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Research Article

Studies on the nutrient quality (NPK ratio) present in the vermicomposting of jackfruit leaf litter by earthworm *Lampito mauritii*

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Keywords
Vermicompost, Jackfruit leaf litter, *Lampito mauritii* and NPK.

Abstract

The nutrients are increasing the fertility value of jackfruit leaf litter it was planned to utilize the vermicompost production. *Lampito mauritii* in different mixtures of jackfruit leaf litter (JLl) with bedding material (BM) were studied for a period of 60 days. In all the experimental trails worms were weighed (15 mg / kg of medium) and inoculated in to the substrate. For chemical analysis, the samples were collected on 0, 30 and 60th day composts and vermicomposts. The macronutrients (NPK) were increased in all treatments and control after vermicomposting over initial substrate. The increased minerlization and conservation of nutrients are due to biocatalytic role of earthworms in the decomposition and conservation mechanisms during vermicomposting.

Introduction

Vermicomposting is one of the ways to reduce the organic waste and its being practically used all over the world. Verms is a latin word for worms and vermicomposting is essential composting with worms (Ghatnekar *et al.*, 1998). All kinds of natural and discarded organic matters, unusable to men are considered as waste. Earthworms accelerate the mineralization rate and convert the manure into casts with higher nutritional value and degree of humification than traditional methods of composting (Albanell *et al* ., 1988). Various researchers have recommended that increase in the levels of the total nitrogen (Orozco *et al.*, 1996), total potassium (Tiwari *et al.*, 1989) and available N, P, *K.* (Vinotha *et al.*, 2000 and Suthar, 2007) during vermicomposting. Hence an attempt has been made to study the nutrient dynamics in the vermicompost produced from jackfruit leaf litter with bedding materials by using *L. mauritii* since no previous similar work was reported. *L.mauritii* in different mixtures of Jackfruit leaf litter (JLI) with bedding material was suited for a period of 60 days (Saranraj and Stella, 2012).

Materials and Methods

L. mauritii were obtained from stock culture maintained in the department of zoology, Annamalai University. Jackfruit leaf litter were collected from different villages surrounding Neyveli, Tamil nadu and stored in jute bags. The dung was collected from dairy yard at the faculty of Agriculture, Annamalai University. Jackfruit leaf litter and bedding material mixed with various combinations all the mixture were maintained at 65-70% moisture content. For each treatment six replicates were maintained. Treatment substrates were prepared inn the following proportions on weight basis such as T_1 –JLI + BM (9:1), T_2 – JLI + BM (8:2), T_3 – JJLI + BM (7:3), T_4 – JLI + BM (6:4) and T_5 –JLI + BM (5:5) alone was used as control (C). In the present study the feed substrates were allowed for 20 days of initial natural decomposition. Chemical analysis (NPK) of worm un worked (initial substrate) and worm worked (vermicomposts) at the intervals of 0, 30 and 60th days. The statistical significance of the data was tested by one -way ANOVA.

Results

In the present investigation of N, P, K (macronutrients) analysis in vermicomposts of *L. mauritii* (Jackfruit leaf litter and bedding material mixture) are presented in Table 1 - 3. For all the tables (one – way analysis of variance and comparison of means based on the Tukey's honestly significance difference test (HSD, $P<0.05$) were used to determine significant difference between treatments) were worked and presented in the respective table.

Table-1 Nitrogen content (%) of the vermicompost of jackfruit leaf litter – bedding material mixture by *L. mauritii*

Substrate Proportions	Vermicomposting days		
	Initial (0)	30	60
C	1.56 ± 0.05	2.39 ± 0.08 cd (53.2)	2.62 ± 0.07c (67.9)
T_1	1.24 ± 0.08	1.58 ± 0.09a (27.4)	1.80 ± 0.05a (45.1)
T_2	1.31 ± 0.05	1.70 ± 0.07ab (29.7)	1.94 ± 0.05a (48.0)
T_3	1.43 ± 0.08	1.91± 0.08b (33.5)	2.14 ± 0.09 ab (49.6)
T_4	1.46 ± 0.09	2.18 ± 0.09c (49.3)	2.40 ± 0.09bc (64.3)
T_5	1.50 ± 0.03	2.02 ± 0.06 bc (34.6)	2.34 ± 0.05b (56.0)

Mean value followed by different letters is significantly different (ANOVA; Tukey's test, P <0.05) ; C– Control, T1 (JLI + BM) - 9 : 1, T2 ((JLl + BM) - 8 :2, T3 (JLl + BM) - 7 :3, T4 (JLl + BM) - 6:4, T5 (JLl + BM) -5 :5. Initial (0) – Worm unworked Substrate, Mean ± SD of six observations.Values in parenthesis is percentage increase /decrease over the initial.

Table – 2 Phosphorous content (%) of the vermicompost of jackfruit leaf litter bedding material mixture by *L. mauritii*

Substrate Proportions	Vermicomposting days		
	Initial (0)	30	60
C	1.12 ± 0.05	1.65 ± 0.07c (47.3)	2.12 ± 0.05 c(89.2)
T_1	0.87 ± 0.03	1.08 ± 0.05 a (24.1)	1.23± 0.06 a(41.3)
T_2	0.92 ± 0.04	1.15 ± 0.02 a (25.0)	1.36 ± 0.09a (47.8)
T_3	0.99 ± 0.05	1.26 ± 0.06 ab (27.1)	1.51 ± 0.08 ab(52.5)
T_4	1.02 ± 0.07	1.32 ± 0.07 c(29.4)	1.69 ± 0.05 b(65.6)
T_5	1.10 ± 0.06	1.40 ± 0.09 b(27.2)	2.06 ± 0.05 c(87.2)

Mean value followed by different letters is significantly different (ANOVA; Tukey's test, P <0.05); C– Control, T1 (JLI + BM)- 9 : 1, T2 ((JLl + BM) -8 :2, T3 (JLl BM) -7 :3, T4 (JLl + BM) -6:4, T5 (JLl + BM) -5 :5. Initial (0) – Worm unworked Substrate, Mean ± SD of six observation. Values in parenthesis are percentage increase /decrease over the initial

Table – 3 Pottassium content (%) of the vermicompost of jackfruit leaf litter bedding material mixture by *L. mauritii*

Substrate Proportions	Vermicomposting days		
	Initial (0)	30	60
C	0.81± 0.03	1.17 ±0.05 bc (44.4)	1.28± 0.04 c (58.0)
T_1	0.60 ± 0.05	0.78 ± 0.04 a (30.0)	0.84 ± 0.05 a (40.0)
T_2	0.62 ± 0.07	0.81 ± 0.08 a (30.6)	0.89± 20.05 a (43.5)
T_3	0.69 ± 0.08	0.91 ±0.06 ab (31.8)	1.02± 0.05 b (47.8)
T_4	0.70 ± 0.06	1.02 ± 0.05 b (41.6)	1.10 ± 0.08 b (57.1)
T_5	0.72 ± 0.06	0.97± 0.06ab (34.7)	1.07 ± 0.06 b (48.6)

Mean value followed by different letters is significantly different (ANOVA; Tukey's test, P <0.05); C– Control, T1 (JLI + BM) - 9 : 1, T2 ((JLl + BM) - 8 :2, T3 (JLl + BM) - 7 :3, T4 (JLl + BM) - 6:4, T5 (JLl + BM) - 5 :5. Initial (0) – Worm unworked Substrate, Mean ± SD of six observation. Values in parenthesis are percentage increase /decrease over the initial.

Nitrogen (N%)

The changes observed in the availability of nitrogen in the 0, 30 and 60th day composts of various mixture are presented in Table - 1. The quantity of nitrogen increased from 0 day – 60th day, on initial the nitrogen present in C, T_1, T_2, T_3, T_4 and T_5 were 1.56 ± 0.05, 1.24 ± 0.08, 1.31 ± 0.05, 1.43 ± 0.08, 1.46 ± 0.09 and 1.50 ± 0.03 respectively. Among various treatments of jackfruit leaf litter, C, T_4 and T_5 showed a higher content of nitrogen than the T_1, T_2 and T_3 treatments. The efficiency of different treatments were found to be ranked in the following order on the basis of percentage change C (67.9%) > T_4 (64.3%) > T_5 (56.0%) > T_3 (49.6%) > T_2 (48.0%) and T_1 (45.1%) respectively on 60th day. The T_1 and T_2 were significantly different from the other treatment.

Phosphorus (P%)

The quantity of phosphorus present in the 0, 30 and 60th day vermicomposts made by *L. mauritii* are presented in table 2. The level of P increased gradually in control and in all treatments. The maximum percentage change of phosphorus over the initial were found in C (89.2%), it was followed by T_5 (87.2%), T_4 (65.6%), T_3 (52.5%), T_2 (47.8%) and T_1 (41.3%) on 60th day in jackfruit leaf litter + bedding material mixture. Among the treatments the C and T5 were significantly different than the other combinations.

Potassium (K%)

The quantity of potassium present in the substrates is presented in table 3. The availability of K on the initial day was 0.81± 0.003, 0.60 + 0.005, 0.62 ± 0.007, 0.69 ± 0.008, 0.70 ± 0.006 and 0.72 ± 0.006 in C, T_1, T_2, T_3, T_4 and T_5 respectively. The amount of potassium increased in all observations from the initial value. Among the treatments the highest mineraliztion of potassium was found on the basic of percentage change over the initial in C (58.0%) followed by T_4 (57.1%), T_5 (48.6%), T_3 (47.8%) and the minimum mineralization in T_2 (43.5%) and T_1 (40.0%) on 60th day. The control (C) were significant different form the other treatments.

Discussion

The increased level of macro nutrients (NPK) in the vermicomposts were in confirm with the results of earlier workers (Saranraj and Stella, 2014). Kale (1988) observed a significant increase in available N, P, K in worm worked cow dung and sheep dung. Increased quantity of N, P and K was reported in the worm casts than the starting feed material (Orozco *et al*., 1996; Edwards and Bohlen; 1996). Ramalingam *et al.* (1998) demonstrated significant increase in the content of N, P and K in the compost of *E. eugeniae* and *L. mauritii.* Ramalingam and Thilagar (2000) found that the level of N, P, K Ca, Mg and Mn have increased in the worm worked compost of sugar cane wastes than the worm un worked compost.

Parthasarathi (2002) demonstrated increased N,P, K in the soil and pressmud after the inoculation of *P. excava*tus and *E. fetida*. Increased content of total N,P,K from the initial levels of vermibed mixtures showed that the activity of earthworms and microbes brought about rapid mineralization (Umamaheswari and Vijayalakshmi 2005).The inoculation of *E. eugeniae* in the cowdung + bagasse mixture increased the N,P,K content in the final product than the initial feed mixtures (Ananthakrishnasamy *et al*., 2007; Suresh Kumar *et al*., 2011). They added that it was due to the effective decomposition of organic waste took place when passed through the gut of worms.

Karmegam and Daniel (2009) have reported that the higher percentage increase of NPK in vermicompost produced by *L. mauritii* and *P. ceylanensis* in different type organic waste than in worm – unworked compost due to the mineralization process caused by earthworm action along with microorganisms organic materials. The highest mineralization of NPK was observed in T_3 (CD + FA (3:1) and it might be due to the availability of higher nutrients for earthworms and good medium for the multiplication of microbes (Ananthakrishnasamy *et al.* 2009).

Manimegala (2011) stated that the increased levels of NPK was observed in the T_2 (FA 3: CLl 3.5: CD3.5) and T_7 (FA 3: JLl 3.5: CD 3.5) vermicompost over the initial, it may be due optimal moisture, availability of higher nutrients for earthworms and suitable medium for multiplication of microbes. Mane and Raskar smitha (2012) stated that the higher mineralization of agriculture waste from market yard by the earthworm *E. fetida* and *E. eugeniae* was observed.

Conclusion

In the present investigation concluded the increased N, P, K was due to higher mineralization during vermicomposting of jackfruit leaf litter and bedding material mixture. In present studies the mineralization of NPK was higher in C (BM alone and T4 (60 JLl + 40 BM) treatments than the other treatments.

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