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RESEARCH ARTICLE

Effect of agricultural waste on growth of *Abelmoschus esculentus l.*

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ABSTRACT: Vermicompost plays a major role in successful growth and yield of different field crops, vegetables, flowers and fruit crops. The utilization of organic residuals reduces production costs and removes the need for landfill disposal and incineration. Vermicomposting is a suitable alternative for the safe, hygienic and cost effective disposal of urban waste. The present study has been carried out to find the potency of vermicompost using *Musa paradisiaca* (banana stem) waste and *Eudrilus eugeniae* earthworm as it effectively decomposes the waste. To analyse the efficiency of vermicompost the physicochemical parameters like pH, EC and the level of macro and micronutrient content namely nitrogen, phosphorous, potassium and C/N ratio of vermicompost has been studied. The efficacy of vermicompost has also been checked and studied on the vegetable plant *Abelmoschus esculentus L.* (ladies finger). The growth parameters namely root length, shoot length, leaf area, number of leaves and Chlorophyll Content has been studied. Hence based on the studies performed it was concluded that vermicompost found from the degradation of *Musa paradisiaca* (banana stem) waste by *Eudrilus eugeniae* is an effective biofertilizer which would enable the uptake of the nutrients by the plants resulting in higher growth and yield.
Keywords: Biofertilizer, Banana stem, *Eudrilus eugeniae, A.esculentus.*

INTRODUCTION

Banana is an important food crop of the world which is cultivated over an area of more than seventy million tons. In India Banana is a major cash crop which is mostly grown in Tamil Nadu State. After the harvest of the fruits the whole plant is left as waste. The aim of this work was to investigate the potential use of agro waste in to vermicomposting. Agro waste Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, flowers and fruit crops. The application of compost to agricultural soil is shown to reduce the number of parasitic nematodes, and increase both the numbers of micro-arthropods and earthworms (Leroy *et al.,* 2007). Stimulation of soil biological activity and increase of micro-arthropods were also demonstrated by Petersen *et al.,* (2003). Melero *et al.,* (2007) showed a clear increase of microbial biomass and enzymatic activities at the fourth year of compost application to clay soils.

Composts have the potential to provide biological control of many soil-borne plant diseases. Foliar, vascular, and root pathogens may be affected by compost application (Hoitink *et al.,* 1997; Noble & Coventry, 2005; Yogev *et al.,* 2006). Reported levels of disease suppression vary, even if similar composted material is used at the same rates. Sterilization of composts generally results in a loss in the disease suppressing capability of composts, indicating that the mechanism is predominantly biological, although chemical and physical factors have also been implicated. The utilization of agro waste is cost benefit and eliminates the need for landfill disposal and burning. Vermicomposting is an appropriate alternative for the safe, hygienic and cost effective disposal of urban waste. The present study deals with vermiculturing and earthworm interaction microflora, physical, chemical parameters of vermicompost material and influence of plant growth on ladies Finger (*Abelmoschus esculentus L.).*

MATERIALS AND METHODS

Banana pseudo stems were collected locally from the farms in Thirukottiyur village in Thanjavur district and were used as cellulosic substrates. The banana stem were dried in the sunlight for 2 weeks and then manually chopped into smaller pieces. Agro waste were mixed with different composting treatments were experimented in the study. First (T1) is the substrate (Banana pseudostem) in combination with cow dung and earth worm. Substrate in combination with cow dung alone was used as control (T). In all the above experiments (T and T1) three different substrate concentration. Agro waste were mixed with standard bedding material and introduced into standard plastic trays occupying about 3kg of the materials. The each pre-decomposed substrates were mixed with cow-dung in 2:2 ratio on dry weight basis in separate plastic trays of 45cm x 35cm x 15 cm sizes with six replicates for a period of 2 months (Gopinathan and Prakash, 2013). Vermicomposting was carried out in an environmentally controlled experimental chamber at a temperature of 27±1°C and the vermin beds were maintained to contain a moisture level of (65-75%) by sprinkling water over the surface daily. 10 worms per kg were introduced in each tray. Exotic earthworm *Eudrilus eugeniae* were inoculated manually in selected bedding materials

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in plastic trays. The bedding material upper surface was covered with wire mesh to avoid entry of predators. The samples for analysis were taken out from the vermicomposting plastic trays at the start of the experiment, then after 30 days, 45 days and lastly, after 60 days.

NUTRIENT ANALYSIS

Samples from vermin bed substrates and vermicompost were dried and sieved .The pH, Electrical conductivity, NPK and C/N ratio was analysed. (Bhat and Limaye, 2012,). The determination of organic carbon was carried out as per the procedure of (Walkley and Black, 1934); Total nitrogen, phosphorus, potassium were determined according to standard methods as described by (Jackson, 1973); C/N ratio was calculated by dividing the percentage of carbon estimated for the sample by the percentage of nitrogen estimated for the same sample.

STUDY ON THE EFFECT OF VERMICOMPOST ON THE GROWTH OF *ABELMOSCHUS ESCULENTUS* L.

CLASSIFICATION:

- kingdom – Plantae
- Division – Magnoliophyta
- Class – Magnoliopsida , Rosids
- Order – Malvales
- Family – Malvaceae
- Genus – Abelmoschus
- Species – A. esculentus
- Binomial name – Abelmoschus esculentus.

The seeds of *Abelmoschus Esculentus* L. were grow in 3 different pots T, T_1, T_2, (Allah Bakhsh Gulshan, 2013)
T - Control (Only soil (7kg) +10 seeds)
T_1- Composting (150 gm) + 10 seeds + Soil (7kg)
T_2 –Vermicompost (150gm) + 10 seeds + Soil (7kg)
10 earthen pots were used to test the vegetative growth parameters of *Abelmoschus esculantus* (lady finger) vegetable. The size of each pot was 10 inches deep and 8 inches width and filled with soil.
The following parameters were observed on 30thday and 60th day of planting.

MEASUREMENTS OF GROWTH PARAMETERS

At each harvest following parameters were recorded; Shoot length (cm), Root length (cm), Number of leaves, Leaf area (mm2), Shoot Fresh weight (gm), Root Fresh weight (gm), Shoot Dry weight (gm) and Root Dry weight (gm), Chlorophyll.
After treatment, stem cuttings were carefully removed from the soil without any damage and washed in running water to remove the adhering soil particles. The length of the root, shoot and leaf counts were done.

RESULTS

TABLE I: PHYSICOCHEMICAL PARAMETERS OF VERMICOMPOST

S.No	Days	Treatments	pH	EC	N (%)	P (%)	K (%)	C/N ratio
1	30th day	T	8.02	0.20	3.457	0.517	8.737	32:1
2		T_1	8.36	0.70	3.700	0.500	8.740	35:1
3	45th day	T	8.10	0.40	3.660	0.500	9.483	39:1
4		T_1	8.32	0.70	3.640	0.500	9.500	42:1
5	60th day	T	8.48	0.10	3.423	0.500	9.467	42:1
6		T_1	8.42	0.50	3.817	0.500	9.500	46:1

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TABLE II: GROWTH PARAMETERS OF *ABELMOSCHUS ESCULENTUS*

S.No	Treatment	Total Chlorophyll
30th Day	T	2.973
	T_1	1.888615
	T_2	1.50313
60th Day	T	4.98951
	T_1	3.904605
	T_2	3.51912

TABLE III: CHLOROPHYLL CONTENT OF *ABELMOSCHUS ESCULENTUS*

S. No	Treatment	No of Plants germinated (%)	No. of leaves	Leaf area	Shoot length (cm)	Root Length (cm)	Plant Height (cm)	Root FW & DW(gm)		Shoot FW & DW (gm)		No. of nodes	No of Flowers after 45th day
30th Day	T	70	28	4.2	12	6	18	0.4	0.01	0.8	0.1	30	20
	T_1	70	25	4.5	15	5	20	0.5	0.01	1.0	0.12	27	18
	T_2	70	23	4.5	15	6	21	0.5	0.01	1.2	0.11	26	24
60th Day	T	70	40	8.9	18.5	7	25.5	0.7	0.1	1.3	0.16	44	
	T_1	70	36	14.2	22	7	28	0.7	0.01	1.6	0.22	38	
	T_2	70	42	6.7	22	7.5	29.5	0.8	0.01	1.9	0.29	43	

T—Control (cowdung + soil), T_1- agro waste+ cowdung, T_2- agro waste + cowdung + earthworm

DISCUSSION

The effects of treatments on leaf N, P and K concentrations, growth and vegetable yield of *A. Esculentus* were studied. Compared with control (T), NPK value T_1 and T_2 increased number of leaf, plant height, number of branches, leaf area, number and weight of fruits significantly ($p>0.05$). Vegetable yields of *A. Esculentus* given by all the Treated compost were similar. The C/N ratio was significantly high in vermicompost of banana waste. The C/N ratio is one of the main criteria that describe the composting process. It is often used as an index of composting maturity, despite many pitfalls associated with this approach, but it seems to be a reliable parameter for following the development of the composting process (Khalil *et al.,* 2001). The changes in C/N ratio could be taken as evidence of the degradation rate of the organic materials and the maturity of compost. Abdel hamid *et al.,* (2004) who stated that C/N value of around or below 20 could be considered satisfactory. Khalil *et al.,* (2001) demonstrated that the C/N ratio of mature compost should ideally be about 10 but this is hardly ever achievable due to the presence of recalcitrant organic compounds, or materials which resist decomposition due to their physical or chemical properties. Some authors reported that a C/N ratio below 20 is an indicative of acceptable maturity. However, Moldes *et al.,* (2007) stated that compost might be considered mature when C/N ratio is approximately 17 or less, unless lignocellulytic materials remain. Definitely, the macronutrients N, P and K are the most consumed elements by plants at the all stages of growth. The quantity and form of N, in particular, present in manure or compost is important in shaping the quality of the material and for its agronomic use and are increasingly more often defined in compost specification (Lasaridi *et al.,* 2006 and Moldes *et al.,* 2007). The concentrations of NPK were increased during the composting process in all treatments (Table, 1). Data clearly showed that the concentrations of NPK in organic manure treatments were higher than that of chemical activator treatment at initial and end of composting process. Generally, the increase in total NPK during composting may have been due to the net loss of dry mass as loss of organic C as CO2. Moreover, total N can also be increased by the activities of associative N-fixing bacteria at the end of composting process (Abdelhamid *et al.,* 2004). These results are in similar with those obtained by different authors (Abd El-Maksoud *et al.,* 2001, 2002; Kaviraj & Sharma, 2003 and Eida, 2007). Increase in nitrogen content in the vermicompost is due to the fact that earthworms enhanced the nitrogen cycle which attributed to the increased levels of nitrogen in vermicompost. The losses of organic carbon might be responsible for nitrogen addition in the form of mucus, nitrogenous excretory substances, Growth stimulatory hormones and enzymes from the gut of earthworms (Tripathi and Bhardwaj, 2004).

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CONCLUSION

From the results, it was observed that, the addition of banana waste used as amendments increased the soil organic matter content as well as increase in soil nutrients such as available P and K, EC and total C/ N ratio. The application of organic manure also improved the physical attributes of the soil. The vegetative growth of *Abelmoschus esculentus.* L recorded more or less similar in all the treatments. Banana pseudo stem fed with cow dung with Earth worm (*Eudrilus eugeniae*) soil shows organic and inorganic values of compost was slightly increased in C/N ratio than the Soil fed with cow dung. The present study reveals that application of vermicompost is quite beneficial in grown *A. esculentus* for higher rate of germination, increased plant using growth; increase in yield parameters and in higher marketable fruit yield. However, the effect of vermicompost dose is again crop dependent, with more yields.

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CONFLICTS OF INTEREST
"The authors declare no conflict of interest".