INTEGRATED EFFECT OF ORGANIC MANURING AND INORGANIC FERTILIZER N ON YIELD AND UPTAKE OF MICRONUTRIENTS BY CHICKPEA IN VERTISOL

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ABSTRACT

A field experiment was conducted to study the effect of different organic manures (compost, vermicompost, farmyard manure, subabul and sunhemp) with different doses of fertilizer N (50% RDN and 100% RDN) on yield (grain, straw) and uptake of micronutrients (Zn, Cu, Mn and Fe) on deep black soils of Vertisol. The chickpea yield and uptake of micronutrients increased significantly with 50% nitrogen through subabul plus 50% recommended dose of nitrogen. Moreover, application of N along with organic manures showed additive effect on these parameters. With the treatments involving combination of organics and inorganics, yield and nutrient uptake were invariably higher than with the recommended dose of N. The effect of different organic manures in combination with fertilizer N on chickpea yields and nutrient uptake were rated as: subabul > sunhemp > compost > FYM > vermicompost. The highest yield of grain (666.54 kg ha⁻¹), straw (1152.13 kg ha⁻¹) were obtained where 50% N through subabul (as green manure) plus 50% of recommended dose of fertilizer N. The uptake of Zn, Cu, Mn, and Fe was highest by chickpea (grain and straw) where 50% N through subabul and 50% RDN as integrated treatment.

INTRODUCTION

Intensive cultivation and growing of nutrient exhaustive crop have made the soil deficient in macro- as well as in micronutrients due to nutrient mining. Now a days, use of only nitrogenous and phosphatic fertilizers has added towards nutrient imbalance in soil, particularly in terms of micronutrients availability. Organic manures, including green manures, not only supply the plant nutrients in easily available form at regulated rate but also improve the soil health. Moreover, the amount of micronutrients present in organic manures is sufficient to meet the requirement of crop production. Amongst the different organic manures, the green manure provides a good amount of nutrients to the soil (Lal and Mathur, 1989, Nambiar, 1989). Subabul/sunhemp are grown as popular green manure crop, but often mineralization rate in the soil does not comensurate with the crop demand and green manuring fails to provide the same desired effects. Application of nitrogen fertilizer in combination with different organic manures may help in mineralization of green manures. Therefore, the field experiment was conducted to study the effect of different organic manures in combination with inorganic fertilizer “N” on yield and uptake of micronutrients by chickpea.

MATERIAL AND METHODS

A field experiment was conducted during 1999-2000 at Regional Research Station, Bijapur (Karnataka). The experimental soil was clay in texture, having pH (1:2.5) 8.25, EC 0.30 dsm⁻¹, available N 180 kg ha⁻¹, available P₂O₅ 18.62 kg ha⁻¹, and available K₂O 461 kg ha⁻¹. Organic manures like compost, vermicompost, FYM and green manures like sunhemp and subabul were incorporated into a soil a month earlier to rabi sowing. The nitrogen concentration of different organic manures viz., FYM 0.80% N, compost 1.22% N, vermicompost 1.60% N, sunhemp 2.15% N, subabul 3.50% N was determined. Chemical fertilizer N was applied as per the treatments given below at the time of sowing.

T₁ - 50% N through farmyard manure with + 50% Recommended dose of N (RDN)  
T₂ - 50% N through compost with 50% RDN  
T₃ - 50% N through sunhemp with 50% RDN  
T₄ - 50% N through subabul with 50% RDN
T₅ - 50% N through vermicompost with 50% RDN
T₆ - recommended dose of Fertilizer Nitrogen (RDN- 25 Kg ha⁻¹) and
T₇ - control (without manure and fertilizer)

These seven treatments were replicated three times in a randomised block design in a plot size of 4.8 x 13.0m.

Chickpea (A-1) was grown as test crop. The soil samples were collected after harvest of the chickpea crop and analyzed for available micronutrients (Zn, Cu, Mn and Fe) as per standard procedure by AAS (Lindsay and Norvell, 1978). The chickpea crop was harvested at full maturity stage. In case of chickpea, pods were separated from the plant and dried and threshed treatment wise. Straw weight was also recorded. The grain and straw yield were recorded. Five plants of chickpea from each treatment were collected at 30, 60, 90 days after sowing and at maturity. These plants were dried in a hot air oven at 60 to 65°C. The plant samples (grain and straw) were ground separately for analysis.

For micronutrients, the plant material digested in a diacid mixture (i.e. 9:4 mixture of HNO₃: HClO₄). The diacid digestion is used for determination of Zn, Cu, Mn and Fe. Methods employed for plant analysis of micronutrients as per standard procedure as described by Jackson (1967).

RESULTS AND DISCUSSION

The yield data of chickpea (Table 1) revealed that incorporation of subabul met 50% N to be compensated with addition of 50% recommended dose of N (RDN) which recorded highest grain (666.54 kg ha⁻¹) and straw (1152.13 kg ha⁻¹) yield. Early decomposition of green succulent legume such as subabul or sunhemp and also FYM caused early release and availability of plant nutrients which in turn favoured the crop for higher yields than that of fertilizers. Satynarayana Rao and Patil (1990) made similar observations with safflower grain yield with sunhemp incorporation.

Table 1. Effect of organic manures in combination with fertilizer N on the yield of Chickpea in Vertisol.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Grain (kg/ha)</th>
<th>Straw (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁ 50% N (FYM) + 50% (RDN)</td>
<td>551.83</td>
<td>958.57</td>
</tr>
<tr>
<td>T₂ 50% N (compost) + 50% (RDN)</td>
<td>511.53</td>
<td>1075.36</td>
</tr>
<tr>
<td>T₃ 50% N (Sunhemp) + 50% (RDN)</td>
<td>601.44</td>
<td>1095.74</td>
</tr>
<tr>
<td>T₄ 50% N (Subabul) + 50% (RDN)</td>
<td>666.54</td>
<td>1152.13</td>
</tr>
<tr>
<td>T₅ 50% N (Vermicompost) + 50% (RDN)</td>
<td>503.81</td>
<td>956.93</td>
</tr>
<tr>
<td>T₆ Recommended dose of fertilizer N (50kg/ha)</td>
<td>520.83</td>
<td>963.08</td>
</tr>
<tr>
<td>T₇ Control (no manures/ Fertilizers)</td>
<td>478.82</td>
<td>924.02</td>
</tr>
</tbody>
</table>

Sem± 42.560 99.024
CD at 5% 129.794 302.025

Uptake of Micronutrients by Chickpea.

Zinc: The uptake of zinc by grain and straw (Table 2) indicated that zinc uptake varied from 243 to 390 ppm and 185 to 291 ppm by grain and straw, respectively.

The highest zinc uptake by grain and straw was found with 50% N through subabul plus 50% RDN (390 and 291 ppm, respectively). However, organics in combination with 50% RDN recorded significantly higher uptake of zinc over control due to higher availability of nutrients and higher absorption of zinc with application of green manure subabul and fertilizers. These observations were in conformity with the results of earlier studies (Anand 1987, Nambari 1989; Rajeev Kumar et al. (1993).

Copper: The uptake of copper by grain and straw (Table 2) indicated that copper uptake varied from 60 to 105 ppm and 74 to 104 ppm by grain and straw, respectively. The highest copper uptake by grain was found with 50% N through vermicompost plus 50% RDF (105 ppm). The highest Cu uptake by straw was found with 50% N through compost plus 50% RDF (104 ppm).
Table 2. Effect of organic manures in conjunction with fertilizers N on micronutrient content and uptake of chickpea in Vertisol.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Concentration (ppm)</th>
<th>Uptake (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zn</td>
<td>Cu</td>
</tr>
<tr>
<td></td>
<td>Grain</td>
<td>Straw</td>
</tr>
<tr>
<td>T1 50% N (FYM)+ 50% (RDN)</td>
<td>57.90</td>
<td>26.13</td>
</tr>
<tr>
<td>T2 50% N (compost)+ 50% (RDN)</td>
<td>55.30</td>
<td>20.83</td>
</tr>
<tr>
<td>T3 50% N (Sunhemp)+ 50% (RDN)</td>
<td>57.50</td>
<td>20.63</td>
</tr>
<tr>
<td>T4 50% N (Subabu)+ 50% (RDN)</td>
<td>58.40</td>
<td>25.23</td>
</tr>
<tr>
<td>T5 50% N (Vermicompost) + 50% (RDN)</td>
<td>55.60</td>
<td>27.30</td>
</tr>
<tr>
<td>T6 RDN (25 kg/ha)</td>
<td>52.40</td>
<td>27.10</td>
</tr>
<tr>
<td>T7 Control</td>
<td>50.77</td>
<td>20.00</td>
</tr>
<tr>
<td>Sem ±</td>
<td>0.140</td>
<td>0.200</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>0.423</td>
<td>0.611</td>
</tr>
</tbody>
</table>
However, organics in conjunction with 50% RDN recorded significantly higher uptake of Cu over control. These results are in agreement with findings of Venkatesh Bharadwaj et al. (1994).

**Manganese**: The uptake of manganese by grain and straw (Table 2) indicated that manganese uptake varied from 302 to 429 ppm and 157 to 210 ppm by grain and straw, respectively. The highest manganese uptake by grain and straw was found with 50% N through subabul plus 50% RDN (429 and 210 ppm respectively) Anand swarup (1987) reported similar results.

**Iron**: The uptake of iron by grain and straw (Table 2) indicated that iron uptake varied from 6227 to 8764 ppm and 1478 to 2189 ppm by grain and straw respectively. The highest iron uptake by grain and straw was found with 50% N through subabul plus 50% RDN (8764 and 2189 ppm respectively). An extra amount of nutrients supplied by organics like subabul/vemicompost/FYM imparted an increase in yield which ultimately showed higher uptake of micronutrients.

**REFERENCES**