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Preparation of Banana Residue Based Compost and its Nutrient Analysis

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Abstract: Crop residues being organic in nature are rich source of organic carbon; essential nutrients need to be recycled for nutrient cycling sustaining soil quality & health and reduced environmental pollution. An experiment was carried out for preparation of banana crop residue based compost enriched with other organic sources and its nutrient analysis. Three recipes of the banana residues for compost making, designed in randomized complete block design (RCBD) were made in piles separately prepared i.e. consisting banana leaves (BL) with sugar cane press mud (SPM), goat manure (GM) and poultry manure (PM). The compost prepared was subjected to laboratory analysis for electrical conductivity, pH, organic matter, organic carbon, total nitrogen, total phosphorus, total potassium, and C/N ratio. The results indicated that the maximum EC (6.12) was recorded for C_2 and minimum EC (5.67) was recorded for C_1. The results revealed that banana crop residue enriched with other organic sources hastened the composting process and significantly increased the organic matter (OM) (55.6%), organic carbon (36.35%), total nitrogen (TN) (2.77%), P (1.75%) K value (3.05%). Further, results revealed that C1= (Banana leaves with sugar cane press mud) compost blend was optimum and best, because this blend has rich nutrient contents. It was concluded that higher OM%, OC%, TN, P, K were observed for C_1= Banana crop residues enriched with sugar cane press mud.

Keywords: Banana crop residue, Compost, Soil Carbon, Waste Recycling

1. INTRODUCTION

The organic wastes production has increased with rapid increase in population, agriculture production and industrialization development (Zhang *et al.*, 2013; Shah *et al.*, 2015; Abro *et al.*, 2019). These wastes are causing threat to environment by releasing pollutants and toxic gases (Iqbal *et al.*, 2007; Zhang *et al.*, 2013). This situation leads to an environment which adversely affects to all living species and soil quality & soil health. Recycling of agricultural wastes by *Composting* is a viable approach for healthy environment. Pakistan being an agricultural country generates abundant quantity of waste materials. These materials can be recycled and reutilized to replenish soil carbon, crop nutrition and mitigate climate change (Aslam, 2008; Abro, *et al.*, 2017). For example Sindh is a major banana growing province covering 93% of total banana acreage (34400 ha) contributing 83% of total banana production 128900 tons (Agri. Stat., GoP, 2017). Major districts of banana are cultivation are Hyderabad, Badin, Mirpurkhas, Tando Allahyar, Matiari, Sanghar, Naushero Feroz, Shaheed Benazir Abad, Khairpur and Thatta (Memon, 1996; Abro *et al.*, 2016). After fruit harvest large quantities of residues like banana stalks, pseudostem, leaves and trashes are left over containing as much as nutrients as fruit harvested. Significant quantities of organic carbon and nutrients are traditionally disposed off through landfills and dumping in soil or incinerated (Memon, *et al.*, 2012; Khokhar, 2019). One ton of banana residue contains 15 kg N, 7 kg P and 23 kg K (Doran, and Kaya, 2005). Composting has been recognized P and 23 kg K (Doran, and Kaya, 2005). Composting has been recognized as a low cost and environmentally sound process for the treatment of many organic wastes (Aslam, 2008). Banana crop residues are selected for this study because of dumping away of this material near the field or roadsides, without considering its richness in moisture, nutrient elements and carbon source (Zhang, *et al*; 2013; Abro *et al.*, 2016). Composting process is a biological decomposition and stabilization of organic substrates under controlled conditions (Vigneswaran *et al.*, 2016). In recent years, the global interest in composting has increased because of land degradation issues, threat to ecosystems by over and inappropriate use of inorganic fertilizers, atmospheric pollution, soil health, soil biodiversity and sanitation (Misra and Roy, 2007). The process of composting offers many benefits including enhanced soil fertility and soil health (thereby increased agricultural production), improved soil biodiversity, and reduced environmental risks (Bernal *et al.*, 2012). Composting of banana crop waste is a cheap source of nutrients, it increases organic matter, stimulates soil microbial life, enhances water holding capacity and increased crop yields (Phirke and Kothari. 2005; Mawahib *et al.*, 2015). The practice of composting is well known in the world, yet little work has been done regarding its preparation methodology, analysis and usage in Pakistan (Iqbal *et al*., 2007; Nasreen and Qazi, 2012). Keeping in view of the facts stated above,

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therefore this study was planned .i) to prepare and obtain optimum blend of banana crop residues compost by enriching it with other organic sources. ii) To determine the EC, pH, organic matter, organic carbon, macro nutrient N, P, K and C/N Ratio contents of the prepared compost.

2. MATERIALS AND METHOD

Preparation of compost

Compost was prepared in the premises of Green house, Department of Soil Science, Sindh Agriculture University Tandojam. Locally available banana crop waste, goat manure, poultry manure and sugar cane press mud were utilized for the composting of banana crop waste. For composting, banana crop waste, leaves were collected from the farmers' fields of Matiari, Tandoallahyar, and Hyderabad Tandojam. Goat manure and poultry manures were collected from Faculty of Animal Husbandry and Veterinary Sciences, SAU Tandojam Press mud were collected from Matiari Sugar Mills Matiari. In case of banana crop waste, stalks were chopped into 1 to 2 inch pieces. The composting process was carried out in a standard pile size of 4 feet height and 3*3 feet width and length $1m^{-2}$. Confined with plastic-lining and wooden bar structure in the center of open top. Three sets of composting in piles were separately prepared i.e. consisting banana leaves (BL), by enriching with sugarcane press mud (SPM), goat manure (GM) and poultry manure (PM). C= Compost, C_1= 17 kg $layer^{-1}$ BL + 9 kg $layer^{-1}$ SPM, C_2= 17 kg $layer^{-1}$ BL + 9 kg $layer^{-1}$ GM, and C_3= 17 kg $layer^{-1}$ BL + 9 kg $layer^{-1}$ PM. Moisture was maintained at 50% to continue the process of decomposition. The compost was mixed and turned every after 2, 4, 6 weeks to avoid excesses temperature build up. The process lasted for 12 weeks. Laboratory analysis of compost samples for nutrient contents was performed by (Mana *et al.,* 2012).

Statistical analysis: The data were analyzed using analysis variance (ANOVA) method. Least significant difference (LSD) was used comparison between the compost values means. All statistical analysis was performed using (Statistix 8.1) software package.

3. RESULTS AND DISCUSSION

i) Electrical conductivity (EC)

From this study it was observed that banana crop residue compost prepared was rich in organic matter, carbon and crop nutrient cycled. The analytical data of three compost products showed little variation regarding nutrients because of the nature of enriched material used for banana crop residues for compost making. The EC of banana residue based compost was determined and presented in **(Fig.1).** The mean EC (6.12) was obtained for C_2 and minimum EC (5.67) was for C_1. It was observed that there was highly significant difference in EC between the compost.

Table: 1 Nutrient composition of the compost prepared

S #	Compost	EC dS m^{-1}	pH	OM %	OC %	N %	P_2O_5 %	K_2O %	C/N ratio
1	C1	5.67	7.8	55.6	32.3	2.77	0.75	3.05	11.66
2	C2	6.12	8.4	33.35	19.35	1.66	0.85	2.55	11.65
3	C3	5.95	7.9	41.52	24.1	2.07	0.42	1.26	11.64

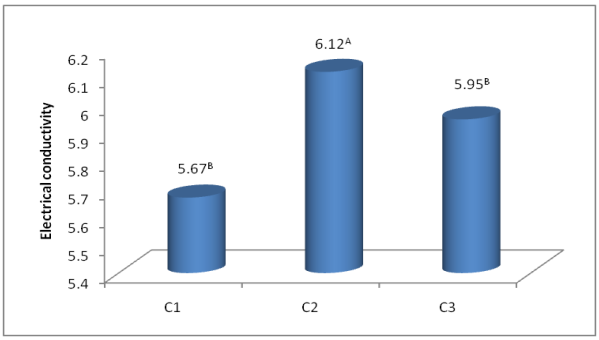

Fig.1 Electrical conductivity of banana residue based compost

ii) pH

The information regarding pH of banana residue based compost was determined and presented in **(Fig. 2).** The data revealed that there as highly significant ($p<0.05$) difference in pH between the compost. Furthermore, results showed that pH was significantly different between C_1, C_2 and C_3. Similar results are found by (Nasreen and Qazi, 2012; Zhang *et al.,* 2013; Khokhar, 2019).

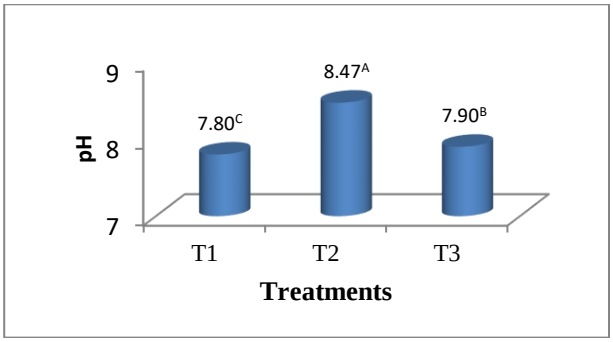

Fig. 2 pH of banana residue based compost

iii) Organic matter %

The data regarding compost organic matter of banana residue based compost was determined and presented in **(Fig. 3).** It was noticed that there was highly significant ($p<0.05$) difference in organic matter amongst banana crop residues compost treatments. Ihan *et al.,* (2016) while working on banana waste compost obtained similar results. The higher organic matter (55.6%) was observed for C_1 and low OM% (33.35%) was obtained for C_2. Because banana crop waste

contains lot of organic matter and carbon. While composting of banana residues Phirke and Kothari (2005) found similar results. Furthermore, results of composting experiment showed that organic matter was significantly different among C_1, C_2 and C_3. Higher organic matter may be attributed from banana crop waste and sugarcane press mud as enriched material. These results are well supported in their research work by (Zhang *et al.*, 2013; Khan, 2016; Khokhar, 2019).

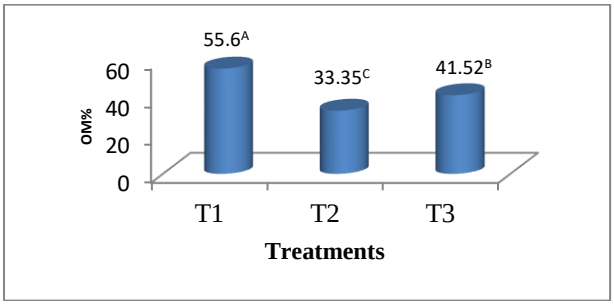

Fig.3 Organic matter (%) of banana residue based compost

iv) Total nitrogen

The data of total nitrogen of banana residue based compost was determined and presented in **(**Fig.4**).** It was revealed that there was highly significant ($p<0.05$) difference in total nitrogen among the compost recipes. The total nitrogen (2.77%) was recorded for C_1 and low N (1.66%) was recorded for C_2. This may be related to high degree of temperature for residue decomposition during compost making. The results in accordance with work of (Zhang *et al.*, 2013; Khokhar, 2019).

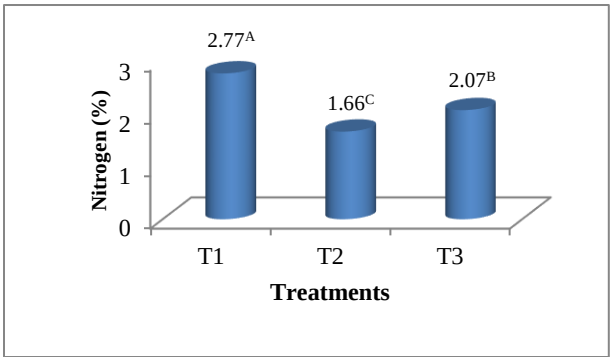

Fig. 4. Total nitrogen (%) of banana residue based compost

v) Total phosphorus

The data of phosphorus of banana residue based compost was determined and presented in **(Fig. 5).** Obtained results revealed that there was highly significant difference in P among three compost recipes. The total P (1.75%) was obtained for C_1 and low P (0.42%) was equally recorded for C_3 and C_2. These results are in complete agreement with the banana compost prepared by (Memon *et al.*, 2012; Mawahib *et al.*, 2015)

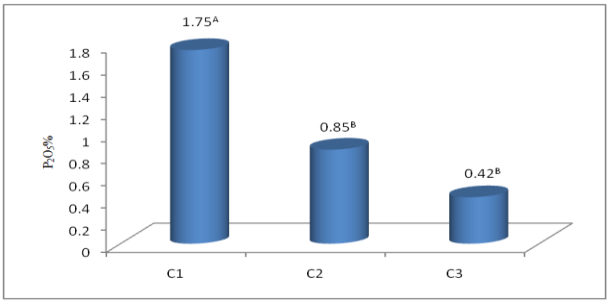

Fig. 5.Total phosphorus (%) of banana residue based compost

vi) Total potassium

The analytical data K of banana residue based compost was determined and presented in **(Fig. 6).** Obtained data revealed that there was significant difference in total K among the compost. The K (3.05%) was obtained for C_1 compared low K (1.26%) was for C_3. The more K values in said treatment may be due to high K content in banana crop residues and press mud. The results found are in agreement with (Khokhar, 2019). Further the nutrient values found for the banana residue compost are well supported by the (Doran and Kaya, 2005) who prepared compost material from banana crop waste.

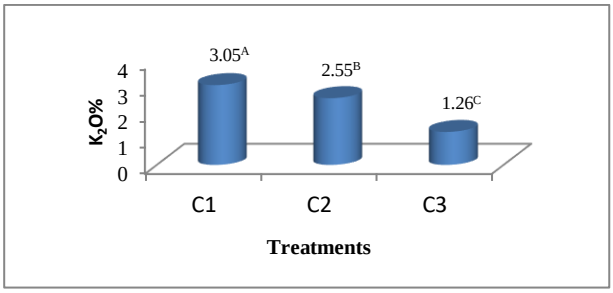

Fig. 6. Total potassium (%) of banana residue based compost

C/N ratio

The C/N ratio of banana residue based compost was determined and presented in **(Fig.7).** Furthermore, data showed that C/N ratio was significantly different for C_1 with C_2 and C_3. While, non-significantly different between C_2 and C_3 was noticed. While working on their research on banana crop residues composting similar results are obtained (Memon *et al.*, 2012; Zhang *et al.*, 2013; Mawahib *et al.*, 2015; Khokhar, 2019).

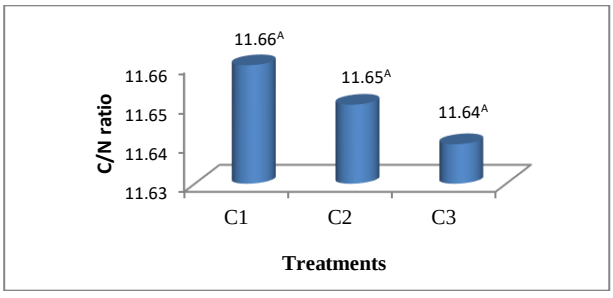

Fig. 7.C/N ratio of banana residue based compost

4. CONCLUSION

It was concluded that banana crop residue compost is a potential source of plant nutrition. This optimum compost blend appears to be (C1= Banana leaves with sugar cane press mud) because more organic carbon and higher nutrient concentration and higher values for OM, OC, TN, P and K were observed for $C_{1,}$ of this product. It is suggested banana crop residues be recycled for compost with other organic sources. Further studies may be conducted on different aspects of compost making from banana crop residues by enriching with other organic sources to improve the final product for crop nutrition.

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