Preparation of organic compost using waste tea powder

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Abstract : The present study was carried out to use the tea-powder that is any how wasted, especially in urban areas which is not utilized for any purpose and discarded as wet garbage. Tea powder can be a great source of biodegradable garbage but it can make a good source of compost as well. The research is about preparing compost using waste tea powder which is generally thrown away and analyzing the physico-chemical parameters of the compost. The compost prepared by using waste tea powder has increased concentration of essential nutrients needed for plant growth and development as compared to the regular soil which are Chloride, Sulphate, Total Phosphorus, Available Phosphorus, Organic matter, Calcium and Magnesium. By using this compost, the plants grow very rapidly and there is increment in the leaf area, leaf density, height, and germination period and germination frequency of the plant. The use of this compost also reduces environmental pollution and also gives better yield of crops.

Key word **:** Tea powder, organic matter, pH

Introduction

Compost application to agricultural land can result in changes in soil physical properties such as structure, water retention and infiltration rates, biological properties and crop yields. Moreover, organic materials such as compost can act as a valuable source of plant available nutrients (e.g. nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and magnesium (Mg)) and thereby reduce the need for manufactured fertilizer inputs (Rollett *et al;2010*).

Compost is rich source of nutrients with high organic matter content and use of compost can be beneficial to improve organic matter status. Physical and chemical properties of soil can be improved by using compost, which may ultimately increase crop yields. The soils, which were, once well supplied with available nutrients, are now gradually becoming deficient (Zia *et al.*, 1994). So use of compost is the need of the time and beneficial to improve organic matter status. Physico-chemical properties like pH, conductivity, sulfate, chloride, total phosphorus, available phosphorus, calcium, magnesium, organic matter and silica were significantly improved resulting in enhanced *Tagetes* spp., *Cicer arietinum* and *Vigna radiata* yields in sodic soil (Hussain *et al.*, 2001).

The present study is conducted with the tea compost and assesses its effects on crop yield.

Materials and methods

Compost was prepared at the campus of the C.K.Thakur college, New Panvel using tea powder that is thrown after use. It was collected from houses, tea stalls and hotels.

Table 1: Methods for Physico-Chemical Analysis of the Soil

Parameter	Method
PH	Digital pH meter
Conductivity	Digital Conductometer
Sulfate	Turbidimetric Method
Chloride	Argenometric Method
Organic Matter	Walkely-Black Method
Total Phosphorus	StannouslChloride Method
Available Phosphorus	Stannous Chloride Method
Silica	Ammonium Molybdate method
Calciumand Magnesium	EDTA Method

Equal layers of soil, cow-dung and soil were laid at the top of the other. The material was allowed to decompose for three months. The temperature was monitored regularly to check the process of completion of the decomposition. The temperature rose initially and when the compost was ready, it remained constant. The compost thus made was analyzed for its following physico-chemical properties, by using methods (Table 1) prescribed in Trivedy and Goel (1986).

The following seed were selected to check the efficiency of the compost as they are important in one or the other aspects as described below-

Vigna Radiata sprouts have been part of Asian cuisine for centuries. It is one of the most familiar beans in the country. It is familiar to many because of its use for bean sprouts common in salad bars across the country. Sprouts are considered a "superfood" because of their high nutrient qualities.

Cicer arietinum has long been valued for their fiber content. They are a very good source of carbohydrates and proteins which altogether constitute about 80% of the total dry seed weight. Starch, which is the principal carbohydrate

component, varies in content from 41-50% and is lower in Desi varieties than in Kabuli varieties. Total seed carbohydrates vary from 52-71%. The crude protein content of chickpea varieties ranges from 16-24%. Crude fibre, an important constituent of chickpeas is mostly located within the seed coat.

Tagetes plants are stout and branching. They vary in size from 0.1 to 2.2 m tall. They are cultivated all over the world for their decorative and ornamental purposes. They are highly valued in festive seasons. They are also known for their antibacterial, insecticidal and antihelminthic activities.

The efficiency of the compost was checked by pot assay of using the above mentioned plants. Two test pots were made varying in the proportion of the compost and soil as 1:1 and 1:3 and compared with the control pots.

Results

The pH of control soil was 7 which was slightly decreased to 6.4 (table 1) indicating insignificant change in soil pH. Elevated pH are responsible for losses of nitrates (Rhoades *et al.* 1976). Though there is slight decrease in pH, it can be taken as a sign as restoration of nitrates through the process of composting.

In non-saline soils, conductivity variations are primarily a function of soil texture, moisture content, and CEC (Rouached *et al.* 2009). The present study reveals indicates increased conductivity. It may indicate the availability of nutrient to the plants through increased free ions.

Sulfur (S) is an essential macronutrient for all living organisms. Plants require large amounts of sulfate for growth and development, and this serves as a major entry point of sulfate into the food web. Plants acquire S in its ionic form from the soil; they have evolved higly controlled mechanisms for the regulation of sulfate uptake in response to its external and internal availability (Marschner, 1995). The enhanced sulfur is good indicator of the compost. In the present study sulphates are elevated from 0.05% to 0.5%.

Table 3: Physico-chemical Analysis

Parameters	Control	Tea Compost
pH	7	6.8
Conductivity	0.540 ms	7.80 ms
Sulphate	0.05%	0.5%
Chloride	0.7%	1.0%
Total phosphorus	0.03%	1.2%
Avail. phosphorus	0.02%	0.05%
Calcium	1%	1.3%
Magnesium	0.26%	0.58%
Organic Matter	8 %	45%

Chlorine is an essential micronutrient for plant and its minimal requirement for crop growth of 1 g kg^{-1} dry weight has been suggested (Pfeiffer 1954).

Increase concentration of chloride is indicator of availability of nitrogen and health of the plants. The chlorides in the compost increased from 0.7% to 7% indicating enhancement in the compost.

Total phosphorus and available phosphorus also increased in the compost. The homemade compost usually has phosphorus ranging between 0.5 to 4 %. The increase from 0.03 to 1.2% indicates the phosphorus enrichment during the present study.

Calcium plays double role in soil fertility as a plant nutrient at the same level as N, P and Mg and as a regulator of soil pH which determines to a large extent solubility, toxicity and absorption of various soil nutrients. The compost formed during present study had elevated calcium concentration from 1% to 1.3%.

Magnesium is the only metal constituent of the chlorophyll and is related to the phosphorus metabolism which activates number of plant enzymes. The present study reveals increased concentration of magnesium from 0.26 to 0.58%.

Organic matter in compost improves soil structure and water holding capacity. The percent of organic matter for general garden compost ranges between 12-20%. In the given compost, organic matter has not achieved increment upto 45% and is appreciable. (table 3).

The morphological features of the plants were also seen in response to compost to see the efficiency of the compost as a good fertilizer. As seen in table 4, leaf length, leaf density, germination rate and height of the Moong, Chick peas and Mari gold are found to be enhanced. The period of germination has been decreased after application of compost. It is also apparent that positive control I is showing improved growth than control II where the later has more amount of compost than earlier. It indicates that the use of this compost should be done optimally.

Table 4: Results of Pot Assay

Parameters	Control			Positive Control (Expt. 1)			Positive Control (Expt. II)		
	I	II	III	I	II	III	I	II	III
Leaf Area (cm^2)	--	--	3	--	--	4	--	--	4
Leaf Density	7	80	08	15	120	17	08	80	12
Height (cm)	5	15	8	07	18	13	03	12	07
Germination Period (days)	5	3	3	4	2	2	5	3	3
Germination Frequency %	80	70	80	90	80	90	80	80	80.

Note - I Tagetes* spp., *II- Cicer arientinum, III- Vigna radiata

An estimate of cost efficacy is as mentioned in table 5. The daily approximate amount of tea powder after its use is given in the form of wet weight. If so collected as mentioned below we can have 260 kg day^{-1}. So, in a month we can have 7800 kg of used tea powder. The amount of compost thus generated may be approximately 10,000 kg in its dry weight. If sold at the rate Rs. 20 kg^{-1}, won can have Rs. 2 lakh out of it. If labour and travelling charges are also excluded considering the amount of Rs. 50,000/-, then also there is profit of Rs. 1.5 lakhs.

Table 5: Cost Efficacy

Houses (per day)	Restaurants (per day)	Tea stalls (per day)
1 = 100 gm 100 x 100 = 10 Kg	1 = 1 Kg 1 x 100 = 100 Kg	1 = 1.5 Kg 1 x 100 = 150 Kg

Conclusion

The used tea powder is the suitable substrate for making compost. The composition of various nutrients showed increment in their concentration. The pot assay results show the improvement in plant growth. The approximate of cost efficacy is also in the favour of making compost in this way.

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