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## A review: Effect of INM practices on growth, yield and quality of Indian mustard

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### Abstract

One of the oldest and most often used edible oilseeds, mustard plays an essential part in balancing the nutritional needs of humans. The agricultural economy of India is heavily dependent on oil seeds. In our agricultural system, oilseed crops come in second place to cereal grains in importance. In terms of global mustard output, India has a significant place. In India, the space used for rapeseed-mustard production accounts for more than 65% of the total land. Chemical fertilisers should not be used excessively as it negatively affects soil fertility, productivity, and other micronutrient levels. It is possible to close the enormous gap between domestic production and consumption of edible oils by either expanding the area under oilseed crops and boosting output per square metre. Integrated nutrient management is crucial because it not only maintains high crop output over time but also enhances soil health and creates a safer environment.

**Keywords:** Soil health, high productivity, organic manure, vermicompost

### Introduction

With an output of 6.31 million tonnes and a production area of 5.79 million hectares, India is the second-largest producer of rapeseed-mustard after China. India is the world's top producer of rapeseed and mustard. A considerable nutritional value is provided by the 28–36% protein content of mustard seeds. During the growth season, mustard needs a moderate amount of soil moisture, a reasonably cold climate, and a dry harvest phase (Budzynski *et al.*, 2019) [6]. Erucic acid, which makes up 40–60% of the oil in rapeseed and mustard seeds, is present in sufficient amounts, along with linolenic acid, which ranges from 4.5–13%. Mustard contains approximately 35–40% oil. Oilseed crops are typically grown in rainfed environments with limited input and inadequate management techniques, which results in reduced productivity levels (Lal *et al.*, 2015) [22]. Under continuous farming, chemical fertilisers cannot maintain the optimum levels of crop output. To increase the health of the soil, chemical fertilisers must be used with organic manure (Prasad *et al.*, 2017) [26]. In addition to restoring the soil's fertility, the nutrients provided to crops by INM also help them to maintain the optimal level of output throughout time (Pal and Pathak, 2016) [25]. Rapeseed-mustard production must be increased by making optimal use of both organic and inorganic sources of nutrients. When used properly in conjunction with fertilisers, farm yard manure (FYM), vermicompost (VC), and bio-fertilizers like Azotobacter have been shown to improve the physical, chemical, and biological aspects of the soil. The availability of all vital plant nutrients is guaranteed by the combined application of organic and inorganic fertilisers, which also enhances the soil's chemical and biological qualities and increases crop yield (Thakur *et al.*, 2009; Meena *et al.*, 2015) [32, 24]. Application of vermicompost @ 6t/ha +80 kg N/ha + 40 kg P<sub>2</sub>O<sub>5</sub>/ha resulted in total growth parameters and nutrient content in Indian Mustard.

### Effect of INM on growth attributes

Singh *et al.*, 2015 reported that total no of branches/ plant, number of siliqua/branches, total number of siliqua/ plant were significantly higher with the application of 100% recommended dose of fertilizers (RDF) + FYM 5 t/ha + VC 2.5 t/ha. Application of 100% RDF+ FYM @10 t/ ha was significant increase the total dry matter accumulation in Indian Mustard. (Shukla *et al.*, 2002) [28]. Application of 100% RDF + FYM+ Sulphur +Zinc +Azotobacter (seed treatment) resulted in maximum dry matter accumulation, plant height and total branches and number of siliqua/plant (Tripathi *et al.*, 2011) [35].

Application of 75% RDF through FYM + 25% through fertilizer +Azotobacter +PSB significantly increased dry matter accumulation, number of branches/plant, number of siliqua/plant and plant height. (Rundal *et al.*, 2013). Kaur *et al.*, 2022 <sup>[16]</sup> reported that 100% RDF + 2 t FYM/ha + 20 kg S/ha + 20 kg ZnSO<sub>4</sub>/ha + 1 t vermicompost/ha + Azotobacter (Seed treatment) significantly increased plant height, number of branches/plant, dry weight in Indian Mustard. Maurya *et al.*, 2019 <sup>[23]</sup> reported that application of 100% NPK+FYM +PSB +S significantly increases plant height, number of functional leaves /plant, number of branches/plant in mustard. Application of 5 t FYM +100% RDF resulted in maximum plant height, number of branches/plant, LCC and dry matter accumulation in mustard crop (Bijarnia *et al.*, 2017) <sup>[5]</sup>. Application of 75% RDF + 2.5 t FYM/ha was gave maximum plant height, number of primary and secondary branches/plant and dry matter accumulation (Bisht *et al.*, 2018) <sup>[7]</sup>. Application of 50% FYM +50% Vermicompost resulted in highest number of branches/plant, plant height and dry weight (Murali *et al.*, 2018). Application of 100%RDF +Azotobacter + PSB significantly increased maximum number of primary and secondary branches/plant, plant height in sarson (Brar *et al.*, 2016) <sup>[8]</sup>. Devkota *et al.*, 2022 <sup>[10]</sup> reported that maximum plant height, leaf size and plant canopy volume were significantly higher with the application of 1/2 NPK+ 2 ton/ha Poultry Manure. Bharti *et al.*, 2022 <sup>[2]</sup> reported that maximum value of growth was received with the application of 100% RDF (80:40:40 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg/ha) and significantly higher value of growth was obtained by zinc solubilizing bio-fertilizer. So, 100%RDF (80:40:40 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg/ha)+ ZSB gave higher growth and production in Indian Mustard. Application of vermicompost @6t/ha +80 kg N/ha + 40 kg P<sub>2</sub>O<sub>5</sub>/ha resulted in total growth parameters and nutrient content in Indian Mustard (Konsotia *et al.*, 2013) <sup>[17]</sup>. Application of 70 kg N+ 50 kg P<sub>2</sub>O<sub>5</sub> + 10 t FYM gave highest number of branches/plant and plant height in Indian Mustard (Thanki *et al.*, 2011) <sup>[33]</sup>. Application of 75% NPK+40 Kg S +10 t FYM resulted in highest plant height, dry weight and number of branches/plant in mustard (Kumar *et al.*, 2017) <sup>[19]</sup>. Application of 75% NPK +25% FYM+40 kg S+ Mulching @10 t/ha gave highest number of branches/plant, number of dry matter accumulation/plant and plant height at 60 DAS as well as at harvest (Diwakar *et al.*, 2021) <sup>[11]</sup>. Application of Azotobacter + PSB + 30 kg/ha N (inorganic fertilizer) + 30 kg/ha N (poultry manure) resulted in maximum number of branches/plant, dry weight and plant height (Saini *et al.*, 2017) <sup>[27]</sup>.

### Effect of INM on yield and yield attributes

Application of Seed treatment (Azotobacter) + PSB +100% RDF resulted in higher stover yield and seed yield (Gudadhe *et al.*, 2005) <sup>[14]</sup>. Application of FYM@10t/ha+ Seed treatment (Azotobacter or Azospirillum) resulted the maximum number of siliqua/plant, 1000 seed weight, seed yield, stover yield and number of seeds/siliqua (Singh *et al.*, 2014) <sup>[30]</sup>. Application of FYM @5 t /ha gave maximum seed yield and seed weight/plant (Bisht *et al.*, 2018) <sup>[7]</sup>. Application of 100% RDF + Vermicompost @2 t/ha + Azotobacter significantly increased seed yield, stover yield, biological yield, number of siliqua/plant and number of seeds/siliqua (Gora *et al.*, 2022) <sup>[13]</sup>. Application of 100% NPK + organic fertilizers (50%+100%) gave maximum seed yield, stover yield and test weight (Vinod KB *et al.*, 2019) <sup>[36]</sup>. Kumar *et al.*, 2016 <sup>[20]</sup>

reported that application of 50%RDF (80 kg N + 40 kg P<sub>2</sub>O<sub>5</sub> + 40 kg K<sub>2</sub>O/ha) + FYM +Azotobacter (seed treatment) was significant increase seed yield, stover yield, number of siliqua/plant, number of seeds/siliqua and test weight. The combined application of RDF + Vermicompost @5 t/ha gave maximum grain yield and yield attributes (Thaneshwar *et al.*, 2017) <sup>[34]</sup>. Ajar *et al.*, 2021 <sup>[1]</sup> reported that application of 75% RDF+S@40 kg/ha+ Vermicompost @5t/ha+ Azotobacter+PSB resulted in maximum yield attributes viz. number of siliqua/plant, number of seeds/siliqua, test weight, seed yield and stover yield. Singh *et al.*, 2016 reported that application of 100% recommended dose of fertilizers (RDF) + FYM 5 t/ha + VC 2.5 t/ha resulted in maximum length of siliqua, 1000-seed weight, seed yield and number of seeds/siliqua. Bhanuwanti *et al.*, 2022 <sup>[3]</sup> reported that application of Azotobacter + PSB + VC 5 t/ha + 50% RDF gave maximum number of siliqua/plant, number of seeds/siliqua, 1000-seed weight, seed yield, stover yield and biological yield. Singh *et al.*, 2018 <sup>[31]</sup> reported that soil test based fertilizer application (75% through chemical fertilizers + 25% through organic fertilizers) resulted in maximum siliqua/plant, siliqua length, test weight, seed yield, straw yield, number of seeds/siliqua and biological yield. Bharti *et al.*, 2022 <sup>[2]</sup> reported that maximum number of siliqua/plant, length of siliqua, number of seeds/siliqua, 1000 seed weight, seed yield, straw yield and biological yield were received with the application of 100% RDF (80:40:40 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg/ha) and significantly higher number of siliqua/plant, length of siliqua, number of seeds/siliqua, 1000 seed weight, seed yield, straw yield and biological yield were obtained by Zinc solubilizing bio-fertilizer. So, 100% RDF(80:40:40 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg/ha)+ZSB gave higher growth and production in Indian Mustard. Kashive *et al.*, 2022 <sup>[15]</sup> reported that application of 100% RDF +Vermicompost followed by 100% RDF + S gave maximum number of siliqua/plant, number of seeds/siliqua, 1000 seed weight and seed yield. Application of 100%RDF +Azotobacter +PSB resulted in higher number of siliqua/plant, number of seeds/siliqua and seed yield in mustard (Brar *et al.*, 2016) <sup>[8]</sup>. Maximum number of siliqua/plant, seed yield and number of seeds/siliqua received with the application of 75% NPK+ 5t FYM +PSB + S. (Kumar *et al.*, 2016) <sup>[2]</sup>. Application of RDN 50% + 25% FYM + 25% vermicompost + 30 kg S + Azotobacter resulted in maximum length of siliqua, number of siliqua/plant, seed yield and stover yield in mustard (Yadav *et al.*, 2018) <sup>[37]</sup>. Application of 50% RDF + FYM 6 t/ha+ Vermicompost 2 t/ha + bio-fertilizer resulted in maximum number of siliqua/plant, number of seeds/siliqua, length of siliqua, seed yield and stover yield (Kumar *et al.*, 2018) <sup>[21]</sup>.

### Effect of INM on quality parameters

Kaur *et al.*, 2022 <sup>[16]</sup> reported that application of 100% RDF + 2 t FYM/ ha + 20 kg S/ha + 20 kg ZnSO<sub>4</sub>/ha+ 1 t vermicompost/ha + Azotobacter (Seed treatment) followed by 100% RDF + 2 t FYM/ha + 20 kg S/ha + 20 kg ZnSO<sub>4</sub>/ha were gave highest oil content 39.65% and 38.38% respectively and also highest protein content (20.98%) was received with 100% RDF + 2 t FYM/ha + 20 kg S/ha + 20 kg ZnSO<sub>4</sub>/ ha+ 1 t vermicompost/ha + Azotobacter (Seed treatment) followed by 100% RDF + 2 t FYM/ha + 20 kg S/ha + 20 kg ZnSO<sub>4</sub>/ha gave second highest protein content (20.31%). Application of 75 RDF+ 40kg S+ 5t vermicompost/ha + Azotobacter +PSB followed by RDF+

40kg S+2t poultry manure/ha+ Azotobacter +PSB were gave highest oil content (40.9% and 40.8%) and oil yield (729.5 kg /ha and 682.8 kg /ha) respectively and application of 75 RDF+ 40kg S+5t vermicompost/ha + Azotobacter +PSB followed by RDF + 40kg S+2t poultry manure/ha+ Azotobacter + PSB were gave maximum protein value in seed (14.6% and 14.4%) and straw (3.38% and 3.25%) respectively and same trend followed in the protein yield of seed (Chandan *et al.*, 2019) <sup>[9]</sup>. Dubey *et al.*, 2021 <sup>[12]</sup> reported that application of 50% RDF + FYM @ 2.5t/ha + Vermicompost @ 0.62t/ha + Bio-fertilizers @ 7.5kg/ha + ZnSO<sub>4</sub> @10kg/ha followed by 75% RDF + Vermicompost @ 0.62t/ha + Bio-fertilizers@ 7.5kg/ha gave highest oil content (40.15% and 39.57%), oil yield (933.48 kg/ha and 906.15kg/ha), protein content (17.37% and 17.35%) and protein yield (403.85 kg/ha and 397.315 kg/ha) respectively. Application of 80 kg N + 40 kg P/ha + vermicompost up to 6 t/ha resulted in highest oil content and protein content in mustard (Kansotia *et al.*, 2015) <sup>[15]</sup>. Application of FYM-N (20 kg N) + 2.75% fertilizers N (60 kg N) + 40 kg S/ha resulted in maximum oil content and protein content in mustard (Bhat *et al.*, 2007) <sup>[4]</sup>.

### Conclusion

The rapeseed and mustard crops production, profitability, and quality are all supported by integrated nutrition management. INM that is integrated enhances and maintains the soil's fertility and production while maintaining ecological balance. In order to produce high-quality crops with increased output and advantages, farmers in the areas where rapeseed and mustard are grown are urged to apply biofertilizer using farmyard manure, compost, vermicompost, crop residues, and inorganic fertilisers.

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