

# Effect of integrated nutrient management on fenugreek (*Trigonella foenum graecum* L.) growth and yield attributes

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## Abstract

A field experiment was conducted during Rabi season of 2017-18 at Agricultural Research Sub Station, Sumerpur, Pali (Rajasthan) to study the effect of integrated nutrient management (INM) on plant growth and yield attributes of fenugreek (*Trigonella foenum graecum* L.). The experiment was laid out in RBD with eight treatments. The results in terms of growth and yield attributes such as number of pods plant<sup>-1</sup>, pod length, seeds pod<sup>-1</sup> and grain and stover yield of fenugreek were significantly affected by given treatments as compared to control and chemical fertilizer alone. The data of current experiment revealed that the maximum growth and yield attributes i.e. plant height (78.10 cm), number of branches plant<sup>-1</sup> (6.20), number of pods plant<sup>-1</sup> (33.27), pod length (9.60 cm), number of seeds pod<sup>-1</sup> (17.7), test weight (13.9 g), grain yield (20.96 qha<sup>-1</sup>) and stover yield (39.50 qha<sup>-1</sup>) were recorded with treatment (T<sub>8</sub>) viz., 75% RDF + vermicompost @ 2tha<sup>-1</sup> + *Rhizobium* + PSB 5 kgha<sup>-1</sup> followed by treatment (T<sub>6</sub>) viz., 75% RDF + vermicompost @ 2tha<sup>-1</sup>. It can be concluded that 25% reduced dose of chemical fertilizer and its combination with vermicompost along with biofertilizer was optimum for growth and yield of fenugreek.

**Keywords:** Biofertilizer, Fertilizer, fenugreek, INM, vermicompost.

## Introduction

India is the leading seed spice producing and exporting country in the world where, it is grown in the states of Rajasthan, Gujarat, Tamil Nadu, Uttar Pradesh, Himachal Pradesh, Madhya Pradesh and Andhra Pradesh. Its seeds have high nutritive values containing protein (9.5%), fat (10%), crude fiber (18.5%), carbohydrate (42.3%) and many other minor nutrients and vitamins. It also contains good percentage of gums (23.06%), mucilage (28%), trigonelline (0.13-30%), saponine (1.7%) and calorific values (Boori *et al.*, 2017). Indian spices have high reputation in the international market because of their peculiar quality. Fenugreek (*Trigonella foenum-graecum* L.) commonly known as methi and its seeds are used as condiment and vegetable for human consumption and as also concentrate feed for cattle. Its green leaves are used as vegetable, while chopped leaves are mixed in flour to prepare delicious preparations. Besides, it is used as an ayurvedic medicine for curing stomach ailments especially the gastric troubles.

Fertilizer is one of the important inputs in crop production. Application of required quantities of chemical fertilizers is expensive as the cost of chemical fertilizers is ever increasing. The role of organic manures (FYM, Biocompost or Vermicompost) is well known as they add organic matter, macro and micro plant nutrients (Parewa *et al.*, 2014, Parewa *et al.*, 2019). The organic

matter also enhances the microbial activity as they act as substrate for microorganisms. It also develops a sustainable agricultural production system by maintaining soil fertility, soil physical properties, ecological balance and providing stability to the production without polluting soil, water and air (Rasul and Thapa, 2004; Bengtsson *et al.*, 2005).

The efficiency of both organic manure and inorganic fertilizer may be increased by integrating inorganic fertilizers with organic materials. The nutrient losses from the inorganic fertilizers could also be prevented substantially if organic manures are added in combination (Schoebitz and Vidal, 2016; Zhang *et al.*, 2016).

The importance of biological nitrogen fixation (through bio-fertilizer) has been well recognized since a long back, increasing use of bio-fertilizer as source of nutrient not only supplies nutrient but minimize dependence on chemical fertilizer as well. Phosphate solubilizing microorganism are known to mobilize the unavailable P in soil and make it available to crop (Yadav and Verma, 2012). Inoculation of seeds with *Rhizobium* as well as phosphate solubilizing bacteria (PSB) culture is a very low cost method of nitrogen and phosphorus fertilization in legumes and is also beneficial for succeeding crops through residual effects. A judicious combination of chemical fertilizers, organic manures and biofertilizer should be formulated for crops and cropping system

within the ecological, social and economic possibilities. Considering the above facts and views the present experiment was planned and conducted to study "Effect of integrated nutrient management on growth and yield of fenugreek (*Trigonella foenum-graecum* L.) cv. AFG 3" during Rabi season of 2017-18 at Agricultural Research Sub Station, Sumerpur, Pali (Rajasthan).

### Materials and Methods

The experiment was carried out during Rabi season of 2017-18 at Agricultural Research Sub Station, Sumerpur (25.09° N and 73.05° E) in the Pali District, Rajasthan. Ten core soil samples were collected randomly from 0-15 cm depth on the site using soil auger, mixed thoroughly, bulked, air dried and sieved to pass through a 2 mm sieve for chemical analysis. All physico-chemical properties of the experimental field's soil were determined by the standard methods. The soil of experimental field was sandy loam in texture having low soil organic carbon (0.36%), low available N (200 kg ha<sup>-1</sup>), bulk density (1.30 Mg M-3), particle density (2.62

Mg M-3) with slightly alkaline in nature pH 8.2 (1:2.5 soil: water ratio). The crop was sown using variety (AFG 3) in the month of November, 2017 at recommended spacing. There were eight treatments namely control (T<sub>1</sub>), 50% RDF (T<sub>2</sub>), 75% RDF (T<sub>3</sub>), 100% RDF (T<sub>4</sub>), 50% RDF + Vermicompost @ 2t ha<sup>-1</sup> (T<sub>5</sub>), 75% RDF + Vermicompost @ 2t ha<sup>-1</sup> (T<sub>6</sub>), 50% RDF + Vermicompost @ 2 ha<sup>-1</sup> + Rhizobium + PSB @ 5 kg ha<sup>-1</sup> (T<sub>7</sub>) and 75% RDF + vermicompost @ 2t ha<sup>-1</sup> + Rhizobium + PSB @5 kg ha<sup>-1</sup> (T<sub>8</sub>) replicated three times and arranged in a randomized block design (RBD). Fertilizer, vermicompost and fenugreek (AFG 3) seeds were obtained from the Agricultural Research Sub Station, Sumerpur. The different inorganic and organic nutrient sources alone and in combinations were applied uniformly as per the treatment and incorporated into the soil at the time of sowing. The irrigation and all other operations were performed as per recommendation for the crop. The data on various growth, yield attributes and yield were recorded in different treatments.

**Table 1.** Effect of integrated nutrient management on growth and yield of Fenugreek cv. AFG-3

Treatments	Plant height (cm)	Number of branches plant <sup>-1</sup>	Number of pods plant <sup>-1</sup>	Pod length (cm)	No. of seeds pod <sup>-1</sup>	Test weight (g)	Grain yield (q ha <sup>-1</sup> )	Stover yield (qha <sup>-1</sup> )
T <sub>1</sub>	59.50	4.50	22.20	7.7	14.5	10.5	12.17	23.39
T <sub>2</sub>	66.40	5.07	25.53	8.0	15.1	11.3	15.67	29.60
T <sub>3</sub>	70.40	5.40	27.53	8.2	15.9	11.8	17.42	33.41
T <sub>4</sub>	75.80	5.60	31.40	8.9	16.8	13.5	19.57	38.55
T <sub>5</sub>	71.80	5.40	29.53	8.5	16.0	13.1	18.00	34.48
T <sub>6</sub>	77.90	5.67	32.93	9.0	17.3	13.6	19.85	38.12
T <sub>7</sub>	73.20	5.40	29.93	8.7	16.3	13.2	18.85	35.51
T <sub>8</sub>	78.10	6.20	33.27	9.6	17.7	13.9	20.96	39.50
SEm±	2.60	0.293	0.666	0.08	0.127	0.21	0.626	1.18
CD	7.87	0.89	2.02	0.24	0.38	0.62	1.90	3.59

Note: T<sub>1</sub> = control, T<sub>2</sub> = 50% RDF, T<sub>3</sub> = 75% RDF, T<sub>4</sub> = 100% RDF, T<sub>5</sub> = 50% RDF + vermicompost @ 2t ha<sup>-1</sup>, T<sub>6</sub> = 75% RDF + vermicompost @ 2t ha<sup>-1</sup>, T<sub>7</sub> = 50% RDF + vermicompost @ 2t ha<sup>-1</sup> + biofertilizer @ 5 kg ha<sup>-1</sup>, T<sub>8</sub> = 75% RDF + vermicompost @ 2t ha<sup>-1</sup> + biofertilizer @ 5 kg ha<sup>-1</sup>.

\* RDF:-20 kg ha<sup>-1</sup> nitrogen and 40 kg ha<sup>-1</sup> phosphorus

### Results and Discussion

#### Growth attributes

The data of growth and yield attributes have been presented in tabular form for the convenient of presentations. Plant height and branches plant-1 are an important growth parameter of plant which is an expression of vegetative growth that directly linked with

grain and stover yield. Data of plant height at harvest of the crop revealed that among all the treatments, T<sub>8</sub> was found significantly superior (Table 1). At the time of harvest of fenugreek, maximum plant height was recorded under treatment (T<sub>8</sub>) 75% RDF + vermicompost @ 2t ha<sup>-1</sup> + Rhizobium+PSB @ 5 kg ha<sup>-1</sup> (78.10 cm) which was at par with treatment (T<sub>6</sub>) 75%

RDF + vermicompost @ 2t ha<sup>-1</sup> (77.90 cm) and T<sub>4</sub> (75.80 cm) over control (59.53 cm). The higher plant height may be attributed due to rapid mineralization. The combined application of inorganic and organic source of nutrients along with soil application of biofertilizer ensured ready availability nutrient throughout crop growing season. Moreover, organics and biofertilizers, have solubilizing effect on native soil nutrients due to the action of organic acids produced during decomposition and resulted in higher growth attributes. The beneficial effect of integrated organic and inorganic sources of nutrients on growth parameters was also reported by Shivran *et al.*, (2016).

### **Yield attributes**

The yield attributes of fenugreek were strongly influenced due to chemical fertilizer alone and combined use of inorganic, organic sources along with biofertilizers and indicated significant difference with respect to number of pods plant<sup>-1</sup>, pod length (cm) number of seeds pod<sup>-1</sup> and test weight and recorded significantly higher values over control during experimentation. The application of 75% RDF + vermicompost @ 2t ha<sup>-1</sup> + biofertilizer @ 5 kg ha<sup>-1</sup> was found superior over sole application 100% RDF through inorganic source without biofertilizer inoculation or over control. Application of 75% RDF + vermicompost @ 2t ha<sup>-1</sup> + biofertilizer @ 5 kg ha<sup>-1</sup> recorded highest pods/plant (33.27), pod length (9.6 cm), seeds pod<sup>-1</sup> (17.7) and test weight (13.9 g) during the field experimentation. It was closely followed by application of 75% RDF + vermicompost @ 2t ha<sup>-1</sup> (treatment T<sub>6</sub>). The prevalence of organic and inorganic source of nutrient combinations could be ascribed to increase in amount of yield parameters. Supply of nutrient through organic and inorganic sources promotes flowering and fruiting and its subsequent partitioning in the sink. The results corroborate with those of Shivran *et al.*, (2016).

### **Seed and stover yields**

The yields were significantly improved by application of inorganic fertilizer alone or in combination with vermicompost and biofertilizer over the control (Table 1). The highest seed (20.96 qt ha<sup>-1</sup>) and stover (39.50 qt ha<sup>-1</sup>) were obtained with conjunctive use of 75% RDF + vermicompost @ 2t ha<sup>-1</sup> + Rhizobium + PSB @ 5 kg ha<sup>-1</sup> which was comparable with 75% RDF + vermicompost @ 2t ha<sup>-1</sup>. The positive response to combined application of inorganic fertilizers and compost might be attributed to the better nutrient availability and its favourable effect on soil physical and biological properties resulting in

increased yield attributes and finally higher yield (Kalasare *et al.*, 2016; Parewa and Yadav, 2018). The results on yield thus confirmed the trend observed earlier worker in the yield attributing characters and upheld the need of supplementing the RDF through inorganic with organic. The results further emphasized the utter need for organic manuring along with chemical fertilizers. The higher yield may be due to fact that integration of chemical fertilizer, organic nutrient sources and biofertilizer enhances direct nutrients availability to the plant and improved soil fertility (Parewa *et al.*, 2014).

### **Conclusion**

Based on the study of present experiment, the results inferred that integrated application of chemical fertilizer, vermicompost and biofertilizers not only reduces the fertilizer requirement and cost of crop production but also significantly improved yield and yield components of fenugreek.

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