

# Waste Management of Temple Floral offerings by Vermicomposting and its effect on Soil and Plant Growth

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**Abstract**— *The safe and environmentally harmonious management of solid wastes becomes a major issue in many cities of developing nations .Enormous production of solid wastes coupled with poor management system, results in a significant environmental degradation..In India at most of the religious places a huge tonnage of solid waste is generated largely during functions, worships, ceremonies and festivals. The quantity of flower waste generated by few major temples of Jaipur city was assessed. In present study different proportions of mixture of cattle dung and floral wastes were taken and performed vermicomposting process using Eisenia foetida earth worm species. The bioconversion ratio i.e., waste into vermicompost was found to be high in 50:50 and 60:40 proportion. Soil was kept as control throughout the study. After Vermicomposting process analysis of various physical and chemical parameters was done. It was found that 25°C temperature, 8.0 pH, 1-2mm particle size , 60% moisture content, black colour, odourless,0.88 bulk density were optimum parameters. Vermicomposting resulted in lowering of EC, C: N ratio, C : P ratio and increase in nitrogen, phosphorus , potassium , Calcium , Magnesium and sulfur. In the pot culture studies of Tomato (Solanum lycopersicum L.) plants (using prepared floral waste vermicompost as fertilizer) various growth parameters like mean stem diameter, mean plant height, mean leaf number, mean length of roots, yield/plant showed good enhancement of growth .The results indicate that integrated effect of all the nutrients present in flower waste vermicompost results in the increased growth and yield of tomato plants and also played a crucial role in improving soil properties, as compared to control. Thus, vermicomposting of temple flower waste is an excellent and ecofriendly method to get valuable products which will lead to a healthier and waste free environment.*

**Keywords**— *Temple Floral Waste, Vermicomposting, Physical -chemical parameters, Tomato, growth.*

## I. INTRODUCTION

Today in all corners of the world managing different organic wastes at low capital and operational cost as well as in eco-friendly and energy saving basis has attracted much attention. Like other developing countries, Indian cities and towns also suffer with the environmental costs of solid waste management. (Kaur and Joshi 2002) Huge amounts of flowers are offered in temples of Jaipur city (India) creating a large amount of flower waste, which creates severe environmental pollution and health hazards. These materials are wholly biodegradable. The organic nature of these wastes offers various biological management options such as vermicomposting instead of disposal to landfill sites, open dumping or any other environmentally risky waste management alternatives. (Sangwan et al 2002, Aalok et al 2008, Adhikary et al 2012) Hence present study of Jaipur city has been under taken to develop proper and eco-friendly process for floral waste management. Jaipur is the city of temples where many temples are situated. Devotees come from outside as well as from city and offer flowers to God and Goddesses. After this tons of floral offerings generated daily this is generally disposed in open dumps or is released in water generating foul odor as well as act as breeding centers for disease causing micro organisms. Looking into the hazardous impact of the improper disposal of wastes on the environment, proper utilization and management is a demand of today. These wasted flowers can be used in various ways and we can get wealth from waste materials. Floral waste generation occur largely during functions, worships, ceremonies and festivals. Biological processes such as composting followed by vermicomposting to convert floral waste in useful organic fertilizer would be of great benefit. In this process, energy rich and complex organic substances have been bio-oxidized and transformed into stabilized products by combined action of earthworms and microorganisms,(Edward et al 1992) hence earthworms play a considerable role by fragmenting and altering all biological activity of the waste (Dominguez, 2004). The main objectives of the present study are to develop efficient technology like vermicomposting for environmentally safe management of temple solid waste and also to see its effect on soil and plant growth. Vermicomposting of flower waste not only prevent damages to natural sources but help, to some extent, in cleaning the nature.

## II. MATERIALS AND METHOD

A large number of temples and other religious places reflect the spiritual value of the Jaipur, and the presence of numerous temples has yielded Jaipur the nickname, '*Chhoti Kashi*'. Bulks of flowers are available from these temples where they are used on daily basis thus making them a regular source. After offering they are left unused and become waste. Ten popular temples were selected and regular visits were made to collect flowers from these selected temples on particular day/festivals, since each temple has its special days depending on the deities.

### 2.1 Preparation of Vermicompost

#### 2.1.1 Collection, Segregation and shredding of Biodegradable waste (flowers)

After collection of flower waste from temples non-biodegradable part was removed by hand sorting and the biodegradable waste i.e garlands and flowers were segregated and shredded into small pieces.

#### 2.1.2 Air Drying/ Pre-composting

The segregated floral waste was air dried by spreading over paper for 48 hours. The air dried samples were then subjected to pre-composting for 10 days to make them suitable for the process of vermicomposting because its thermophilic nature helps in mass reduction and pathogen reduction (Nair et al., 2006).

#### 2.1.3 Selection of earthworm species

For composting *Eisenia foetida* species of earthworm was selected. It is omnipresent with a world-wide distribution. It has good temperature tolerance and can live in organic wastes with different moisture contents.

#### 2.1.4 Preparation of HDPE Vermi Beds

Portable HDPE Vermi Beds of dimensions 4ft \* 10ft, was used which has aluminium stand and green shade. It is unique and latest technology concept for Earthworm Farming. It is Light Weight, waterproof U.V. Stabilized. Flexible, mobile, economical and Easy to handle and install.

### 2.2 Experimental Design

For flower waste vermi-composting, flower waste and cow dung was mixed in different proportions.

1. Group 1- Control (*Garden Soil*)
2. Group 2- 50:50: (*50% flower waste + 50% cowdung + earthworm*)
3. Group 3- 60:40: (*60% flower waste + 40% cowdung + earthworms*)
4. Group 4- 70:30: (*70% flower waste + 30% cowdung + earthworms*)

For Flower waste vermi-composting, flower waste, cow dung (raw material) and earth worms were mixed in selected proportions and then it is added to soil. *Eisenia foetida*, and cowdung was procured from Rajasthan Gosewa Sangh, Tonk Road, Durgapura, Jaipur. Cowdung was used as an inoculant (Adegunloye et al 2007). Alternate two layers of 4l each floral waste and cow dung are placed over one another. Adult clitellate worms, *Eisenia foetida*, ranging in length from 4to8cm were added at the rate of 2.5 kg worms per square meter of composting bed. The moisture content was maintained (60%) throughout the period of vermicomposting by periodic sprinkling of water. Watering was stopped (45-50 days) when the VC got ready as indicated by uniform dark brown to black colored granular structure, The cast was passed through 2-3 mm sieve, the earthworms were removed manually. The cast was air dried by spreading in large trays. The bioconversion ratio of flower waste into vermicompost for all the groups was calculated. After sufficient moisture was lost, samples were analyzed.. The optimal plant growth study was conducted for a period of three month in pots containing vermicompost and control.(See Fig 3) Significant differences were observed in the plants grown in the floral waste vermicomposting as compared to the plants grown in soil without flower waste vermicompost.

### 2.3 Physico- Chemical Analysis of Vermicompost

The matured vermicompost samples about 500 gm were collected in Ziploc polythene bags (Control, 50:50, 60:40 and 70:30) labelled and sealed air tightly these bags are free from adventitious contaminations and were brought to the laboratory for investigation.

#### 2.3.1 Physical Parameters

Particle size (3.0 mm IS sieve), Colour, Odour, Bulk density ( $\text{g/cm}^3$ ), Moisture content, Temperature (by Mercury thermometer), pH (pH meter) and EC (EC meter) was measured.

### 2.3.2 Chemical parameters

The chemical parameter of the vermicompost sample includes -Total N was done by Kjeldahl method and Organic C by rapid titration method of Walkley & Black (1934). Analysis of total and available P and K was carried out by following standard methods of Bhargava & Raghupathi, (1993) , Ca and Mg by the method of Cheng & Bray (1951) and sulfur by Johnson and Nishita.

### 2.4 Growth parameters

Mean plant height (cms), Mean stem diameter and Mean length of roots (cms) was recorded using scale, Mean number of leaves and yield per plant were counted manually. (see Fig 3)

### 2.5 Statistical analysis

In the present study, data was analysed using SPSS version 17.0. One way Analysis of Variance (ANOVA) was used. A significance level of  $p \leq 0.05$  was considered throughout the study.

## III. RESULT AND DISCUSSION

In the present study floral vermicompost prepared was dark black granular in appearance (see fig 2) which indicated that the decomposition of flower waste was occurred successfully, as the earthworms consume floral wastes organic matter very rapidly and fragment them into finer particles, by passing them through a grinding gizzard. (Lakshmi Prabha et al 2014). They derive their nourishment from the microorganisms that grow upon the wastes; at the same time they promote further microbial activity in the wastes (Jadhav et al, 2013) also there was no foul smell during the process of compost formation because of the oxygen rich hemoglobin circulation through the skin of the earthworms. Earthworm emits sufficient oxygen to oxidize foul smell producing compounds like  $H_2S$ , mercaptans, skatol, etc. (Nagavallema et al, 2000) The study showed high bulk density (table 1) because the porosity was increased which further improved the availability of nutrients to crop growth. Because during this process the important plant nutrients that the wastes contain, particularly nitrogen, phosphorus, potassium, magnesium, sulfur and calcium are released and converted through microbial action into forms that are much more soluble and available to plants than those in the parent compounds (Bhargava et al, 1993, Pramanik et al 2007). The moisture content was fluctuating which was maintained at 60%-70% by sprinkling water. Similarly the temperature was maintained below  $35^\circ$  because exposure of the earthworms to temperatures above this, even for short periods can kill them and to avoid such overheating careful management of the wastes was done. (Taiwo and Oso, 2004). The decrease in pH from 7.9 to 6.9 i.e. from alkaline to nearly neutral was observed for all the four beds. It might have caused by the volatilization of ammonical nitrogen and  $H^+$  released due to microbial nitrification process by nitrifying bacteria (Eklind and Kirchmann, 2000, Singh, et al 2005). The increase in EC might have been due to release of different mineral salts in available forms. As the composting process further progressed the available salts were converted into insoluble salts which may be the reason for the reduction of EC.

**TABLE 1**  
**PHYSICO-CHEMICAL CHARACTERISTICS OF FLORAL WASTE VERMICOMPOST**

S.No.	Parameters	Control (Soil)	VB -1(50:50)	VB-2 (60:40)	VB-3 (70:30)
1	Colour	Dark Brown	Black	Black	Black
2	Odour	Odourless	Odourless	Odourless	Odourless
3	Particle size (3 mm IS Sieve)	93.70	94.20	94.20	94.16
4	Moisture	20.50	22.80	19.50	20.74
5	Bulk Density( $g/cm^3$ )	0.88	0.89	0.90	0.89
6	pH	7.9	7.0	7.2	6.9
7	Conductivity( $ms\ cm^{-1}$ )	3.50	3.35	3.37	3.44
8	Organic Carbon	16.5	19.4	20.2	19.37
9	Total Nitrogen	0.90	2.0	1.5	1.0
10	C/N ratio	20.0	21.55	20.2	20.40
11	Total Phosphorus ( $P_2O_5$ )	2.57	2.0	1.9	1.8
12	Potassium ( $K_2O$ )	0.4	0.9	0.8	0.8
13	Calcium	4.4	5.9	5.7	5.6
14	Magnesium	0.2	0.3	0.25	0.25
15	Sulphur	0.40	0.50	0.45	0.45

In the present research work lower C/N ratio in vermicompost produced by *E. foetida* implied that this species enhanced the organic matter mineralization more efficiently. The loss of carbon through microbial respiration and mineralization and simultaneous addition of nitrogen by worms in the form of mucus and nitrogenous excretory material lowered the C/N ratio of the substrate. (Dash and Senapati 1986, Orozco et al., 1996). The deficiency in organic carbon reduces the storage capacity of soil nutrients and reduction in soil fertility. The incorporation of floral waste vermicompost has been shown to increase organic carbon content in the soil. (Nelson and Sommers 1982) In present study organic carbon increased up to 20.76% indicating it is beneficial for growth and productivity of crops. The availability of Nitrogen was also increased. Indicating vermicompost may attribute the significant increase in nitrogen of the soil by using floral vermicompost due to the presence of nitrogen fixing bacteria, which increase the nitrogen content of the soil. (Parmelle et al., 1988, Tiwari et al. 1989, Scheu, 1993.) In present investigation that the vermicompost shows the 18.25% phosphorus as  $P_2O_5$  in worm's vermicast which suggested that the passage of organic matter through the gut of worm results in phosphorus (P) converted to forms which are more bio-available to plants. (Mackay et al. 1982, Satchel and Martin 1984, Iyer et al. 2012) The total average of potassium ( $K_2O$ ) was 0.81% in vermicompost. Indicating nutrients N & P and the intestinal mucus excreted by worms are further used by the microbes for multiplication and vigorous soil remediation and fertility improvement action. The secondary nutrients calcium, magnesium, and sulphur which are needed in lesser amounts were also found to be increased. (see table 1) Vermicomposting contains plant hormones like Auxin and gibberellins and enzymes which believed to stimulate plant growth and discourage plant pathogens. (Businelli et al. 1984, Tomati et al. 1988) The result in Fig.1-4 demonstrate that the growth of tomato plants in four weeks grown in floral waste vermicompost (50:50) was maximum height of plant (42 cm) along with number of leaves (146), length of roots (24 cm), the maximum diameter of (0.8cms) (Shadanpour et al. 2011) as compared to growth of plants grown in other proportion vermicompost (60:40 and 70:30) and control.



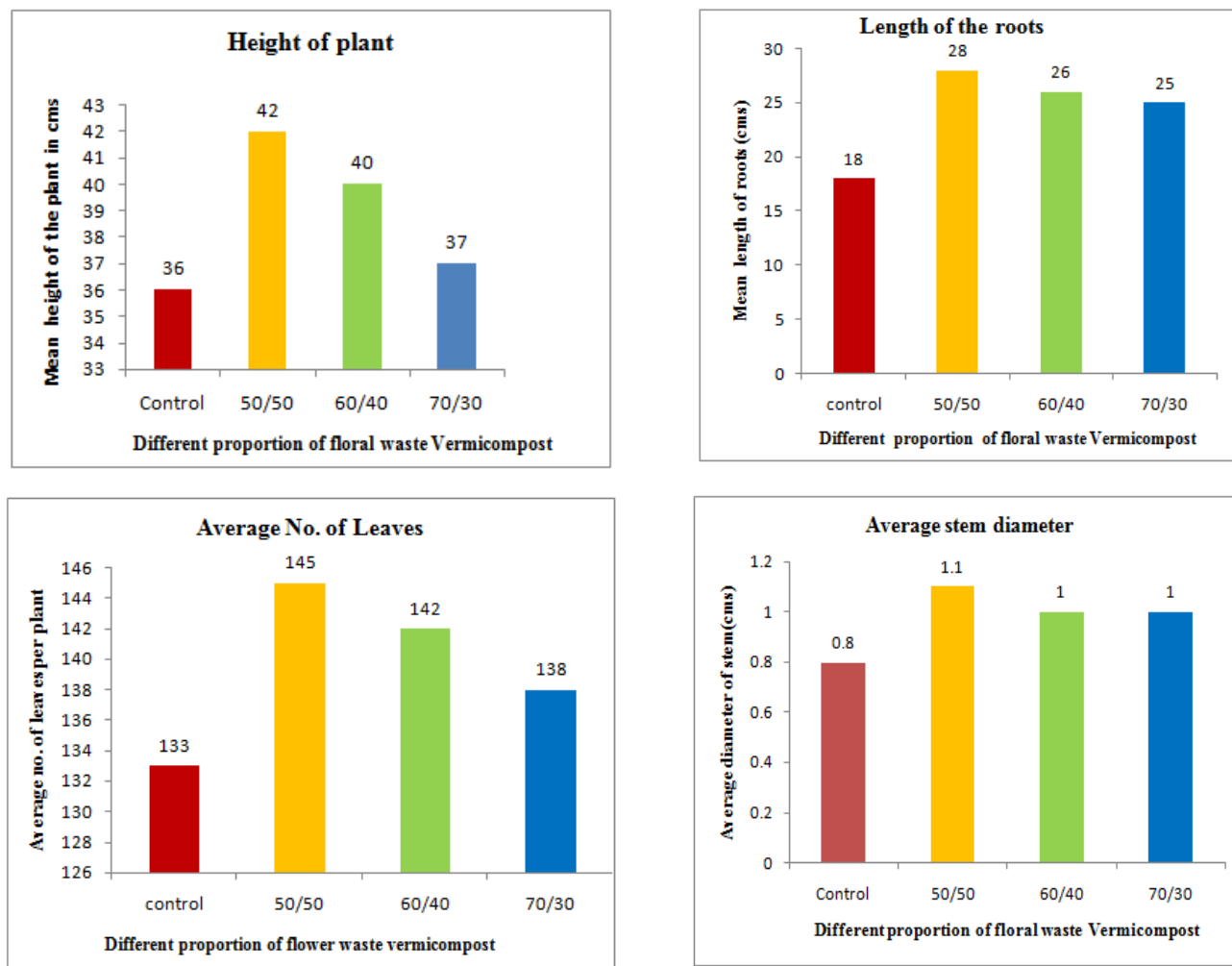
**FIGURE 1: WASTE OUTSIDE TEMPLE (BEFORE SEGREGATION)**



**FIG-2: PORTABLE HDPE VERMI BED**



**FIG-3 POT CULTURE OF FLORAL WASTE VERMICOMPOST**



**FIG.1: GRAPH SHOWING THE COMPARATIVE IMPACT OF DIFFERENT PROPORTION OF FLORAL WASTE VERMICOMPOST AND CONTROL ON DIFFERENT GROWTH PARAMETERS OF TOMATO PLANT AFTER 90 DAYS**

#### IV. CONCLUSION

The present study proved that the Vermicomposting of floral waste with cow dung at 50:50 and 60:40 appears to be the most promising high value bio-fertilizer. This is not only increases the plant growth (as seen in tomato plant) and productivity by nutrient supply but also is cost effective and pollution free. It helped to reduce volume of agro (temple flower) waste, but also generate additional revenue. Thus vermicompost technology can be successfully applied in temples as a solid waste management strategy with flower as the major organic waste.

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