Efficacy Of Integrated Nutrient Management On Growth And Yield Of Mustard (*Brassica Juncea* L.)

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Abstract: A field experiment was conducted at Crop Research Centre (CRC), School of Agriculture, Uttaranchal University, Dehradun during *rabi* season 2021-22. Seven treatments were tested in three replicated Randomized Block Design. Results found that significantly better growth attributes, yield attributes and quality attributes was obtained with 75 per cent RDF + vermicompost + Sulphur over rest of the treatments. The maximum plant height (197.54cm), siliqua length (6.76 cm), test weight (6.26 g), seed yield (1690 kg/ha), oil content (35.76%), oil yield (604 kg/ha) and protein content (42.87 %) was received in treatment 75%RDF + vermicompost + Sulphur. The minimum plant height (153.85cm), siliqua length (5.03cm), test weight (3.24g), seed yield (1120kg/ha), oil content (33.2%), oil yield (371kg/ha) and protein content (29.03%) was received in Control (100%RDF).

Keywords: Growth, Integrated Nutrient Management, Mustard, Sulphur, Vermicompost

INTRODUCTION:

The major oilseed crop known as Indian mustard, or *Brassica juncea* (L), is a perennial annual herb that belongs to the Brassicaceae family. Indian mustard is an amphidiploids plant with 36 chromosomes (2n). Known and used since the ancient times and called the greatest among the herbs in the Bible. Rai and laha are two common names for Indian mustard. Crops can be cultivated under a variety of agro climatic conditions. The most important member of the Brassica family is Indian mustard. Mustard crops are grown both on irrigated and rainfed conditions, on both sandy and heavy soils. The seed and oil is used as cooking as well as making of hair oils and medicines for humans. The oil cake is utilized as both a feed and fertilizer. Green feed for cattle can be obtained from the stem and leaves.

Due to India's growing population, per capita consumption of oil and fat is steadily increasing. In the last 13 years, demand has increased at a rate of around 6 per cent per year, reaching nearly 12.5 million tonnes of oil in 1998-99. Our population is predicted to reach 1180 million people by 2010. By 2010, the predicted demand for edible oil at a consumption level of 15kg capita^{-1} year^{-1} is estimated to be 17.7 million tonnes, or nearly 51 million tonnes of oilseeds **(Hedge, 2000)**.

Rapeseed and mustard are significant oilseed crops, but their productivity in the state is well below their potential yield, which can only be raised through balanced fertilisation and other management measures, particularly sulphur and zinc in semi-arid soils. In recent years, the widespread use of high-grade chemical fertilisers devoid of micronutrients, along with a lack of attention to organic recycling in rain-fed agro-ecosystems, has led in the depletion of soil resources of several important elements for plant growth.

Scarce and late water availability, as well as adequate soil fertility, is the main factors contributing to low mustard output. The field is left fallow during the rainy season to store moisture, and farmers give one or two irrigations depending on water availability, even to the crop grown on conserved moisture. Water supply at the most essential growth stages (flowering stage and siliqua development stage) achieve the maximum growth and yield attributes, according to **Yadev *et al*. (2010)**.

The present study was carried out to study the efficacy of integrated nutrient management on growth and yield of mustard (*Brassica juncea* L.) in Uttarakhand.

MATERIALS AND METHOD:

The field experiment was carried out during rabi 2021-22 at School of Agriculture, Uttaranchal University, Dehradun, Uttarakhand. The soil at the location has a sandy clay loam texture with 1.31% organic carbon, EC (0.33 dSm^{-1}), 301.5 kg/ha available N, 12.14 kg available P, 233.6 kg available K and pH 7.2. The seven treatment viz. Control (100 % RDF),75 per cent RDF + Vermicompost, 50 per cent RDF + Vermicompost, 75 per cent RDF + Rhizobium, 50 per cent RDF + Rhizobium, 75 per cent RDF + Vermicompost + Sulphur, 50 per cent RDF + Rhizobium + Sulphur, laid out in RBD, with three replication. PSB culture was used for seed inoculation thoroughly as per treatment. Vermicompost is applied by broad casting and mixed with soil by hand according to the treatment required just a day before sowing. NPK and S were applied as basal dose. Thinning and weeding was done by manual labour. Three irrigation were applied at 30 DAS, at flowering stage and at 60 DAS. The crop was harvested on 4th March, 2022. The data regarding growth, yield parameters and quality were analysed with statistical analysis and significance of treatments were tested with the help of "F" test.

RESULTS AND DISCUSSION:

Growth parameters of mustard as influenced by INM:

Plant height (cm):

The maximum plant height of 197.54 cm was recorded at harvest with 75 per cent RDF + Rhizobium + Sulphur which were significant over control. The minimum plant height of 153.85 cm was observed with control. The increased in plant height might be due to Sulphur, which regulates the production of chlorophyll and hence improves growth properties. Similar findings were reported by **Chaubey *et al.* (2001), Giri *et al.* (2006).**

Dry matter production (g):

The highest dry matter production at 60 DAS was 10.37 g with the application of 75 per cent RDF + Vermicompost + Sulphur (T_6) which was significant over control. The least dry matter production was 6.3 g with Control. The favourable soil condition might have aided in greater root proliferation and nutrient uptake which have accelerated the formation of new tissues and in turn enhanced the dry matter production. Similar findings were reported by **Shukla *et al.* (2002), Tripathi *et al.* (2011).**

Table 1: Effect of INM on plant height and dry matter production of mustard

Treatments	Plant height (cm)	Dry matter production(g)
T_1 – Control (100 % RDF)	153.85	6.3
T_2 – 75 % RDF + Vermicompost	167.2	7.67
T_3 – 50 % RDF + Vermicompost	161.05	7.08
T_4 – 75 % RDF + Rhizobium	171.29	7.80
T_5 – 50 % RDF + Rhizobium	182.6	8.28
T_6 – 75 % RDF + Vermicompost + Sulphur	197.54	10.37
T_7 – 75 % RDF + Rhizobium + Sulphur	185.07	9.38
SEm±	0.25	0.23
C.D. at 5%	0.89	0.86

Yield attributes of mustard as influenced by INM:

Siliqua length (cm):

The highest siliqua length was 6.76 cm with the application of 75 per cent RDF + Vermicompost + Sulphur (T_6) and the lowest siliqua length was 5.03 cm with control (T_1). The increase in the length of the siliqua might be due to the availability of sulphur and vermicompost which stimulates to increases soil porosity and infiltration of water, improves nutrient content and increases yield of the plant. Similar results were found by **Rundala *et al.* (2013) and Singh *et al.* (2011).**

Test weight (g):

The highest test weight of 6.26 g was with the application of 75 per cent RDF + Vermicompost + Sulphur (T_6) and the lowest was 3.24 g with control (T_1). Test weight is a genetic character, but due to good management, weight of mustard grain increased with the combination of NPK, Sulphur and Rhizobium. These findings are similar as findings reported by **Ajnar *et al.* (2021)** and **Chandan *et al.* (2019).**

Seed yield (kg/ha):

The maximum seed yield of 1690 kg/ha was obtained with the application of 75 per cent RDF + Vermicompost + Sulphur (T_6) and the minimum seed yield of 1120 kg/ha was obtained with control (T_1). The availability of nutrients and growth hormones may have increased N metabolism and protein synthesis in plant tissues, which may have contributed to the increase in seed output. Similar findings were reported by **Kumar *et al.* (2017)**.

Stover yield (kg/ha):

The highest stover yield was recorded to be 4799 kg/ha on T_6 (75 % RDF + Vermicompost + Sulphur) and the lowest stover yield was recorded as 3926 kg/ha on T_1 (Control). The higher increase in stover yield could be attributed to the

combined application of organic manures and chemical fertilisers, which improves nutrient utilisation through improved micro environmental conditions. Similar findings were reported by **Pati and Mahapatra (2015).**

Table 2 : Effect of INM on siliqua length, test weight, seed yield and stover yield of mustard

Treatments	Siliqua length (cm)	Test weight (g)	Seed Yield (kg/ha)	Stover Yield (kg/ha)
T_1 – Control (100 % RDF)	5.03	3.24	1120	3926
T_2 – 75 % RDF + Vermicompost	5.33	4.34	1247	4255
T_3 – 50 % RDF + Vermicompost	5.16	3.75	1211	4025
T_4 – 75 % RDF + Rhizobium	5.33	4.25	1382	4326
T_5 – 50 % RDF + Rhizobium	5.4	4.89	1460	4615
T_6 – 75 % RDF + Vermicompost + Sulphur	6.76	6.26	1690	4799
T_7 – 75 % RDF + Rhizobium + Sulphur	5.7	4.71	1572	4719
SEm±	0.08	0.06	0.83	0.68
C.D. at 5%	0.52	0.45	1.62	1.47

Quality parameters of mustard as influenced by INM:

Oil content (%):

75 per cent RDF + Vermicompost + Sulphur resulted in significantly highest oil content of 35.76 % and Control resulted in lowest oil content of 33.20 %. The increase in oil content might be due to increased availability of S that involves in an increased conversion of primary fatty acids metabolites to the end products of fatty acids. Similar findings were reported by **Sahoo (2018).**

Oil yield (kg/ha):

75 per cent RDF + Vermicompost + Sulphur resulted in significantly highest oil yield of 604 kg ha^{-1} and Control resulted in lowest oil yield of 371 kg ha^{-1}. The increased in oil yield might be due to the higher dry matter production under integrated application of organic and inorganic sources of nutrients. Similar findings were found by **Mandal and Sinha (2002)**, **Mehta (2002).**

Protein content (%):

The highest protein content was recorded as 42.87 % with 75 % RDF + Vermicompost + Sulphur and the lowest was 29.03 % with Control. The higher content of protein might be due to the availability of NPK throughout the crop growth. Similar findings were reported by **Kumpawat (2010)** and **Saikia *et al.* (2013).**

Table 3: Effect of INM on oil content, oil yield and protein content of mustard

Treatments	Oil content (%)	Oil Yield (kg/ha)	Protein content (%)
T_1 – Control (100 % RDF)	33.20	371	29.03
T_2 – 75 % RDF + Vermicompost	33.71	420	33.76
T_3 – 50 % RDF + Vermicompost	33.50	405	32.3
T_4 – 75 % RDF + Rhizobium	34.24	473	34.93
T_5 – 50 % RDF + Rhizobium	34.71	506	36.1
T_6 – 75 % RDF + Vermicompost + Sulphur	35.76	604	42.87
T_7 – 75 % RDF + Rhizobium + Sulphur	35.23	553	36.45
SEm±	0.01	0.11	0.13
C.D. at 5%	0.22	0.60	0.65

CONCLUSION:

The result shows that Integrated Nutrient Management was important for the mustard crop as it improves the growth, yield and quality of the mustard crop. Among the integrated nutrient treatments, 75 per cent RDF + Vermicompost + Sulphur (T_6) is so far the best treatment as compared to the other remaining treatments.

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