Fertilizers Effects on Growth and Yield Components of Fenugreek Vegetable (Trigonella Foenum-Graecum L.) in a Field Trial

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Abstract

A field experiment was carried out to study the effects of organic and chemical fertilizer on growth and yield of Fenugreek (Trigonella foenum-graecum) in outdoor nursery of School of Earth Sciences, Solapur University, agricultural farm in district of Solapur, Maharashtra. The experiment was laid out in randomized block design with five treatments and three replications. Plot size 2m x 1m (2m2) was used for this experiment. Fenugreek local seeds were treated with different fertilizer treatments in field including vermicompost (T1) @ 0.6 kg/plot (@ 0.3 kg/sq. m), NADEP compost (T2) @1.25 kg/plot (@ 0.625 kg/sq. m), pit compost (T3) @ 1.25 kg/plot (@ 0.625 kg/sq. m), chemical fertilizer (T4) @ 80:40:40 Kg of NPK/ha according to RDF and control (T5). The results showed that the growth parameters viz., plant height (28.75cm), fresh and dry weight per plant were improved after 60th day with application of vermicompost treatment (T1). Number of pods per plant (2.66) were higher in control treatment (T5). Total weight of pods per plant (0.78 gm/plant) and mean weight per pods per plant (0.3 gm/pod/plant) was more with application of straight chemical fertilizers (T4). Application of chemical fertilizer is better and sustainable for higher yield of Fenugreek vegetable per plot than the other remaining fertilizer treatments.

Keywords: Field, Fenugreek (Trigonella foenum-graecum), growth, organic and chemical fertilizers, yield

I. INTRODUCTION

Fenugreek (Trigonella foenum-graecum) belonging to the family Leguminosae. It is an important minor spice regularly grown for its seeds and leaves. Seeds of Fenugreek (Trigonella foenum-graecum) are used as a condiment for flavouring of foods regularly and leaves are used as vegetable. It has medicinal value in our daily life. Therefore it is used for treatment of flatulence, dysentery, diarrhoea, enlargement of liver and spleen, rickets and diabetes. [1]. Fertilizers are an essential agricultural inputs to increase the crop yield. It is essential to apply the fertilizers according to the requirement of crops. Otherwise, it is not possible to grow the good growth, quality and optimum yield of the crop. Main goal of sustainable agriculture in present days is to maintain the production at the level essential to meet the increasing aspiration of expanding country population without degrading the quality of the environment [2]. In a field trial of research farm, Godara et al (2012) observed significant increase in Fenugreek (Trigonela-foenium-graecum) growth and yield parameters through application of chemical fertilizers as compared with organic manures such as vermicompost and poultry manures [3]. Anita et al (2015) while working on Fenugreek (Tringilla foenium-graecum) reported that there was no difference in treatment combinations of inorganic and organic manures in her seedling growth study. Quality parameters reached to maximum in 50% inorganic fertilizers, 50% organic manure and biofertilizers inoculation [4]. Ghadage and Jadhav (2013) showed that chlorophyll a, total chlorophyll, β-carotene and ascorbic acid contents were highest in dry leaf manure treated plots followed by vermicompost, whereas chlorophyll b was more in vermicompost application followed by dry leaf manure [5]. Meena et al (2015) reported that plant height, number of branches, number of pods, days to flowering, days to germination, length, yield per plant and days to maturity of Fenugreek (Trigonella foenium-graecum) were maximum with 50% recommended dose of NPK through chemical fertilizers and 50% Rhizobium biofertilizers, minimum was noted in control [6]. Vermicompost has considerable impact on physical, chemical and biological soil properties. As compared to other organic fertilizers it has a higher rate of major element contents. Vermicompost contains nitrogen, phosphorous, potassium, iron copper, zinc and manganese which have critical roles in plant life growth and their activities [7]. Excessive use chemical fertilizers can have adverse effect on human life and the overall environment. Therefore, use of organic fertilizers is one of the best solution for healthy environment with sustainable agricultural productivity [8]. The purpose of this study was to evaluate the effects of organic and chemical fertilizers on growth and yield components of Fenugreek (Trigonella foenium-graecum L) vegetables in the field.
II. MATERIALS AND METHODS

The test crop selected for present research work was Fenugreek (Trigonella foenum-graecum). The experiment was laid out in randomized block design with five treatments and three replications. The variety of fenugreek used as local. The treatments were compost from vermicompost (T1), NADEP method of composting (T2), pit composting method (T3), chemical fertilizers was applied in the proportion 80:40:40 Kg of NPK/ha according to recommended dose of fertilizers as T4 and control (T5). Plot size used for the experiment was 2m x 1m (2m²). The seeds were sown manually such as keeping spacing between two rows was 10cm, i.e., near about 2000 plants were cultivated per plot. Drip irrigation system was used in entire study field. Vermicompost was applied at the rate of @ 0.6 kg/plot (@ 0.3 kg/sq. m) to the plots. A common dose of NADEP and pit compost was used at same rate @ 1.25 kg/plot (@ 0.625 kg/sq. m) as per usual practice of farmers. Straight chemical fertilizers (urea-34.72gm + single super phosphate –50gm + murate of potash –13.28gm) combinally used in Treatment T4 having plot size 2m x 1m. Organic fertilizers were applied to plot before one of sowing and chemical fertilizers was applied afterward 15 days of sowing. The experimental view is presented in photo plate 1.

A. Experimental details and cultivation practice for fenugreek (Trigonella foenum-graecum) vegetable was discussed below,

- Botanical name: Trigonella foenum-graecum L.
- Variety: Local
- Experiment: Field experiment
- Design: Randomized block design
- Plot size: 2m X 1m (2m²)
- Crop population per plot: 2000
- Treatment details:
  - T1 - Vermicompost prepared from agricultural solid waste (ASW) @ 3 t/h, [3].
  - T2 - NADEP compost prepared from agricultural solid waste (ASW) @ 6.25 t/ha, [9].
  - T3 - Pit compost prepared from Municipal solid waste (MSW) @ 6.25 t/ha, [9].
  - T4 - Chemical fertilizer- 80:40:40- N: P₂O₅: K₂O Kg/ha, [10].
  - T5 –Control (Soil without fertilizer)
- Quantity of fertilizers used according treatment details in plot size 2m X 1m.
  - T1 @ 0.6 kg/plot (@ 0.3 kg/sq. m)
  - T2 @ 1.25 kg/plot (@ 0.625 kg/sq. m)
  - T3 @ 1.25 kg/plot (@ 0.625 kg/sq. m)
  - T4 According to Recommended Dose of Fertilizer (urea-34.72gm+single super phosphate-50gm+murate of potash-13.28gm)
  - T5 –Control (Soil without fertilizer).

Data of growth and yield of Fenugreek (Trigonella foenum-graecum) characters were taken from 50 tagged plants. Observations were recorded after 30th and 60th day on different parameters, viz., plant height (cm) and number of leaves/plant, number of pods/plant, mean pod weight/plant (gm/plant), total weight of pods/plant (gm/plant) fresh and dry weight (gm/plant), yield (Kg)/plot.

Fig. 1: General view of experimental plot of Fenugreek (Trigonella foenum-graecum) vegetable.
III. RESULT AND DISCUSSION

Results obtained in present investigation are discussed below.
All the all values of nutrients found after their analysis in laboratory using known standard methods for prepared organic fertilizers and experimental soil are represented in table 1.

Table – 1
Soil and organic fertilizers characteristics.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Soil</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>08.11</td>
<td>8.07</td>
<td>7.66</td>
<td>7.16</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>8.09</td>
<td>30.21</td>
<td>18.35</td>
<td>05.36</td>
</tr>
<tr>
<td>Org. matter (%)</td>
<td>1.00</td>
<td>16.43</td>
<td>11.76</td>
<td>11.31</td>
</tr>
<tr>
<td>N (%)</td>
<td>0.35</td>
<td>1.02</td>
<td>0.93</td>
<td>0.78</td>
</tr>
<tr>
<td>P (%)</td>
<td>0.26</td>
<td>1.51</td>
<td>1.07</td>
<td>0.18</td>
</tr>
<tr>
<td>K (%)</td>
<td>0.16</td>
<td>1.06</td>
<td>1.92</td>
<td>0.89</td>
</tr>
</tbody>
</table>

T1 indicates vermicompost, T2 indicates NADEP compost and T3 indicates Pit compost.

Table – 2
Effects of fertilizers treatment on fenugreek (Trigonella foenum-graecum) after 30th days.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Mean plant height (cm)</th>
<th>Mean No. of leaves/plant</th>
<th>Mean fresh weight (gm/plant)</th>
<th>Mean dry weight (gm/plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>16.39 (±1.36)</td>
<td>25.14 (±5.12)</td>
<td>2.09 (±1.33)</td>
<td>0.18 (±0.05)</td>
</tr>
<tr>
<td>T2</td>
<td>18.78 (±1.56)</td>
<td>24.66 (±6.84)</td>
<td>1.56 (±1.56)</td>
<td>0.19 (±0.06)</td>
</tr>
<tr>
<td>T3</td>
<td>18.03 (±2.35)</td>
<td>24.85 (±3.83)</td>
<td>1.63 (±0.73)</td>
<td>0.18 (±0.06)</td>
</tr>
<tr>
<td>T4</td>
<td>15.58 (±15.58)</td>
<td>21.85 (±6.74)</td>
<td>1.11 (±1.11)</td>
<td>0.13 (±0.07)</td>
</tr>
<tr>
<td>T5</td>
<td>16.57 (±16.57)</td>
<td>23.42 (±5.39)</td>
<td>1.35 (±0.40)</td>
<td>0.17 (±0.06)</td>
</tr>
</tbody>
</table>

T1 indicate vermicompost, T2 indicate NADEP compost, T3 indicate pit compost, T4 indicate chemical fertilizers and, T5 indicate control.

A. Plant height (cm) after 30th day:
Average plant height (cm) in the treatments T1, T2, T3, T4 and T5 were found to be 16.39cm, 18.78gm, 18.03, 15.58gm and 16.57gm respectively. Plant height of Fenugreek was maximum at 30th day in treatment T2 (18.78cm) then followed by treatment (T3) and lower in T3 (18.03 cm) and minimum in T5 (15.58 cm).

B. Number of leaves per plant after 30th day:
Average number of leaves per plant in the treatments T1, T2, T3, T4 and T5 were found to be 25.14, 24.66, 24.85, 21.85 and 23.42 respectively. Number of leaves per plant was more in treatment (T1) compared to remaining fertilizers treatment.

C. Fresh and dry weight (gm/plant): after 30th day:
The results of the experiment after 30th days shows that fresh weight per plant (2.09gm) was maximum with application of vermicompost (T1) at @ 0.6 kg/plot (@ 0.3 kg/sq. m) per plot. Average fresh weight (gm) in the treatments T1, T2, T3, T4 and T5 were found to be 2.09gm, 1.56gm, 4.63gm, 1.11gm and 1.35 respectively. Mean dry weight (gm/plant) (2.09gm) was maximum with application of nadep organic fertilizer (T2) compared to remaining fertilizer treatments after 30th day.

Table – 3
Effects of fertilizers treatment on fenugreek (Trigonella foenum-graecum) after 60th days.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Mean plant height (cm)</th>
<th>Mean No. of pods/plant</th>
<th>Mean weight of pods/plant (gm/plant)</th>
<th>Mean total weight of pods/plant (gm/plant)</th>
<th>Mean fresh weight of plant (gm/plant)</th>
<th>Mean dry weight of plant (gm/plant)</th>
<th>Yield (Kg/plot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>28.75 (±3.69)</td>
<td>2.66 (±0.47)</td>
<td>0.20 (±0.07)</td>
<td>0.73 (±0.55)</td>
<td>4.88 (±0.50)</td>
<td>1.06 (±0.23)</td>
<td>1.653</td>
</tr>
<tr>
<td>T2</td>
<td>28.69 (±4.32)</td>
<td>2.57 (±0.72)</td>
<td>0.16 (±0.09)</td>
<td>0.43 (±0.25)</td>
<td>3.24 (±0.91)</td>
<td>0.76 (±0.31)</td>
<td>0.969</td>
</tr>
<tr>
<td>T3</td>
<td>28.51 (±2.37)</td>
<td>2.28 (±0.88)</td>
<td>0.24 (±0.11)</td>
<td>0.62 (±0.42)</td>
<td>3.18 (±1.21)</td>
<td>0.69 (±0.25)</td>
<td>1.044</td>
</tr>
<tr>
<td>T4</td>
<td>25.18 (±2.83)</td>
<td>2.42 (±2.42)</td>
<td>0.30 (±0.07)</td>
<td>0.78 (±0.43)</td>
<td>2.92 (±1.26)</td>
<td>0.61 (±0.24)</td>
<td>1.862</td>
</tr>
<tr>
<td>T5</td>
<td>23.66 (±3.79)</td>
<td>3.20 (±1.6)</td>
<td>0.21 (±0.05)</td>
<td>0.55 (±0.49)</td>
<td>3.54 (±1.57)</td>
<td>0.83 (±0.46)</td>
<td>0.874</td>
</tr>
</tbody>
</table>

T1 indicate vermicompost, T2 indicate NADEP compost, T3 indicate pit compost, T4 indicate chemical fertilizers and T5 indicate control.

The data (Table 3) revealed that different organic fertilizers and chemical fertilizers treatments significantly influenced by growth components of Fenugreek. To evaluate the effects of treatments, observations were done at 60th days and were discussed bellow

D. Plant height (cm):
From Table 3, Average plant height (cm) in the treatments T1, T2, T3, T4 and T5 were found to be 28.75cm, 28.69gm, 28.51cm, 25.18 cm and 25.66cm respectively. Plant height of Fenugreek was maximum at 60th day in treatment T1 (28.75cm) followed by other organic treatment and lower in T2 (28.69 cm) and minimum in T4 (25.18 cm).
E. No. of pods/plant:
Average number of pods plant in the treatments T$_1$, T$_2$, T$_3$, T$_4$ and T$_5$ were found to be 2.66, 2.57, 2.28, 2.42 and 3.20 respectively. Maximum mean no. of pods/plant (3.20) was noticed in treatment (T$_5$) then followed by treatment (T$_1$) and lower in T$_3$ (2.28) and minimum in T$_2$ (2.57).

F. Mean fresh weight of pods/plant (gm/plant):
Maximum mean fresh weight of pods/plant (0.30gm/plant) was recorded with application of straight chemical fertilizers (T$_4$).

G. Total fresh weight of pods/plant (gm/plant):
Total mean fresh weight of pods per plant (0.78 gm/plant) was more with application of straight chemical fertilizers.

H. Fresh weight of plant (gm/plant) and dry weight of plant (gm/plant):
Vermicompost organic fertilizers sources produced significantly higher mean fresh weight of plant and dry weight per plant over control. Maximum mean fresh weight of plant (4.88gm/plant) and mean dry weight of plant (1.06gm/plant) were recorded respectively with application of vermicompost @ 0.6 kg/plot (@ 0.3 kg/sq. m).

I. Yield /plot:
Application of chemical fertilizer is better sustainable for higher yield of Fenugreek vegetable per plot than other remaining fertilizers treatments. Maximum yield of Fenugreek vegetable (1.862kg/plot) was recorded with application of chemical fertilizers (T$_4$) then followed by Vermicompost treatment (T$_1$) and minimum in treatment (T$_2$) and lower in treatment (T$_5$).

IV. CONCLUSION

Based on result it is concluded that morphological characteristics such as plant height, fresh and dry weight of Fenugreek plant were better with the application of vermicompost but use of straight chemical fertilizer showed highest yield components of Fenugreek vegetables as compared to other fertilizer treatments.

REFERENCES