

Why coconut farmers should take up vermicomposting of coconut leaves... ?

Murali Gopal and Alka Gupta,

Microbiology Section, ICAR-Central Plantation Crops Research Institute,
Kudlu P.O., Kasaragod, Kerala- 671124

Vermicompost, a low external input resource, is one of the major components of organic farming practice for sustaining soil health, fertility and crop productivity. Vermicompost production is a process that can recycle many of the agricultural refuse into wealth. Among plantation crops, coconut produces more than 6-8 tonnes of leaves as biomass from 1 ha. area on annual basis. The coconut leaves contain approximately 31% lignin, which offers high resistant natural decomposition, making them highly recalcitrant. However, certain group of earthworm that survives on organic matter alone (called compost worm) can enhance the decomposition process of such materials. For composting of coconut leaves, an indigenous strain of earthworm related to African Night crawler, *Eudrilus sp.*, is used, for which a low-cost grass-root level technology has been developed for large scale production of vermicompost from coconut leaves.

Using this technology, coconut leaves mixed with 10-20% cow dung, filled in cement tanks protected from direct sunlight and rains by a roof, aided by *Eudrilus sp.*, can be converted to vermicompost within 90 days period (Fig.1). The vermicompost produced by *Eudrilus sp.* from coconut leaves is dark brown coloured, granular matter possessing desirable C:N ratio, high organic carbon and humic acid content, easily available important plant nutrients. It usually is excreta of the earthworm obtained after organic matter undergoes physical, chemical and biochemical changes by the combined effect of earthworm and the microbial activities in the gut of the worm. It is also rich in plant growth promoting hormones viz. indole acetic acid, gibberellic acid and phenolics. Biologically, it harbours high counts of nitrogen fixing, phosphate solubilizing, cellulose degrading and plant growth promoting bacteria like fluorescent pseudomonads and *Bacillus spp.* Application of



Fig. 1. Production of vermicompost from coconut leaves

vermicompost improves the soil aggregation, aeration and water holding capacity, root growth, microbial activity and the overall crop production capacity of the soil in sustainable manner.

As much as 4000 kg of good quality vermicompost (air-dried with about 30% moisture) can be generated from around 6000 to 8000 kg of leaf biomass refuse obtained from 1 ha. of healthy, well managed coconut garden, every year by this worm that can meet a considerable percentage of nutrient need of the coconut palm. The vermicompost produced from coconut leaves can also be used for improving the productivity of other annuals, vegetables, fruits, flowers as well as cash crops. The coconut leaf vermicomposting technology is not only useful for farmers but also peri-urban horticulture crop growers, ornamental and floriculture crop cultivators, etc.

This technology is just not restricted to production of manures; it has a wide ramification in terms of environmental application that is extremely invaluable for society and the earth. The following points highlight this aspect-

Recycles tough coconut leaves quickly

Coconut leaves take more than a year to decompose naturally as they contain 39% lignin and 8% phenols which makes them resistant to microbial attack. But with the help of an indigenous strain of *Eudrilus sp.* earthworm isolated from CPCRI farm, this lignin-rich biomass admixed with 10-20% cow-dung can be converted to carbon rich granular vermicompost within 90 days. Thus, this technology offers an efficient method of recycling the 6-8 tonnes of leaf litter produced annually from 1 ha coconut garden to 4-5 tonnes of healthy organic manure.

Can convert other agro-wastes too

In addition to coconut leaves, the *Eudrilus sp.* can also digest pineapple wastes or banana pseudostem or glyricidia leaves or jackfruit leaves or mango leaves or sugarcane bagasse or coir-pith when mixed @ 25% (w/w) with coconut leaves and cow dung. Thus, the leaf or plant biomass wastes available from intercrops or homestead garden trees grown along with coconut can also be used as substrate for the vermicompost production.

Round the year activity

As large quantities of agro-wastes are available regularly and continuously, the conversion of these

wastes, therefore, becomes an year round activity for the end-users. The optimum weather conditions for efficient vermicomposting of coconut leaves by *Eudrilus sp.* is 28-32°C temperature and 90-95% RH which coincides with monsoon and post-monsoon periods in coastal tract of Kerala.

Circular carbon economy

Carbon is the energy currency of soil. Its rapid depletion leads to erosion of productive soil, loss of below and above-ground diversity and low agriculture output. The coconut leaf vermicompost is bulky stabilized manure with total carbon content of 35-37% and organic C content as high as 17-20%. Regular addition of this compost will be able to build organic matter content of the soil which is the main nutrient source for the plants and microorganisms. Thus, coconut leaf vermicompost returns carbon to soil and helps in producing higher plant biomass.

Replenishes soil with plant nutrients

As this vermicompost contains 1.8% N, 0.2% each of P and K, one tonne of this manure can add 18-21 kg of N, 2-3 kg each of P and K approximately to the soil. It can thus reduce application of chemical fertilizers to a great extent. For example, application of 25-30 kg of vermicompost/ coconut palm can meet all of its N requirement, but only 16% of P and 5 % of K which needs to be supplemented via other sources. Though the NPK content is low compared to chemical fertilizers, other positive aspects of this vermicompost makes it an ideal low-external input for improving the soil health and fertility.

Source of plant growth hormones

Coconut leaf vermicompost is rich in humic acid that improves the establishment of healthy root and shoot system in plants. It also contains indole acetic acid and gibberellic acid, which are known plant growth promoting hormones.

Conserves soil moisture

With 116-150% water holding capacity, addition of the coconut leaf vermicompost can significantly enhance water holding capacity of low water retention soils. This will greatly improve soil moisture conservation especially in rain-fed cropping areas to help overcome plants from water-deficit stress.

Adjusts soil pH

Coconut leaf vermicompost has near to neutral



As much as 4000 kg of good quality vermicompost (air-dried with about 30% moisture) can be generated from around 6000 to 8000 kg of leaf biomass refuse obtained from 1 ha. of healthy, well managed coconut garden, every year by this worm that can meet a considerable percentage of nutrient need of the coconut palm.



pH range of 6.2-6.5. Its addition can marginally improve those acidic soils having pH below 5.5 and as a result improve the availability of the nutrients to the plants.

Enhances soil microbial properties

Microbial biomass of this vermicompost is 20% higher compared to normal sandy loam soil. The biomass includes large population of plant beneficial microbial communities like nitrogen-fixers, phosphate solubilizers, plant growth promoting *Pseudomonas* and *Bacillus spp.*, cellulose degraders. The coconut leaf vermicompost, thus, becomes a novel source of plant beneficial microorganisms, which can be tapped for biofertilizer development as well for other biotechnological applications.

Can be used as manure for all crops

The coconut leaf vermicompost is an ideal source of organic manure for all types of crops. It can be one of the main components of the integrated nutrient management. The response to application of coconut leaf vermicompost can be best noted in case of vegetable and ornamental crops.

Source of liquid fertilizer

Vermiwash, liquid organic fertilizer, can be produced during the coconut leaf vermicomposting process. The vermiwash thus produced contains 2.8 ppm inorganic N, 10.28 ppm phosphorus, 205 ppm potash and 100-142 ppm humic acid. Application of vermiwash : water at 1:5 and 1:10 dilutions have shown to improve crop production capacities of soil and enhance the growth/yield of some agronomic and horticultural crops.

Can lock carbon in soil

The coconut leaf vermicompost is a stabilized form of manure which locks up carbon in its organic matter and retains it in the soil more than raw manure or inorganic fertilizer. With its total carbon content ranging from 35-37% and organic carbon around 17-20%, consistent application of it could gradually raise the level of carbon in the soils and can also lock organic carbon in soil for not less than 20 to 40 years owing to the presence of humic acids in it. The addition of this physically-protected humus organic carbon fraction of the vermicompost significantly improves the soil physical properties that enhance the root proliferation and nutrient acquisition by standing crop. Since the humus organic carbon remains in soil for long periods, even subsequent crops stands benefitted by its application. However, research data on the dynamics, stability of the coconut leaf vermicompost carbon as soil organic C over time needs to be generated for understanding the C-sequestration.

Ideal medium for soilless cultivation

Coconut leaf vermicompost is granular and of lighter density. It can be used as a substitute for peat in potting media. Already work done at ICAR-CPCRI has clearly indicated that coconut leaf vermicompost can be used as an alternative medium to potting mixture for raising coconut, arecanut, cocoa and vegetable seedlings in polybags/pot trays. It is therefore very much possible to use this vermicompost as soilless medium for raising several horticultural and ornamental plants.

Can be used as an animal feed

During the vermicompost production, there is multiplication of the earthworm numbers also. The earthworm biomass is a rich source of protein. It can be used as feed supplement for poultry, duckery and fish farming. The live worms are also good fish bait.

Improves farmers' economy

Production of coconut leaf vermicompost adds to the income of the family through the sale of vermicompost as well as the earthworms. If a farmer produces one tonne of vermicompost on his own farm with available infrastructure and substrates, he can earn approximately Rs. 12,000 from the sale of the vermicompost and earthworms, against production cost of Rs. 5500/- per production cycle. ■