

Vermicompost technology

for recycling arecanut biomass under Asom condition

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Under Asom condition, it is estimated that on an average six to seven tonnes of dry arecanut leaves are available from one hectare of well maintained garden. Decomposition of dry leaves and other organic biomass is rather slow because of their high lignin and polyphenol content. Earthworms can mediate decomposition of lignin as well as polyphenol and this accelerate the humification process. Vermicomposting is the method of composting the organic matter by earthworms.

UNDER Asom condition, it is estimated that on an average six to seven tonnes of dry arecanut leaves are available from one hectare of well maintained garden. The nutrient requirement of these crops can be met to a considerable extent if they are composted or recycled in the field. However, decomposition of dry leaves and other organic biomass is rather slow because of their high lignin and polyphenol content. Earthworms can mediate decomposition of lignin as well as polyphenol and thus accelerate the humification process. Vermicomposting is the method of composting the organic matter by earthworms under favourable soil moisture and temperature conditions. Central Plantation Crops Research Institute at Kasaragod, Kerala has identified a local strain of earthworm (*Eudrilus* sp.), similar to African Night Crawler, which is quite efficient in composting coconut and arecanut leaves into granular vermicompost.

weeds and vegetable peels. It also derives nutrition from microorganisms and decaying animals present in soil. Organic wastes that are decomposable are to be subjected to certain preliminary decomposition to enhance vermicompostability and its efficiency. Collect the arecanut biomass from the garden and spread them in a layer up to 30 cm and expose to sun for a day. Cut the materials into smaller pieces for enhancing decomposition and vermicomposting process.

Requirements for vermicomposting

Container: For small scale vermicomposting, the container can be of any shape or size and mainly depends upon quantity of waste to be composted and number of earthworms available. On an average, 2,000 adult earthworm can be maintained in a container of 1 m² dimension. These with appropriate conditioning of composting material would convert approximately 200 kg waste every month. For large scale production, pits, thatched shed or cement tank of suitable dimensions can be used.

Bedding material: Any biodegradable matter like banana leaves and pseudostem, coir pith, coconut and arecanut leaves,

Multiplication of earthworms

To undertake large production of vermicompost, one require earthworms in large numbers. Population of earthworms can be increased considerably in a short period of time, as their multiplication rate is very high. For this purpose, one can use any container like plastic bucket, wooden box or cement tubs of convenient size with provision of adequate drainage at the bottom. Fill the container with a mixture of cow dung and decaying leaves at 1:1 ratio. Earthworms may be released at the rate of fifty per ten kg into this mixture. Sprinkle water at regular intervals to maintain moisture in the container. Adequate shade may be provided for the unit. The earthworms eat the decaying materials and start multiplying by producing cocoons, which on hatching gives two-three young earthworms. It is noticed that the multiplication is often more than 300 times. The young worms can be used for large scale vermicomposting.

Materials for vermicomposting

Earthworms mainly feed on organic matter (partially decomposed) like leaf litter, animal dung, effluents,

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sugarcane trash, grasses etc. can be used as bedding material for the earthworms.

Moisture content: Moisture content during vermicomposting should be maintained in between 30-40%. If moisture is high, dry cowdung manure or leaf litter should be mixed and applied with substrate.

Temperature: The ideal temperature for optimal result is 20^o-30^oC. Activity of earthworms is found to slow down at very low temperature experienced during winter months.

Selection of ideal earthworm species: Earthworm species to be used for vermicomposting should have good survival capacity in high organic matter, high conversion efficiency, high temperature and pressure tolerance as well as have high reproduction rate etc.

Methods of vermicomposting

Small scale vermicomposting: A suitable container is to be selected and cleaned thoroughly. Provide small holes at the bottom covered with fine mesh to drain excess water. Place about 5 cm thick layer of any biodegradable matter at the bottom. Over this apply a thin layer of partially decomposed cow dung, moisten the bedding materials sufficiently and gently release the earthworms. A box or container of 1 m × 1 m × 0.5 m size can hold around 1,000 to 1,500 worms which require about 30-40 kg of whole organic matter. Later on, apply feed materials in thin layers at regular intervals and water it. Spread a moist gunny bag on top to cover the container, which will help to retain the moisture and gives shade. The

earthworms eat the feed materials and produce vermicompost within 55 to 65 days.

Large scale vermicomposting: Select a suitable site, which may be cement tank, or pit, or ground heap method can be adopted. Adequate drainage should be provided at the bottom. If concrete cement tank is made, it will last longer. It can be of convenient length and breadth, but the depth should be less than 1 m². The ideal size will be 3-4 m in length, 1 m wide and 0.75 m depth. Collect dried and fallen arecanut leaves, which are weathered for two to three months and place them by facing the lower side upwards in layers in the tank or pit as such or after chopping into pieces. Apply fresh cow dung slurry @ 100 kg per tonne of materials and allow it to remain as such for about two to three weeks for partial decomposition. On an average 1,350 to 1,500 arecanut leaves make one tonne. Keep the materials sufficiently moist by periodic sprinkling of water along with turning and mixing of the material. After partial decomposition of biomass, release earthworms @ 1,000 worms per tonne of leaves. Mulch the tank or pit with locally available materials like dry grass, straw, banana leaves etc. Provide shade to the tank by erecting overhead pandal to protect the earthworms from direct sunlight and rain. Protect the worms from predator birds, rats and ants by using wire mesh or such other materials.

Vermicomposting efficiency

The earthworms come up from the bedding materials during night time and eat the biomass materials and defecate the castings. On an average,

a grown-up earthworm can feed material of its own body weight in a day. Thus, initially the first lot of vermicompost will be ready within 55-65 days.

Collection of vermicompost

When vermicompost is ready for collection, the top layer appear somewhat dark brown with full of granular vermicasts. Stop watering for 4-5 days to allow it to dry. Scrape the compost gently from the container or tank to a suitable depth. This should then be removed to a side and left undisturbed for about one day. If there were adult worms present, they will move down or away from the composted material. At that stage, vermicompost can be collected, dried under shade and sieved if needed, and used as such or after storage.

When earthworms from the bottom layers are removed, coriander seed shaped semi hardy cocoons of earthworms can be seen along with the left over or partially composted materials. Earthworms left at the bottom layer of the tank or pit as well as the cocoons can be collected and used for further vermicomposting.

The process of vermicomposting by earthworms undergoes bio-chemical process inside the worms and comes out as faecal excreta, which is a rich source of plant nutrients, beneficial microorganisms, and plant growth substances. The time taken for conversion of areca leaves to suitable compost was less by earthworms compared to normal compost, and vermicompost from arecanut leaves, generally contains around 1.55% nitrogen, 0.42% phosphorus and 1.14% potash, besides other micronutrients (Table 1). The vermicompost was also rich in microbial population compared to normal compost.

Precautions while vermicomposting

- Protect the earthworms from direct sunlight and rain by making

Table 1. Comparative characters of composts

Compost	Time taken (days)	Recovery (%)	N (%)	P (%)	K (%)	Microbial population (cfu/g soil)		
						Fungi (x10 ⁴)	Bacteria (x10 ⁵)	Actino-mycetes (x10 ⁵)
Vermicompost	55-65	75-80	1.55	0.42	1.14	92	20	8
Normal compost	95-100	65-72	0.67	0.45	0.98	68	16	5

- provision of shade.
- Adopt preventive measures to get rid of predatory birds, red ants, rats etc.
- Periodic sprinkling of water to keep the materials sufficiently moist. There should not be any water stagnation; otherwise it will cause death of worms or fleeing from the tank or pit etc.

Application of vermicompost

Vermicompost is ideal organic manure for all the crops. Depending upon the growth of plants, the recommendation is to apply 10 to 15 kg/palm for arecanut in the basin by following the ring method during the pre-monsoon period. Care should be taken to apply sufficient mulch materials at the basin after application of vermicompost to prevent splash erosion of compost and at the same time it will serve as feed material for earthworms and cocoons, if present in the added compost.

Advantages of vermicompost

- Vermicompost contains various

- plant nutrients that are in the easily available form and it also contains plant growth promoting substances such as hormones and vitamins.
- It contains higher number of beneficial microorganisms, which help in improving soil fertility and plant growth.
- Vermicompost is an ecofriendly organic manure, highly stabilized product and not very bulky. Hence its storage, transportation and field application is easy.
- Being granular in nature, it improves soil aeration, water holding capacity of the soil and root growth of plants.
- Vermicompost can be produced nearest to the site of use.
- The production of vermicompost is simple and not costly.
- It can be applied to any type of crop and very much suitable for fruits and vegetables.

SUMMARY

Under Asom conditions, it is

estimated that on an average six to seven tonnes of dry arecanut leaves are available from one hectare of well maintained garden. The nutrient requirement of these crops can be met to a considerable extent if they are composted or recycled in the field. Earthworms can mediate decomposition of lignin as well as polyphenol and thus accelerate the humification process. Vermicomposting is the method of composting the organic matter by earthworms under favourable soil moisture and temperature conditions. Central Plantation Crops Research Institute at Kasaragod has identified a local strain of earthworm (*Eudrilus* sp.), which can convert the areca biomass into suitable vermicompost. The vermicomposting of areca leaves with above earthworm was standardized at CPCRI, RC, Kahikuchi, Guwahati. The vermicompost produced from areca leaves is rich in plant nutrients and microbial population and can be used as organic manure for any crop. □

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