Field Trail of Enriched Compost in Red-Yellow Latosol of Jaffna Peninsula, Sri Lanka

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Abstract: Solid waste management is indispensible to conserve the environment globally. Population growth and economic development lead to high waste generation. Collection and removal of municipal solid waste has become a serious problem in Jaffna, Sri Lanka. Toddy distillery Spent Wash (TDSW) is an effluent generated from the distilleries located in the Jaffna peninsula, having good nutritional properties for the plant growth. But, open dumping of this effluent causes severe environmental degradation. Hence, a concept was developed to convert the decomposable solid waste into organic fertilizer by spraying toddy distillery spent wash (TDSW) over Municipal Solid Waste. Bin method of composting was selected for the pilot experiment which was conducted in completely randomized design (CRD) with five treatments and three replicates. Treatments were T1, T2, T3, T4 and C those are once/week, once/two week, once/three week AND once/month and without spraying TDSW, respectively. Available nitrogen was analyzed for the samples after the maturity. statically analysis (\( \alpha = 0.5 \)) showed that the available nitrogen in the compost produced from T1 had significantly differed from other treatments. The available nitrogen from the T1 and C were 38.3 and 14.3 mg/100g, respectively. Hence, the best compost from T1 and compost from C were applied to the tobacco plants at the field to examine field response of enriched compost in Red-Yellow latosol. The average length and width of demarked leaves were measured at weekly interval. The maximum average length and width of the plants under the treatments T1 and C were 60, 52, 32 and 27cm, respectively. There were significant differences in both length and width of the leaves from T1 to C. Thus, it can be concluded that the compost produced by mixing MSW with TDSW is good for the plant growth and it is the best way to manage both wastes, generated in Jaffna Peninsula, Sri Lanka, without environmental degradation.

Key words: Municipal solid waste • Compost • Red-Yellow latosol • Enrich

INTRODUCTION

In Sri Lanka the required basis for integrated Solid Waste Management (SWM) is provided by the present policies, strategies and the legal provisions. In Sri Lanka, daily waste collection by local authorities is estimated as 2683 tons. However total municipal solid waste generated in Sri Lanka is around 6400 tons [1]. In Jaffna Municipal Council (JMC) 78,781 inhabitants [2] generating 9702 tons of solid waste per year [3]. Liquid waste that is the distillery spent wash promotes the EC, TDS and texture of the soil thus promoting the crop growth and yield. Large amount of spent wash is produced from both of Thiccam and Navali distilleries, but this spent wash is dumped either into the ocean or in the bare land and causing environmental pollution [4].

The MSW comprises higher fraction of food and yard wastes. But in developed countries, MSW comprises higher portion of plastic and paper waste [5]. In Jaffna the collection and removal of MSW has become a serious problem. Local government authorities have been adopting various measures to mitigate this problem. Due to the rapid urbanization and economic development, MSW per capita is 1 kg/day [6], who also stated that waste generation in Sri Lanka would continuously increase at a growth rate of 2% per year. Hence, an attempt has been taken in this study to recommend suitable waste management strategy for the Jaffna municipal council. Then this enriched organic fertilizer was applied to the tobacco as it is a sensitive crop for fertilizer application.

Scope of the Study: On the basis of this, JMC has already made an attempt to convert this organic fraction into valuable organic fertilizer therefore they made a compost yard at kakaithheevu where the waste materials were converted as compost by making heaps. But, this attempt was not successful due to several reasons. Heap method of composting is not ideal for Jaffna municipal council because scavengers act on the heaps and polluting the
environment and the rate of decomposition is low. The compost produced by the Jaffna municipal council is of poor quality in terms of low nitrate concentration and higher sand percentage (33%) in the final compost. Application palymarah distillery spent wash increases the soil nutritional properties of available nitrogen phosphorous and potassium. Liquid waste that is the distillery spent wash promotes the EC, TDS and texture of the soil thus promoting the crop growth and yield. This enriched organic fertilizer was applied to tobacco plant to check the crop response [4].

Objectives of the Study: To analyze available nitrogen in the enriched compost and investigate the response of tobacco in the Red-Yellow latasolof Jaffna Peninsula, Sri Lanka.

MATERIALS AND METHODS

Pilot Scale Study: Barrel shape compost bin, with the height of 1 m and the diameter of 0.5 m, was introduced by the JMC to promote home composting was selected. The bin has hole on its surface except the top. Compost starter was placed at the bottom of the bin and same volume of well segregated municipal waste was placed inside the bin.

Experimental Designed and Treatment Scheduling: The experiment was conducted on complete randomized design (CRD) with three replicates. Distillery spent wash (DSW) was obtained from Navalli toddy distillery unit located in Jaffna Peninsula, Sri Lanka. This was transferred to the experimental site in the shield containers. The DSW was sprayed to waste to the bin at the rate of 2lit/10kg.

In addition to this, the waste materials were moisturized with water at 3 days interval to promote the decomposition rate.

Rating of Decomposition: Based on the visual observation, the compost maturity was determined. Samples were sieved through 4 mm sieve to find out the decomposition rate. About 80% of decomposition was achieved in T1 at 41 days and it was 48, 55, 65 and 72 for T2, T3, T4 and C, respectively.

Sampling of Compost: Samples were taken by using soil sampling jackets. Random samples which were representative of the compost bin were taken at ten points of each bin. Samples were taken at different depths of the bin at different locations. The samples obtained from treatments were mixed to form composite samples. Again the samples were reduced by spreading on a clean paper and mixing thoroughly and quartering each time, till the quantity is enough for analysis. To get final test sample, all lumps were broken down and pulverized the material. The final samples were stored in air tighten plastic bottles for analysis.

Determination of Available Nitrogen: Standard kjaldhal method was used for determining available nitrogen.

The following steps were followed to determine the available nitrogen in the compost sample.

- 5 g of compost was placed in 250 ml conical flask and 50 ml of 2N KCl was added.
- Mechanical shaking was carried for one hour and this compost KCl suspension was allowed to settle down.
- 20 ml of aliquot was pipette into distillation flask.
- The conical flask containing 50ml of boric acid and two drops of mix indicator was placed under the receiving tube of the distillation tube.
- 0.2 g of MgO, 0.2 g of Devards alloy and 50 ml of distilled water were added into the distillation flask.
- Distillation was carried out by steam.
- Finally the distillate was titrated against 0.05M HCl until the color changes from green to pink. Available nitrogen in 100g of soil

$$\text{Available nitrogen in 100g of soil} = \frac{(14*0.05*X*50)}{20} \times (100/5) \text{ mg.}$$

In which,

- $X$ - Volume of the HCl for titration

Application of Compost to the Field: The best compost obtained from the treatment T1 was applied to the tobacco crop at the field level. Healthy vigorous seedlings were taken and they were planted at 3x3 feet distance thereafter, all essential agronomical practices were followed. Each 0.5kg of DSW treated compost and DSW not treated compost were applied to the plants. Two healthy leaves from each plant were demarked and its maximum length and width was measured in weekly interval. Fifty plants were selected for T1 and fifty plants were selected for C. The average value of both length and width of demarked leaves was used to plot the graph.

RESULTS AND DISCUSSION

Figure 1 shows the available nitrogen of the bin samples. Lab sale experiment that is bin method of composting was performed to avoid the adverse environmental condition prevailing in the study period.
Also the highest percentage of available nitrogen was recorded for the treatment T1. That was due to the highest microbial activity in the treatment T1 which was treated with DSW frequently that is once per week. In the bin method, the environment is defined therefore no any unwanted losses from the composting environment. This led to have higher amount of available nitrogen in the bin method than pit method.

According to the results obtained from the nitrogen analysis in bin method, it could be concluded that the application of DSW had fasten decomposition rate and increased available nitrogen through better microbial activity. The direct application of DSW to the soil has increased the available nitrogen, available potassium and available phosphorous [4].

**Rating of Compost:** The humus color is the one of the indication which determines the compost quality. The compost samples obtained from bin method were ranked according to the color of the humus and the particle size through 4mm sieve. The samples from T1, T2, T3, T4 and C were ranked. About 80% of decomposition was achieved in T1 at 41 days and it was 48, 55, 65 and 72 for T2, T3, T4 and C, respectively.

**Field Application of Compost:** The compost from T1 and C were applied to the tobacco plants since it is an indicator plant. The average length and width of the leaves from the DSW treated and not treated compost applied plants are shown in Figure 2. There is clear different in both length and width of leaves from the plants treated with T1 and C. the average length for the T1 treated plants and C treated plants ranges from 32 -60 cm and 24 -52 cm respectively. Width of the leaves for T1 treated and C treated plants is 14 -32 cm and 10 -27 cm respectively. This may be due to the good supply of nutrients from the DSW treated compost than the compost from the control.

**CONCLUSION**

As the compost produced from MSW treated with DSW promotes plant growth, it can be concluded that the compost is not harmful for the plant growth. Further, this concept is well suited for the Jaffna Peninsula where disposal of MSW and TDSW have been a big environmental problem for several years. It is clear that TDSW had promoted available nitrogen in the compost produced from various treatments among the treatments. T1 had high available nitrogen. Hence, the compost produced from T1 and the compost from Control (C) were applied to tobacco plant planted in Red-Yellow latosol of Jaffna, Sri Lanka. There was significant different obtained in both length and width of the leaves of the plants under T1 compared to control. Hence, it can be concluded that
the compost produced from TDSW and MSW is not harmful for the crop growth. Therefore, this concept is productive to use both wastes to produce enriched compost with an intention of promoting organic agriculture in Jaffna Peninsula, Sri Lanka.

REFERENCES