Effect of soil and foliar applied fertilizers on yield attributes and yield of **Rabi** sesame

**CH Deepthi, AV Ramana, A Upendra Rao and P Guru Murthy**

**Abstract**

A field experiment was conducted during **rabi** 2016-17 on sandy loam soils of Agricultural College Farm, Naira, to study the effect of soil application of varied levels of NPK and foliar nutrition on yield and yield attributes of sesame. The experiment was laid out in split-plot design with four levels of NPK applied to soil and four levels foliar nutrition practices, each replicated thrice. Application of 125% RDF (M3) along with foliar application 19:19:19 @ 1.0 % at early budding stage followed by 1.0 % KNO₃ at early capsule formation stage (F₁) recorded the highest number of capsules plant⁻¹, capsule length, number of seeds capsule⁻¹, test weight, seed yield (923 kg ha⁻¹) and stalk yield (2095 kg ha⁻¹). The lowest values for yield and yield attributes were found with the lowest level (75% RDF) of NPK supplied to soil and non supply of foliar nutrients (F1).

**Keywords:** foliar nutrition, NPK levels, **rabi** sesame, yield attributes, yield

**Introduction**

Sesame (**Sesamum indicum** L.) is one of the important oilseed crop in Indian agriculture. Sesame seeds are rich source of food, nutrition, edible oil and bio-medicine. Sesame oil has excellent nutritional, medicinal, cosmetic and cooking qualities for which it is known as ‘the queen of oilseeds’. Due to the presence of potent antioxidants, sesame seeds are called as ‘the seeds of immortality’. Sesame cake or meal obtained as a byproduct of the oil milling industry is rich in protein, vitamin (Niacine) and minerals (Ca and P). Sesame has high oil content (46-55%) and a dietary energy of 6355 Kcal Kg⁻¹. The seeds serve as rich source of protein (20-28%), sugars (14-16%) and minerals (5-7%). Sesame oil has about 80 per cent of unsaturated fatty acids, mainly oleic and linolic acids.

In India, sesame is grown in 1784 lakh ha with an annual production of 850 M t and productivity of 486 kg ha⁻¹ (www.indiastat.com, 2015-16). In Andhra Pradesh, it is grown in an area of 8.5 lakh ha with a production of 2.8 M tonnes and productivity of 329 kg ha⁻¹ (Ministry of Agriculture, Government of India, 2014-15).

Despite of being such an important crop, the average productivity is very low in A.P comparison to global as well as national level. This may be due to cultivation of sesame on marginal and sub marginal lands of poor fertility under very poor agronomic practices and inadequate or even no use of fertilizers are the main reasons for low productivity of the crop. North coastal Andhra Pradesh is a traditional zone for sesame cultivation, especially during **rabi** in the pockets where meager water resources are available to provide a couple of irrigations. Farmers of this region usually pay little attention towards the nutritional needs of this crop due to its poor growing conditions and hence realizing very low yields. Since the crop receives one or two irrigations, soil application of all the required nutrients becomes a practical constraint, while application of nutrients at a right time is important in obtaining good yields.

Chemical fertilizers play a major role to meet nutrient needs of sesame, but continuous use of chemical fertilizers has adverse effects on soil physical and chemical conditions. Use of organics alone does not result in spectacular increase in crop yield, due to their low nutrient status. Therefore, integrated use of organic and chemical nutrients found to be promising not only in maintaining higher productivity and yield stability, but also contributes to sustenance of soil health (Sunita Verma et al., 2013).

Fertilizer applied to the crop at the time of sowing is not fully available to the plants as the crop approaches maturity, so supplemental foliar application is one of the techniques to increase yield of the crop. Foliar fertilization is gaining more importance in recent years due to availability of soluble fertilizers and is of great significance in rainfed areas and under changing climatic conditions. Many research reports indicated positive effect in enhancing crop yield and quality of oilseed/pulse crops.
It constitutes one of the important milestones in the progress of agricultural production.

**Material and Methods**

A field experiment was conducted during *rabi* of 2016-17 at the Agricultural College Farm, Naira, Andhra Pradesh. The soil was sandy loam in texture with a pH of 7.04 and EC of 0.078 dS/m, low in organic carbon (0.61%), low in available nitrogen (252.5 kg ha⁻¹), medium in available phosphorus (29.5 kg ha⁻¹) and high in available potassium (352.5 kg ha⁻¹). Brown colored seed of sesame ‘YLM-66’ were line sown at a spacing of 30 cm x 10 cm at a seed rate of 4 kg ha⁻¹ on 24th December, 2016. The plot size was 6 m x 5 m. The experiment was laid out in split-split plot design, comprising of four NPK levels: 100% RDF (40:20:20 kg NPK ha⁻¹-M₁), 75% RDF (M₂), 125% RDF (M₃) and 75% RDF + 25% nitrogen through vermicompost (M₄) allotted to main plots and four foliar nutrition treatments viz., control (F₁), foliar application of 19:19:19 @ 1.0% at early budding stage (F₂), foliar application of KNO₃ @ 1.0% at early capsule formation stage (F₃) and 19:19:19 @ 1.0% at early budding stage followed by 1.0% KNO₃ at early capsule formation stage (F₄) allotted to subplots and each treatment replicated thrice. The crop was harvested on 4th April, 2017.

**Results and Discussion**

**Yield attributes**

Yield attributes of sesame viz., number of capsules plant⁻¹, capsule length, number of seeds capsule⁻¹ and test weight were significantly varied with soil application of varied levels of NPK. The highest number of capsules plant⁻¹, capsule length, number of seeds capsule⁻¹ and test weight were recorded with application of 125% RDF (M₃). Significantly lower values for all the yield attributes were observed with the lowest level of (75% RDF) NPK applied to soil (M₂). Adequate and balanced nutrition might have produced large yield structure. These findings are in line with those reported by Gayatri Sahu et al. (2017) and Mahajan et al. (2016) [4].

As regards the response of sesame in terms of seed yield and stalk yield due to foliar feeding of nutrients, significantly highest values for seed yield (838 kg ha⁻¹) and stalk yield (1947 kg ha⁻¹) were noticed with F₃ (foliar application of 19:19:19 @ 1.0% at early budding stage followed by 1.0% KNO₃ at early capsule formation stage). While, non application of foliar nutrients to sesame (F₁) resulted in the lowest seed yield (697 kg ha⁻¹) and stalk yield (1841 kg ha⁻¹).

There was an enhancement in the seed yield of sesame to the tune of 20.2% due to application of F₂ (foliar application of 19:19:19 @ 1.0% at early budding stage followed by 1.0% KNO₃ at early capsule formation stage) over non application of foliar nutrients (F₁ - control). Similar views were also expressed by Bhosale et al. (2011) [1].

Harvest index, the ratio between seed yield to that of biological yield was not markedly altered either due to of varied levels of NPK to soil or due to foliar feeding of nutrients. The interaction effect between these two factors was also not statistically measurable.

It can be concluded that rabi sesame can be grown in North Coastal Zone of Andhra Pradesh with application of 50:25:25 kg NPK ha⁻¹ (125% RDF) and supplemented with 19:19:19 @ 1.0% at early budding stage followed by 1.0% KNO₃ at early capsule formation stage (F₄) as it has resulted in maximum seed and stalk yield.

**Table 1:** Yield components of sesame as influenced by varied levels of NPK application to soil and foliar application of nutrients

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Number of capsules plant⁻¹</th>
<th>Capsule length (cm)</th>
<th>Number of seeds capsule⁻¹</th>
<th>1000 grain weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Varied levels of NPK application to soil</strong></td>
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</tr>
<tr>
<td>M₁: 100% RDF (40:20:20 kg NPK ha⁻¹)</td>
<td>32.3</td>
<td>2.43</td>
<td>55</td>
<td>2.48</td>
</tr>
<tr>
<td>M₂: 75% RDF</td>
<td>29.9</td>
<td>2.17</td>
<td>50</td>
<td>2.40</td>
</tr>
<tr>
<td>M₃: 125% RDF</td>
<td>35.7</td>
<td>2.62</td>
<td>59</td>
<td>2.64</td>
</tr>
<tr>
<td>M₄: 75% RDF + nitrogen through vermicompost</td>
<td>31.8</td>
<td>2.42</td>
<td>54</td>
<td>2.44</td>
</tr>
<tr>
<td>SEm (±)</td>
<td>1.02</td>
<td>0.09</td>
<td>2.04</td>
<td>0.04</td>
</tr>
<tr>
<td>C.D (P=0.05)</td>
<td>1.7</td>
<td>0.17</td>
<td>3</td>
<td>0.07</td>
</tr>
<tr>
<td>CV%</td>
<td>5.44</td>
<td>7.12</td>
<td>6.49</td>
<td>3.21</td>
</tr>
<tr>
<td><strong>Foliar application of nutrients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁: Control</td>
<td>30.4</td>
<td>2.23</td>
<td>50</td>
<td>2.35</td>
</tr>
<tr>
<td>F₂: Foliar application of 19:19:19 @ 1.0% at early budding stage</td>
<td>32.8</td>
<td>2.41</td>
<td>56</td>
<td>2.48</td>
</tr>
<tr>
<td>F₃: Foliar application of 19:19:19 @ 1.0% at early budding stage followed by 1.0% KNO₃ at early capsule formation stage</td>
<td>31.9</td>
<td>2.37</td>
<td>54</td>
<td>2.47</td>
</tr>
<tr>
<td>F₄: Foliar application of 19:19:19 @ 1.0% at early budding stage followed by 1.0% KNO₃ at early capsule formation stage</td>
<td>34.7</td>
<td>2.63</td>
<td>59</td>
<td>2.65</td>
</tr>
<tr>
<td>SEm (±)</td>
<td>0.71</td>
<td>0.08</td>
<td>1.44</td>
<td>0.09</td>
</tr>
</tbody>
</table>

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### Table 2: Seed and stalk yield (kg ha\(^{-1}\)) of sesame as influenced by varied levels of NPK application to soil and foliar application of nutrients

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Seed yield (kg ha(^{-1}))</th>
<th>Stalk yield (kg ha(^{-1}))</th>
<th>Harvest Index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varied levels of NPK application to soil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M(_1): 100% RDF (40:20:20 kg NPK ha(^{-1}))</td>
<td>786</td>
<td>1891</td>
<td>29.32</td>
</tr>
<tr>
<td>M(_2): 75% RDF</td>
<td>668</td>
<td>1753</td>
<td>27.55</td>
</tr>
<tr>
<td>M(_3): 125% RDF</td>
<td>873</td>
<td>2036</td>
<td>30.03</td>
</tr>
<tr>
<td>M(_4): 75% RDF + nitrogen through vermicompost</td>
<td>777</td>
<td>1893</td>
<td>29.07</td>
</tr>
<tr>
<td>SEm (±)</td>
<td>38.38</td>
<td>74.95</td>
<td>1.40</td>
</tr>
<tr>
<td>CV%</td>
<td>8.57</td>
<td>6.86</td>
<td>8.40</td>
</tr>
<tr>
<td>Foliar application of nutrients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(_1): Control</td>
<td>697</td>
<td>1841</td>
<td>27.35</td>
</tr>
<tr>
<td>F(_2): Foliar application of 19:19:19 @ 1.0 % at early budding stage</td>
<td>793</td>
<td>1908</td>
<td>29.24</td>
</tr>
<tr>
<td>F(_3): Foliar application of KNO(_3) @ 1.0 % at early budding stage</td>
<td>776</td>
<td>1878</td>
<td>29.28</td>
</tr>
<tr>
<td>F(_4): Foliar application of 19:19:19 @ 1.0% at early budding stage followed by 1.0% KNO(_3) at early capsule formation stage</td>
<td>838</td>
<td>1947</td>
<td>30.10</td>
</tr>
<tr>
<td>SEm (±)</td>
<td>13.07</td>
<td>23.99</td>
<td>1.46</td>
</tr>
<tr>
<td>CV%</td>
<td>2.92</td>
<td>2.20</td>
<td>8.78</td>
</tr>
</tbody>
</table>

**Fig 4.1:** Seed yield vs. capsules plant\(^{-1}\) of sesame as influenced by varied levels of NPK application to soil and foliar nutrition

**Fig. 4.2:** Seed yield vs. stalk yield of sesame as influenced by varied levels of NPK application to soil and foliar nutrition

### References


