Influence of Organic Sources of Nutrients on the Yield and Economics of Crops under Maize Based Cropping System

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Abstract: Field experiments were conducted from June 2001 to April 2003 at Tamil Nadu Agricultural University, Coimbatore with an objective to evaluate the organic sources of nutrients and Panchagavya spray on the yield and economics of crops in the maize - sunflower - green gram cropping system. The experiment consisted of nine treatments comprising six treatments of organic sources of nutrients with and without Panchagavya (blend of five products obtained from cow) foliar spray; two treatments were recommended dose of fertilizers with and without recommended foliar spray and one control (neither manured nor fertilizer applied). The treatments were fitted in a randomized block design replicated thrice. The study revealed that higher yield of maize and sunflower was recorded under Biogas slurry (BGS) with Panchagavya. Grain yield of greengram was higher under recommended fertilizer treatments but it was comparable to BGS with Panchagavya. The economic analysis showed that BGS with Panchagavya was commercially viable since it registered the highest net returns and BCR than recommended dose of fertilizers and foliar sprays over years.

Keywords: Organics, nutrients, biogas slurry, panchagavya, maize, sunflower, greengram

INTRODUCTION

Heavy use of chemicals in agriculture has weakened the ecological base in addition to degrading the soil, water resources and quality of the food. At this juncture, a keen awareness has sprung on the adoption of “Organic Farming” as a remedy to cure the ills of modern chemical agriculture[2]. It is very much essential to develop a strong workable and compatible package of nutrient management through organic resources for various crops based on scientific facts, local conditions and economic viability[1]. Panchagavya is a foliar nutrition prepared by organic growers of Tamil Nadu and used widely for various agricultural and horticultural crops[3]. In Sanskrit, Panchagavya means a combination of five products obtained from cow. When suitably mixed and used, these have miraculous effects. Panchagavya is used in different means such as foliar spray, soil application along with irrigation water, seed or seedling treatment etc. For foliar spray 3% concentration is being adopted by organic farmers[3] using hand-operated sprayers with high pore sized nozzle. In jasmine it ensures continuous flowering and in annual moringa doubles the fruit yield besides giving resistance to pest and diseases[12].

An agricultural strategy based on indigenous knowledge and traditional cropping systems can bring moderate to high levels of productivity using local resources alone. Given favourable political, social and ecological conditions, such systems are sustainable at a low cost for a long period[4]. Understandably, Indian agro products are known to be more organic than that of most developed countries, keeping in view the traditional agronomic practices followed by small farmers[4]. Exclusively organically grown produce has got its own export values for which a systemic research and development programme in respect of sustaining agricultural system through pure organic agriculture needs initiation[5]. Now the need has come to re-examine and then gradually re-introduce the effective traditional methods of plant nutrition using organic sources. Hence an attempt was made to assess the effect of organics application on the yield and economics in maize based cropping system.

MATERIALS AND METHODS

Field experiments were conducted from June 2001 to April 2003 at Tamil Nadu Agricultural University, Coimbatore to evaluate the organic sources of nutrients and Panchagavya spray on the yield and economics of crops under maize - sunflower - greengram cropping system. The experiment consisted of nine treatments viz.,
• T₁, *Navathaniyam* as intercrop incorporated *in situ* on 45 DAS
• T₂, T₁ + *Panchagavya* spray
• T₃, Bio-gas slurry from 3 milch animals (BGS)
• T₄, T₃ + *Panchagavya* spray
• T₅, *Sesbania aculeata* as intercrop incorporated *in situ* on 45 DAS
• T₆, T₅ + *Panchagavya* spray
• T₇, Recommended NPK fertilizers (RDF)
• T₈, T₇ + recommended foliar spray (RDF + RFS)
• T₀, Control (Neither manures nor fertilizers)

The treatments were fitted in a randomized block design replicated thrice. The inorganic fertilizer treatments received full dose of recommended NPK (135: 62.5: 50 kg ha⁻¹ for maize, 40: 20: 20 kg ha⁻¹ for sunflower and 25: 50: 0 kg ha⁻¹ for greengram) for which all the recommended package of practices were followed. For the organic nutritional treatments the recommended dose of N alone was substituted through organic sources such as *Navathaniyam*, biogas slurry and *Sesbania aculeata* and no P and K were applied. No agro-chemicals were used for the treatments receiving nutrients through organic sources. Seed treatment and soil application of biofertilizers were done common to all the treatments except control. *Navathaniyam* (mixture of nine crop seeds viz., pearl millet, sesame, cowpea, pigeon pea, black gram, green gram, horse gram, chick pea and sword bean in equal proportions on weight basis) was sown @ 50 kg ha⁻¹ one day prior to sowing of main crop in such a way that it formed an intercrop in between the main crop rows. *Panchagavya* was prepared using the ingredients viz., biogas slurry / cow dung (5 Kg), cow’s urine (3 L), cow’s milk (2 L), cow’s curd (2 L), cow’s clarified butter / ghee (1 L), sugarcane juice (3 L), tender coconut water (3 L) and ripe banana (12 Nos). All the above items were added to a wide mouthed mud pot and kept open under shade. The contents were stirred twice a day for about 20 minutes both in the morning and evening to facilitate aerobic microbial activity. After fifteen days of incubation, a three per cent spray solution was prepared from the *Panchagavya* stock solution. The spray solution (500 litres ha⁻¹) was sprayed on 15, 30, 45 and 60 DAS for maize and sunflower where as it was given on 15, 25, 40 and 50 DAS for greengram using hand-operated sprayer with high pore size nozzle in T₂, T₃ and T₄ treatments.

The soil of the experimental field was moderately deep, well-drained sandy clay loam (*Typic Ustropept*), with a pH of 8.3. The soil was low (175 kg ha⁻¹), medium (20 kg ha⁻¹) and high (975 kg ha⁻¹) in available N, P and K, respectively. Gross and net returns ha⁻¹ was computed for the cropping system as a whole in each year, considering the prevailing market price of the inputs and produces. The benefit cost (B: C) ratio was worked out for different treatments in all the crops by dividing the gross returns by cost of cultivation.

**RESULTS AND DISCUSSIONS**

**Yield of Crops:**

**Maize:** Biogas slurry + *Panchagavya* recorded the highest grain yield of 8.34 t ha⁻¹ during 2001 followed by RDF + RFS. But during the 2002, RDF + RFS recorded the highest grain yield followed by Biogas slurry + *Panchagavya* and were comparable (Table 1). Even though, the highest pooled mean grain yield of 8.22 t ha⁻¹ was produced by RDF + RFS, but was comparable to BGS + *Panchagavya* during both the years. Better nutrient availability, uptake and the resultant increased growth and yield parameters as evidenced in the present study under BGS + *Panchagavya* treatments might have increased the yield of maize. Improvement in yield attributes and yield of maize treated with biogas slurry as reported by Rameshwar Singh and Totawat[7] is concomitant to this finding.

**Sunflower:** Biogas slurry + *panchagavya* produced the highest grain yield of 3.14 and 3.24 t ha⁻¹ during 2001 and 2002 and it was followed by RDF + RFS and both were found superior to RDF + BGS treatments (Table 1). The narrow C: N ratio and quick mineralization of BGS as compared to other organic sources of nutrients might have facilitated formation of rich nutrient pool contributing to higher grain yield. Similar quick mineralization of BGS was reported by Lakshmanan et al.,[11].

**Greengram:** Highest grain yield of 1614 and 1372 kg ha⁻¹ during I and II year was produced under RDF + RFS (Table 1) and it was comparable with RDF in both years and also with BGS + *Panchagavya* during first year. Since, the greengram was grown after high nutrient demanding maize, which is a heavy feeder of N as attributed by Shivay et al.,[10] and exhaustive sunflower, the better responses to direct application of nutrients was observed from the increased values of nutrient uptake. However, quick N mineralization by microbes in BGS and also supply of nutrients through *Panchagavya* could have met the requirement of greengram and hence appreciable grain yield was also observed under BGS + *Panchagavya*. Similar positive influence of BGS on pod yield of green gram was observed by Nagarajan and Balachandar[40] and Somasundaram et al.[11].
Economies: The economic evaluation done in the present investigation showed that among the organic sources of nutrients, BGS + Panchagavya which recorded the highest BCR. Panchagavya enhanced the net return to a tune of 14 to 20 per cent and thus exhibited its economic viability. Panchagavya enhanced the BCR to a tune of 2 to 5 per cent thereby proved its economic sustainability over years. The economic analysis over years showed stable trend of the treatment BGS + Panchagavya which registered the highest net return and BCR (Table 2).

Biogas slurry + Panchagavya was economically viable since it registered the highest net returns (Rs. 74,484/-) and BCR (3.01) than RDF + RFS, which registered Rs. 74,273/- and 2.89 as NR and BCR, respectively. This might be due to increased yield obtained under each component crop and also comparatively lower cost of cultivation in BGS + Panchagavya. The percentage increase in NR and BCR due to Panchagavya spraying was in the range of 14-20 per cent and 2-5 per cent, respectively over no Panchagavya.

Conclusion: The study revealed that higher yield of maize and sunflower was recorded under Biogas slurry with Panchagavya. Grain yield of greengram was higher under recommended fertilizer treatments but it was comparable to BGS with Panchagavya. The economic analysis showed that, BGS with Panchagavya was commercially viable since it registered the highest net return and BCR than recommended dose of fertilizers and foliar sprays over years.

Table 1: Yield of crops as influenced by organic sources of nutrients and Panchagavya spray

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Maize (grain yield t ha⁻¹)</th>
<th>Sunflower (grain yield kg ha⁻¹)</th>
<th>Greengram (grain yield kg ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (No manures or fertilizers)</td>
<td>4.47</td>
<td>3.59</td>
<td>4.03</td>
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<tr>
<td>Recommended NPK fertilizers (RDF)</td>
<td>8.22</td>
<td>7.59</td>
<td>7.90</td>
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<tr>
<td>Bio-gas slurry from 3 milch animals (BGS)</td>
<td>7.74</td>
<td>7.24</td>
<td>7.49</td>
</tr>
<tr>
<td>Panchagavya spray</td>
<td>8.34</td>
<td>8.05</td>
<td>8.20</td>
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</tbody>
</table>

Table 2: Economics (Rs. ha⁻¹) of the maize based cropping system as influenced by organic sources of nutrients and Panchagavya spray

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Cost of cultivation</th>
<th>Gross return</th>
<th>Net return</th>
<th>BCR</th>
<th>Cost of cultivation</th>
<th>Gross return</th>
<th>Net return</th>
<th>BCR</th>
<th>Cost of cultivation</th>
<th>Gross return</th>
<th>Net return</th>
<th>BCR</th>
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</thead>
<tbody>
<tr>
<td>Control (No manures or fertilizers)</td>
<td>52416</td>
<td>80408</td>
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<td>2.48</td>
<td>30451</td>
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<td>76586</td>
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<td>Panchagavya spray</td>
<td>35761</td>
<td>93386</td>
<td>57625</td>
<td>2.61</td>
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<td>81140</td>
<td>47344</td>
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<td>Bio-gas slurry from 3 milch animals (BGS)</td>
<td>34445</td>
<td>101685</td>
<td>67240</td>
<td>2.95</td>
<td>32775</td>
<td>96307</td>
<td>63532</td>
<td>2.94</td>
<td>33610</td>
<td>98996</td>
<td>65386</td>
<td>2.94</td>
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<td>37790</td>
<td>115106</td>
<td>77316</td>
<td>3.05</td>
<td>36120</td>
<td>107773</td>
<td>71653</td>
<td>2.98</td>
<td>36953</td>
<td>111439</td>
<td>74484</td>
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<td>Sesbania aculeata as intercrop incorporated in situ on 45 DAS</td>
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<td>51239</td>
<td>2.59</td>
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<td>31380</td>
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<td>65190</td>
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<td>33805</td>
<td>86512</td>
<td>52502</td>
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<td>34725</td>
<td>93673</td>
<td>58948</td>
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<td>2.89</td>
<td>36344</td>
<td>105602</td>
<td>71258</td>
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<td>Bio-gas slurry + Panchagavya spray</td>
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<td>76171</td>
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<td>37794</td>
<td>110669</td>
<td>72375</td>
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<td>2.89</td>
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<td>Control (No manures or fertilizers)</td>
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<td>14348</td>
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REFERENCES


