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# Growth and yield attributes of mustard as influenced by nutrient management in mustard-cowpea cropping sequence

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**Abstract**
Experimental was conducted at college farm of N. M. College of Agriculture, Navsari Agricultural University, (Gujarat) during the years 2017-18 and 2018-19 in mustard-cowpea cropping sequence" was conducted. The field experiment consisted of eight treatments of integrated nutrient management *viz*., $T_1$ (Control), $T_2$ (10 t FYM/ha), $T_3$ (5 t biocompost/ha), $T_4$ (4 t vermicompost/ha) $T_5$ (RDF 50:50:00 kg N-P-K/ha), $T_6$ (RDF + 5 t FYM/ha), $T_7$ (RDF + 2.5 t biocompost/ha) and $T_8$ (RDF + 2.0 t vermicompost/ha) to mustard in *rabi* season and replicated three times in randomized block design. On the basis of pooled analysis of *rabi* mustard growth and yield attributes and yield of mustard were improved significantly due to combine of organic and inorganic manures. Significantly higher seed yield (1593 kg/ha) and stover yield (3454 kg/ha) were obtained under application of RDF + 2.0 t vermicompost/ha ($T_8$) which were remained at par with RDF + 2.5 t biocompost/ha ($T_7$) and RDF + 5 t FYM/ha ($T_6$).

**Keywords:** Mustard, nutrient management, biocompost, vermicompost, FYM

## 1. Introduction
Indian mustard (*Brassica juncea* L.) is predominantly cultivated in the states of Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana, Gujarat, Punjab and Bihar. Its cultivation is also being extended to non-traditional areas of southern states like Karnataka, Andhra Pradesh conditions during *rabi* season depending on availability of water and suitable cropping system. Being more responsive to fertilizers, it gives higher returns under irrigated conditions. Only, 30-40% of nutrients applied through fertilizers are utilized by the crop and the remaining is lost through various pathways (Davari and Mirzakhani, 2009) [4]. Indian mustard is nutritionally rich and its oil content varies from 37-49%. The seed and oil are used as a condiment in preparation of pickles, flavoring, curries and vegetables as well as for cooking and frying purposes. Its oil is used in many industrial products, cake as cattle feed and manure and green leaves for vegetable and green fodder (Chauhan *et al.*, 2011) [3].
Mustard is an important oilseed crop of India, cultivated in over 57.62 lakh ha with an annual gross production of 68.2 lakh tonnes and productivity of 1184 kg/ha during year 2015-16 (Anonymous, 2017) [7].
Although increased level of production can be achieved by increasing use of inorganic fertilizers alone but it may lead to deterioration of soil health. This can only be maintained at sustainable level by nutrients via integrated approach. Organic manures is very popular and the use of organic manure has become an higher input in the integrated nutrient management.
Experiences from long term fertilizer experiments revealed that integrated use of farm yard manures, vermicompost, biocompost, *etc.*, with fertilize levels of chemical fertilizers is promising not only in maintaining higher productivity but also in providing maximum stability in crop production. The response of N as chemical fertilizer generally increases, when it is used, *etc* and saves N fertilizer organic manure (Nambiar and Abrol, 1989) [5].
Nutrient management is one of the most important agronomic factors that affect the yield of oilseed crops. Continuous and imbalance use of different fertilizers in crop production have resulted in deterioration of soil health, cost of production and decline in productivity. Balanced nutrition could be used through integrated nutrient management in mustard based cropping system. FYM is most common and easily available amendment. It's plays an important role in improving physio-chemical properties of soil.

## 2. Materials and Methods

Experiment was laid out on "Growth and yield of mustard as affected by nutrient management in mustard-cowpea cropping sequence" at college farm, NAU, Navsari (Gujarat) during the year 2017-18 and 2018-19. Data of soil analysis showed that soil of experimental plot was clayey, low in available N (196.80 kg/ha) and organic carbon (0.42%), medium in available $P_2O_5$ (38.30 kg/ha) and high in available $K_2O$ (351.43 kg/ha). The soil was slightly alkaline (pH 8.23) and normal EC (0.30 dS/m). The field experiment consisted different INM treatments *viz*., $T_1$ (Control), $T_2$ (10 t FYM/ha), $T_3$ (5 t biocompost/ha), $T_4$ (4 t vermicompost/ha) $T_5$ (RDF 50:50:00 kg N:$P_2O_5$:$K_2O$/ha), $T_6$ (RDF + 5 t FYM/ha), $T_7$ (RDF + 2.5 t biocompost/ha) and $T_8$ (RDF + 2.0 t vermicompost/ha) to mustard in *rabi* season and it was replicated three times in RBD design. The recommended dose of fertilizers for *rabi* mustard is 50 N + 50 $P_2O_5$ + 00 $K_2O$ kg/ha.

The mustard *cv*. GDM - 4 was sown with spacing of (45 cm × 15 cm) in November and harvested in March during both the years. The required well decomposed biocompost, vermicompost and FYM as a different treatment in mustard crop. The N fertilizer was applied in form of urea (46% N) whereas $P_2O_5$ was applied through SSP (16% $P_2O_5$). The 50% dose of N fertilizer and 100% dose of $P_2O_5$ were applied at the time of sowing and remaining 50% dose of N fertilizer was applied at 30 DAS and seeds were inoculated with biofertilizer *Azotobacter* @ 20 ml, suspended in 80 ml water and used for inoculating 2 kg seed. Mustard seeds were well mixed with *Azatobactor*, air-dried and sown in field during both the years. The sowing was done manually in previously opened furrows at a depth of 2 cm on 10$^{th}$ and 13$^{th}$ November in 2017 and 2018, respectively using seed rate 2 kg/ha. The plots were irrigated immediately after sowing to ensure uniform germination.

For different observations, it was taken five plants from the each net plot for periodical observations. All selected plants were well labelled and growth and yield attributing characters were recorded. Takfing observation for dry matter production per plant, samples were taken from either side of each plot. Seed and strover yield were taken from net plot area.

## 3. Results and Discussion

Different growth parameter (Table.1) of mustard *viz*., Plant height, Number of branches/plant and Dry matter accumulation/plant noted at different stages were significantly influenced by treatments except at 30 DAS during both the years and in pooled results. Results of two years pooled data for plant height found to significantly higher in the treatment $T_8$ (RDF+2.0 t Vermicompost/ha) and remained at par with treatment $T_7$ and $T_6$ at 60 DAS and 90 DAS. Same as, highest plant height, number of branches/plant and dry matter accumulation/ plant were obtained in the same treatment i.e. treatment $T_8$ at 60 DAS and 90 DAS.

All these growth parameter remained in $T_8 > T_7 > T_6 > T_5 > T_4 > T_3 > T_2 > T_1$ order of their significance. Due to cell division and cell enlargement plant height was increase also plant growth was increase due to availability of nutrients threw out of vegetative growth because well balance nutrient available due to integrated approach. INM might have helped in early root formation and establishment of the crop growth and development. Similar results were noted by Pati and Mahapatra (2015b) [6], Singh *et al.* (2016), Rauniyar and Bhattarai (2017) [7], Sharma *et al.* (2017) [8] and Singh *et al.* (2018b) [10].

Yield attributes (Table. 2) *viz*., Number of siliqua/plant, Length of siliqua/(cm), Number of seeds /siliqua, test weight and seed yield and stover yield were affected by treatments imposed on crop. On two year pooled basis, all yield attributes were found to be significantly higher with treatment $T_8$ (RDF + 2.0 t Vermicompost/ha) which remained at par with treatment $T_7$, $T_6$, $T_5$. Application of INM treatments did not exert any significant difference on test weight (g) of mustard in pooled of two years analysis. It maybe due to synergetic effect of combined application of organic and inorganic fertilizer on growth of plant.similar finding was also reported by Pati and Mahapatra (2015b) [6].

The treatment $T_8$ (RDF + 2.0 t Vermicompost/ha) found significantly higher and which remained at par with treatment $T_7$, $T_6$, $T_5$ for yield during both the years of pooled analysis. Yield of a crop is due to application of balanced nutrient to plant by combined application of organic and inorganic fertilizer which result in better vegetative and reproductive growth, ultimately turn in to higher crop yield. These findings are in similar to Singh *et al*. (2016) [9], Rauniyar and Bhattarai (2017) [7], Bijarnia*et al.* (2017) [2], Sharma *et al*. (2017) [8] and Singh *et al*. (2018b) [10].

**Table 1:** Growth attributes of mustard as influenced by different treatments (Two year pooled results)

| Treatments | Plant height (cm) | | Number of branches/plant | | Dry matter accumulation/plant (g) | |
|---|---|---|---|---|---|---|
| | 60 DAS | At harvest | 60 DAS | At harvest | 60 DAS | At harvest |
| $T_1$ | 106.3 | 140.4 | 10.5 | 13.3 | 47.1 | 69.1 |
| $T_2$ | 110.4 | 144.7 | 10.7 | 13.7 | 48.8 | 71.5 |
| $T_3$ | 114.6 | 149.0 | 11.0 | 14.1 | 50.5 | 74.0 |
| $T_4$ | 118.7 | 153.3 | 11.2 | 14.5 | 52.2 | 76.4 |
| $T_5$ | 122.9 | 157.6 | 11.4 | 14.9 | 53.9 | 78.8 |
| $T_6$ | 127.0 | 161.9 | 11.7 | 15.3 | 55.6 | 81.2 |
| $T_7$ | 131.2 | 166.2 | 11.9 | 15.7 | 57.3 | 83.6 |
| $T_8$ | 135.3 | 170.5 | 12.2 | 16.1 | 59.0 | 86.1 |
| S.Em± | 3.37 | 4.60 | 0.27 | 0.43 | 1.85 | 2.60 |
| CD (P=0.05) | 9.77 | 13.31 | 0.78 | 1.26 | 5.35 | 7.53 |
| CV (%) | 6.84 | 7.24 | 5.86 | 7.24 | 8.53 | 8.21 |
| General mean | 120.8 | 155.5 | 11.3 | 15.0 | 53.1 | 77.6 |

**Table 2:** Yield attributes and yield of mustard as influenced by different treatments (Two year pooled results)

| Treatments | Number of siliqua/plant | Length of siliqua(cm) | Number of seeds/siliqua | Test weight (g) | Seed yield (kg/ha) | Stover yield (kg/ha) |
|---|---|---|---|---|---|---|
| $T_1$ | 171.9 | 4.1 | 9.8 | 4.0 | 901 | 1821 |
| $T_2$ | 177.0 | 4.3 | 10.1 | 4.1 | 1000 | 2054 |
| $T_3$ | 182.1 | 4.4 | 10.4 | 4.1 | 1099 | 2288 |
| $T_4$ | 187.2 | 4.6 | 10.7 | 4.2 | 1198 | 2521 |
| $T_5$ | 192.3 | 4.7 | 10.9 | 4.2 | 1297 | 2754 |
| $T_6$ | 197.4 | 4.8 | 11.2 | 4.3 | 1396 | 2987 |
| $T_7$ | 202.4 | 5.0 | 11.5 | 4.3 | 1494 | 3221 |
| $T_8$ | 207.5 | 5.1 | 11.8 | 4.4 | 1593 | 3454 |
| S.Em± | 5.65 | 0.13 | 0.29 | 0.10 | 68.55 | 124.9 |
| CD (P=0.05) | 16.36 | 0.38 | 0.84 | NS | 198.6 | 361.8 |
| CV (%) | 7.29 | 7.00 | 6.58 | 6.05 | 13.46 | 11.60 |
| General mean | 189.7 | 4.6 | 10.8 | 4.22 | 1247 | 2637 |

## 4. Conclusion

Mustard crop should be fertilized with recommended dose of inorganic fertilizer (50:50:00 kg $N:P_2O_5:K_2O$/ha) combined with 2.5 t biocompost/ha or 2 t vermicompost/ha in *rabi* mustard- cowpea cropping sequence under south Gujarat condition.

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