



Vermicompost Production Using Dry Coconut Fronds A Waste Recycling Technology in Coconut Gardens

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Coconut fronds fallen from one ha of coconut garden can be converted in to 5.58 tones of vermicompost. Under the given situation of environmental pollution, high prices of fertilizers, soils losing their fertility and productivity due to lack of enough organic matter, scarcity of organic manures as a result of poor resource base at the farm level, conversion of crop by products/residues is the only option to maintain soil organic matter.

Abstract

An attempt was made at ZARS, Navile, Shimoga, for recycling dried coconut fronds through vermicomposting. Around 5.58 tones of vermicompost can be produced out of coconut fronds available from one ha plantation in a year having nutrient composition of 1.38, 0.31, and 0.24 per cent of N, P and K, respectively, and N-fixing and P solubilizing organisms.

Introduction

Coconut is one of the important commercial crops of Karnataka State. It is not only a source of food (Fresh and dry coconut, oil) and drink (tender coconut) but also provide raw materials for coir industry in rural areas, particularly in Southern and Central Dry Zones of Karnataka comprising Tumkur, Hassan, Bangalore, Mysore, Chitradurga, Chickmagalur and Kolar districts. It is one of the main sources of fuel. Tones of dry coconut shell, husk and frond are being burnt annually in the state. Otherwise, this huge quantity of bio resource can be converted into good manure which can partly substitute part of the fertilizer nutrition of the crops grown in the region.

Among the by products coconut fronds form the major share of the total biomass produced by a coconut tree. On an average each frond weighs about six kg. Similarly, average number of dry fronds fallen from individual tree is 10-12. Based on these figures and @ 150 trees per ha, it was worked out that nearly 17.12 and 3.64 m. t. of dry coconut frond biomass is available for composting in Karnataka and India, respectively (Table-1). This much of valuable natural resource is being annually burnt to ash. Instead, it can be converted into useful organic manure, if it is composted properly.

Table 1. Estimated production of dried coconut fronds

Particulars	Coconut area (000'ha)	Dried coconut fronds biomass (m.t.)
Karnataka	405	3.64
India	1903	17.13

In this regard, an attempt was made at ZARS, Navile, Shimoga, to produce vermicompost out of coconut fronds.

Material and methods

A study was taken up at ZARS, Navile, Shimoga, to know the



possibilities of production of vermicompost out of coconut fronds available right on the farm. The dried coconut fronds were collected as and when fallen and subjected to chaffing through a 5 HP chaffing machine (shredder) into small pieces.

of water) was sprinkled and kept for 8-10 days. After this incubation period, 2.5 kg of earthworms were released in to the pit at 3-4 spots. Later on cow dung slurry was sprinkled twice in a week @ the rate of 5 kg per 50 l of water. At the end of 14-15 weeks the

completed by 14-15th week. The results showed that around 248 kg of compost (on air dried basis) was produced from a pit of size 7.5 x 1.5 x 0.5 m (5.62 cum) by filling chaffed coconut fronds fallen @ of 71 kg/cum. The estimated quantity of vermicompost that can be produced



Feeding coconut fronds to shredder



Chaffed material from shredder outlet

The chaffed material of around 400 kg was put into compost pit of size 7.5 x 1.5 x 0.5 m (on an average 70 kg of material can be put into one cum). On this material, cow dung slurry (10 kg of cow dung in 100 l

vermicompost was analyzed for its nutrient content and for the microbial load.

Results and Discussion

The vermicompost production started from 45-50th day and

out of the total frond biomass available per annum per ha on air dried basis was 5.58 tones (Table 2).

Quality of the compost produced

The nutrient value of the vermicompost produced is given in



Vermicompost pit filled with chaffed material



Chaffed coconut frond being subjected to action of earthworms



Table 2. Extent of vermicompost produced and estimated production potential from per ha frond biomass

Raw material (Kg)	Quantity of material used		Extent of final product		Raw material to compost ratio
	For sample pit (5.62 cum)	Estimated for available frond biomass /annum	From sample pit (5.62 cum) (kg)	Estimated production from one ha frond biomass/annum (tones)	
1.Coconut fronds	400	9000	248	5.58	0.58
2.Cow dung	28** (140)*	630** (3150)*			

*Wet weight of cow dung **Dry weight of cow dung

Table 3, which contains 1.38, 0.31, and 0.24 per cent of N, P and K, respectively. The microbial composition is given in Table 3. The total microbial population (Bacteria, fungi, actinomycetes) was higher in vermicompost prepared from coconut fronds than raw coconut

Table 3. Nutrient composition of vermicompost prepared out of coconut fronds

Nutrient	Coconut fronds	End product (Vermicompost)
Nitrogen (N) %	1.06	1.38
Phosphorous (P)%	0.08	0.31
Potassium (K)%	0.85	0.24

Table 4. Microbial population in vermicompost and coconut fronds (cfu/g)

Microbial group	Coconut fronds	Vermicompost
Bacteria	17 x 10 ⁴	218 x 10 ⁵
Fungi	9 x 10 ²	44 x 10 ³
Actinomycetes	5 x 10 ²	28 x 10 ²
N-fixing organisms	Nil	57 x 10 ²
P-solubilizing organisms	Nil	25 x 10 ²

fronds. This may be attributed to higher nutrient contents of vermicompost and addition of cow dung which can act as starter culture for these microbes. And also found the N-fixing and P-solubilizing organisms in vermicompost, which were absent in the raw coconut fronds.

The vermicompost production potential through utilization of coconut fronds available is around 10.62 and 2.34 m.t. in India and Karnataka, respectively. In terms of nutrients, it is equal to 146, 32.92 and 25.5 thousand tones of nitrogen,

phosphorus and potassium, respectively, at the national level (Table 5). The coconut fronds which were used as base material for preparation of vermicompost had a nutrient content of 1.06, 0.08 and 0.85 per cent of N, P and K, respectively. Vageesh *et al.* (2010) reported that the compost prepared from primary ETP sludge and press mud (1:1 proportion) had a nutrient content of 0.94, 0.40 and 0.52 per cent N, P and K, respectively. Elinthamby (2010) reported a critical concentration of 2.5-2.6 % of N, 0.17-0.18 per cent of P and 0.8 to 1.05 % of K in frond 17 of mature oil palm. The recommended quantity of this is given in table 6. Based on this and nutrient content of vermicompost prepared out of coconut fronds, it is possible to substitute 100, 36 and 7.44 per cent of recommended N, P and K through recycling of this huge biomass (Table 6).

Table 5. Estimated nutrient production potential of vermicompost out of dry coconut fronds

Boundary	Million tones	Nitrogen	000' tones	potassium
	Vermicompost		Phosphorus	
India	10.62	146	32.92	25.49
Karnataka	2.34	32.2	7.25	5.62



Semi decomposed material



Final product of vermicomposting



Table 6. Extent of nutrients recycled back through vermicomposting of dry coconut fronds

Nutrient	Recommended quantity (kg ha ⁻¹)	Quantity of nutrients supplied through recycling (kg ha ⁻¹)	Extent of substitution (%)
Nitrogen	75	77	100
Phosphorus	48	17.3	36
Potassium	180	13.4	7.44

This line of work could be made more useful, if we work on the following points also.

- Effect of coconut fronds on population dynamics of earthworms as compared to other residues.
- Duration of composting for fallen coconut fronds in relation to other crop residues
- Study on extent of earthworm production and income through earthworm sale

Conclusion

Coconut fronds fallen from one ha of coconut garden can be converted in to 5.58 tones of vermicompost. Under the given situation of environmental pollution, high prices of fertilizers, soils losing their fertility and productivity due to lack of enough organic matter, scarcity of organic manures as a result of poor resource base at the farm level, conversion of crop by products/residues is the only option to maintain soil organic matter. As

there is a greater thrust for organic farming in recent years, residues of coconut plantations like dry fronds can alleviate the pollution problem and sustain soil productivity in the years to come.

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