Influence of Enriched FYM with Inorganic Fertilizers on Nutrient Uptake, Soil Available Nutrients and Productivity of Rainfed Finger Millet

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A field investigation was carried out at Millet Breeding Station (MBS), Tamil Nadu Agricultural University, Coimbatore during NEM season 2004-05 to investigate the influence of enriched FYM with inorganic fertilizers on nutrient uptake, soil fertility and productivity of rainfed finger millet. The experiment was laid out in a randomized block design with thirteen treatments replicated thrice. As compared to different treatments, the nutrient uptake was the highest with broadcasting of enriched farm yard manure (enriched FYM) 4 t ha⁻¹ + 100 percent of recommended N and K for nitrogen, phosphorus and potassium with values of 64, 20.9 and 55.5 kg ha⁻¹, respectively. With regards to the treatments band placement of enriched FYM 2 t ha⁻¹ + 100 percent of recommended N and K recorded higher soil available nutrients (NPK) and grain yield (3269 kg ha⁻¹). The results revealed that combined application of enriched compost with inorganic fertilizers had enhanced effect on soil available nutrients as well as yield of finger millet crop over the application of either straight fertilizers or compost alone.

Key words: Enriched FYM, finger millet, band placement, nutrient uptake, yield

Finger millet (Eleusine coracana L. Gaertn) is an important small millet crop grown in India and has the pride of place in having highest productivity among millets. It is also known as Ragi, African millet and Bird's foot millet and an important staple food crop in part of eastern and central Africa and India. In fact, it is the main cereal crop of monsoon season in some hilly areas, where it is grown both for grain and fodder purpose. In India, it is cultivated in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Jharkhand, Uttarakhand, Maharashtra, and Gujarat. The annual cultivated area under millets is around 29 million hectares, of which small millets alone accounts for about 3.5 million hectares. Among small millets, finger millet alone occupies 50 percent area and contributes more than 2/3rd production (2.8 million tonnes). Wide adoption, easy cultivation, free from major pests and diseases and drought tolerance have made this crop an indispensable component of dry farming system. Often in the lands where finger millet crop is raised, no other crop worth mentioning can give a reasonable harvest (AICSMIP, 2002).

To improve the productivity, integrated nutrient management is an important practice. Fertilizer application not only should influence the economic return of the investment through optimized yield and quality but also cause minimum level of environmental hazards (Christian Hera, 1996). This calls for balanced use of fertilizers and adoption of integrated nutrient management practices. Integrated Nutrient Management (INM) aims at efficient and judicious use of all the major sources of plant nutrients in an integrated approach so as to get maximum economic yield without any deleterious effect on physico-chemical and biological properties of the soil (Balasubramaniyan and Palanippan, 2001). Hence the present investigation was taken up to develop an INM technology using FYM for direct sown finger millet under rainfed condition.

Materials and Methods

A field experiment was carried out during NEM season 2004-05 at Millet Breeding Station (MBS), Tamil Nadu Agricultural University, Coimbatore to study the effect of enriched FYM with inorganic fertilizers on nutrient uptake, soil fertility and productivity of rainfed finger millet. The experiment was laid out in a randomized block design with thirteen treatments replicated thrice. The treatments were, T₁ - Absolute control, T₂ - 50% recommended NPK (20:10:10) alone, T₃ - 100% recommended NPK (40:20:20) alone, T₄ - Broad casting 2.0 t FYM ha⁻¹ + 50% recommended level of NPK, T₅ - Broad casting 2.0 t FYM ha⁻¹ + 100% recommended level of NPK, T₆ - Broad casting enriched FYM at 2.0 t ha⁻¹ + 50% recommended level of NPK, T₇ - Broad casting enriched FYM at 2.0 t ha⁻¹ + 100% recommended level of NPK, T₈ - Broad casting 4.0 t FYM ha⁻¹ + 50% recommended levels of NPK, T₉ - Broad casting 4.0 t FYM ha⁻¹ + 100% recommended levels of NPK, T₁₀ - Broad
the different treatments had significant influence on uptake of N, P and K (Table 1) by finger millet. Among the treatments, broadcasting 4 t enriched FYM ha\(^{-1}\) + 100 percent recommended N and K, T\(_{11}\) - Band placement of 2.0 t FYM ha\(^{-1}\) + 100 percent recommended N and K, T\(_{12}\) - Band placement of enriched FYM at 2.0 t ha\(^{-1}\) + 100% of recommended N and K. The recommended dose of fertilizer was 40:20:20 kg NPK ha\(^{-1}\). Enrichment of FYM was done with 100 percent recommended N (20 kg ha\(^{-1}\)). Finger millet variety Co(Ra)14, a medium duration variety with 100 percent recommended P (20 kg ha\(^{-1}\)). The soil of the field was clay loam in texture. The experimental soil was low in available nitrogen (217.0 kg ha\(^{-1}\)), medium in available phosphorus (12.6 kg ha\(^{-1}\)) and high in available potash (330.0 kg ha\(^{-1}\)). A total quantity of 615.30 mm of rainfall was received in 37 rainy days during 2004.

Results and Discussion

Effect on nutrient uptake

The different treatments had significant influence on uptake of N, P and K (Table 1) by finger millet. Among the treatments, broadcasting 4 t enriched FYM ha\(^{-1}\) + 100 percent recommended N and K, T\(_{11}\) - Band placement of 2.0 t FYM ha\(^{-1}\) + 100 percent recommended N and K, T\(_{12}\) - Band placement of enriched FYM at 2.0 t ha\(^{-1}\) + 100% of recommended N and K. The recommended dose of fertilizer was 40:20:20 kg NPK ha\(^{-1}\). Enrichment of FYM was done with 100 percent recommended N (20 kg ha\(^{-1}\)). Finger millet variety Co(Ra)14, a medium duration variety with 100 percent recommended P (20 kg ha\(^{-1}\)). The soil of the field was clay loam in texture. The experimental soil was low in available nitrogen (217.0 kg ha\(^{-1}\)), medium in available phosphorus (12.6 kg ha\(^{-1}\)) and high in available potash (330.0 kg ha\(^{-1}\)). A total quantity of 615.30 mm of rainfall was received in 37 rainy days during 2004.

Effect on productivity and economics

Band placement of enriched FYM 2 t ha\(^{-1}\) + 100 percent recommended N and K registered higher number of productive tillers m\(^{-2}\), finger length, grain and straw yield (Table 2) than all other treatments. Similar findings were already reported by Rani Perumal et al. (1988) and Parasuraman and Mani (2003). The absolute control registered the least yield attributes and yield. The quality character of enriched FYM which supplies nutrients in readily available form to the crop which in turn react with native soil nutrients and enhanced their availability to crops there by increased the plant growth, yield

Table 1. Effect of enriched FYM with inorganic fertilizers on nutrient uptake and soil nutrient status

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Crop uptake (kg ha(^{-1}))</th>
<th>Soil available nutrient (kg ha(^{-1}))</th>
<th>Organic Carbon content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>P</td>
<td>K</td>
</tr>
<tr>
<td>T(_1) - Absolute control</td>
<td>31</td>
<td>14.7</td>
<td>37.9</td>
</tr>
<tr>
<td>T(_2) - 50% rec. NPK (20:10:10)</td>
<td>36</td>
<td>16.3</td>
<td>40.3</td>
</tr>
<tr>
<td>T(_3) - 100% rec. NPK (40:20:20)</td>
<td>43</td>
<td>14.0</td>
<td>43.6</td>
</tr>
<tr>
<td>T(_4) - BC 2t FYM ha(^{-1})+50% rec. NPK</td>
<td>39</td>
<td>17.1</td>
<td>43.0</td>
</tr>
<tr>
<td>T(_5) - BC 2t FYM ha(^{-1})+100% rec. NPK</td>
<td>46</td>
<td>19.2</td>
<td>45.8</td>
</tr>
<tr>
<td>T(_6) - BC 2t EFYM ha(^{-1})+50% rec. N&amp;K</td>
<td>44</td>
<td>18.7</td>
<td>44.5</td>
</tr>
<tr>
<td>T(_7) - BC 2t EFYM ha(^{-1})+100% rec. N&amp;K</td>
<td>49</td>
<td>19.3</td>
<td>48.9</td>
</tr>
<tr>
<td>T(_8) - BC 4t FYM ha(^{-1})+50% rec. NPK</td>
<td>50</td>
<td>19.4</td>
<td>49.1</td>
</tr>
<tr>
<td>T(_9) - BC 4t EFYM ha(^{-1})+100% rec. NPK</td>
<td>58</td>
<td>20.5</td>
<td>53.2</td>
</tr>
<tr>
<td>T(_10) - BC 4t EFYM ha(^{-1})+50% rec. N&amp;K</td>
<td>54</td>
<td>20.4</td>
<td>49.9</td>
</tr>
<tr>
<td>T(_11) - BC 4t EFYM ha(^{-1})+100% rec. N&amp;K</td>
<td>64</td>
<td>20.9</td>
<td>55.5</td>
</tr>
<tr>
<td>T(_12) - BP 2t FYM ha(^{-1})+100% rec. NPK</td>
<td>57</td>
<td>20.8</td>
<td>49.6</td>
</tr>
<tr>
<td>T(_13) - BP 2t EFYM ha(^{-1})+100% rec. N&amp;K</td>
<td>60</td>
<td>20.5</td>
<td>51.2</td>
</tr>
<tr>
<td>SEd</td>
<td>1.3</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>CD(P=0.05)</td>
<td>2.8</td>
<td>0.9</td>
<td>0.9</td>
</tr>
</tbody>
</table>

(BC = Broad Casting, BP = Band Placement)
parameters and yield. The highest net return and B:C ratio of Rs.13,446 ha⁻¹ and 2.69 were obtained with band placement of enriched FYM 2 t ha⁻¹ + 100 percent recommended N and K (Table 2). This was closely followed by band placement of 2 t FYM ha⁻¹ + 100 percent recommended dose of NPK which registered higher net return (Rs.11,825 ha⁻¹) and B:C ratio (2.50).

Table 2. Effect of enriched FYM with inorganic fertilizers on productivity and economics of finger millet

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. productive tillers m⁻²</th>
<th>Finger length (cm)</th>
<th>Grain yield (kg ha⁻¹)</th>
<th>Straw yield (kg ha⁻¹)</th>
<th>Net return (Rs ha⁻¹)</th>
<th>B:C</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁ - Absolute control</td>
<td>98</td>
<td>5.93</td>
<td>988</td>
<td>2218</td>
<td>1861</td>
<td>1.40</td>
</tr>
<tr>
<td>T₂ - 50% rec. NPK (20:10:10)</td>
<td>108</td>
<td>6.10</td>
<td>1406</td>
<td>3120</td>
<td>3652</td>
<td>1.65</td>
</tr>
<tr>
<td>T₃ - 100% rec. NPK (40:20:20)</td>
<td>115</td>
<td>6.43</td>
<td>2042</td>
<td>4316</td>
<td>6745</td>
<td>2.01</td>
</tr>
<tr>
<td>T₄ - BC 2t FYM ha⁻¹+50% rec. NPK</td>
<td>114</td>
<td>6.40</td>
<td>1864</td>
<td>4119</td>
<td>4938</td>
<td>1.66</td>
</tr>
<tr>
<td>T₅ - BC 2t FYM ha⁻¹+100% rec. NPK</td>
<td>123</td>
<td>6.55</td>
<td>2347</td>
<td>4789</td>
<td>7799</td>
<td>2.07</td>
</tr>
<tr>
<td>T₆ - BC 2t EFYM ha⁻¹+50% rec. N&amp;K</td>
<td>121</td>
<td>6.50</td>
<td>2141</td>
<td>4530</td>
<td>6557</td>
<td>1.86</td>
</tr>
<tr>
<td>T₇ - BC 2t EFYM ha⁻¹+100% rec. N&amp;K</td>
<td>129</td>
<td>6.59</td>
<td>2481</td>
<td>4939</td>
<td>8526</td>
<td>2.09</td>
</tr>
<tr>
<td>T₈ - BC 4t FYM ha⁻¹+50% rec. NPK</td>
<td>142</td>
<td>6.65</td>
<td>2678</td>
<td>5222</td>
<td>9153</td>
<td>2.08</td>
</tr>
<tr>
<td>T₉ - BC 4t FYM ha⁻¹+100% rec. NPK</td>
<td>156</td>
<td>6.76</td>
<td>2864</td>
<td>5470</td>
<td>10003</td>
<td>2.13</td>
</tr>
<tr>
<td>T₁₀ - BC 4t EFYM ha⁻¹+50% rec. N&amp;K</td>
<td>149</td>
<td>6.74</td>
<td>2789</td>
<td>5383</td>
<td>9707</td>
<td>2.12</td>
</tr>
<tr>
<td>T₁₁ - BC 4t EFYM ha⁻¹+100% rec. N&amp;K</td>
<td>165</td>
<td>7.01</td>
<td>3105</td>
<td>5706</td>
<td>11660</td>
<td>2.34</td>
</tr>
<tr>
<td>T₁₂ - BP 2t FYM ha⁻¹+100% rec. NPK</td>
<td>162</td>
<td>6.88</td>
<td>3003</td>
<td>5622</td>
<td>11825</td>
<td>2.50</td>
</tr>
<tr>
<td>T₁₃ - BP 2t EFYM ha⁻¹+100% rec. N&amp;K</td>
<td>176</td>
<td>7.14</td>
<td>3269</td>
<td>5908</td>
<td>13446</td>
<td>2.69</td>
</tr>
<tr>
<td>SEd</td>
<td>2</td>
<td>0.13</td>
<td>61</td>
<td>151</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD(P=0.05)</td>
<td>4</td>
<td>0.27</td>
<td>126</td>
<td>312</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(BC = Broad Casting, BP = Band Placement)

From this study it is concluded that band placement of enriched FYM 2 t ha⁻¹ + 100 percent recommended N and K (T₁₃) and broadcasting of enriched FYM at 4 t ha⁻¹ + 100 % N and K were found to be the best treatments for rainfed finger millet for improving the soil fertility status, yield and net monetary return.

References


