

Sustainable transformation of oil palm recyclable biomass into organic manure through vermicomposting

The increasing global demand for edible oils has resulted in the increase of oil palm cultivation but there are concerns over the large amount of waste that are being generated in the field. The ability of vermicomposting process to utilize organic waste and bio-convert them into higher value added products makes it an attractive technology. The aim of this study was to investigate the characteristics and physico-chemical changes of vermicompost during composting of palm oil processed by epigeic earthworm (*E. eugeniae*).

PALM oil, edible oil, is derived from the fleshy mesocarp of the fruit of oil palm (*Elaeis guineensis*). In India, an area of 19.33 lakh ha in 18 states is identified as potential area for oil palm cultivation. Oil palm is one of the leading oil yielding perennial crop that produces 4 to 6 tonnes of crude palm oil and 0.4 to 0.6 tonnes of palm kernel oil per ha per year from 4th to 30th year of its productive life span. There is an urgent need to increase the production and productivity of vegetable oils to meet the increasing per capita consumption along with the population growth and reduce the dependency on import of edible oil.

As oil palm is a highly nutrient demanding crop using waste from palm oil processing unit as fertilizer supplement in place of inorganic nutrients is an environmentally friendly option. The waste products from oil palm processing consist of oil palm trunks (OPT), oil palm fronds (OPF), empty fruit bunches (EFB), palm pressed fibres (PPF) and palm kernel shells, less fibrous material such as palm kernel cake and liquid discharge palm oil mill effluent (POME). One hectare of oil palm produces 10 to 35 tonnes of fresh fruit bunches (FFB) per

year. The production of 1 tonne of crude palm oil requires 5 tonnes of fresh fruit bunches.

If cut fronds are left over in the field it hinders harvesting and other cultural operations as it takes longer period for decomposition. There is a need of appropriate waste minimization or recycling technology which should be easy to operate and cost effective. In this regard 'Vermicomposting' has been reported to be a viable, cost effective technique for the efficient management for disposal of recyclable biomass. Recycling of organic recyclable biomass from oil palm gardens by converting them into stabilized decomposed products could be the base for sustainable crop production. As oil palm leaves and fronds are hard containing high amount of lignin and polyphenols, natural decomposition under field conditions takes place at slower rate, vermicomposting under artificial shade could be the best choice. Hence, study was conducted for utilization of oil palm fronds for vermicomposting under All India Coordinated Research Projects on Palms (Oil Palm) at College of Horticulture, Mulde Tal: Kudal Dist: Sindhudurg (Maharashtra).



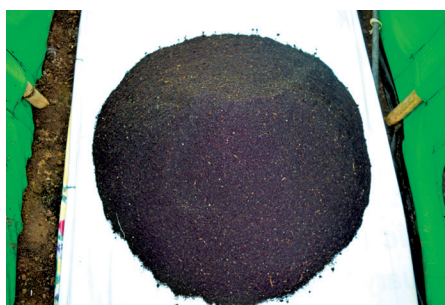
Heap of cut frond leaves



Chopping of leaves with tractor operated chopper



Vermicomposting in readymade plastic bed



Vermicompost



Eudrillus eugeniae

Table 1. Dimensions, cost of fixing, quantity of chopped fronds and vermicompost

Particular	Dimensions/ bed (cm)	Cost of Construction/ bed (₹)	Quantity of dry material with cow dung (25%) (kg)	Quantity of Vermicompost (kg)
Readymade plastic bed	300 × 120 × 60	1200/-	600	210
Kaddappa	420 × 75 × 90	9800/-	400	150
Lateritic stones	420 × 75 × 90	9100/-	400	140

Table 2. Nutrient composition of vermicompost using oil palm waste

Particular	pH	EC (dSm ⁻¹)	OC (%)	N (%)	P (%)	K (%)	Fe (mg/kg)	Mg (mg/kg)	Zn (mg/kg)	Cu (mg/kg)
Oil Palm Vermicompost	6.6	1.00	13.50	0.75	0.39	0.89	0.895	1.461	0.543	0.205

Composting by Earthworms

Vermicomposting is a composting processing (recyclable biomass) involving the interaction of earthworms and microorganisms. Earthworms have the capacity of feeding on any organic debris and converting them into quality manure. Species like *Eisenia fetida* and *Eudrillus eugeniae* are common for preparing vermicompost from coconut and oil palm waste. However, species *Eudrillus eugeniae* had a wide adaptability under humid tropical conditions of India and potential to convert the oil palm leaves into the value added products. Vermicompost is a final peat-like material with excellent structure, porosity, drainage and moisture holding capacity.

Preparation of compost bed

The experiment was performed in compost beds of plastic, Kaddappa and lateritic stones in open condition of the shaded yard. Readymade plastic unit having dimensions of 3" × 3" × 10" were used for preparation of vermicompost. Dimensions, cost of construction, quantity of chopped fronds and quantity of vermicompost are given below.

Dried as well as partial green oil palm leaves and fronds were chopped into pieces with the help of tractor driven mechanical shredder. Chopped material was spread in a single vermicompost unit layer by layer mixed with fresh cow dung slurry at 25% of biomass. Final layer was covered with thick slurry of cow dung and after filling the bed it was covered with weed mat to protect the entry of Rhinoceros beetle and excess sunlight and heavy rains during monsoon. The beds were incubated for 4-5 weeks and moistening was done through the two foggers. Besides, the moisture content was maintained at 60–80%

by periodic sprinkling of adequate quantity water on the bed throughout the study. After 2-3 weeks turning of waste at weekly interval was done. After 5 weeks when material started decomposing, earthworm species *Eudrillus eugeniae* were introduced at a rate of 1,000 worms/ bed. Compost was ready after 7 months when chopped oil palm waste was used while dried unchopped oil palm fronds took 12 months for decomposition and final vermicomposting. After the trial, watering was stopped one month prior to harvesting of bed. The product was air-dried and collected in polythene bags for further analysis.

Nutrient value of vermicompost

After 7 months of vermicomposting process using *E. eugeniae* the final produce of vermicompost was analyzed. The colour of vermicompost was also darker with granular grain size of 1 to 1.5 mm with black colour, pH 6.6, organic carbon (13.50%), nitrogen (0.75%), phosphorus (0.39%) and potassium (0.89%). In short, this study suggests that the chopped oil palm wastes which were mixed with an appropriate ratio of cow dung could be easily vermicomposted by *E. eugeniae* when compared to dried un-chopped oil palm fronds and the vermicompost produced could be utilized as an efficient organic fertilizer for sustainable land restoration practices.

For further interaction, please write to:

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