



Comparative Evaluation of Tank and Open Bed Method of Vermicomposting

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ABSTRACT

Vermicomposting is one of the simplest methods of recycling organic waste materials into a high quality compost. It is a major component of organic farming and has been gaining popularity among the farmers because of its manifold benefits. The present study was conducted during the year 2020-21 in four locations namely, Barjar, Sandheli, Sariahtoli and Bali villages of Nalbari district, Assam with two treatments viz., open bed method and tank method with a view to compare the duration of composting, earthworm population build up and production of quantity of vermicompost between the two methods. For tank method concrete tank of size 1.8 m x 0.9 m x 0.6 m (L x B x H) was constructed whereas for open bed method of same size were prepared on the ground demarcating with bamboo. Organic waste materials such as banana pseudostem, water hyacinth and other farm wastes and cowdung were used as raw materials and species of earthworm *Eisenia foetida* were inoculated @ 200 numbers per tank/ bed. The results indicated that duration of composting, earthworm population build up and quantity of vermicompost produced were significantly higher in open bed method of vermicomposting as compared to the tank method of vermicomposting. The time taken for vermicomposting was lowered by 20 days, maximum population was increased by 133 numbers and quantity of vermicompost produced significantly higher by 13 kg per bed in open bed method than the tank method. The open bed method was proved to be more feasible, suitable and beneficial in terms of production cost, time and labour saving, earthworm multiplication and generate higher economic return than the tank method. This method can be adopted for large scale commercial production of vermicompost.

Key Words : Vermicomposting, Tank, Open bed, Earthworm, Organic wastes.

INTRODUCTION

Vermicomposting is a composting process in which certain species of earthworms are used to accelerate the process of organic waste conversion and produce a good quality compost. Earthworms feed the organic waste materials and pass it through their digestive system and give out worm casts known as vermicompost. It is one of the simplest methods to recycle organic wastes and to produce quality compost and becoming popular as a major component of organic farming because it is rich in all major and micro nutrients. Nutrients are in readily available form, contains

hormones essential for plant growth and also acts as organic soil amendment improving physical, chemical and biological properties of soils. (Manyuchi and Phiri, 2013, Gopal *et al*, 2010). Vermicompost provides essential plant nutrients for supporting organic agriculture while improving and sustaining the soil health without any threat to the ecosystem functioning and environment (Singh and Singh, 2018, Fudzagbo and Iderawumi, 2020). Vermicomposting can be an avenue for income generation and self-employment when produced on commercial basis in large scale (Devkota *et al*, 2014; Chakravarty *et al*, 2018). For Vermicompost

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production a unit may be set up in cement or brick tank, wooden boxes, low cost bamboo tanks, plastic buckets, sipaulin bag, baskets, etc. The unit is covered with a roof made of thatch grass or any other locally available materials. In general concrete tanks are prescribed for production of vermicompost in large scale (Nagavallemma *et al*, 2006). Open bed method may be another feasible method for vermicomposting. The present study was designed with a view to compare the tank method with open bed method of vermicomposting in order to find out the best method.

MATERIALS AND METHODS

The present study was conducted in four locations viz. Barjar, Sandheli, Sariahtoli and Bali villages of Nalbari district during the year 2020-21 to compare the two methods of vermiomposting-tank method and open bed method. The study was laid out in RBD design with two treatments T1- tank method and T2-Open bed method with four replications (R1,R2, R3 and R4). The study was conducted during summer season and the data recorded were analysed for statistical significance with one-way ANOVA and Standard Error Mean (SEm $\pm$) and critical differences were computed.

For tank method concrete tank was constructed under a roof and open from all sides to protect from direct sunlight and rain water. On the other hand, the open bed was made on the ground by providing a boundary out line with bamboo. Such type of bed was made under the roof in a well-drained, high and shady place. The size of the tank (T1: Tank method) and open bed (T2: Open bed method) was 1.8 m length x 0.9 m width x 0.6 m height. Following procedures were undertaken during the vermicomposting process for both the treatments.

Organic wastes materials such as banana pseudo stem, water hyacinth, and other farm wastes were collected and shredded into small pieces and sprinkled with cow dung slurry and kept in heap for 5 days for partial decomposition to enhance the acceptability of organic wastes as food for

the earthworms. The predigested organic waste materials and cow dung were placed layer wise one after another to fill up the tank and bed. The quantity of organic waste and cow dung used was 100kg per treatment and organic waste to cow dung ratio was 70:30. The adult earthworm of species *Eisenia foetida* was inoculated @ 200 number for each treatment. The materials of the tank was sprinkled with water as and when required to keep moist (50-60%) throughout the decomposition period and a wet gunny bag was spread over the materials to facilitate maintenance of suitable moisture regime and temperature. The accumulated worm casts were collected and sieved to separate the earthworms and worm casts. Thus, the earthworms were counted by hand picking. The total earthworm's population, period taken for vermicomposting and quantity of vermicompost produced and cost of production were recorded for each treatment.

RESULTS AND DISCUSSION

Duration of composting

In open bed method the vermicompost was ready for harvesting after 40 days. In this method the rate of production was higher which may be attributed due to proper aeration from all the sides and created a natural environmental condition because of direct contact with earth surface. In such condition the earthworms also feed on the substrate from all sides. The vermicompost produced in this method became mature and dry in a short period of time as the excess water was absorbed by the floor and for prevailing good aerated condition. On the other hand, the vermicompost prepared in concrete tank was ready for harvesting in 60 days. In comparison to the open bed method, in tank the earthworms start feeding from the surface and most of the time bottom portion remains undigested because of accumulation of water and poor aerated condition. Thus in bed method time required for vermicompost production was reduced by 20 days which was significant higher than the open bed method as indicated by statistical analysis (CD at 5% level is 3.46) (Table 1, Fig 1). Yadav *et al* (2022)

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Table 1. Duration (days) of composting, Earthworm population (number) and Vermicompost production (kg) under open bed and Tank method of vermicomposting (Mean value)

Treatment	Duration of composting (days)	Earthworm Population (nos.)	Vermicompost production (Kg)
Open bed method (T1)	40	581.25	83
Tank Method (T2)	60	448	70
SEm±	1.47	21.42	1.68
CD@5%	3.46	50.40	3.96

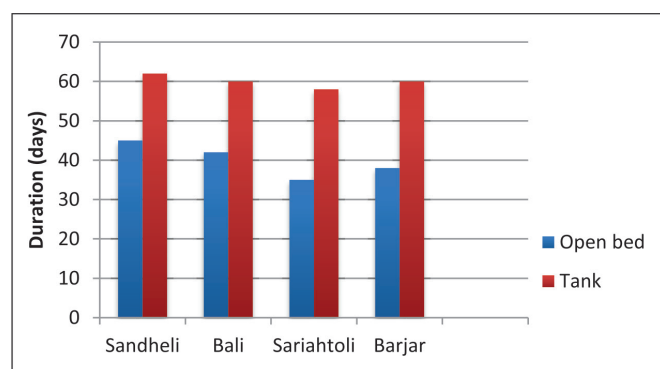


Fig. 1. Duration of vermicompost production at different locations

reported that abiotic factors like aeration, moisture content, temperature etc. affects the process of vermicompost production.

Population of earthworm

Population of Earthworm (numbers) after 40 days from both the treatments were counted. The increased population of earthworm was found in open bed system as compared to the tank method which was statistically significant (CD at 5% 50.4) (Table1, Fig 2). The increase in earthworm population in open bed method than tank method was attributed due to better aerated

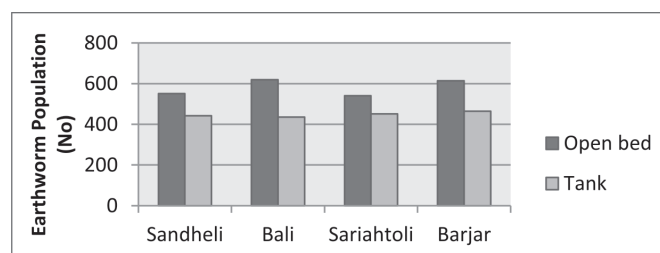


Fig. 2. Population of earthworm at different locations

condition. This method eliminates gas and water accumulation in the waste material heap and hasten the decomposition process and creates a favourable environment for earthworm multiplication. The growth and reproduction of earthworm during vermicomposting is affected by abiotic factors like aeration, moisture content and temperature (Yadav *et al*, 2022).

Production of Vermicompost

The quantity of vermicompost produced was significantly higher in open bed method than the tank method at 40 days (Table 1, Fig 3). In case of open bed method 83kg /bed vermicompost was produced whereas in tank method it was 70kg /tank. Higher quantity of vermicompost production was associated with higher population of earthworms due to conducive environment for earthworm multiplication.

Cost of Production

From this study it was revealed that open bed

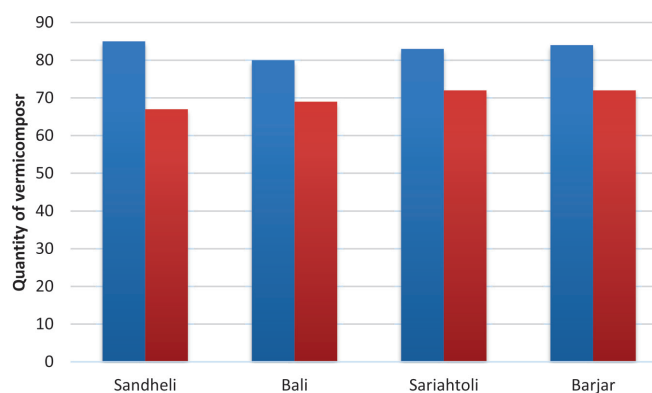


Fig. 3. Quantity of Vermicompost produced at different locations

method was easy to maintain and practice. It was recorded that the labour cost was reduced by 50% in case of open bed system compared to the tank system. In tank system loading and unloading of materials requires more labour as it is time consuming. On the other hand, heaping the materials on the floor and harvesting requires 50% less labour and harvesting become easy and comfortable in open bed method.

Another advantage in open bed method was time required for drying the vermicompost after harvest was less as compared to the tank method. Therefore, more quantity of vermicompost could be harvested in a short period of time resulting higher economic return in open bed method.

CONCLUSION

The open bed method is more suitable method of vermicompost production in our region where there is prevalence of high humidity and rainfall. This method is easy to practice and saves time, labour and generates more economic return. As it is more profitable therefore, can be adopted for large scale commercial production of vermicompost.

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