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Nutrient Analysis in the Vermicomposts of Aquatic Weeds Prepared By Eisenia Fetida

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Abstract- **Aquatic weeds are still regarded by many people as a menace because they are not yet aware of the great potential and economic value of these profusely growing uncomfortable plants. The works presents the dynamic use of vermicomposts of Aquatic weeds waterhyacinth (Eichornia sps) and Chara sps prepared using Eisenia fetida. The nutrients of vermicompost was analysed after 60 days to determine the amount of macro elements and microelements. High amount of nutrients were observed in the vermicompost of waterhyacinth than the vermicompost of Chara sps and control soil. The study shows that vermicompost of water hyacinth can be used as an organic fertilizer in the field to increase the fertility of soil and also to solve the chronic problem of Eutrophication in aquatic water habitats.**

Keywords: Aquatic weeds, Vermicompost , Nutrients, Environmental reclamation.

INTRODUCTION

The practice of vermiculture is at least a century old but it is now being received world wide with diverse ecological objectives such as waste management, soil detoxification, regeneration and sustainable agriculture (Joshi and Chauhan 2006). The earthworms have beneficial, physiological chemical and biological effects on soil and many researchers have documented that these effects can increase the plant growth and crop yield (Edwards and Bohlen 1996). Vermicompost contains growth regulators like growth hormones which increase the growth and yield of crops (Canellas et al., 2002).

Vermicompost is described as "biooxidation, and stabilization of organic material involving the joint action of earthworms and mesophilic microorganisms" (Aira et al 2002). Vermicompost of aquatic weeds have a good nutrient value and is significantly, influenced by the origin, type and proportion of the organic wastes utilized. In Tamilnadu, studies have indicated that the coon tail, Ceratophyllum demersum, submerged macrophytes is very efficient in removing ammonia (97%) and phosphorus (60%) from raw sewage and also removes 97% BOD5.

Aquatic weed plants grow very luxuriously in lotic and lentic type of water bodies, they have a devastating effect on water quality. Water hyacinth (Eichonia sps), also known as blue devil, grows rapidly as a dense green mat over stagnant water bodies such as lakes, streams, ponds, waterways, ditches and backwaters. It alters the ecosystem of the water body, causing fluctuation and raising the water temperature. The seeds of the plant will sprout even after 20 years of dormancy due to drought conditions. This weed is a good absorber of Nitrogen, Phosphorus and potassium from water and can be used as a good source of compost material.

The objective of the present study are preparation of vermicomposts from aquatic weeds Chara and Waterhyacinth using Eisenia fetida and to analyse the amount of nutrients in the vermicomposts of aquatic weeds.

MATERIALS AND METHODS

Experimental design

The Water hyacinth and Chara materials were dried in air, cut into small pieces and mixed with cow dung (nutrient mixture) on dry weight basis in a ratio of 5:1 for the experiment (Deka et al., 2011). This mixture was pre decomposed for 15 days to make it palatable for the earthworms.

The compost was prepared in wooden box of 3 feet breadth and 2 feet height. A thin layer of 1.5 cm thick sterilized soil is filled at the bottom and broken bricks 5 cm size was spread over the bottom layer as the supporting material for vermicomposting. Partially decomposed cow dung was placed over the soil layer. The experiment was setup by taking 5kg nutrient mixture (on dry weight basis) in each wooden box and no extra feeds were provided during the study. Fifty earthworms, Eisenia foetida were released over the mixture. The compost of mixture was covered with paddy straw. Two vermibeds were prepared for Waterhyacinth and Chara sps. Three replications were setup for statistical analysis of the results. A similar setup was also maintained with garden soil without adding weeds and earthworms for control. Vermicomposting was conducted under laboratory conditions in darkness at an average ToC at 25oC and a substrate moisture content of 70 -75%. The experiment was conducted for 60 days after releasing the earthworms. The nutrient content of the vermicompost was analysed after 60days.
Total nitrogen was determined by Kjeldhal method, phosphorus was estimated by vanado – molybdate method, and potassium was estimated by ammonium acetate

extractable method. Micro nutrients were determined using standard laboratory procedure.

RESULTS AND DISCUSSION:

At the end of experimental period the nutrient content of vermicomposts was analysed to determine the amount of nutrients. The amount of nutrients is presented in Table1 and Increasing percentage of nutrients in the vermicompost is shown in Table 2.

Table 1. Amount of nutrients in the vermicompost

S. No	Sample	Macro Nutrients (g/kg of dry mass)			Micro Nutrients(mg/kg of dry mass)				
		N	P	K	Zn	Cu	Fe	Ca	Mg
1	Control	3.92±0.86	2.68±0.24	4.35±0.55	2.56±0.17	1120±87	1022±58	122±18	225±38
2	Chara *sps.*,	6.25±0.33	3.71±0.36	5.34±0.85	3.32±0.46	1251±64	1136±112	185±23	287±49
3	Water hyacinth	8.68±0.57	4.81±0.12	6.62±1.20	4.89±0.62	1876±15	1611±135	236±67	420±28

Table 2. Increasing percentage of nutrients in the vermicompost

S.No	Sample	Macro Nutrients (%)			Micro Nutrients (%)				
		N	P	K	Zn	Cu	Fe	Ca	Mg
1	Control Vs Chara	59.44	38.43	22.76	29.68	11.69	11.15	51.64	27.55
2	Control Vs Water hyacinth	1.21	79.47	52.18	91.01	67.50	48.04	93.44	86.66

MACRONUTRIENT COMPOSITION

Vermicompost contains macro and micronutrients in plant available forms, enzymes vitamins and plant growth hormones. It has more beneficial impacts on plant than normal compost (Gajalakshmi and Abbasi, 2004)

The vermicompost samples of aquatic weeds showed higher levels of macronutrients as compared to the control. There was 59.44% increase in N level in the vermicomposted material of Chara sps and 1.21% increase in the compost sample of waterhyacinth from the control soil. Nitrogen is an important constituent of proteins, coenzymes and porphyrins. It plays a vital role in growth and metabolism by constituting porphyrins that are the important part of chlorophylls and cytochromes. Increase in nitrogen content in the vermicompost is due to the fact that earthworms enhanced the nitrogen cycle which attributed to the increased level s of nitrogen in vermicompost (Tripathi and Bhardwaj, 2009).
Similarly, compost recorded 38.4% increase in available P in Chara sps, whereas in case of vermicompost sample of waterhyacinth it was found to be 79.47 % increase as compared to the control. Phosphorus is an integral component of cell membranes, which keep out unnecessary compounds and allow in those needed for plant cells to function properly. Phosphorus is an important constituent of nucleic acids, nucleotide chains, NADP and ATP. Through ATP formation and nucleic acid, phosphorus enhances protein synthesis. Further, coenzymes like NAD, NADP and ATP, phosphorus is necessary in oxido - reduction and energy transfer reactions of respiration and photosynthesis.

The total K increase was 22.76% in vermicompost sample of Chara sps., as against 52.18% in the compost of waterhyacinth. The earthworm processed waste material contains high concentration of exchangeable potassium, due to enhanced microbial activity during the vermicomposting process, which consequently enhanced the rate of mineralization (Suther , 2004). Potassium balances charges between ions within plant cells and regulates turgor pressure, helping to protect plant cells from invading diseases. Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen.

MICRONUTRIENT COMPOSITION

Similarly, there was 51.64% and 93.44% increase in Ca level, 27.55% and 86.66% increase in Mg level, 11.15% and 48.04% increase in Fe level, 11.69% and 67.50% increase in Cu level and 29.68% and 91.01% increase in Zn level in the vemicomposts of Chara sps., and Waterhyacinth respectively.

Increase of copper content in vermicompost might be due to the increased content of several Cu containing oxidizing enzymes. Copper is the important constituent of several oxidizing enzymes and coenzymes. Iron and copper are required in comparatively lesser amounts, hence they are considered as a micronutrient. Iron is an important constituent of iron porphyrin proteins like cytochrome catalases and cytochrome peroxidases and for synthesis of chlorophyll. Iron is an important constituent of ferrodoxin which involves in primary photochemical reactions and biological nitrogen fixation. The presence of enzymes and co-factors in the earthworm gut increased the iron content in the vermicompost (Mall, et. al, 2005).

The compost sample recorded 51.5% increases in Ca level and 27.55% increase of Mg value in the vermicompost of Chara sps., and 93.44% increase in Ca level and 86.66% increase of Mg value in the vermicompost of waterhyacinth . It has been suggested that activity of earthworms drives the mineralization process efficiently and transforms a large proportion of Ca and Mg from bind to free form that may enhance the composition of the elements in the final product (Suther, 2009). Water hyacinth is a good absorber of nitrogen, phosphorus and potassium from water. The increasing amount of macronutrients in the vermicompost of Chara and Water hyacinth is attributed to its efficient nutrient stripping ability.

CONCLUSION:

In the vermicompost of Aquaticweeds macro element was high, where as microelements were with in permitted levels, thus making these vermicomposts extremely useful in agriculture and reclamation of Eutrophication in the aquatic environment. Aquatic weeds are obnoxious to eradicate from natural environment which create pollution and .it is difficult to manage in lotic and lentic types of water bodies. Accordingly the present investigation proves that the conversion of aquatic weed biomass into vermicompost is an effective eco-friendly technology for managing the rapid growth of aquatic weeds.

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