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STATUS OF N P K IN VERMICOMPOST PREPARED FROM TWO COMMON WEED AND TWO MEDICINAL PLANTS

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Abstract

Vermicomposting is a bio-technique and vermicompost are good superlatives for organic farming. During vermicomposting the nutrients are released and converted into soluble and available forms that's providing nutrients such as available N (nitrogen), soluble K (potassium), exchangeable Ca (calcium), Mg (magnesium), P (phosphorus) and microelements such as Fe (iron), Mo (molybdenum), Zn (zinc), and Cu (copper) which can easily taken up by plants. Vermicompost contains plant growth regulators, soil treated with vermicompost showed better plant growth than treated with inorganic and other organic fertilizers. Adding of vermicompost to soil improves the soil structure, increasing the water holding capacity and porosity. Vermicomposts have also been shown to suppress attacks by soil and foliar transmitted plant diseases. This article reviews various attribute as NPK values of *Parthenium hysterophorus*, *Azadirachta indica*, *Argemone mexicana*, and *Vitex negundo* vermicompost. pH of each compost are in range of 7.5 – 8.1. Nitrogen (N) content (%) is low in cow dung compost (1.7%) and higher in other plant compost except *Azadirachta indica* and *Vitex negundo*, maximum in *Parthenium* vermicompost (1.8%). Phosphorus (P %) ranges 1.3% to 1.6% and maximum in *Azadirachta indica* vermicompost. Potassium (K %) ranges 0.8% to 15.8% and all four vermicompost has significantly higher K contents than the cow dung compost. Organic carbon - nitrogen ratios (C/N) were also higher in vermicomposts produced with plant except in *Argemone mexicana*.

Keywords: Argemone Mexicana; Azadirachta indica; NPK; organic farming; Parthenium hysterophorus; vermicompost; Vitex negundo.

Introduction

Organic composting is an ancient agricultural manure producing technique. From last century Vermiculture for producing a better manure or compost called vermicompost developed by agriculturist is now being expanded a new branch in agriculture, termed as Organic Farming. Vermicomposts are stabilized organic soil amendments that are produced by a non-thermophilic process, in which organic matter is broken down through interactions between earthworms and microorganisms, under aerobic conditions. During vermicomposting the nutrients are released and converted into soluble and available forms (Ndegwa and Thompson, 2001) that's providing nutrients such as available N, soluble K, exchangeable Ca, Mg, P and microelements such as Fe, Mo, Zn, and Cu (Amir and Fouzia, 2011) which can easily taken up by plants. Sugar factory waste (Lakshmi and Vijayalakshmi, 2000), horticultural residues (Edwards 1988), agricultural residues (Bansal and Kapoor 2000), cattle dung (Gunadi *et al.* 2002) and weeds (Gajalakshmi *et al.* 2001) could all be converted into good quality vermicompost with a moderate values of NPK. Vermicomposts have much greater microbial

biodiversity and activity than conventional thermophilic composts (Edwards *et al.*, 1998; Edwards 2004). Microbes present in gut wall of earthworm responsible for the biochemical degradation of organic matter and transformed it vermicompost (Aira *et al.*, 2002). Vermicompost contains plant growth regulators and other plant growth influencing materials produced by microorganisms (Grappelli *et al.*, 1987) including humates (Atiyeh *et al.*, 2000), cytokinins and auxins (Krishnamoorthy and Vajrabhiah, 1986). In agriculture soil treated with vermicompost showed better plant growth than treated with inorganic fertilizers or cattle manure (Subler *et al.* 1998). Adding of vermicompost to soil improves the chemical and biological properties (Purakeyastha and Bhatnagar, 1997), improve the soil structure, increasing the water holding capacity and porosity (Parthasarathi *et al.*, 2008).

Materials and Methods

Composting materials

Leaves of Neem plant (*Azadirachta indica* A. Juss.), Parthenium (*Parthenium hysterophorus* Linn.), Sialkanta (*Argemone mexicana*) and Nisinda (*Vitex negundo*) plants

collected from the Krishnath College, Berhampore, Murshidabad campus were washed, shade dried, and cut into pieces of 3-4 cm length.

Cow dung

One week old cow dung was used in experiments because fresh cow dung may be dangerous for earthworms due to decomposition process, when generation of heat take place that may kill earthworms.

Earth worm

The earthworm *Eisenia fetida* and *Perionyx excavatus* was purchased from the specimen supplier and cultures were maintained in the laboratory over a period of two years with cow dung as the substrate and food.

Experimental design

The present study was carried out during June 2010 to Nov 2010. After collecting plants from the K. N. College campus it was cut into very small pieces and then these small pieces were placed separately in the cemented pits. The pits were covered with polythene. After a period of 30 days all these partially decomposed weeds were mixed with cow dung. By using above plant materials and cow dung, five sets of experiments were set up in cemented pits (100 cm in diameter, depth 45 cm). In all experiment 30 young earthworms were introduced. The moisture content was 50% throughout the study period and maintained by sprinkling of adequate quantities of water. In first set (A) of experiment the bedding was prepared by partially decomposed cow dung. In second set (B) of experiment the bedding was prepared by mixing of partially decomposed cow dung with partially decomposed *Azadirachta indica* A. Juss. Use in 5:1 (wt/wt) ratio. The third set (C) of this bedding was prepared by mixing of partially decomposed cow dung with partially decomposed *Parthenium hysterophorus* used in 5:1 (wt/wt) ratio. In the fourth set (D) the bedding was prepared by taking 5:1 (wt/wt) of partially decomposed cow dung and partially decomposed *Argemone mexicana*. The fifth set (E) of this experiment bedding was prepared by taking 5:1 (wt/wt) of partially decomposed cow dung and partially decomposed *Vitex negundo*. After five days interval turned the compost mixture of bed manually up to 30 days. After 60 to 70 days granular tea like vermicompost appear on the upper surface of compost beds.

Characteristics of the composts

After 70 days, worms were removed from the composts. Samples of composts were then shed dried and analysed for pH (1:2.5 soil water suspension), organic carbon (OC) (Walkley and Black, 1934), nitrogen (N) (Humphries, 1956), phosphorous (P) (Jackson, 1973), potassium (K) (Toth and Prince, 1949).

Result

The nutrient values of vermicompost obtained in this study are presented in Table 1. The pH of cow dung compost (control, A) value was 8.1. The pH of other four compost (B, C, D, E) showed significantly similar value. pH of each compost are in range of 7.5 – 8.1. Nitrogen (N) content (%) is low in cow dung (A) compost and higher in other plant compost, except in Neem and Nishinda. There was no significant difference in the N and P content between the Nishinda plant and Neem leaves compost. All compost has significantly higher K contents than the cow dung compost (A). Potassium (K) contents are high in all plant vermicompost. When compared to cow dung compost, significant difference of OC was found in Sialkanta compost. Accordingly the carbon nitrogen ratios were also higher in composts produced with plant except in Sialkanta. Organic carbon (OC) is less in Neem and Sialkanta.

Discussion

The pH values of soil ranges 7.5 to 8. The pH of five composts showed significantly in same range (A - 8.1, B - 7.9, C - 8.1, D - 7.5, E - 8.0). Decomposition of nitrogenous substrate in to ammonia that may be attributed overall increases of pH (Cohen and Lewis, 1949). The observed increase in the nitrogen (N) in all composts (except in the case of in Neem and Nishinda leaves compost) showed that the activity of earthworm along with microorganisms promoted mineralization process and brought the nutrients to ready to use form for plant growth. The increased nitrogen may be due to nitrogenous metabolic products of earthworms. Atiyeh et al. (2000) reported that by enhancing nitrogen mineralization, earthworms have a great impact on nitrogen transformation in manure, so that nitrogen retained in the nitrate form. Hand et al. (1988) have been already reported that *Eisenia foetida* in cow dung slurry increased the nitrate-nitrogen content.

Table 1: Values of different parameter in vermicompost (values are given in percentage).

Vermicompost	pH	N % (Nitrogen)	P % (Phosphorus)	K % (Potassium)	OC % (Organic Carbon)	C/N Ratio
Cow dung (A)	8.1	1.7	1.30	0.8	30.00	17.64
Neem leaves + Cow dung (B)	7.9	1.5	1.60	15.8	28.10	18.73
Parthenium + Cow dung (C)	8.1	1.8	1.30	15.0	30.20	16.77
Sialkanta + Cow dung (D)	7.5	1.7	1.40	09.6	24.00	14.11
Nishinda + Cow dung (E)	8.0	1.5	1.50	14.2	29.20	19.46

Lee (1985) reported that vermicompost contain more nitrogen, phosphorous and calcium. Phosphate (P) values are higher (1.6%, 1.4% and 1.5%) in all vermicompost except cow dung and Parthenium (1.3%). According to Lee (1992) the passage of organic residue through the gut of earthworm releases phosphorus. Available forms of Phosphate is performed partly by earthworm gut wall microbial phosphatase and further released of phosphorus might be attributes to phosphorus solubilising micro organism present in worm cast (Zhang et al. 2000). Total potassium (K) concentration was increased in vermicomposts of all the combination except cow dung. Delgado et al. (1995) have reported a higher content of K in the new sewage sludge vermicompost. Benitez et al., (1999) studied that the leacheates collected during vermicomposting process had higher K concentrations. Kaviraj and Sharma (2003) observed that level of K was increased 10% by *Eisenia foetida* and 5% by *L. maturitii* during vermicomposting. Organic carbon (OC) decreases in Neem, Sialkanta and Nishinda in comparison to the cow dung and Parthenim vermicompost. 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). Observed C:N

ratio in all combination are nearly similar and the values ranged in 14.11 to 19.46. According to Senesi (1989) declined in C:N ratio to less than 20 which indicates an advance degree of organic matter stabilization and reflects a satisfactory degree of organic wastes. Suthar, (2008) reported that the C:N ratio of substrate material reflects the organic waste mineralization and stabilization during the process of decomposition. The loss of carbon as CO₂ through microbial respiration and added of nitrogenous excretory material between the C:N ratio of the substrate. C:N ratio is one of the most widely used indicators of vermicompost maturation, decreases sharply during vermicompost process (Kale, 1998; Suther, 2008). A similar reduction in C:N ratio was reported by Bansal and Kapoor (2000) and Karmegam and Daniel (2000). Muthukumaravel, 1996 and Vasanthi et al., 2005 observed that the mixture of plant waste and cow dung is suitable for the production of higher quality vermicompost when compared with the subjecting the same components individually. Ravichandran et al., 2001 observed more NPK in the vermicompost than that in the initial soil. The Parthenium hysterothorus vermicompost contains two times more nitrogen, phosphorus and potassium than Farm Yard Manure (FYM) (Angiras, 2008; Channappagoudar et al., 2007).

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