Vermicomposting of Food Wastes

Seinn Lei Aye

DepartmentofIndustrialChemistry,UniversityofYangon,KamayutTownship, Yangon11041,Myanmar

Abstract

With the progressive increase in the size of the Myanmar's population, large volumes of organic wastes produced all over the country are creating a serious disposal problem and a major source of environmental pollution. In the study, effective recycling of food wastes was carried out to produce organic fertilizer – vermicompost. The locally available earthworm Red Wigglers *Esenia Fetida* and Indian Blue earthworm *Preionyx Excavatus* were used for the purpose. The characteristics of vermicompost such as nitrogen content, phosphorous content, potassium content, organic matter content, calcium and magnesium contents, pH, carbon and nitrogen ratio were determined. The vermicompost products were applied in Mustard Greens (*Brassica Juncea* var.) (Mon-hnyin) plantation and its effect on growth characters were investigated.The vermicomposting process took 3 months to produce black, light and odourless products. The results showed that vermicompost produced from mixed earthworm species gave higher yield than those produced by single species. The analysis of vermicompost revealed that it contained sufficient amount of both primary macronutrients – nitrogen (1.32%), phosphorus (0.72%), potassium (0.58%), and secondary macronutrients – calcium (0.79%) and magnesium (0.32%). It was also found that Mustard Greens plants with the application of vermicompost had better growth characters in terms of numbers of leaves per plant, leave length and leave width than those plants without application of vermicompost.

Keywords:organic fertilizer, vermicompost, earthworm, macronutrients

Introduction

Rapid growth of population and industrialization in Myanmar has resulted in large volumes of solid wastes which are creating a serious disposal problem. Unscientific and indiscriminate disposal of solid waste is a matter of serious health concern. Immediate actions are therefore warranted for proper management of urban solid waste. Under these circumstances there is an immediate need for improved technologies for reduction in generation of solid waste and for recycling and reuse. Further, it is very important to adopt the most economically viable method for solid waste disposal.

Organic waste makes up a major component of solid waste in most municipalities throughout Myanmar. As of the survey conducted at Hlaing Tharyar Township in 2009, organic waste constituted 74% of total solid waste (Seinn Lei Aye, Bo Bo Thet and Nwe Ni Win, 2009). Vermicomposting, or composting with the help of earthworms, is an excellent technique for recycling food waste in the apartment as well as composting yard wastes in the backyard. Certain species of earthworms consume a wide range of food waste very rapidly and converting them into vermicompost which is more effective organic fertilizer than garden compost (Hailu, K.A., 2009). Vermicompost contain higher percentage (nearly twofold) of both macro and micronutrients than the garden compost (ICRISAT, 2006). Vermicompost is an essential material in organic farms and greenhouse bedding plants.

Thus, the present study aims to produce vermicompost at house level from food waste, and assessing its efficacy by applying it to Mustard Greens (*Brassica Juncea* var.) (Mon-hnyin) plantation. The specific objectives of the study are (1) to produce vermicompost from food wastes (outer leaves of banana stem, watermelon peels, and outer leaves of cabbage and cauliflower) by using different worm species *Eisenia Fetida* and *Preionyx Excavatus*, (2)to analyze the characteristics of vermicompost such as nitrogen content, phosphorus content, potassium content, calcium and magnesium contents, organic matter content, moisture content, pH and carbon and nitrogen ratio, and (3) to apply the vermicompost in Mustard Greens (*Brassica Juncea* var.) (Mon-hnyin) plantation and study its effect on plant growth characteristics.

Materials and methods

Experimental site and set up

The vermicomposting experiments were conducted at the Laboratory of Department of Industrial Chemistry, West Yangon University during the year 2011, and taking threemonths (from January 5 to April 4). There were three experiments in the study:

Experiment 1 - Vermicomposting by 300 numbers of locally available Red Wigglers *Eisenia Fetida.*

Experiment 2 - Vermicomposting by 300 numbers of Indian Blue earthworm *Preionyx Excavatus.*

Experiment 3 - Vermicomposting by combination of 150 numbers each of Red Wigglers and Indian Blue earthworms.

Collection of earthworms

450 numbers each of locally available Red Wiggler (*EiseniaFetida*) and Indian Blue earthworms (*Preionyx Excavatus*) were obtained from Myanmar International Crop Development Enterprise, Ministry of Agriculture and Irrigation, 9th mile, Pyay Road, Yangon.

Preparationofvermibin

The three cement tanks having a diameter of 90 cm and height of 45 cm were placed in the shaded area in the laboratory. Each cement tank was filled with gravel to about 5 cm, then with sand to about 3 cm, and finally with loamy soil to about 12 cm. To this, about 300 earthworms were inoculated. 5 kilograms of cow dung were scattered on top and covered with 5 kilograms of dry leaves. One liter of water was sprinkled daily and maintained for 20 days.

Feeding the earthworms

Food wastes like vegetable peels, unwanted leaves, fruit skins, egg shells, non-greasy leftovers and coffee grounds can all be used to feed the earthworms. In this experiment, they were fed with outer leaves of banana stem, watermelon peels and outer leaves of cabbage and cauliflower. Food wastes, collected from Da-Nyin-Gown Market, were weighed and introduced into the vermibin on the 20th day of the experiment. Into each vermibin, 5 kilograms of food waste was added once every three days until the 44th day of the experiment.

Watering the compost bed

One liter of water was sprinkled every day in order to maintain adequate moisture and body temperature of the earthworms. The vermibin contents were kept moist but not soaked because the earthworms could be killed either by the stagnant water or by the lack of moisture. As the vermicompost was getting ready, the change of refuse into spongy and good smelling dark brown compost was noticeable. Watering was stopped on the 42nd day of last application of food waste.

Harvesting the vermicompost

The vermicompost was harvested 45 days after the last application of the food waste. The processed vermicompost was black, light in weight and free from bad odor. The compost was carefully taken with spade without disturbing the bed and heaped in ambient condition for a couple of hours when all the worms move down the heap. The upper portion of the pile was separated and the lower portion was sieved to separate the earthworms from the vermicompost. The weight of vermicompost obtained from each experiment was measured. The vermicompost was packed in polythene bags to retain moisture and stored them in a cool place.

Analysis of vermicompost

The physical characteristics of vermicompost samples, moisture content and pH, were measured at the Laboratory of Department of Industrial Chemistry, West Yangon University. The chemical characteristics of vermicompost samples such as nitrogen content, phosphorus content, potassium content, calcium and magnesium contents, organic matter content and carbon and nitrogen ratio were analyzed at the Laboratory of Department of Land Use Division, Myanmar Agriculture Service (MAS), Ministry of Agriculture and Irrigation, West Gyogone, Bayint Naung Road, Yangon.

Application of vermicompost to vustard greens (Brassica Juncea var.) (Mon-hnyin) plantation

The field experiments for the effect of vermicompost on the growth and development of mustard greens was conducted during December 2011 to January 2012 at the organic farm of Central Bank of Myanmar, Yankin Township, Yangon.To test the efficacy of vermicompost upon plant growth, mustard greens was chosen as the candidate plant.

Two plots of dimension 120 inches x 35 inches was measured and selected. Soil tilling was done for proper aeration and water penetration. To avoid seepage and leaching of vermicompost in between the plots a polythene sheet filled with small pieces of bricks was placed to the depth of 6 inches. Plots were then watered uniformly and left undisturbed for a day.

The plots were labeled as I and II. Of these, 700 g of prepared vermicompost was applied to plot I and plot II was left as control for comparison. On the next day, each plot was divided into 7 equal rows. The seedlings of mustard greens were obtained from nursery bed in the organic farm of Central Bank of Myanmar, Yankin Township, Yangon. The seedlings were transplanted to the plots in the late afternoon to minimize transplant shock. The seedlings were inserted in holes so the cotyledons were above the surface. The soil around the root was pressed firmly. The plant spacing was 5 inches. Then, the bases of plants were watered to settle the soil.

The average number of leaves, average leaf length, and average leaf width were noted based on 6 random samples from each plot, once a week from 30 December 2011 to 26 January 2012 (4 weeks). The collected data were analyzed