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Analyzing Composts from Different Sources and Checking the Availability of Nutrients

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Abstract

The purpose of the present study was to analyze and determine the effects of compost in plant growth. In this study four types of composts have been analyzed such as urea based co-co peat, effective microorganisms, vermicompost and kitchen waste. These samples were taken from Perandapalli, near Hosur, Tamilnadu. This study has analyzed the pH, soil salinity, organic matter and all the nutrients required for the growth of plants in these composts. N, P and K are the primary macronutrients which are highly recommended for maximum yield and growth. The final result showed that vermicompost had more nutrients available for the growth of the plants.

***Key words**: compost, macronutrients, soil, micronutrients, vermicompost, plant growth*

1. Introduction

Soil analysis plays an important role because it contains different types of nutrients for the growth of plant such as primary nutrients, secondary nutrients and micronutrients. The term "soil testing" refers to the full range of chemical, physical and biological tests that may be carried out on a submitted sample of soil, though in the present context only nutritional aspects would have been considered. Since soil as a living entity is the basis of management in sustainable food production, enhancing soil productivity through utilization of organic fertilizers has been gaining significant importance in organic food production. [7] In organic farming composts, organic manures and their extracts are used for improving soil fertility and in combating pests and diseases. [1][4][5][6]

Organic manures and composts have been found to have direct anti disease effect by stimulating competing micro organisms and also by inducing resistance to plant diseases. [3] However, there are other contradicting evidences indicating the reverse impact of using these sources. [2] The use of fertilizers and manure to enhance soil fertility and hence crop yield improvement is a traditional method which was used by farmers since a long time. [8]

Essential nutrients: In addition to carbon, hydrogen and oxygen which form the basis of all organic compounds, healthy turf grass requires sufficient amounts of 12 essential nutrient elements. These essential elements are divided into macronutrients (required in larger quantities because of their structural roles in the plant) and micronutrients (required in smaller quantities because they tend to be involved in regulatory roles in the plant). Nitrogen (N), phosphorus (P) and potassium (K) are the primary macronutrients, and the ones most often in short supply in soils. The elements N, P and K are therefore the most likely to require replenishment in the form of applied fertilizers. Deficiencies of the secondary macronutrients calcium (Ca), magnesium (Mg) and sulphur (S) are less commonly encountered. The micronutrients required are iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), molybdenum (Mo) and boron (B).

1.1 Compost

Compost is the best all round source of organic material as a nutrient for soil organisms. It helps the soil particles to bond and form soil aggregates; it helps these aggregates retain and release plant nutrients and it helps to create better porosity. Composting is the natural process of 'rotting' or decomposition of organic matter by microorganisms under controlled conditions. Raw organic materials such as crop residues, animal

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wastes, food garbage, some municipal wastes and suitable industrial wastes, enhance their suitability for application to the soil as a fertilizing resource, after undergoing composting. Compost is a rich source of organic matter. Soil organic matter plays an important role in sustaining soil fertility, and hence in sustainable agricultural production. In addition to being a source of plant nutrient, it improves the physico-chemical and biological properties of the soil. As a result of these improvements, soil becomes more resistant to stresses such as drought, diseases and toxicity. It also helps the crop in improved uptake of plant nutrients and possesses an active nutrient cycling capacity because of vigorous microbial activity. Compost has high organic matter content relative to most upland soils. By incorporating compost into soil, Soil Organic Matter (SOM) is increased making the soil healthier. The benefits of increasing SOM by adding compost are many and fall under four categories: biological, physical, chemical, and environmental. Organic matter provided from compost promotes the growth of beneficial microorganisms. Improved soil physical properties results in both improved plant growth and soils that absorb water and hold nutrients more efficiently. The chemical benefits of increased SOM are enhanced cation exchange capacity, which helps make nutrients more available to plants, and chelation of metallic micronutrients, which binds trace elements so that they can be released slowly and made available as needed for plant uptake. Compost provides a balanced source of slow release nutrients necessary for healthy plants.

2. Materials and methods

In this study four different types of compost have been chosen. They were Urea composed co-co peat, Effective microorganism, Vermicompost and Kitchen waste. These samples were taken from Perandapalli, near Hosur, Tamilnadu.

Fig: 1 Samples taken for the studies

5g of the sample was weighed and transferred to a 50 ml flask. It was placed on a mechanical shaker set at 180 oscillations per minute. The sample was shaken for 5 mins. The sample was immediately filtered through Whatman No. 1 filter paper. The filtered sample extract were transferred into flasks and used for the analytical determinations.

3. Result

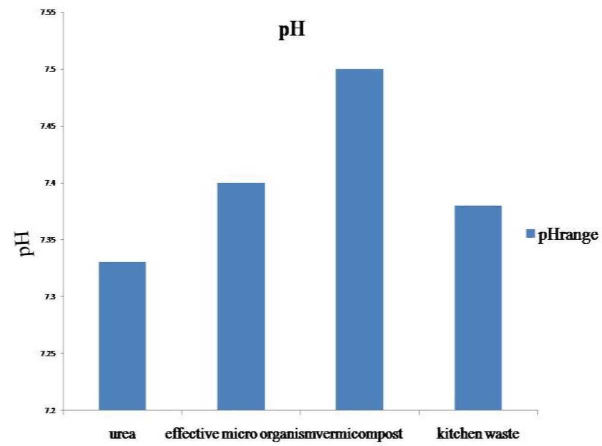


Fig: 2 pH values of the taken samples

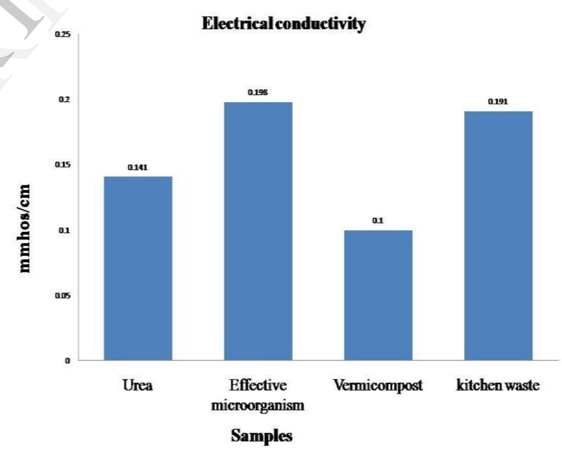


Fig: 3 Electrical conductivity of the taken samples

Table 1: Values of boron and graph shows their variation in the taken samples.

Standard values	OD at 420nm
2ppm	0.4106ppm
4ppm	0.5312ppm
6ppm	0.6913ppm
8ppm	0.7712ppm
10pm	0.8213ppm

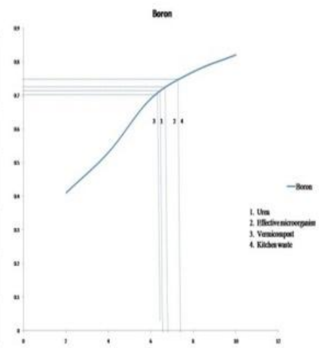


Table 2: Values of sulphur and graph shows their variation in the samples.

Standard	OD at 420nm
1000ppm	6.2ppm
2000ppm	9.16ppm
3000ppm	20.19ppm
4000ppm	34.44ppm
5000ppm	44.03ppm

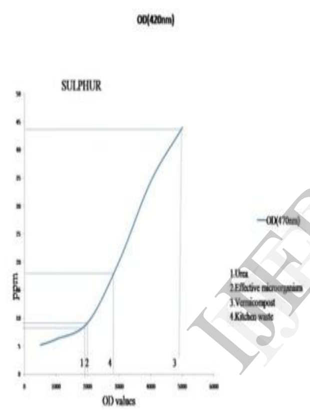


Table 3: Values of phosphorus and graph shows their variation in the samples.

Standard values	OD values
0.2ppm	0.8910ppm
0.5ppm	1.0005ppm
1ppm	1.1186ppm
2ppm	1.1500ppm
5ppm	1.1820ppm
10ppm	2.01ppm

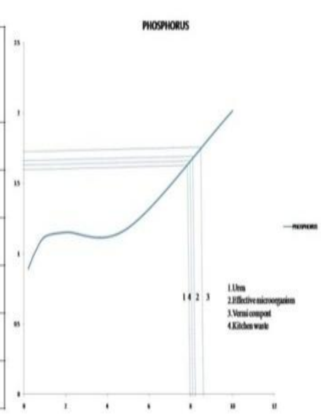


Table 4: Values of nitrogen and graph shows their variation among the samples

Standard values	OD values
0.5ppm	2.008ppm
1ppm	2.55ppm
1.5ppm	3.016ppm
2ppm	3.555ppm
2.5ppm	3.7ppm
3ppm	4.6ppm

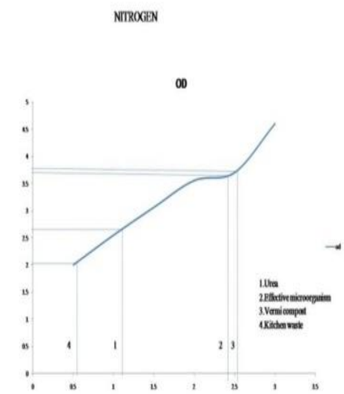


Table 5: Values of sodium and graph shows their variation among the samples

Standard values	OD values
4ppm	0ppm
8ppm	2ppm
12ppm	3ppm
16ppm	4ppm
20ppm	6ppm

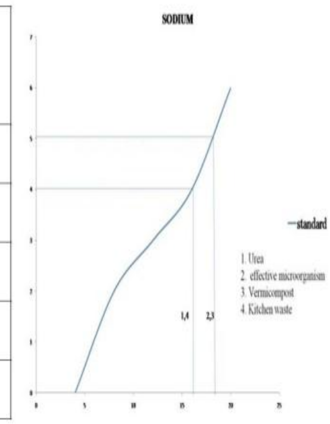


Table 6: Values for pottasium and graph shows their variation in the samples.

Standard values	OD values
100ppm	150ppm
200ppm	210ppm
300ppm	220ppm
400ppm	240ppm
500ppm	250ppm

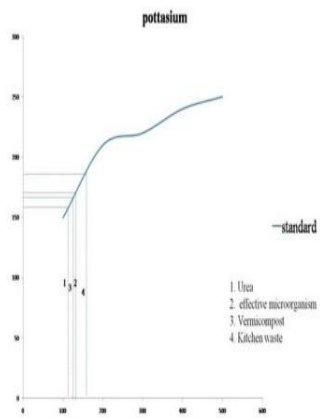


Table 7: Values of zinc and graph shows their variation among the samples

Standard values	OD values
200ppm	23.3ppm
400ppm	23.85ppm
600ppm	23.91ppm

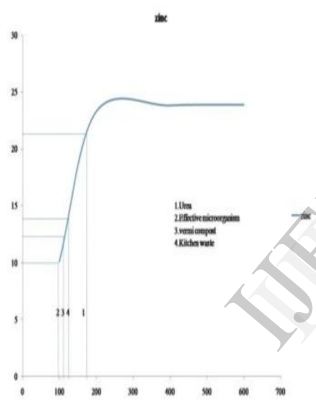


Table 8: Values of copper and graph shows their variation among the samples

Standard values	OD values
200ppm	11.01ppm
400ppm	24.37ppm
600ppm	39.44ppm
800ppm	51.ppm
1000ppm	71.19ppm

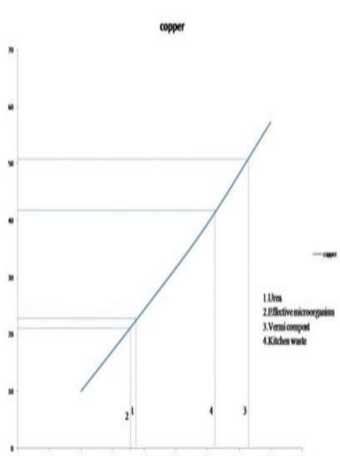


Table 9: Values of manganese and graph shows their variation among the samples

Standard values	OD values
20ppm	0.548ppm
40ppm	0.913ppm
60ppm	1.365ppm

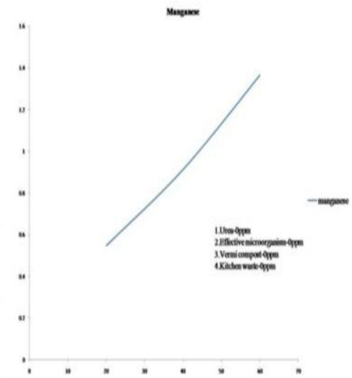
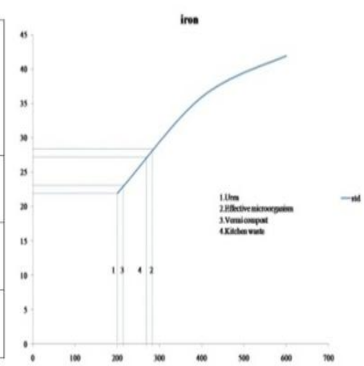


Table 10: values for iron and graph shows their variation among the samples.

Standard values	OD values
200ppm	22ppm
400ppm	36ppm
600ppm	42ppm



Calcium and magnesium calculation:

$$Ca,Mg\ (meq / l) = \frac{(V-B)\times N\times R\times 1000}{Wt}$$

Table 11: values of calcium and graph shows their variation in the samples

Samples	Values
Urea	1.2%
EM	1.9%
Vermicompost	4.2%
Kitchen waste	2.5%

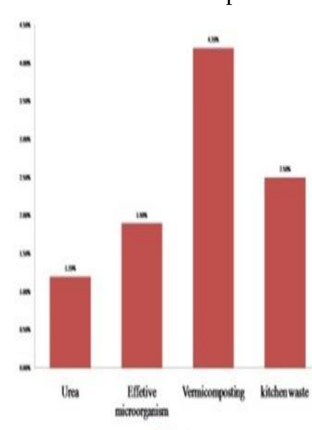


Table 12: Values of magnesium and graph shows their variation among the samples.

Samples	Values
Urea	1.3%
EM	0.02%
Vermicompost	0.035%
Kitchen waste	0.075%

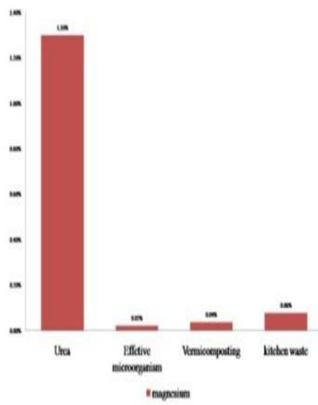


Table 13: Level of nutrients in the taken samples

Nutrients	Urea	EM	Vermicompost	Kitchen waste
Ca	1.2%	1.9%	4.2%	2.5%
Mg	1.3%	0.02%	0.035%	0.075%
P(ppm)	1.6622	1.6916	1.7369	1.6854
S (ppm)	8.3006	9.473	44.366	17.985
B (ppm)	0.7230	0.7337	0.7120	0.7542
N (ppm)	2.591	3.623	3.762	2.000
Na(ppm)	4	5	5	4
K(ppm)	155	170	164	188
Zn (ppm)	22.5	11	12.88	14.48
Cu(ppm)	22.69	21.89	52.46	43.29
Fe (ppm)	22.43	27.83	24.33	26.33
Mn(ppm)	0	0	0	0

4. DISCUSSION

Table (13) shows the 12 essential nutrient values in the four different samples. These are required for the growth of plants and their maximum yield.

Most compost has a pH between 6 and 8. pH and organic matter of the composts are the most important factors that control the availability of micronutrients in the soil. It depends upon the level of nutrition (or) amount of nutrition present in the soil. In this study all the four composts pH ranges inbetween 7.3 to 7.5. On comparing these samples, vermicompost has the highest pH (Fig 2). It suits the growth of plants. Further mostly plants grow best in a pH range of 5.0 to 8.5

Soluble salt concentration is the concentration of soluble ions in solution (or) the soil's ability to conduct electricity. It is usually expressed as electrical conductivity. Soluble salt levels in compost can vary considerably, depending on feed stock and processing. The salinity (EC) of the soil should be less than 4.0 dS/m. On comparing these samples effective microorganisms are rich in electrical conductivity (Fig 3).

Soils containing less than 1/4 ppm are considered deficient. Boron is more abundant in kitchen waste than that of vermicompost and effective microorganisms (Table 1). In this study, effective microorganism and vermicompost almost have the same level of boron in their composition.

Since soil organic matter is the primary source of S, soils low in organic matter are more likely to be deficient than soils with higher organic matter. Table (2) shows that vermicompost has higher amount of sulfur nutrients. Other samples such as urea and effective microorganism have similar amounts of sulfur level. kitchen waste has higher amount of sulphur than urea or effective microorganisms.

Phosphorus is the second most important macronutrient after nitrogen that plays a significant role in physiological and biochemical reactions such as photosynthesis and transfer characteristics. This study shows that levels of phosphorus variation in the respective composts were based on their composting methods. On investigation of these samples, higher amount of phosphorus was present in vermicompost (Table: 3). Nitrogen in the compost can increase P uptake by maintaining this nutrient in a more available form. Also, roots proliferate in response to N and P, so compost containing these two nutrients can increase nutrient availability by producing more roots to absorb the nutrients the level of nitrogen was higher in vermicompost and in effective microorganism. These two have the equal amount of nitrogen in their composition (Table: 4). the use of urea produces ammonia, which inhibits root growth and thus negatively impacts P and N uptake.

Sodium is required in large amounts by plants, being the second most concentrated nutrient in plant leaves and shoots after N. In this experimental analysis, vermicompost and effective microorganisms have the highest level of sodium compared to other composts (Table: 5). Among the three primary nutrients potassium is one which is required for maximum yield. Kitchen waste has the highest amount of potassium among the samples. (Table: 6)

Urea has the highest amount of zinc when compared with the other composts (Table: 7). The level of zinc should be in the range of 10ppm. Zinc is also one of the essential micronutrients required for crop growth since it is an important component carbonic anhydrase enzyme which is present in all photosynthetic tissues, also required for chlorophyll biosynthesis. The deficiency of zinc in agricultural crops is one of the most common micronutrient deficiencies. While comparing the level of copper, the maximum amount was present in vermicompost (Table: 8).

Soil always has less amount of manganese for the growth of plant. In this study all the four samples have the same amount of manganese (Table: 9). Iron is essential for chlorophyll synthesis. The variation among the samples in the level of iron is shown (Table: 10). The effective microorganisms were rich in iron.

Calcium and magnesium also has an important role in plant growth. The variation among the samples in magnesium level is shown in Table (11). The highest amount of magnesium was present in urea. High amount of organic matter in composts increases the soil organic carbon. Due to this range of pH, soil $CaCO_3$ increased. Vermicompost has the highest level of calcium (Table: 12) among all the samples.

5. CONCLUSION

This study showed increased plant growth as well as the availability of certain nutrients in vermicompost compared with other composts. Vermicompost has the required amount of plant nutrients for the growth of plants. It was demonstrated that the application of compost to soil improves some soil chemical properties. The nitrogen availability of this compost is closely related to the maturity of this material. Vermicompost nutrition level is depends on the storage of the components that vary with seasons, places and time. Compost application to soil has a positive effect on the growth of the plants.

6. REFERENCES

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