x 4.05 meters. On October 22, 2022, mustard seeds of the Pioneer 45s46 kind were planted with 45 cm X 15 cm spacing between each one. Each plot was used for a 1 m^2 harvesting area. Four plants were then randomly chosen from it to record the growth and yield characteristics. Plant height, number of branches per plant, number of leaves per plant, dry weight, days till 50% flowering, seed yield, stover yield, biological yield, and harvest index were all noted in the observations.

Result and Discussion

Growth attributes

The Data recorded on plant population per meter row length, Plant height, Number of branches per plant, Number of leaves per plant, Dry matter accumulation and Days to flowering demonstrates how the plants react to the treatments differently. Plant population was maintained by proper placement of seeds at proper spacing and thinning at 15 DAS. Plant population was 6-7 plants per meter row length which was similar to other treatments (Table 1). INM nutrient sources had a considerable impact on plant height during the whole crop growth cycle. According to research, a crucial rise in plant height peaked between 30 DAS and 60 DAS but declined between 90 DAS and harvest. The maximum plant height was seen in T_7 (190.1 cm) which was *at par* with T_3, T_4, T_5 and T_8 (Table 1). The better growth and development under the aforementioned treatments may be due to the increased availability of nitrogen and phosphorus to the plant, first through organic manure and then through fertilisers in the cropping season. Because of the balanced nutritional environment that results in enhanced growth and development of the mustard crop, vermicompost may have had a significant influence on improved root development and increased microbial activity. In the case of Indian mustard, similar results were also found by Thaneshwar *et al*., 2017 [16] and Singh *et al*., 2018 [15]. The number of branches at 60 DAS and 90 DAS is significantly impacted by integrated nutrient management. The therapy T_7, which had the most treatments overall, also had the highest number of branches. The application of 75% inorganic and 25% organic fertilisers after the soil test value may have increased the availability of nitrogen to the plant at early growth stages because nitrogen is a crucial component of nucleic acid, protoplasm, and protein and plays a crucial role in metabolism, growth, development, reproduction, and the transmission of heritable characteristics. As a result, the number of secondary branches was also increased by this circumstance. These outcomes matched those of Singh *et al*., 2018 [15]. INM also has a significant effect on number of leaves was seen highest in T_7 and was *at par* with maximum treatments. Dry matter accumulation also has a significant effect except at 30 DAS. At 60 DAS dry matter accumulation was seen increasing at a higher rate than 90 DAS and at harvest. Dry matter accumulation was seen highest in treatment T_7 which was at par with T_3, T_4, T_5, T_6, T_8. With the application of both inorganic fertilisers and organic manures, the increase in dry weight caused by the branches (primary and secondary) increased the total number of leaves per plant, resulting in the accumulation of photosynthates overall and enhanced plant growth. These results concurred with those of Lal *et al*., 1993 [5]. Integrated Nutrient management also influences the days to 50% flowering in plants, but treatments were found to be non-significant. The highest number of days were taken by T_7, that is 52 DAS and lowest at control at 46 DAS.

Yield attributes and yield

Integrated nutrient management has a significant effect on the number of siliqua $plant^{-1}$, seeds yield and Stover yield. While seeds per siliqua had a non-significant effect. The number of siliqua $plant^{-1}$ was highest in T_7 which was *at par* with T_3, T_4, T_5, T_6 and T_8 (Table 2). With the administration of nitrogen fertiliser and vermicompost in an integrated pattern, a substantially higher number of siliqua plants-1 were seen, which may have helped to deliver adequate nutrients throughout the growth period. These findings agree with those of Patel *et al*., 2022 [7]. Seeds $siliqua^{-1}$ was found non-significant. The highest no. of seeds was found in T_3 (12.99) and lowest in T_8 (11.08) (Table 2). With the application of vermicompost, a significant and maximum number of seeds of siliqua-1 were produced, which could have improved crop development generally at a cost. The number of siliqua/plant and seeds/siliqua appears to have increased as a result of

increased availability of metabolic activity and nutrients to generate reproductive structures. The research by Singh *et al*., 2014 [10] and the current findings are very similar. Seed yield was highest in treatment T_7 which was at par with T_3, T_4 and T_5 (Table 2). This finding suggests that the good effects of vermicompost were brought about by a sufficient supply of nutrients in the root zone and plant system. More photosynthates may have been produced and accumulated in different plant sections as a result of the root zone's enhanced nutritional availability and higher metabolic activity. Parihar *et al.*, 2014 [8] research supported this finding. Stover yield was also found significant and the highest stover yield was found in T_7 and was at par with treatment T_3, T_8, T_6, T_4 and T_5 (Table 2). This could be a result of the mix of organic and inorganic fertilisers' effects on improving growth characteristics and producing more dry matter. These results agree with those of Sharma *et al*., 2017 [9].

Table 1: Effect of integrated nutrient management on Plant population at 15 DAS/m, Plant height (cm), No. of branches/plant, Number of leaves plant^{-1}, Dry matter g/plant, Days to flowering

Treatments	Plant population at 15 DAS m^{-1} row length	Plant height (cm)	No. of branches plant^{-1}	No. of leaves plant^{-1}	Dry matter (g plant^{-1})	Days to flowering
T_1-Control	6.67	151.1	12.6	11.5	37.3	46.0
T_2- 100%RDF	7.00	151.7	13.9	12.5	46.1	47.6
T_3- 100% RDF + VC @ 1 t ha^{-1} + Azotobacter	7.00	179.3	16.6	16.0	63.2	52.3
T_4- 100% RDF + VC @ 1 t ha^{-1} + PSB	6.68	174.5	16.3	15.2	60.3	51.6
T_5- 75% RDF + VC @ 2 t ha^{-1} + Azotobacter	7.34	170.1	16.2	15.1	59.0	50.6
T_6- 75% RDF + VC @ 2 t ha^{-1} + PSB	7.00	160.1	15.1	14.7	56.0	49.3
T_7- 75% RDF + VC @ 2 t ha^{-1} + FYM @ 3 t ha^{-1} + Azotobacter	6.33	190.5	16.9	16.1	66.6	52.6
T_8- 75% RDF + FYM @ 6tha^{-1} + PSB	6.67	169.2	15.7	15.0	58.8	50.6
T_9- 75% RDF + FYM @ 6 t ha^{-1} + VAM	6.68	155.5	15.0	14.3	53.2	48.6
T_{10}- 100% RDF + VAM + Azotobacter	7.00	154.8	14.1	13.2	51.2	48.0
S.E (m)±	0.33	7.89	0.76	0.8	3.57	0.48
C.D. at 5%	N.S	23.44	2.26	2.4	10.6	N.S

Table 2: Effect of integrated nutrient management on No. of siliqua plant^{-1}, No. of seeds siliqua^{-1}, Seed yield (kg ha^{-1}), Stover yield (kg ha^{-1})

Treatments	No. of siliqua plant^{-1}	No. of seeds siliqua^{-1}	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1-Control	262.1	11.3	1437.9	3865.3
T_2- 100% RDF	301.8	11.2	1884.7	4606.7
T_3- 100% RDF + VC @ 1 t ha^{-1} + Azotobacter	384.2	12.9	2746.1	6105.9
T_4- 100% RDF + VC @ 1 t ha^{-1} + PSB	371.8	12.6	2637.8	5862.7
T_5- 75% RDF + VC @ 2 t ha^{-1} + Azotobacter	361.2	12.0	2577.1	5912.6
T_6- 75% RDF + VC @ 2 t ha^{-1} + PSB	356.4	11.6	2370.1	5542.7
T_7- 75% RDF + VC @ 2 t ha^{-1} + FYM @ 3 t ha^{-1} + Azotobacter	392.6	12.7	2803.9	6436.0
T_8- 75% RDF + FYM @ 6tha^{-1} + PSB	355.0	11.0	2401.0	5805.8
T_9- 75% RDF + FYM @ 6 t ha^{-1} + VAM	328.1	11.2	2201.1	5353.7
T_{10}- 100% RDF + VAM + Azotobacter	308.4	11.4	2034.1	5120.9
S.E (m)±	23.67	0.70	127.3	313.5
C.D. at 5%	70.32	N.S.	378.4	931.4

Conclusion

It can be concluded that combining FYM and vermicompost with inorganic fertilizers works well and enhances the growth and production characteristics of mustard. With the application of 75% RDF + Vermicompost @ 2 t ha^{-1} + FYM @ 3 t ha^{-1} + Azotobacter, the highest seed yield and stover yield were noted. These results are based on a single season; thus, additional trails may be needed for further validation.

References

1. Anonymous. Agricultural Statistics at a Glance. Directorate of Economics and Statistics, Govt. of India; c2014.
2. Anonymous. Rajasthan Agricultural Statistics at a glance, Commissionerate of Agriculture, Jaipur, Rajasthan; c2019-20, 88.
3. Bijarnia AL, Yadav RS, Rathore PS, Singh SP, Saharan Bhawana, Ramesh C. Effect of Integrated Nutrient Management and weed control measures on growth and yield attributes of mustard (*Brassica juncea* L.). Journal of Pharmacognosy and Phytochemistry. 2017;6(4):483-488.
4. Kumawat A, Yadav RS, Pareek NK. Residual effect of FYM and fertilizers on soil fertility, productivity and economics of pearl millet (*Pennisetum glaucum* L.). Journal of Soil and Water Conservation. 2018;17(11):102-106.
5. Lal K, Dravid MS. Interaction effect of P, S, K_2SiO_3 and FYM manure on drymatter accumulation and utilization of P and S by mustard in Balsamand sandy soil of Hissar. Journal of Nuclear Agriculture and Biology. 1993;22(3-4):184-188.
6. Government of India. Economics and Statistics of Indian Agriculture. Annual Report, Government of India, New Delhi; c2020-21.
7. Patel PM, Saini AK, Desai JS, Patel PD. Productivity and profitability of Indian mustard (*Brassica juncea* L.) under different nutrient management practices. The Pharma Innovation Journal. 2022;11(3):1791-1794.
8. Parihar S, Kameriya PR, Choudhary R. Response of

mustard (*Brassica juncea*) to varying levels of sulphur and fortified vermicompost under loamy sand soil. Agriculture Science Digest. 2014l;34(4):296-298.
9. Sharma, Kumar, Jitendra, Gajanand, Jat, Meena RH, Purohit HS, Choudhary RS. Effect of vermicompost and nutrients application on soil properties yield uptake and quality of Indian mustard (*Brassica juncea*). Annals of Plant and Soil Research. 2017;19(1):1722.
10. Singh R, Singh AK, Kumar P. Performance of Indian mustard (*Brassica juncea* L.) in response to integrated nutrient management. Journal of Agriculture Search. 2014;1(1):9-12.
11. Singh R, Sinsinwar BS. Effect of integrated nutrient management on growth, yield, oil content and nutrient uptake of Indian mustard (*Brassica juncea*). Indian J Agric. Sci. 2006;76:322-24.
12. Singh JP, Tomar S, Chaudhary M, Maurya JK. Yield and Quality of Aonla (*Emblica officinalis* Gaertn.) as influenced by foliar application of different sources of potassium with and without urea spray, International Journal of Current Microbiology and Applied Sciences. 2017;6(9):1530-33.
13. Singh JP, Tomar S, Chaudhary M, Shukla IN. Effect of Organic, Inorganic and Biofertilizers on Physico-Chemical Properties of Fruits of Guava cv. L-49, International Journal of Chemical Studies. 2018a;6(3):3233-38.
14. Singh K, Kumar R, Singh, Pankaj SK, Singh SB, Singh RN. Effect of Integrated Nutrient Management on Yield and Economics of Mustard (*Brassica juncea* L.). International Journal of Current Microbiology and Applied Science. 2018;7:5261-5269.
15. Singh JP, Chaudhary M, Tomar S, Shukla IN. Assess the effect in integrated nutrient management on growth and yield parameters of Guava cv. L-49, International Journal of Chemical Studies. 2018b;6(3):676-680.
16. Thaneshwar, Singh V, Jai P, Kumar, Kumar M, Sateesh, *et al*. Effect of Integrated Nutrient Management on Growth and Yield of Mustard (*Brassica juncea* L.) in Irrigated Condition of Upper Gangetic Plain Zone of India. International Journal of Current Microbiology and Applied Sciences. 2017;6(1):922-932.
17. Kumar CS, Rana NS, Vivek, Dhyani BP, Bhim S, Aparna V, *et al*. Effect of novel sources of nutrients, their dose and mode of application on yield, quality and profitability of Indian mustard [*Brassica juncea* (L.) Czern & coss]. Biological Forum. An International Journal. 2022;14(3):1385-1390.
18. Meena VD, Dotaniya ML, Coumar V, Rajendiran S, Ajay, Kundu S, *et al*. A case for silicon fertilization to improve crop yields in tropical soils. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. 2014 Sep;84:505-518.
19. Thakur AK, Jayaraman M, Mishra R, Thakur M, Chellgren VM, Byeon LIJ, *et al*. Polyglutamine disruption of the huntingtin exon 1 N terminus triggers a complex aggregation mechanism. Nature structural & molecular biology. 2009 Apr;16(4):380-389.