Influence of integrated nutrient management on growth, yield and quality of Kasuri Methi (*Trigonella corniculata* L.) under hill zone of Karnataka

B. B. Sunanda¹, G. R. Shetty² and J. Venkatesh³

¹²College of Horticulture, Mudigere, UAHS Shimoga
Department of Plantation, Spices, Medicinal and Aromatic Crops
³Directorate of Research, UHS, Bagalkot

Abstract

An experiment was conducted during winter season of 2013-14 at Zonal Agricultural and Horticultural Research Station Mudigere, Chikmagalur to assess the influence of integrated nutrient management on growth and physiological attributes of kasuri methi (*Trigonella corniculata* L.) under hill zone of Karnataka. Growth parameters differed significantly at all the stages of crop growth. At 90 Days After Sowing (DAS) and at harvest, maximum plant height (42.81 & 45.64 cm), number of leaves (58.89 & 86.05), number of branches (23.51 & 25.64) were recorded in the treatment supplied with 75% Nitrogen+ Recommended Dose of Phosphorus and Potassium +Farm Yard Manure (7.5 t ha⁻¹) + *Rhizobium* (1.5t ha⁻¹)+ Azospirillum (5 kg ha⁻¹)+ Phosphate Solubilizing Bacteria (5 kg ha⁻¹). Maximum leaf area (414.27 cm²), leaf area index (1.38), chlorophyll content (21.44 mg/100 mg of tissue), Absolute Growth Rate (0.26 g/day), Cumulative Growth Rate (9.23 g/m²/day), dry herb yield (1.88 t/ha), fresh herb yield (8.02 t/ha), No. of pods plant⁻¹ (620.17), Pod length (2.14cm) and quality attributes like crude protein in herb (13.31 %) and in seed (21.33 %) were recorded in the same treatment. This was followed by the treatment supplied with 50% Nitrogen+ Recommended Dose of Phosphorus and Potassium +Farm Yard Manure (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + Azospirillum (5 kg ha⁻¹) + Phosphate Solubilizing Bacteria (5 kg ha⁻¹). It was observed that integrated nutrient management significantly helped to improve growth, yield and quality of kasuri methi.

Key words: Biofertilizers, inorganic fertilizers, kasuri methi organic manures.

Introduction

Kasuri methi (*Trigonella corniculata* L.) is an herbaceous, bushy, slow growing annual spice crop mainly grown for herbage green as well as dry herb. Dried leaves are used as a spice to add aroma and flavour to the food products. It is an important herb spice crop grown as winter season crop of plains of north India. It is rich source of proteins and minerals especially iron, calcium and vitamins. Being a leguminous crop, kasuri methi is highly responsive to nitrogenous fertilizer application especially in early stages. Combination effect of organic manures and nitrogen fixing biofertilizers and phosphate solubilizing bacteria helps to increase the nitrogen availability. Balanced or integrated nutrient management which enhances the synthesis of the carbohydrates, phytohormones and even biofertilizers also promote maximum growth of crop and build up organic status of the soil that also increases the availability of other nutrients. Keeping all these points in view the present study was carried out.

Material and methods

The experiment was conducted at farm field of Zonal Agricultural and Horticultural Research station Mudigere during 2013-14. In this study inorganic fertilizers, organic manures and biofertilizers consisting of twelve treatment combinations were tried in the Randomized Block Design with three replications. Treatments were as follows

- **T₁**: RD NPK (80:25:50 kg ha⁻¹) + RD FYM (7.5t ha⁻¹)
- **T₂**: RD NPK + Vermicompost (4t ha⁻¹)
- **T₃**: 75% N + RD PK+ FYM (7.5t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹)
- **T₄**: 75% N+RD PK+ Vermicompost (4t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹)
- **T₅**: 75% N+ RD PK +FYM (7.5t ha⁻¹) + Azospirillum (5 kg ha⁻¹) + PSB (5 kg ha⁻¹)
- **T₆**: 75% N+ RD PK +Vermicompost (4t ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹)
- **T₇**: 75% N+ RD PK +FYM (7.5t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* + PSB (5 kg ha⁻¹)

*Corresponding author e-mail: rrshetty2059@gmail.com*
The seed rate of 18-20 Kg ha⁻¹

The seeds of the variety Pusa Kasuri were used with the

Provision was made for bunds and irrigation channels.

black musli, (Joy et al., 7).

The seeds of the variety Pusa Kasuri were used with the

Provision was made for bunds and irrigation channels.

physiological condition by increasing its capacity to absorb

uptake in the soil. The growth promoting effect of FYM as

enhances the nitrogen and phosphate availability and

biofertilizers and phosphate solubalizing bacterias which

(5 kg ha⁻¹)

The experimental plot was ploughed thrice by tractor
drawn cultivator and leveled well. The clods were

were removed to fine tilt. The land

was divided into plots of required size (2.9 m² x 2.1 m²).

 Provision was made for bunds and irrigation channels.

The seeds of the variety Pusa Kasuri were used with the

seed rate of 18-20 Kg ha⁻¹. It is an early bearing and high

yielding variety. Seeds were sown with a spacing of 30x10

cm. Furrows were properly covered with a thin layer of

and the plots were irrigated lightly. Excess seedlings

were thinned out at 30 days after sowing, to maintain the

10 cm distance between the plants. The plots were kept

free from weeds by hand weeding at 15, 30, 45, 70 and 95
days after sowing. Irrigation was given at an interval of

4-5 days during the whole cropping period depending on

the soil moisture conditions. About 18-20 irrigations were
given. In order to evaluate the effect of different treatments
on growth, yield and quality of crop under hill zone of

Karnataka, necessary periodical observations were

recorded.

Results and discussion

Effect on growth attributes

The performance of Kasuri methi was better under

combination of organic and inorganic fertilizers. All the

treatments influenced the growth attributes of kasuri methi

appreciably (Table 1 and Table 2.). At 90 DAS and at

harvest, maximum plant height (42.81 & 45.64 cm),

number of leaves (58.89 & 86.05), number of branches

(23.51 & 25.64) respectively, were recorded in the
treatment supplied with 75% N+ RD PK +FYM (7.5t ha⁻¹)+

Azospirillum (5 kg ha⁻¹)+ PSB (5 kg ha⁻¹)

Increase in the growth might be due to the

combined effect of organic manures FYM, nitrogen fixing

biofertilizers and phosphate solubalizing bacterias which

enhances the nitrogen and phosphate availability and

uptake in the soil. The growth promoting effect of FYM as

a source of plant nutrients and humus improved the soil

physiological condition by increasing its capacity to absorb

and store water, improving aeration and favouring beneficial

microbial activity in ground nut (Choudhary et al. 2) and in

black musli, (Joy et al., 7).

Maximum leaf area (414.27 cm²), leaf area index (1.38),
chlorophyll content (21.44 mg/100 mg of tissue), AGR
(0.26 g/day), CGR (9.23 g/m²/day) were also recorded in
the same tratment. This could be due to production of
more number of leaves and branches which enhanced
availability of nutrients at the appropriate time thus
increased leaf area and leaf area index. These results are
in accordance with the findings of Khiriya et al.(9),
Manjunatha et al. (12) in patchouli, Mehta et al. (14) in
fenugreek, Singh et al. (16) in kasuri methi. More
chlorophyll content in leaves might be due to the major
and micronutrients supplied by the organic manure,
inorganic fertilizers and biofertilizers which would retard
leaf senescence and improve the photosynthates
assimilation. Similarly also increases nitrogen availability
for seed biomass. Beneficial effects of balanced nutrients
helped in increasing the dry matter production at different
stages of crop growth. The similar results were obtained
by Ali et al. (1) in fenugreek and S. Kumar et al. (11) in
coriander.

Yield and quality

Highest fresh herb yield (1.88 t/ha), dry herb yield
(1.13 t/ha), number of pods plant⁻¹ (620.17), pod length
(2.14 cm), seed yield (465.31kg/ha), crude protein content
in herb (13.31%), Crude protein content in seed (21.33%) were
recorded in the treatment T₇, which consisting of 75% N+
RD PK + FYM (7.5t ha⁻¹) + Rhizobium (1.5 kg ha⁻¹)+
Azospirillum (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) and followed by
the treatment T₈ consist of 50% N+ RD PK + FYM (7.5t
ha⁻¹) + Rhizobium (1.5 kg ha⁻¹) + Azospirillum (5 kg ha⁻¹) +
PSB (5 kg ha⁻¹). Increased fresh herb yield and dry herb
yield could be attributed to better vegetative growth interms
of plant height, number of branches and plant spread due
to the application of balanced nutrients in integrated
sources which promotes better photosynthetic activity
resulted in increased carbohydrate synthesis and better
plant growth. Similar results were obtained by Mehta
et al. (14), Choudhary et al. (2) in fenugreek. Increased
no. of pods plant⁻¹, pod length and seed yield could be due
to significant increase in the number of branches, plant
height, number of leaves, pods per plant and pod length and
also integrated nutrient management provided basic
source for yield attributes and seed yield is an output of
sequential metamorphosis from the chain of source to
sink relationship. It was also related to INM practice which
improved soil physical, chemical and biological properties,
resulting in higher fertilizer use efficiency. Dutta et al. (3),
Patel et al. (15), Choudhary et al. (2), Jat and Ahlawat (6),
Mehta et al. (14), (Mehta et al., 13), (Mukesh kumar et
al., 10). Maximum days taken for 1st and 50 % of flowering
was recorded in the treatment T₉, which might be due to
the slow and prolonged availability of major and
micronutrients and growth promoting hormones, released
by organic manures biofertilizers and primary nutrient

T₈: 50% N+ RD PK + FYM (7.5t ha⁻¹) + Rhizobium
(1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹)

T₉: 50% N+ RD PK + Vermicompost (4t ha⁻¹) +
Rhizobium (1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹)

T₁₀: 50% N+ RD PK +FYM (7.5t ha⁻¹) + Azospirillum
(5 kg ha⁻¹) + PSB (5 kg ha⁻¹)

T₁₁: 50% N+ RD PK + Vermicompost (4t ha⁻¹)
+ Azospirillum (5 kg ha⁻¹) + PSB (5 kg ha⁻¹)

T₁₂: 50% N+ RD PK + FYM (7.5t ha⁻¹) + Rhizobium
(1.5kg ha⁻¹) + Azospirillum (5kg ha⁻¹) + PSB
(5 kg ha⁻¹)
nitrogen, which may have positive influence on vegetative growth. Similar results were reported by Kalidasu et al. (8) in coriander. Maximum crude protein content in seed (21.33%) and herb (13.31%) in the same treatment might be due to the supplementary application of FYM, vermicompost and N fixing biofertilizers which supply the available nitrogen throughout the cropping period and resulting in better uptake and assimilation of crude protein in herb and seed. The results are in conformity with Deora et.al. (4), Pramod Kumar Dubey et al. (5) in fenugreek.

**Conclusion**

The nutrients play an important role in the crop production but under intensive cultivation use of chemical fertilizers alone for long period could result in deterioration of soil fertility and quality of produce. The use of organic manure in combination with inorganic fertilizers and biofertilizers helps in balancing soil fertility, environment and reduce the cost of inputs was reported by several workers. In view of better quality, sustainable yield, returns and to maintain the soil fertility status, kasuri methi grown by adopting INM practices was quite beneficial.

**Table 1**: Influence of integrated nutrient management on growth attributes of Kasuri Methi (Trigonella corniculata L.).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant height (cm)</th>
<th>No. of leaves plant⁻¹</th>
<th>No. of branches plant⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 DAS</td>
<td>60 DAS</td>
<td>90 DAS</td>
</tr>
<tr>
<td>T₁</td>
<td>5.36</td>
<td>25.13</td>
<td>41.59</td>
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<td>T₂</td>
<td>3.90</td>
<td>19.77</td>
<td>34.25</td>
</tr>
<tr>
<td>T₃</td>
<td>5.33</td>
<td>24.20</td>
<td>41.11</td>
</tr>
<tr>
<td>T₄</td>
<td>5.04</td>
<td>23.55</td>
<td>39.06</td>
</tr>
<tr>
<td>T₅</td>
<td>4.97</td>
<td>23.16</td>
<td>36.18</td>
</tr>
<tr>
<td>T₆</td>
<td>5.29</td>
<td>22.90</td>
<td>38.51</td>
</tr>
<tr>
<td>T₇</td>
<td>5.11</td>
<td>27.26</td>
<td>42.81</td>
</tr>
<tr>
<td>T₈</td>
<td>4.47</td>
<td>20.53</td>
<td>34.63</td>
</tr>
<tr>
<td>T₉</td>
<td>5.06</td>
<td>21.21</td>
<td>34.74</td>
</tr>
<tr>
<td>T₁₀</td>
<td>4.70</td>
<td>21.51</td>
<td>35.09</td>
</tr>
<tr>
<td>T₁₁</td>
<td>4.94</td>
<td>23.24</td>
<td>38.63</td>
</tr>
<tr>
<td>T₁₂</td>
<td>5.35</td>
<td>25.50</td>
<td>41.92</td>
</tr>
<tr>
<td>F-test</td>
<td>*</td>
<td>NS</td>
<td>* *</td>
</tr>
<tr>
<td>S. Em ±</td>
<td>0.23</td>
<td>1.54</td>
<td>1.75</td>
</tr>
<tr>
<td>C.D. @ 5%</td>
<td>0.68</td>
<td>4.51</td>
<td>5.12</td>
</tr>
</tbody>
</table>
Table 2: Influence of integrated nutrient management on physiological attributes of Kasuri Methi (Trigonella corniculata L.).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total dry matter (g/plant)</th>
<th>AGR (g/day)</th>
<th>CGR (g/m²/day)</th>
<th>Leaf area (cm²) 60 DAS</th>
<th>Leaf area index 60 DAS</th>
<th>Chlorophyll contents (mg/100 mg of tissue at 60 DAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 DAS</td>
<td>60 DAS</td>
<td>90 DAS</td>
<td>30-60 DAS</td>
<td>60-90 DAS</td>
<td>30-60 DAS</td>
</tr>
<tr>
<td>T1</td>
<td>0.58</td>
<td>6.50</td>
<td>13.58</td>
<td>0.20</td>
<td>0.25</td>
<td>6.58</td>
</tr>
<tr>
<td>T2</td>
<td>0.48</td>
<td>5.13</td>
<td>9.42</td>
<td>0.14</td>
<td>0.15</td>
<td>4.77</td>
</tr>
<tr>
<td>T3</td>
<td>0.61</td>
<td>6.41</td>
<td>13.36</td>
<td>0.19</td>
<td>0.23</td>
<td>6.44</td>
</tr>
<tr>
<td>T4</td>
<td>0.56</td>
<td>6.12</td>
<td>13.25</td>
<td>0.19</td>
<td>0.22</td>
<td>6.17</td>
</tr>
<tr>
<td>T5</td>
<td>0.51</td>
<td>5.86</td>
<td>12.30</td>
<td>0.18</td>
<td>0.21</td>
<td>5.94</td>
</tr>
<tr>
<td>T6</td>
<td>0.55</td>
<td>6.10</td>
<td>12.41</td>
<td>0.18</td>
<td>0.21</td>
<td>6.17</td>
</tr>
<tr>
<td>T7</td>
<td>0.76</td>
<td>7.14</td>
<td>15.45</td>
<td>0.21</td>
<td>0.26</td>
<td>7.09</td>
</tr>
<tr>
<td>T8</td>
<td>0.51</td>
<td>5.39</td>
<td>11.15</td>
<td>0.16</td>
<td>0.19</td>
<td>5.42</td>
</tr>
<tr>
<td>T9</td>
<td>0.54</td>
<td>5.59</td>
<td>11.27</td>
<td>0.17</td>
<td>0.19</td>
<td>5.61</td>
</tr>
<tr>
<td>T10</td>
<td>0.50</td>
<td>5.75</td>
<td>12.02</td>
<td>0.17</td>
<td>0.21</td>
<td>5.83</td>
</tr>
<tr>
<td>T11</td>
<td>0.56</td>
<td>6.36</td>
<td>13.36</td>
<td>0.19</td>
<td>0.23</td>
<td>6.45</td>
</tr>
<tr>
<td>T12</td>
<td>0.65</td>
<td>6.63</td>
<td>13.92</td>
<td>0.20</td>
<td>0.25</td>
<td>6.65</td>
</tr>
</tbody>
</table>

**F-test** * * * * * * * * * *

**S. Em ±**

|          | 0.02 | 0.20 | 0.25 | 0.01 | 0.01 | 0.33 | 0.38 | 6.95 | 0.01 | 0.35 |

**C.D. @ 5%**

|          | 0.09 | 0.85 | 1.00 | 0.03 | 0.04 | 0.96 | 1.13 | 20.37 | 0.07 | 1.03 |

References


### Table 3. Effect of integrated nutrient management on yield attributes of kasuri methi (*Trigonella corniculata* L.)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of days taken to flowering initiation</th>
<th>Number of days taken for 50% of flowering</th>
<th>Fresh herb yield (kg/plot)</th>
<th>Fresh herb yield (t/ha)</th>
<th>Dry herb yield (kg/plot)</th>
<th>Dry herb yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>55.13</td>
<td>82.32</td>
<td>4.70</td>
<td>7.83</td>
<td>0.99</td>
<td>1.64</td>
</tr>
<tr>
<td>T2</td>
<td>46.25</td>
<td>71.06</td>
<td>3.94</td>
<td>6.56</td>
<td>0.77</td>
<td>1.28</td>
</tr>
<tr>
<td>T3</td>
<td>55.62</td>
<td>82.07</td>
<td>4.78</td>
<td>7.95</td>
<td>0.97</td>
<td>1.62</td>
</tr>
<tr>
<td>T4</td>
<td>51.3</td>
<td>80.07</td>
<td>4.68</td>
<td>7.79</td>
<td>0.83</td>
<td>1.54</td>
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<tr>
<td>T5</td>
<td>49.03</td>
<td>75.11</td>
<td>4.32</td>
<td>7.20</td>
<td>0.88</td>
<td>1.47</td>
</tr>
<tr>
<td>T6</td>
<td>52.38</td>
<td>75.71</td>
<td>4.52</td>
<td>7.53</td>
<td>0.92</td>
<td>1.54</td>
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<tr>
<td>T7</td>
<td>56.34</td>
<td>83.72</td>
<td>4.81</td>
<td>8.02</td>
<td>1.13</td>
<td>1.88</td>
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<tr>
<td>T8</td>
<td>49.81</td>
<td>71.81</td>
<td>4.09</td>
<td>7.02</td>
<td>0.81</td>
<td>1.35</td>
</tr>
<tr>
<td>T9</td>
<td>47.94</td>
<td>72.09</td>
<td>4.22</td>
<td>7.02</td>
<td>0.84</td>
<td>1.31</td>
</tr>
<tr>
<td>T10</td>
<td>48.23</td>
<td>72.53</td>
<td>4.30</td>
<td>7.16</td>
<td>0.87</td>
<td>1.44</td>
</tr>
<tr>
<td>T11</td>
<td>51.30</td>
<td>78.85</td>
<td>4.63</td>
<td>7.71</td>
<td>0.98</td>
<td>1.63</td>
</tr>
<tr>
<td>T12</td>
<td>55.62</td>
<td>82.46</td>
<td>4.79</td>
<td>7.97</td>
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<td>1.68</td>
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<tr>
<td>F-test</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>S. Em ±</td>
<td>1.78</td>
<td>2.62</td>
<td>0.16</td>
<td>0.29</td>
<td>0.05</td>
<td>0.09</td>
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<tr>
<td>C.D. @ 5%</td>
<td>5.21</td>
<td>7.69</td>
<td>0.47</td>
<td>0.85</td>
<td>0.22</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Table 4. Effect of integrated nutrient management on yield and quality attributes of kasuri methi (*Trigonella corniculata* L.)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of pods plant⁻¹</th>
<th>Pod length (cm)</th>
<th>No. of seeds pod⁻¹</th>
<th>Seed yield kg/ha</th>
<th>Test weight (g)</th>
<th>Crude protein content in herb (%)</th>
<th>Crude protein content in seed (%)</th>
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<tbody>
<tr>
<td>T₁</td>
<td>562.00</td>
<td>1.80</td>
<td>5.73</td>
<td>420.03</td>
<td>1.64</td>
<td>11.79</td>
<td>19.50</td>
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<tr>
<td>T₂</td>
<td>513.67</td>
<td>1.23</td>
<td>5.56</td>
<td>325.02</td>
<td>1.46</td>
<td>10.27</td>
<td>17.08</td>
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<tr>
<td>T₃</td>
<td>570.67</td>
<td>1.71</td>
<td>5.61</td>
<td>387.17</td>
<td>1.47</td>
<td>11.56</td>
<td>18.83</td>
</tr>
<tr>
<td>T₄</td>
<td>567.67</td>
<td>1.76</td>
<td>5.67</td>
<td>380.06</td>
<td>1.60</td>
<td>11.35</td>
<td>18.33</td>
</tr>
<tr>
<td>T₅</td>
<td>535.60</td>
<td>1.49</td>
<td>5.60</td>
<td>367.63</td>
<td>1.54</td>
<td>10.23</td>
<td>17.81</td>
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<tr>
<td>T₆</td>
<td>544.61</td>
<td>1.50</td>
<td>5.60</td>
<td>371.18</td>
<td>1.61</td>
<td>10.58</td>
<td>11.10</td>
</tr>
<tr>
<td>T₇</td>
<td>620.17</td>
<td>2.14</td>
<td>6.06</td>
<td>465.31</td>
<td>1.75</td>
<td>13.31</td>
<td>21.33</td>
</tr>
<tr>
<td>T₈</td>
<td>528.48</td>
<td>1.50</td>
<td>5.28</td>
<td>330.34</td>
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