Optimising feed composition to enhance growth and reproduction rate of earthworm (*Eudrilus eugeniae*)

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Abstract

Intensive cultivation with meagre addition of organic manures made the soil less fertile. Because of depletion of organic sources and bulky in nature, the farmers find it difficult to use in crop production. Vermiculture technology comes in handy to overcome the drawbacks of other organic sources. Vermicasting reduces the volume by 50% and make available most of the nutrients to crops with more of beneficial microbes. This vermiculture technology is fast emerging in non-toxic solid waste management systems. The feed mixture composition influences the casting formation rate, growth and reproduction of earthworms. Hence, in the context of finding out suitable feed mixture to boost the growth and reproduction rate, the study was carried out. Different feeds namely, farm yard manure, leaf mould or crop wastes, pressmud and composted coir pith were taken for the study. The sole or in combination, 12 feed mixtures were tried. The earthworm species *Eudrilus eugeniae* was taken for test. Observations were recorded at intervals for assessing growth and reproduction rate along with casting weight from an initial known population and weight of worms. The findings revealed that growth is significantly higher with farmyard manure feeding. Reproduction rate was better with leaf mould or crop waste fed treatments. Optimum casting formation, growth and reproduction rate was recorded for the feed mixture combination of equal parts of farmyard manure, crop waste and pressmud. Application of raw pressmud resulted in more mortality of worms due to temperature build up.

Media summary

Understanding the feeding likings of the earthworm and its reflection on the reproduction behaviour for commercial exploitation in vermicompost production units.

Key words

Feed bed, decomposition, temperature, earth worm, growth, reproduction.

Introduction

The available organic wastes are used almost sparingly in crop production. The present scenario of fertilizer use efficiency and soil productivity is an eye opener for the tropical agriculture. Poor organic content directly reflects on soil degradation. In most of the cases organic wastes are burnt or dumped on roadsides. Because of bulkiness and innumerable organic waste sources, a break through in optimal combination can arouse interest for vermiculture. The potentiality of vermiculture technology in the disposal of organic wastes is vast and differs from other methods of composting (Gandhi et al. 1997). Bulkiness of the waste materials is reduced by 40-60% during vermicomposting. The resultant castings are rich in readily available nutrients, beneficial microbes and plant growth hormones (Tara Crescent 2003; Nagavallemma et al. 2004). Like any other living being, the growth and reproduction of earthworm is solely depending upon the feed materials used in the culturing. Most failures and problems are due to the enormous temperature build up during decomposition. The physical and chemical properties of the waste materials can also influence. It is essential in the tropical countries to maintain the optimum temperature in the organic matter between 25º and 35º C and moisture level ranging from 50 -60%. Hereunder, the study carried out to sort out a better combination of different organic wastes for feeding earthworms to increase growth and reproduction behaviour is presented.

Methods

In the preliminary study, the organic manures namely farm yard manure, leaf mould/ crop wastes, pressmud, composted coir pith, and their combinations with or without jaggery 0.1% solution comprising 12 treatments were imposed. According to Bhat (1974) yard manure enhanced the feeding and also on colonization of N-fixers. Hence, farm yard manure was included in all the combinations. The preliminary study was carried out to assess the temperature stabilization pattern and performance of feed materials on the worm culture. A known quantity of earthworm (*Eudrilus eugeniae*) (1000grams) was inoculated into the feed beds after five days of bed preparation. The feed mixtures were placed in tanks with 60cm length, 60cm breadth and 90cm height. Moisture was adequately taken care. The feed beds were least disturbed. Daily temperature was observed at 60cm depth. At 50 days after inoculation weight of earthworms were taken for each treatment. Because of earthworm mortality and poor multiplication indices in sole pressmud, coirpith and 50% coir pith combinations, the treatments were modified. Thereon from second to fourth cycle the number of feed material combinations was reduced to seven. Feed materials decomposed for forty five days were used and checked for thermal stabilization. For hastening the process of decomposition, moisture (50- 60%) and aeration were maintained by adding water and stirring upside down till worms were inoculated. Feed material of 0.5 kilogram was taken in well aerated containers (20cm diameter and 20cm height). For each container ten worms were inoculated. At ten days interval, earthworm weight, number of worms, and number of cocoons were observed. From each treatment, sample cocoons were maintained separately in well aerated petri dishes to observe number of hatchlings per cocoon. From the observed values relative growth rate and reproduction rates were worked out.

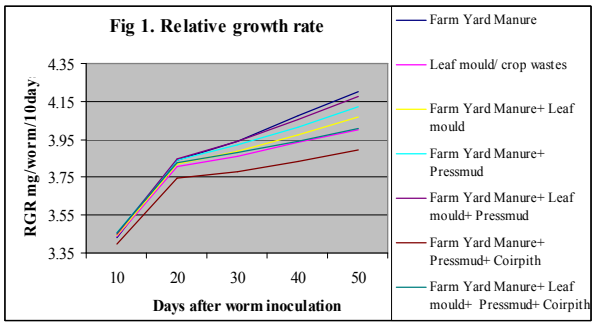
Results

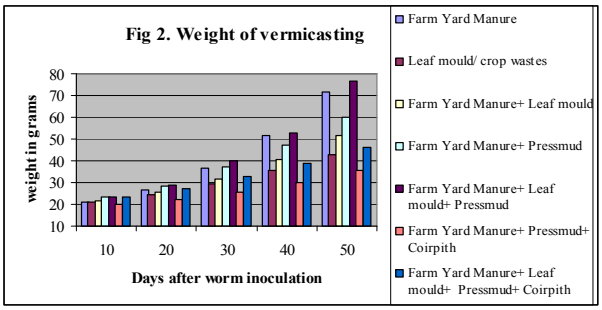
In the first cycle (preliminary study), the observed temperature ranged from 34.1°C at the time of inoculation to 70.4°C at 20 DAI in sole press mud feed beds. In all other feed beds the temperature ranged between 25.2°C and 52.1°C. The observed temperature values are presented in the table 1. Inoculation of worms was done after five days of bed preparation. Mortality was observed in the feed beds with either full of pressmud or coir pith or 50% coirpith. In later cycles of study, worms were inoculated only after forty five days. By which time, the decomposition part was almost over and thermal stabilization between 25.0°C and 30.0°C was observed in all beds (Kale, 1994). Farm yard manure fed beds gave well grown worms with higher relative growth rate (RGR) as highlighted in the figure 1. At the same time, the leaf mould feed beds had more number of cocoons and higher number of young hatchlings. More quantity of castings was collected in the pressmud mixed feed combinations (Figure 2). Comparatively better growth, optimum cocoon production and higher reproduction rates were observed for the feed material combinations of equal quantities of FYM, leaf mould and pressmud. Figures 3 to 5 show the cocoon production, number of hatchling per cocoon and hatchling success percentage respectively.

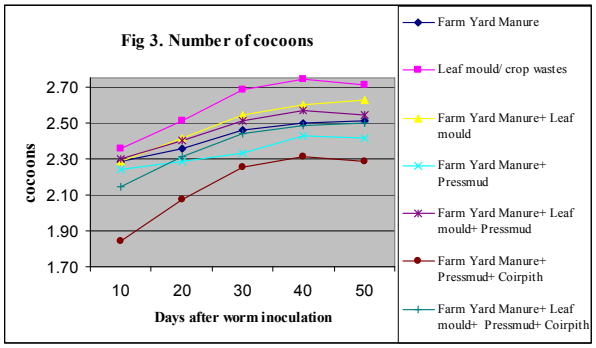
Table 1. Observed temperature* in the feed beds in °C

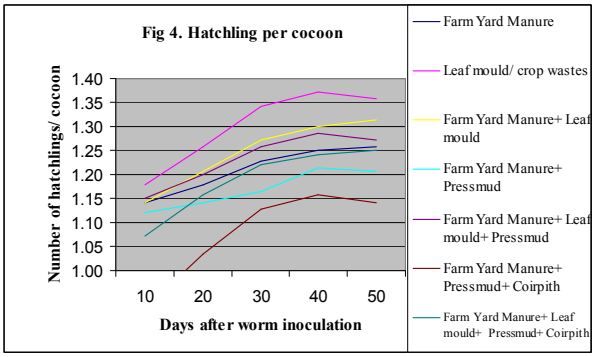
Treatments		0 DAI	5 DAI	10 DAI	15 DAI	20 DAI	25 DAI	30 DAI	35 DAI	40 DAI	45 DAI	50 DAI
T_1	FYM	30.0	30.1	32.3	35.0	42.9	39.1	32.8	30.7	28.4	27.7	25.5
T_2	LM	31.2	34.3	39.5	44.4	50.5	49.7	45.2	39.3	33.5	29.9	27.9
T_3	PM	34.1	40.0	44.3	51.7	70.4	68.0	63.2	49.9	40.5	36.8	33.9
T_4	CP	32.7	33.0	34.2	35.0	34.0	34.5	33.3	31.0	29.1	27.7	25.8
T_5	FYM+ LM	31.1	31.8	33.0	37.4	41.0	40.0	38.1	33.7	30.3	28.9	26.0
T_6	FYM+ PM	33.0	34.8	41.1	48.7	52.1	50.1	48.5	42.5	35.1	31.1	29.8
T_7	FYM + CP	33.0	34.3	35.0	35.9	34.3	35.1	33.1	31.3	28.2	26.3	25.7
T_8	FYM+ LM+ PM	32.0	33.7	35.8	38.1	43.9	43.0	40.5	35.4	31.2	29.4	27.6
T_9	FYM+ PM+ CP	33.9	36.7	40.4	46.4	48.3	51.0	43.6	36.8	31.5	28.0	27.1
T_{10}	FYM+ LM+ PM+ CP	31.4	33.1	35.0	39.2	45.1	43.7	40.8	35.7	30.1	27.6	26.5
T_{11}	FYM+ LM+ CP+JS	31.0	33.1	35.3	38.7	43.5	42.8	37.8	33.9	29.4	27.0	25.2
T_{12}	FYM+ LM+ PM+ CP+JS	31.1	33.4	36.1	38.3	45.8	44.4	41.0	35.2	30.5	28.4	26.8

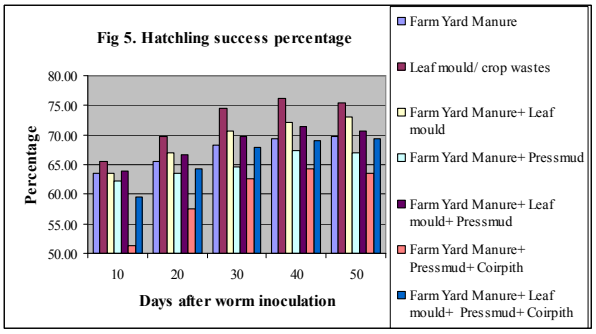
DAI- Days after inoculation; FYM- Farm yard manure; LM-Leaf mould; PM- Pressmud; CP- Coirpith; JS-0.1% Jaggery solution.
* mean of 5 days observation (two times per day at 8.05 and 14.10 IST)











Conclusions

Better relative growth rate was observed in farm yard manure fed treatments. Leaf mould yielded higher cocoon number, hatchlings and success rates. But optimum growth rate coupled with better reproduction was observed for the combination of equal proportion of farm yard manure, leaf mould and pressmud. Undecomposed pressmud is deleterious to vermiculture due to high temperature build up. Coirpith with its abrasiveness render the worms helpless.

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