



Short Communication

Utilization of oil palm wastes for vermicomposting

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Abstract

Recycling of organic wastes from gardens by converting them into stabilized decomposed products known as compost or organic manure is the basis for sustainable crop production systems. Compost not only supplies plant nutrients but also improves the soil physico-chemical properties and support the activities of beneficial microorganisms and soil fauna. High vegetable oil yield potential (4-6 t ha⁻¹ of oil) of Oil Palm (*Elaeis guineensis* Jacq.) has been one of the the main driving forces behind promoting this crop for cultivation under irrigated conditions by the Government of India. The yield levels of 4-6 tonnes ha⁻¹ of oil are possible provided the crop is supplied with all the necessary inputs. With an oil yield of 4-6 tonnes which accounts for about 20 % of the fresh fruit bunches (FFB), the total biomass that is harvested in the form of FFB will be 25 tonnes or more.

Keywords biomass, organic manure, palm, vermicompost

Introduction

On the basis of fruit biomass harvested for commercial purpose, oil palm probably ranks among the highest biomass yielding crops, even with a C3 type of photosynthetic system [1]. Oil palm gives a large amount of byproducts of nutrient value in the form of fronds, empty fruit bunches mesocarp wastes, shell etc. which have a great potential for reducing fertilizer cost in Oil Palm plantations by the *in-situ* contribution and the recycling of Oil Palm wastes [2].

Large vegetative growth coupled with heavy removal of harvested bunches makes oil palm a high nutrient demanding crop [3]. A comparatively higher dose of chemical fertilizers recommended by Gawankar et al., [4] during 2010 for palm under Konkan conditions (1200: 600: 2700 g NPK palm⁻¹year⁻¹) may pose threat to soil health and environment. Varghese et al., 2000 also reported that 41 percent of the annual cost of cultivation of oil palm is spent on chemical fertilizers.

On an average, for every tonne of FFB produced 220 kg of empty fruit bunches (FFB), 670 kg of palm oil mill effluent (POME), 120 kg of mesocarp fiber, 70 kg of shell and 30 kg of palm kernel cake are produced. Hence, cut fronts are to be spread over the inter-rows for recycling of nutrients as an organic source. If such materials are properly managed and recycled in the form of vermicompost in the field, a major part of the nutrient requirement of palms could be met. Nutrient content of oil palm parts and nutrient uptake by oil palm have been reported by many workers. However, no

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Figure 1. Chopping of palm leaves with the help of tractor driven shredder machine

work has been reported on the potential of nutrient supply through composting of oil palm wastes into organic manure. Varghese et al., [3] found that vermicomposting was most effective in producing quality manure which could supply 175 kg N, 73 kg P₂O₅, 129 kg K₂O, 70 kg CaO and 71 kg MgO ha⁻¹ year⁻¹. A considerable part of the nutrient requirement of oil palm can be met by converting the leaves and fronds into compost and recycling the same in plantation.

Earthworms have the capacity of feeding on any organic debris and converting them into quality manure. Though different species of earthworm are available, species like *Eisenia fetida* and *Eudrillus euginiae* are common for making vermicompost from coconut and oil palm. However, species *Eudrillus euginiae* may be used because it had a wide adaptability under humid tropical conditions of India. It is quite efficient in converting the coconut and oil palm leaves into granular vermicompost. About 3000 to 3500 kg of such granular vermicompost can be produced from the leaves and fronds obtained from one hectare of a well-managed oil palm garden.

Hence, the present study was conducted to recycle palm wastes available from the plantation at College of Horticulture, Mulde, Tal: Kudal, Dist. Sindhudurg during the year 2014-15 and 2015-16 under All India Coordinated Research Project on Palms (Oil Palm).

Chopping of the available biomass

As oil palm leaves and fronds are hard containing high amount of lignin and polyphenols, natural decomposition under field conditions take place at slower rate. Hence, it is necessary to cut the entire leaf into small pieces to increase the rate of decomposition. This can be done with the help of tractor driven shredder. Either entire leaf or cutting the leaf into two to three pieces and then putting these into hopper of the shredder can make it in small pieces (Figure 1).

Preparation of beds

Composting can be done in earthen pits, cement tanks or pits plastered with bricks and cement. Readymade plastic vermicomposting units of different sizes are available in market. For present study, plastic unit having dimensions of 3' X 3' X 10' were used for preparation of the vermicompost from oil palm leaves and fronds (Figure 2). Dried as well as green oil palm leaves and fronds were chopped in to pieces with the help of tractor driven mechanical shredder. About 600 kg of such chopped material was spread layer by layer in a single vermicompost unit (Figure 2). Fresh cow dung slurry was spread on each layer. Total 150 kg fresh cow dung (25 % of bio mass) was used for the preparation of slurry for one bed. Final layer was

covered with thick slurry (Figure 3) and after filling the bed it was covered with shed net to protect the entry of Rhinoceros beetle and



Figure 2. Spread of chopped material in layers



Figure 3. Final layer was cover with thick cow dung slurry

kept for 4-5 weeks for incubation. For moistening the bed, two foggers were installed per bed (Figure 4). After 2-3 weeks, turning of waste at weekly interval was done. The entire vermicomposting unit was covered with Silpauline roof to protect it from excess sunlight and heavy rains during monsoon (Figure 5).

Release of earthworms

After 5 weeks when material starts decomposing and temperature of the material in bed comes down to normal, earthworm species *Eisenia fetida* and *Eudrillus euginiae* were introduced at rate of 1000 worms per bed (one worm per kg oil palm waste) (Figure 6). Compost was ready after 5 months when chopped oil



Figure 4. Installation of foggers for moistening the bed



Figure 5. Unit covered with Silpauline roof



Figure 6. Release of earthworms

palm waste was used, while dried oil palm fronds took 8 months for decomposition and final vermicomposting (Figure 7). Watering was stopped one month prior to the harvesting of bed.

The vermicompost was separated with the help of sieve. Harvested vermicompost was spread on floor for drying under shed. From 750 kg material (600 +150 cow dung slurry), 320 kg final product was obtained in the form of vermicompost. The remaining un-decomposed material was used to fill fresh bed. The final product was analyzed for nutrient content.

Nutrient analysis of oil palm waste vermicompost

The compost prepared was granular and black in colour. Grain size was 1 to 1.5 mm with nutrient status as given in table 1.

Table 1.

Particulars	pH	EC (dSm ⁻¹)	OC %	N %	P %	K %	Fe mg/kg	Mg mg/kg	Zn mg/kg	Cu mg/kg
Oil Palm Vermicompost	6.69	1.00	14.50	0.36	1.6	1.05	0.918	1.56	0.554	0.210



Figure 7. Final vermicompost product



Thus, preparation of nutrient rich organic manure through vermicomposting within the Oil Palm plantation revealed that the huge nutrient demands of oil palm could be met through proper recycling of waste material. This could help in ensuring the proper disposal of oil palm wastes, maintaining a healthy environment and a sustainable crop system.

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