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# Indigenous Approach in Organic Solid Waste Management in Guyana (South America)

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**Abstract:** Organic waste posses a serious environmental problem globally. This can be solved by combination of effective technologies like Biodung composting and Vermitech (incorporating earthworms for the production of vermicompost). The present work was carried out during the year 2006-2007 at University of Guyana, Georgetown to recycle grass clippings, water hyacinth and cattle dung by using *Eisenia fetida* the locally available surface species of earthworm. The results indicated that the organic waste (grass clipping s and water hyacinth) were successfully processed through partial biodung composting and vermicomposting during the period of 60 days. The temperature study during biodung composting showed two peak rise of temperature resulting in destruction of harmful microbes. Subsequent vermicomposting resulted in production of vermicompost confirming to the excellent nutrient status recorded in earlier experiments. The temperature study during vermicomposting showed that fluctuation was restricted to ±0.83.

**Key words:** Organic waste · Biodung composting · Vermitech · Vermicompost · Earthworms

## INTRODUCTION

Guyana is a country of few million people of various origin including Indians and is dominted by agriculture practices for the cultivation of sugarcane and rice.Being A developing country it also face basic problem of organic waste management. Therefore recycling of organic solid waste from the campus at university of Guyana was carried out during the year 2006-07. Vermicomposting is the biological degradation and stabilization of organic waste by earthworms and microorganisms to form vermicompost [1]. This is an essential part in organic farming today. It has been recognized that the work of earthworms is of tremendous agricultural importance. Earthworms along with other animals have played an important role in regulating soil processes, maintaining soil fertility and in bringing about nutrient cycling [2].

**Objectives:** The objective of the study carried out was to develop combination of effective and low cost technologies to recycle organic waste like grass clippings and water hyacinth and produce biofertilizer vermicompost with rich nutrient status which could play a role in agricultural enrichment of a developing country like Guyana.

## MATERIALS AND METHODS

Solid waste management unit were established based on the infrastructural guidelines of Vermitechnology. Organic solid waste (large quantity) was processed through biodung composting (pre-digestion) and then loaded into the vermicomposting units in a cyclic manner. Vermicompost was harvested after every sixtieth day from the start of biodung composting. Temperature was recorded regularly during the process of biodung composting. The concept of vermitech (vermiculture and vermicomposting) was developed to perfection for implimentation successfully. A shed and platform with three vermiculture tanks of dimension 1.9m x 1.5m x 1m were constructed. *Eisenia fetida* (epigeic species of earthworms) were inoculated in all the tanks with vermitech setting. Mean while the vermiculture tanks were sprinkled with water on weekly basis to maintain moisture (Fig. 1).

Biodung composting units were set up (in triplicate), by using the combination of water hyacinth and grasses (Fig. 2). The biodung composting were turned after 15 days and were transferred to respective vermitech units after total time period of 30 days for further processing and vermicomposting. During march, 2007, vermicompost from the three tanks was harvested (Fig. 3).

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Fig. 1: Vermiculture tanks

Fig. 2: Biodung composting unit

Fig. 3: Vermicompost at harvest

## RESULTS AND DISCUSSION

Many investigations have been carried out on industrial level large scale composting of organic waste in municipal setting [3, 4]. Present study conclusively proves that large scale recycling of organic waste by the application of biodung composting followed by vermicomposting is a feasible technology.

The combination of grass clippings, water hyacinth and cattle dung was used as organic waste for the process of biodung cum vermicomposting. The results indicated that the organic waste (grass clipping s and water hyacinth) were successfully processed through partial biodung composting and vermicomposting during the period of 60 days.

Biodung composting of grass which was carried out for the period of 8 weeks during which it was turned twice. The weekly temperature recorded shows that there were

Table 1: Harvest data (vermicompost)

| Units | BD GRASS+HYACINTH |
|---|---|
| Initial mass(kg) | 210 |
| Transfer to vermitech unit (kg) | 120 |
| Conversion rate (%) | 57.14 |
| Harvested vermicompost (kg) | 65 |
| Dried vermicompost (kg) with 40 percent mositure | 41 |
| Productivity of vermicompost (%) | 34.17 |

Table 2: Physicochemical properties of vermicompost (Mean±SD)

| Parameters | Vermicompost |
|---|---|
| pH | 6.12±0.03 |
| Total salts (ppm) | 3148.67±48.58 |
| Total Nitrogen (%) | 1.11±0.05 |
| Organic Carbon (%) | 9.77±5.05 |
| C/N ratio | 8.80 |
| Available Phosphate (ppm) | 597.67±0.58 |
| Calcium (ppm) | 322.33±24.91 |
| Magnesium (ppm | 137.33±19.50 |
| Potassium (ppm) | 2428.33±326.28 |
| Manganese (ppm) | 0.69±0.01 |
| Iron (ppm) | 0.11±0.01 |
| Copper (ppm) | 0.01±00 |
| Zinc (ppm) | 2.13±0.05 |

two major peaks of temperature increase (2$^{nd}$ week-54.3°C and 6$^{th}$ week-34°C) indicating the activity of thermophilic microorganisms. The temperature increase brings about killing of harmful microbes. The process of biodung composting involves partially aerobic and partially anaerobic process. This reduces the bulk of organic waste to one third of the volume. The cattle dung solution serves the purpose of providing inoculum of microbes which carry out degradation of organic waste (Fig. 4). After 8 weeks of biodung composting, the processed biodung compost was transferred to specific vermicomposting unit. Temperature was also observed during the process of vermicomposting in the 3 vermicomposting units. The temperature study showed that fluctuation was restricted to ±0.83 (grass clippings + water hyacinth) (Fig. 5).

Table 1 indicated that productivity in vermicomposting units was 34.17 % which was very well supported by the earthworm activity due to their preferred palatability in the processes of vermicomposting. During the process of biodung composting, mesophilic flora predominates with their metabolic activity resulting in the increase in temperature of the organic waste.

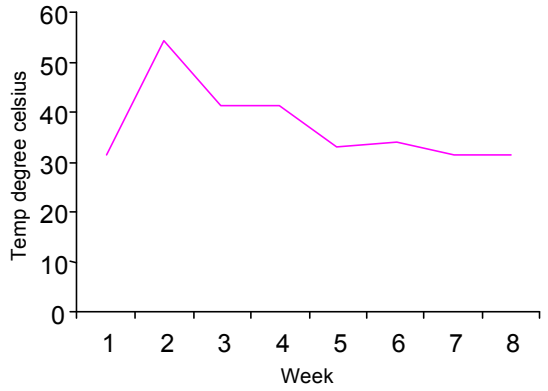


Fig. 4: Temperature changes during biodung composting

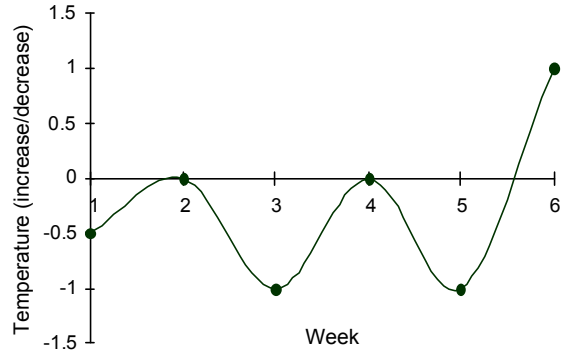


Fig.5: Fluctuation in temperature in vermicomposting units

They are replaced by thermophilic organisms which survive at temperatures greater than 45°C to facilitate composting. When the temperature falls, mesophilics become active again. The changes in the microflora like bacteria, actinomycetes and fungi during composting have been well studied [5-7].

Nutrient status of vermicompost (Table 2) produced from the organic waste correlates with the earlier reports [8].Vermicompost is an excellent bio-fertilizer, which has been investigated to have favorable influence on the growth and yield parameters of several crops like paddy, sugarcane, tomato, brinjal and okra [2]. Vermicompost contributes to the supply of essential micro-nutrients [9] and moreover, contains growth promoting substances like auxins and cytokinins [10].

## CONCLUSION

The investigations carried out at University of Guyana showed that the combination of effective technologies like Biodung composting and vermicomposting results in reduction of time period of recycling with minimum resources at an affordable cost with locally available resources. The nutrient status of the product vermicompost obtained confirmed to the standards recorded in the earlier experiments. Such technologies in organic waste management would lead to zero waste techno farms without the organic waste being wasted and burned rather then would result in recycling and reutilization of precious organic waste bringing about bioconservation and biovitalization of natural resources.

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