MBM-CARI-XIV

Vermicompost Production

Rationale

Andaman and Nicobar (A&N) Islands is known for its natural resources and biodiversity. Paddy, coconut, arecanut, clove, black pepper, cinnamon, nutmeg and vegetables are the major agricultural crops in these islands. Agriculture has always been a challenge for the people of the islands, both due to availability of limited cultivable area and low productivity. It is further constrained due to reduction of paddy land from 12000 ha to 7685 ha and plantation area from 28000 ha to 24978 ha after tsunami 2004.

Initially, agriculture in these islands was promoted to attain self sufficiency and thus intensive farming technologies, use of chemical fertilizers and pesticides were promoted in the past few decades. Subsequently, these islands have been seen as potential area for organic farming. Considering the limited area under crops, these islands can be brought under organic farming with available plant residues, animal wastes and forest litters from buffer zone. Since both area and productivity are constrained, farmers income can be enhanced through organic farming based agricultural products that fetch higher prices.

What is Vermicompost? : Organic manure in the form of vermicompost obtained from the earthworm is one way to overcome the problems of low productivity. The production of compost from any organic waste (agriculture and homestead) using earthworms is called vermicomposting. Earthworms feeds the organic waste materials and passes it through their digestive system (digested by microbes present in the guts of worms) and gives out in a granular form (cocoons) which is known as vermicompost. Vermicompost made from mix of dung, crop residues and kitchen wastes along with earthworms are rich in terms of nutrient availability compared to farm yard manure (FYM) which is from mere decomposition of dung.

Requirements for Vermicomposting

The following are the four major requirements for vermicomposting:

- Suitable organic wastes
- Multiplication of earth worms
- Structure for composting
- Suitable method of composting

Suitable organic wastes: Crop residues, plant litters, weeds, farm yard manure and kitchen wastes are the common organic wastes available in a typical farm.

Availability of organic waste from different sources

Source	Type of wastes	Residue production (kg/ha/year)
Paddy	Straw, weed biomass	3000-4000
Vegetables	Leaves, stalks, infected fruits, plants	2500-3250
Homesteads	Kitchen wastes, dried leaves, weeds	500 / family
Coconut	Coconut husk, coir pith, leaf litter	8100
Arecanut, blackpepper	Leaf litter, weed biomass	6900
Gliricidia in fence	Green leaves	1250
Livestock	Cowdung	5500 kg/cow/year
	Poultry	65 kg /bird/year
	Pig	750 kg/pig/year
	Goat	290 kg/goat/year

Multiplication of Earthworms: About 2-3 kg of earthworms is required for 1000 kg of biomass, whereas about 1100 number earthworms are required for 1 m^2 area. Non burrowing species are mostly used for compost making. Red earthworm species like *Eisenia foetida* and *Eudrillus enginae* are most efficient in compost making. Following steps should be taken for small scale multiplication of worms:

- Use flower pots or abandoned bucket for small scale earth worms multiplication
- Make small holes on the side of pot or buckets
- Put 3-4 big size gravels on the bottom of bucket /pot to enable aerobic condition
- Fill pot with well chopped (4-5 cm length) organic wastes of about 2 cm thickness
- Spread 2 cm thick layer of fresh cowdung (2-3 days old) over the organic wastes
- Fill organic wastes and cowdung alternatively till the pot is filled
- Introduce red earthworms (10 to 20 numbers) and cover the pot with gunny bag
- Sprinkle water once in a day on the gunny bag to keep it sufficiently moist
- Once decomposing process starts, space will be available on the top. Fill it with organic wastes and cowdung alternatively to give sufficient feed to earthworms
- Within 2 months, 4-5 kg of worms can be produced from 10 to 20 numbers which can be utilized for farm scale vermicompost production

Structure for composting: For production of farm scale vermicomposting in island conditions, different structures i.e. plastic tubs, earthen pits, cement concrete tank and RCC rings can be used.

RCC ring

RCC rings of 1, 1.5, 2 and 2.5 m diameter are commonly available in the islands. The number of rings required will vary depending upon the availability of ring diameter and quantity of organic wastes available.

- 2 m diameter rings will be the optimum size for production of vermicompost
- 6 RCC rings are required to produce vermicompost from one ha of each lowlying paddy areas and hilly plantations. Two units of 3 RCC rings each should be made in case of paddy land alone or hilly lands alone so that height (0.9 M) of structure is manageable for mixing and collection activities
- 8 rings are sufficient for producing vermicompost from 2 ha land having 1 ha each of paddy-vegetable and coconut/Arecanut+ Black pepper. Make two units of 4 RCC rings each, so that the height is 1.2 m only
- Make a thatched shed over the RCC ring at a height of 2.5 m using coconut leaves, so that structure can be protected from heavy rain
- In the bottom of the ring, put either gunny bag or boulders to protect earthworm moving inside the soil
- Approximate cost of one 2 m diameter RCC ring will be Rs.1500/-

Method of preparation: Vermicompost can be prepared in any one of the above mentioned structures by adopting the following steps:

- Collect the available organic wastes from crops and *Gliricidia*
- Chop the wastes in to small pieces of 5 cm using knife for hastening the decomposition process
- Heap the chopped materials under sun for about 7-10 days
- Sprinkle cow dung slurry (5 kg of dung in 5 litres of water) on the heap
- Place a thin layer of half decomposed cow dung (3-5 cm) at the bottom
- Place the chopped weed biomass and partially decomposed cow dung layer wise (10-20 cm thickness) in the rings up to the depth of 75 cm
- Organic waste and cow dung ratio should be mixed at 60: 40 on dry weight basis
- Release about 2-3 kg of red earthworms per 1000 kg of biomass
- Place wire net / bamboo net over the tank to protect earthworm from birds.
- Sprinkling of water should be done to maintain 70-80 % moisture content.
- Provide a shed over the compost to prevent entry of rainwater and exposure to direct sunshine.
- Sprinkling of water should be stopped when 90 % bio-wastes are decomposed.

- Maturity could be judged visually by observing the formation of granular structure of the compost at the surface of the tank. Normally after 60 days, compost will be ready for collection.
- Harvest the vermicompost by scrapping layer wise from the top of the tank and heap under shed. This will help in separation of earthworms from the compost. Sieving may also be done to separate the earthworms and cocoons.

Do's

- Always use chopped and wilted organic residues
- Bed temperature should be in range of 20-30°C and protected from predators like red or white ants, centipedes and others like rats, cats, poultry birds or even dogs
- Worms should not be injured during handling
- Frequent observation of culture bed is essential as accumulation of casts' retards growth of worms
- Optimum size of structure should be used for timely decomposition of materials
- Earth worms find it difficult to adopt themselves in new environments hence addition of inoculums as a bait from earlier habitat helps in early adaptation to new site of rearing
- After removing the earthworms from compost, mix 5 packets of *Trichoderma* or *Pseudomonas* in compost for value addition of compost in controlling pathogens

Don'ts

- Do not add raw green wastes as it will affect the survival of earthworms
- Moisture level in the bed should not exceed 40-50%. Water logging in the bed leads to anaerobic condition and change in pH of medium. This hampers normal activities of worms leading to weight loss and decline in worm population
- Do not mix non degradable materials such as polythene papers etc
- Do not mix any soil or stones with residues of crops or cowdung

Some composting tips

- Mixture of cattle dung with vegetable wastes forms ideal feed for worms
- Addition of neem cake in small quantity enhances growth of worms
- Biogas slurry aged aerobically for 15 days enhances vermicomposting process
- Mix *Trichoderma* or *Pseudomonas* with the compost which will increase the value of compost in controlling pathogens of crops
- The compost is very dark in colour and it is very similar to farmyard manure in uses and appearance
- Compost should be dark brown in colour and has a fine smell and should have 15-20 % moisture in it.

Application of Compost to Crops

Crop	Quantity (kg/ha)	Time of application
Paddy	2500	After transplanting
Vegetables (Chillies, Brinjal, Okra, Cowpea, Tomato)	5000	Just before sowing
Groundnut	1250	Just before sowing
Coconut	2500	2 kg/plant at the time of planting (Jun-Jul) 5 kg/plant (1-5 year old plants) 10 kg / Tree (6-9 year old trees) 20 kg/Tree (>10 years old trees)
Arecanut + Black Pepper	2500	2 kg/plant at the time of planting (Jun-Jul) 5 kg/plant (1-5 year old plants) 10 kg/tree (6-9 year old trees) 20 kg/tree (>10 years old trees)

Production of Vermicompost at Farm Scale

Production of vermicompost both at farm scale and large scale is essential for converting the agricultural lands in to organic production units.

Summary for Production of Vermicompost at Farm Scale

Parameters	Lowlying area	Hilly area	Low lying + Hilly area
Area (ha)	**1 (7.5 bigha)**	**1 (7.5 bigha)**	**1 + 1 = 2 (15 bigha)**
Cropping System	Paddy-vegetable	Coconut/ arecanut/ spices	Paddy-vegetable (1 ha) +Coconut/ arecanut/ spices (1 ha)
Vermicompost requirement (kg/year)	2500 + 5000 = 7500	2500	7500 + 2500 =10000
Crop residue requirement (kg)	7750 Paddy system + homestead waste	1750* from coconut or arecanut plantations	3000 from paddy system + 6500 from plantations
Gliricidia production from fence (kg)	1250	1250	2500

Cow dung required (kg)	6000	2000 kg	8000
Number of animals required	1 cow + 4 goats+ 10 poultry birds	1 cow	2 cows
Total waste for composting (kg)	15000	5000	20000
Earth worms required (kg)	7.5	2.5	10
RCC rings required Number of units	6 rings 2 (3 rings + 3 rings)	2 rings 1 (2 rings)	8 rings 2 (4 rings+ 4 rings)
Expenditure/year			
Capital Cost / year (A)			
Cost of rings (Rs.)	9000	9000	12000
Cost of shed (Rs)	2500	2500	3500
Running cost /year (B)			
Labour and Miscellaneous cost (Rs)	6000	6000	7500
Packaging cost @ Rs 10 for 20 kg bag (Rs)	3750	3750	5000
Total (A+B)	**21250**	**21250**	**28000**
Returns / year			
Vermicompost production (kg/year)	7500	7500	10000
Returns** (Rs/year) @ Rs 9/kg	67500	67500	90000
Net returns (Rs) /year	**46250**	**46250**	**62000**

* Coconut and arecanut produces around 8100 and 6900 kg of wastes/year, respectively. Hence, on an average, 7500 kg of wastes will be available per year for composting. If all the available wastes are utilized for production, the requirement of cowdung will be 5500 kg/year which can be met from one cow. Including *Gliricidia*, the total waste availability will be 15000 kg/year which requires 7.5 kg of earth worms and 2 units comprising 3 rings + 3 rings for composting. The total production will be 7500 kg of vermicompost/year. The additional quantity of 5000 kg/year available can be sold.

** Besides essential macro and micro nutrients, Vermicompost has potential to improve the soil environment which will enhance crop growth.

Net returns / year : Rs 46250+ Rs 46250+ Rs 62000 = Rs. 154500/=

The cost includes cost of family labour and therefore, the total income to family will be much higher.

Market linkage : Sale of compost to farmers and gardeners