Recycling Organic Waste and Composting at Direct Plantain Field for The Cost Effective Production of Biofertilizer and Application Studies at Tiruchirapalli District of South India

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Abstract

In this study we discuss cost effective methods and advantages of adopting direct plantain cultivation field of bio-composting agriculture, poultry and aqua wastes that includes plantain litters, neem litters, poultry excreta, cattle manure and waste fish mass for the cost-effective production of biofertilizer. We have demonstrated simple, inexpensive methods to produce organic fertilizer in the plantain field and reduce the cost involved in production, transport and labor. The 120 days compost was found to be most deserved organic fertilizer that effected healthy plant, disease resistant, with the resistance to withstand wind pressure and irrespective of variety affected 20% increase in banana counts and weight by ignoring the weight of the unwanted trunk. The biggest advantages of the techniques help to reduce the fertilizer cost and enhance soil fertility, every time when the compost is done at banana cultivation field and applied directly.

Key words: Organic recycling, Biofertilizer, Earthworms, composting and Plantain.

Introduction

Organic farming is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides and growth regulators additions. Organic farming is an eco-friendly farming that advocates for stopping or restricting the use of chemical fertilizers, pesticides, weedicides and other chemicals and creates
an ecological balance environment. Organic farming is considered as a holistic management system, which promotes and improves the health of the agro-ecosystem related to biodiversity, nutrient biocycles, soil microbial and biochemical activities.

Bananas are farmer’s principle staple crop and a major source of income in Tamil Nadu. Other crops are intercropped with young banana plants. However, land pressure has increased and intercropping is nowadays widely practiced in older plantations, resulting in an acceleration of nutrient depletion and reducing the life span of the plantation. Hence we propose the simple and cost effective methods on field direct composting to increase the soil fertility regularly.

Good compost of all micronutrient is the key for increasing productivity and sustainability increasing fertilizer use may not give the expected yield particularly in areas where it is being used. Experts point out that the fertilizer use efficiency is only 30-35 per cent and the remaining 65-70 per cent of nutrient reached the underground water resources in the form of nutrient, which along with phosphates pollutes water bodies. Therefore, restoring to organic farming is unavoidable not only to prevent contamination of food by chemicals but also to make sick soil healthy and productive. It has been proved all over India under ICAR multi location trials, that the use of organic manure is essential not only for better utilization of applied fertilizer but also to make soil productive and agriculturally sustainable. Well decomposed organic matter and farmyard manure, applied under the sight soil moisture condition, would not only improve soil texture and structure but also provide the crop necessary resistance against pest and diseases.

The nutrient supplying capacity of banana residues in combination with leguminous materials and chicken manure was investigated in composting studies. Changes in the chemical composition of ten formulations of banana residue-based compost involving leguminous plants (Sesbania rostrata, Flemingia macrophylla, Arachis hypogea) and chicken manure were analyzed periodically during a composting period of 16 weeks. Results showed that combinations of banana residues (BnR) and chicken manure or leguminous plants were highly decomposed compared to untreated BnR. The use of leguminous plants and/or chicken manure enhanced the composting process significantly compared to the effect of Bioquick.

In an experiment conducted during 2002-03 on effect of organic fertilizer doses and vermicompost on growth and yield revealed that response of vermicompost was significant for all the vegetative growth parameters recorded at different stages from 45 days after planting (DAP) to 285 DAP. Initially in all the treatments, the increase for these parameters was more prominent from 45 DAP to 195 DAP. Significantly maximum values were recorded by 100 per cent recommended dose of fertilizer (RDF), while, minimum values in in-situ vermiculture plots for all the growth parameters. The treatment 100 per cent RDF recorded significantly maximum (21.29 t/ha) yield, while it was minimum in in-situ vermiculture plots (12.34 t/ha).

The banana plants were grown under a heated glasshouse and in a soil with physical and chemical properties are suitable for banana growing. The contents of N, P, K and Mg in compost and in farmyard manure were found to be similar. Farmyard manure, farmyard manure + mineral fertilizers and 45 kg plant (-1) of compost increased growth, yield and fruit quality characteristics. According to obtained results,
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45 kg plant (-1) of compost was determined more suitable in terms of economical production and organic farming than the other fertilizer types.

In this study, the possible utilization of removed shoots and plant parts of banana as compost after fruit harvest were investigated. Three doses (15-30-45 kg plant(-1)) of the compost prepared from the clone of Dwarf Cavendish banana were compared with Farmyard manure (50 kg plant(-1), Mineral fertilizers (180 g N + 150 g P + 335 g K plant(-1)) and Farmyard manure + Mineral fertilizers (25 kg FM + 180 g N + 150 g P + 335 g K plant(-1)) which determined positive effects on the nutrient contents of banana leaves. The banana plants were grown under a heated glasshouse and in a soil with physical and chemical properties suitable for banana growing. The contents of N, P, K and Mg in compost and in farmyard manure were found to be similar. Nitrogen, phosphorus and potassium contents of leaves in all applications except control, and Ca, Mg, Fe, Zn, Mn, Cu contents in all applications were determined between optimum levels of reference values. There were positive correlations among some nutrient contents of leaves, growth, yield and fruit quality characteristics. Farmyard manure, Farmyard manure + Mineral fertilizers and 45 kg plant(-1) of compost increased the nutrient contents of banana leaves.

Cattle manure used to be the most important source of nutrients for the banana crop, but has become less available with population increase and the decrease in farm size. Organic manures are the most important fertility amendments that farmers apply. They give priority to bananas. Cattle manure used to be the most important source of nutrients, but has become less available due to decreases in farm size.

Organic matter management was separated into five general categories depending on the reliance upon bananas, other crops, manures and composts as organic additions to soils, significant differences in reported average bunch weights were obtained. The farmers applying banana stalks, field crop residues and cattle manures reported the largest bunch weights (20.3 kg per bunch). Farmers relying upon banana stalks alone, banana stalks with field crop residues and either small livestock manure or domestic compost reported the lowest yields (13.1, 14.3 and 12.9 kg per bunch, respectively). The study concluded that the farmers are developing strategies to resist fertility depletion, in part through better recycling of on-farm resources and intercropping but greater reliance upon external inputs may be required to ameliorate declining banana yields.

Fertility of soil is very important for successful cultivation. In this study we address the low nutrient concentrations or depletion of organic manure due to intercropping and repeated cultivations. The paper discusses the formulation of alternative soil fertility management strategies, and to create more awareness on recycling organic waste by direct composting of agro, poultry, cattle manure and aqua wastes at direct plantain field to produce cost effective Biofertilizer and tested at Tiruchirapalli District of South India. The study affected the cost effective methods of producing on field organic biofertilizer, healthy and increased production of banana fruits.
Materials and Methods

General method of banana cultivations involves water irrigation with the dip of water canals in 2 *2 fts dimension in organized form of rows and column. With the compartments or segregations of rectangle distance of 6 to 11mts length and 5 to 7 meters breadth and the boundaries are covered by water stream line. The immediate two fts distance of the boundaries are planted with young banana plant at the equal distance of 2 meter. The centre area covers minimal of nearly 5*7 mts size which was unused or used for intercropping. This centre portion is largely available for sun light for first three to four months period of time, when banana plant is young. This central unused area is selected for production of on filed or direct field biofertilizer composting.

Organic waste origin from agriculture waste, plantain residues, poultry excreta waste, cattle manure, neam litters and aqua wastes are collected from local market and villages of Tiruchirapalli District of South India. A trench of suitable size, 2m long, 1.5m broad and 1m deep of pit was made in unused mid space areas of the banana cultivation field. The bottom and sides of the pit are made hard by compacting with a non-degradable material. The accumulated wastes are well mixed, and a layer 30 cm in thickness, is spread all along the length of the trench. This layer is well moistened by sprinkling cowdung slurry and water over it. 3 kg of fish mass waste + 3 kg of Bagasse waste, 3 Kg of Poultry excreta, 10 to 12 Kg of plantain waste, and 1 kg of cow dung juice are mixed together with normal filed earth worms to each pit. A second layer (30 cm thick) of the mixed refuse is then spread. The process is repeated till the heap rises to a height of 45 cm to 60 cm above ground level. The top is then covered with a thin layer of soil. Every week the packed layer is moisture with water spraying. After 30 days of decomposition, the mass is taken out of the trench and formed into a conical heap above the ground, moistened with water, if necessary, and covered with soil and further extended for another 90 days. After another month or two, the manure will be ready for application to field. The range of pH of water should be 6.5-7.5. As Tiruchirapalli district is a Cauvery delta largely composed of the heavy clay soil and some of the areas are covered with and the red lateritic soil that favors the beneficial composting.

After completion of 120 days, composting, the biofertiliser is ready and directly applied to the each plant at the age of 3 to 4 month with minimal of 5 to 7 kg per plant. The addition is easy and simple as the organic fertilizer is readily available at the field itself. The study was performed without the addition of any subsequent inorganic fertilizer. Initially the method of production was tested at 10 % of the total field of cultivation. The advantages of the techniques and benefits have allowed conducting the study largely in various places of Tiruchirapalli District.

During the composting part of the unused areas are tested with intercrops such as radishes, cauliflower, cabbage, spinach, chilli, brinjal, lady's finger, gourds, marigold and cassava the mixed cropping was found to healthy and nutrient depletion was prevented and supported with the on filed biocomposting.

Table 1 comprises various location of Cauvery delta of trichurapalli district. The 120 days decomposed suits as the most deserved organic compost that effected healthy plant, disease resistant, with the resistance to with stand wind pressure and
achieved 20% increase in banana counts and weight by ignoring the weight of unwanted trunk.

### Table 1

<table>
<thead>
<tr>
<th>S.No</th>
<th>Locations</th>
<th>Plantain Varieties Commercial names</th>
<th>Total areas (acres)</th>
<th>Soil type</th>
<th>Normal Fruit Bunches</th>
<th>Compost Treated Bunches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jeeyapuram</td>
<td>Nendran</td>
<td>3</td>
<td>Clay</td>
<td>6-7</td>
<td>8-9</td>
</tr>
<tr>
<td>2</td>
<td>Kulithalai</td>
<td>Red banana</td>
<td>2</td>
<td>Clay</td>
<td>6-7</td>
<td>9-10</td>
</tr>
<tr>
<td>3</td>
<td>Kulzumini</td>
<td>Elarasi</td>
<td>1</td>
<td>Red</td>
<td>7-8</td>
<td>9-10</td>
</tr>
<tr>
<td>4</td>
<td>Lalgudi</td>
<td>Rasthali</td>
<td>3</td>
<td>Red</td>
<td>5-7</td>
<td>8-9</td>
</tr>
<tr>
<td>5</td>
<td>Lallapet</td>
<td>Robusta</td>
<td>1</td>
<td>Clay</td>
<td>7-9</td>
<td>10-11</td>
</tr>
<tr>
<td>6</td>
<td>Mahadanapuram</td>
<td>Poovan</td>
<td>2</td>
<td>Clay</td>
<td>8-9</td>
<td>10-11</td>
</tr>
<tr>
<td>7</td>
<td>Musiri</td>
<td>Elarasi</td>
<td>3</td>
<td>Red</td>
<td>7-8</td>
<td>10-11</td>
</tr>
<tr>
<td>8</td>
<td>Pettavaithalai</td>
<td>Karpooravalli</td>
<td>2</td>
<td>Clay</td>
<td>7-8</td>
<td>10-11</td>
</tr>
<tr>
<td>9</td>
<td>Sirugamani</td>
<td>Rasthali</td>
<td>1</td>
<td>Clay</td>
<td>5-7</td>
<td>9-10</td>
</tr>
<tr>
<td>10</td>
<td>Sithalavai</td>
<td>Poovan</td>
<td>4</td>
<td>Clay</td>
<td>8-9</td>
<td>10-11</td>
</tr>
</tbody>
</table>

**Conclusion**

This study allowed farmers to gain confident and benefits by saving the fertilizer cost and nutrient saving management approaches. On field composting, integrated nutrient management methods, combining mineral and organic nutrient sources that offers better results on Banana productivity and increase the overall production by 20% in number of banana and weight gain by ignoring the unwanted trunk. The generated knowledge should be turned into implementable, national policies.

**References**


