GROWING ORGANIC-CANE THROUGH ORGANIC BASE

By

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Abstract

A field experiment was conducted in vertisol to study the influence of organic materials and fertiliser on sugarcane and on the physical, chemical and biological properties of soil. Treatments consisted of trash, farmyard manure, vermicompost, bhumilabh, in situ green manuring as intercrop and chemical fertilisers viz., 0, 50, and 100% of the recommended dose of fertiliser (RDF) applied alone and in combination. Cane yields were lower where organics were applied alone as compared to 100% RDF. Bhumilabh at 10 t/ha applied alone produced the highest cane yield among the organics and also produced the highest yield when it was applied with 50% RDF. This was followed by in situ green manuring plus the RDF. Similar improvements in organic carbon, bulk density and microbial activity of the soil were also observed where the organics were applied.

Introduction

Organic farming is gaining importance as a contributing factor towards achieving sustainability in crop production. Bhawalkar and Bhawalkar (1993) advocate total organic farming, while others express the necessity of integrated use of organic and chemical fertilisers to achieve sustainability and targeted production. Since the nutrient turn over in a soil-plant system is considerably higher under intensive farming, neither the fertilisers nor organic sources alone can achieve sustainability.

Material and methods

Field experiments were conducted at the K.J. Somaiya Institute of Applied Agricultural Research, Sameerwadi during the 1996–97 and 1997–98 growing seasons to evaluate the effect of organics, chemical fertilisers and their combination on the yield of cane and sugar and also their effect on soil properties. Treatments included: trash (TR) at 8 t/ha, farmyard manure (FYM) at 25 t/ha, vermicompost (VC) at 5 t/ha, bhumilabh (BL) at 10 t/ha and the in situ green manuring of sunnhemp (GM) along with a no organic (Control) as the main plots with three replications. The recommended dose of fertilisers (RDF) for this region is 250, 75, and 190 kg/ha of N, P2O5 and K2O. Data were pooled over the two years. Bhumilabh is a harmonious blend of press mud, distillery effluents enriched with cellulolytic bacteria, N-fixers and P-solubilisers.

Results and discussion

Addition of TR, FYM, VC, BL, and GM alone produced higher cane yield than the control (Table 1). The highest cane yield occurred where the combination of RDF1 + BL (117.2 t/ha) and RDF1 + GM (108.0 t/ha) were applied. Among the organics applied alone, bhumilabh produced the highest cane yield (97.1 t/ha) followed by the FYM (84.4 t/ha) and GM (84.4 t/ha) treatments (Table 1). The VC was effective in enhancing cane yield, but as Kale et al. (1992) observed, it should be used in bulk quantities like other manures.

Combination of the TR with RDF1 produced significantly higher cane yields (102.4 t/ha) than the RDF1 alone. Reduced levels of inorganic fertilisers in conjunction with the trash did not produce desirable cane yields. The combination of FYM with 100% RDF1 produced the highest cane yield when compared to the other treatments as these have complimentary effects with an adequate supply of nutrients (Mathukai et al., 1999). Further, bhumilabh, in conjunction with 50% RDF, gave cane yields that were similar to the 100% RDF. Dey et al. (1997) have reported that bhumilabh can replace 50% of chemical fertilisers.

Among the organics evaluated, BL, TR, FYM, GM and VM increased organic carbon by 61.4, 36.11, 36.11, 25.00 and 22.22% over the no organic control, respectively (Table 2). Additionally, soil bulk density was significantly lower due to application of all organics compared to the control (1.44 g/cc).

Significantly higher microbial numbers of P-solubiliser, actinomycete, fungi and azotobacter were observed due to bhumilabh over the other organics and the control (Table 2). Soil organic carbon following the addition of the organics plays a vital role in enhancing microbial activity and microbial biomass of soil (Anger et al., 1995). These microbes are directly responsible for degradation of complex organic matter and act as powerful anti fungal, antibacterial agents by competition, antagonism and hyper parasitism.

KEYWORDS: Fertiliser, Trash Management, Soil Properties.
Table—Response of sugarcane yield (t/ha) to organic and chemical fertilisers.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Organic manures</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR</td>
<td>FYM</td>
<td>VC</td>
</tr>
<tr>
<td>RDF&lt;sub&gt;1&lt;/sub&gt;</td>
<td>102.4</td>
<td>106.0</td>
</tr>
<tr>
<td>RDF&lt;sub&gt;2&lt;/sub&gt;</td>
<td>75.0</td>
<td>85.4</td>
</tr>
<tr>
<td>RDF&lt;sub&gt;3&lt;/sub&gt;</td>
<td>58.4</td>
<td>61.7</td>
</tr>
<tr>
<td>Mean</td>
<td>77.9</td>
<td>84.4</td>
</tr>
</tbody>
</table>

Source of variation

- SEM ± C.D at 5%
- Organic manures: 1.94 5.33
- Chemical fertilisers: 1.24 3.44
- Interaction: 3.03 8.41

1 Organics included leaf trash (TR) at 8 t/ha, farmyard manure (FYM) at 25 t/ha, vermicompost (VC) at 5 t/ha, bhumilabh (BL) at 10 t/ha, and a sunnhemp green manure (GM) cover crop, and control (CON).
2 Fertiliser was applied at 100 (RDF<sub>1</sub>), 50 (RDF<sub>2</sub>) and 0% (RDF<sub>3</sub>) of the recommended rate of 250, 75, and 190 kg/ha of N, P, and K, respectively.

Table 2—Physical, chemical and biological properties of soil after harvest of cane as influenced by organic and chemical fertilisers.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Bulk density [g/dm&lt;sup&gt;3&lt;/sup&gt;]</th>
<th>Organic carbon [%]</th>
<th>P-solubiliser [10&lt;sup&gt;4&lt;/sup&gt;/g soil]</th>
<th>Actinomycete [10&lt;sup&gt;4&lt;/sup&gt;/g soil]</th>
<th>Fungi [10&lt;sup&gt;4&lt;/sup&gt;/g soil]</th>
<th>Azotobacter [10&lt;sup&gt;4&lt;/sup&gt;/g soil]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Organic manures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR</td>
<td>1.36</td>
<td>0.49</td>
<td>16.75</td>
<td>22.75</td>
<td>25.75</td>
<td>16.00</td>
</tr>
<tr>
<td>FYM</td>
<td>1.37</td>
<td>0.49</td>
<td>13.75</td>
<td>19.75</td>
<td>21.50</td>
<td>13.50</td>
</tr>
<tr>
<td>VC</td>
<td>1.42</td>
<td>0.44</td>
<td>14.25</td>
<td>21.25</td>
<td>24.50</td>
<td>15.50</td>
</tr>
<tr>
<td>BL</td>
<td>1.34</td>
<td>0.58</td>
<td>19.25</td>
<td>25.25</td>
<td>26.50</td>
<td>20.00</td>
</tr>
<tr>
<td>GM</td>
<td>1.38</td>
<td>0.45</td>
<td>13.00</td>
<td>20.00</td>
<td>21.50</td>
<td>13.00</td>
</tr>
<tr>
<td>NO&lt;sup&gt;+&lt;/sup&gt;</td>
<td>1.44</td>
<td>0.46</td>
<td>8.25</td>
<td>17.75</td>
<td>16.75</td>
<td>6.75</td>
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<tr>
<td>C.D at 5%</td>
<td>0.047</td>
<td>0.042</td>
<td>0.908</td>
<td>0.962</td>
<td>1.042</td>
<td>0.962</td>
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<tr>
<td>B. Chemical fertilisers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDF&lt;sub&gt;1&lt;/sub&gt;</td>
<td>1.36</td>
<td>0.48</td>
<td>17.25</td>
<td>22.75</td>
<td>26.25</td>
<td>14.75</td>
</tr>
<tr>
<td>RDF&lt;sub&gt;2&lt;/sub&gt;</td>
<td>1.37</td>
<td>0.48</td>
<td>14.00</td>
<td>20.25</td>
<td>21.75</td>
<td>13.75</td>
</tr>
<tr>
<td>RDF&lt;sub&gt;3&lt;/sub&gt;</td>
<td>1.43</td>
<td>0.44</td>
<td>11.25</td>
<td>19.50</td>
<td>21.00</td>
<td>13.00</td>
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<tr>
<td>Sem&lt;sup&gt;+&lt;/sup&gt;</td>
<td>0.016</td>
<td>0.007</td>
<td>0.341</td>
<td>0.233</td>
<td>0.245</td>
<td>0.328</td>
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<tr>
<td>C.D at 5%</td>
<td>0.044</td>
<td>2.364</td>
<td>0.943</td>
<td>0.654</td>
<td>0.685</td>
<td>0.917</td>
</tr>
</tbody>
</table>

1 Organics included leaf trash (TR) at 8 t/ha, farmyard manure (FYM) at 25 t/ha, vermicompost (VC) at 5 t/ha, bhumilabh (BL) at 10 t/ha, and a sunnhemp green manure (GM) cover crop, and control (CON).
2 Fertiliser was applied at 100 (RDF<sub>1</sub>), 50 (RDF<sub>2</sub>) and 0% (RDF<sub>3</sub>) of the recommended rate of 250, 75, and 190 kg/ha of N, P, and K, respectively.

Conclusion

Of the organics evaluated, bhumilabh at 10 t/ha provided the greatest enhancement of cane yield. The higher yield response due to bhumilabh is attributed to better nutrient content and its positive effect on soil microorganisms. Further, farmyard manure at 25 t/ha and green manuring as an intercrop produced yields that were equivalent indicating green manuring can serve as an alternative to the farmyard manure, which is usually in short supply. Trash incorporation and vermicomposting produced the greatest increase in the biota of the soil.

Acknowledgments

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REFERENCES


CULTURE DE LA CANNE ORGANIQUE EN MILIEU BIOLOGIQUE

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Résumé
Les effets des matières organiques tels que le paillis, le fumier de ferme, le vermicompost, Bhumilabh et l’engrais vert seul ou en combinaison avec les engrais chimiques (aux taux de 50 et 100% de la dose recommandée) sur la productivité de la canne et sur les propriétés bio-physicochimiques d’un vertisol ont été étudiés au champ. Les applications des matières organiques seules ont provoqué une baisse de rendement en canne par rapport à une application d’engrais chimique au taux recommandé (RDF). Le meilleur rendement fut obtenu avec le Bhumilabh appliqué au taux de 10 t/ha en combinaison avec 50% de RDF, suivi par l’engrais vert en combinaison avec RDF. L’apport des matières organiques s’est accompagné par une amélioration du taux de carbone, du poids spécifique et de l’activité microbienne du sol.

Mots clés: Engrais, gestion des paillis, propriétés du sol.

CULTIVO DE CAÑA ORGÁNICA CON BASE ORGÁNICA

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Resumen
Se realizó un experimento de campo en un suelo vertisol para estudiar el efecto de materiales orgánicos y fertilizantes sobre la caña de azúcar y en las propiedades físicas, químicas y biológicas del suelo. Los tratamientos incluyeron residuos, estiercol, lombricompuesto, Bhumilabh, abonos verdes como cultivo intercalado y fertilizantes químicos, Ej: 0, 50 y 100 % de la dosis recomendada de fertilizante fue aplicada sola o en combinación. Las producciones de caña fueron menores en los sitios en donde solamente se aplicó materia orgánica. Bhumilabh en dosis de 10 t/ha aplicada sola produjo la mayor producción de caña entre los abonos orgánicos y también presentó la mayor producción cuando se le complementó la dosis con 50% de fertilizante químico. Este tratamiento fue seguido por los abonos verdes incorporados complementados con fertilizante. Se obtuvieron mejoras en el contenido de carbono orgánico, densidad aparente y en la actividad microbial del suelo cuando se aplicaron compuestos orgánicos.