

## Soil reclamation using vermicompost amended theri soil in tuticorin district

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**Abstract:** A special type of Red sandy dunal soil [Theri-soil] of Tamil Nadu is called Theri-soils. Theri-soils are located in Tuticorin, Tirunelveli and Kanyakumari districts of Tamil Nadu. The Merits of Theri lands are deep sand zone, good permeability and quality ground water. The Demerits of Their lands are unsuitable for agriculture, the surface of the soil is not plane, higher level of soil erosion, sand dunes, from the top to the bottom only sand, low nutrients and minerals and Low water holding capacity. Vermicompost is the material used for the amendment of the Theri soils selected for the study to improve the fertility constraints of the soil. Measurements were made on the physico chemical and physical properties such as pH, EC, Particle density, Bulk density, Porosity, Water holding capacity, Organic carbon content, and Hydraulic conductivity. To convert this soil into a cultivable land, attempts were made to improve the soil moisture characteristics of the soil using soil amendment.

**Key words:** Theri soils, Vermicompost, Organic amendments, Bulk density, Water holding capacity

### 1. INTRODUCTION:

(Theri-soil) occupy about 20,000 hectares in Tuticorin, Tirunelveli and Kanyakumari districts. Tuticorin district has the highest area 11,200 ha. Theri (mettu) lands are deep land zones. About 20,000 hectares of Theri-lands are left unused in the aforesaid three districts. These are considered to be unsuitable for continuous irrigation. The mean annual rainfall of the area is between 610 to 700mm. (Jawahar et al., 1999 a).

Fertility capability classification indicated that these are not suitable for agriculture but can easily be brought to use through appropriate soil management technologies and conservation. (Janakiraman et al., 1997)

The organic wastes and residues offer the best possible means of restoring the productivity of severely eroded agricultural soils or of reclaiming marginal soils. The proper use of organic amendments is utmost important in maintaining the soil moisture level and hence the fertility and the productivity of the soils and in minimizing the wind and water erosion. The desired increase of water holding capacity will improve the ability to supply nutrients to the soil. Nowadays, the cultivable lands are gradually becoming the sites for constructing houses and industries. Due to the emergence of population, we need more cultivable lands. Bringing Theri soils to cultivation will add to the development of the economy of the country. Reclamation of soils without environmental pollution is the urgent need of the hour.

### 2. MATERIALS AND METHODS:

This study was undertaken in parts of Tuticorin district located in Tamilnadu which lies between 73° 1' and 73° 4'E longitude and 8°33' and 8°28'N latitude. The study area has semi-arid tropical climate. The average annual rainfall is 630mm. The material used is Theri-soil collected from an area of the village called Sawyerpuram that is 26 Km in the west from Tiruchendur in Tuticorin district of Tamil Nadu. The soil samples were taken from the top surface of the soil to a depth of 15 cm. Vermicompost was the amendment used in the study. Vermicompost was prepared according to the advice given by the Agriculture department. Let T be Theri-soil. Ten different combinations viz : T+ 5% of Amendment, T+ 10% of Amendment, T+ 15% of Amendment, T+ 20% of Amendment, T+ 25% of Amendment, T+ 30% of Amendment, T+ 35% of Amendment, T+ 40% of Amendment, T+ 45% of Amendment, T+ 50% of Amendment on volume basis were made. The different combinations were thoroughly ameliorated mechanically before use. For example, in T+10% of amendment, 400 cc of amendment was mixed with 4000 cc of T. The volume of the soil is fixed. The different combinations of amendments were thoroughly mixed mechanically before use. Each treatment (combination) was replicated five times in pots to minimize error. The mixtures were subjected to sustainable wetting with water and allowed to settle for a period of 60 days without allowing them to get dried. After this incubation period, the mixtures were removed from the pots and once again dried and powdered. For each replication, measurements were made on the physico chemical and physical properties such as pH, EC (dSm<sup>-1</sup>), Particle density (g/cm<sup>3</sup>), Bulk density (g/cm<sup>3</sup>), Porosity (%), Water holding capacity (%), Organic carbon content (%), and Hydraulic conductivity (mm/hr).(Piper, 1966).

To study the cause and effect of the various parameters measured, simple regression equations were tried. Simple regression analysis shows that the variations in the properties of Vermicompost amended Theri soil can be best represented by the linear model,

$$Y = a + b x$$

### pH

It is observed from the correlation table that pH has positive association with Bulk density (0.9879), EC (0.9776), Hydraulic conductivity (0.9790), Particle density (0.9902) and, Porosity (0.9810) and negative association with Organic carbon (0.9586) and Water holding capacity (0.9642) and the equation selected is

$$Y = 7.8840 - 0.0173^{**} x ; R^2 = 0.992^{**}$$

\*\* - Significant at one percent level of probability.

### Electrical conductivity (EC)

The correlation table reveals that the EC has positive association with bulk density (0.9615), Hydraulic conductivity (0.9567), Particle density (0.9670), pH (0.9776) and Porosity (0.9653) and negative association with organic carbon (0.9485), and water holding capacity (0.9360).

The equation in the case of EC is

$$Y = 0.3380 - 0.0026^{**} x ; R^2 = 0.953^{**}$$

### Particle density

The correlation table reveals that the particle density is positively related to bulk density (0.9985), EC (0.9670), Hydraulic conductivity (0.9781), pH (0.9902) and Porosity (0.9731) and negatively associated with organic carbon (0.9507) and water holding capacity (0.9571).

The fitted equation is

$$Y = 2.7973 - 0.0198^{**} x ; R^2 = 0.992^{**}$$

### Bulk density

From the correlation table, we observe that the bulk density is positively related to Electrical Conductivity (0.9615), Hydraulic conductivity (0.9771), Particle density (0.9985), pH (0.9879) and Porosity (0.9750) and negatively related to Organic Carbon (0.9535), and Water holding capacity (0.9629).

In the case of Bulk density, the fitted equation is

$$Y = 1.9527 - 0.0132^{**} x ; R^2 = 0.991^{**}$$

### Porosity

The porosity of the soil has got positive association Bulk density (0.9750), Electrical conductivity (0.9653), Hydraulic conductivity (0.9894), Particle density (0.9731) and pH (0.9810) and negative association with Organic carbon (0.9211) and Hydraulic conductivity (0.9781).

The equation fitted in this case is

$$Y = 43.6640 - 0.2076^{**} x ; R^2 = 0.973^{**}$$

### Water holding capacity

The correlation table reveals that the water holding capacity has positive association with Organic carbon (0.9061) and negative association with Bulk density (0.9629), Electrical conductivity (0.9360), Hydraulic conductivity (0.9535), Particle density (0.9571), pH (0.9642) and Porosity (0.9781)

The equation fitted in this case is

$$Y = 25.1867 + 0.2239^{**} x ; R^2 = 0.942^{**}$$

### Organic carbon

The organic carbon has positive correlation of 0.9061 respectively with water holding capacity and negative association of 0.9535, 0.9485, 0.9082, 0.9507, 0.9586 and 0.9211 respectively with bulk density, Electrical Conductivity, Hydraulic conductivity, particle density, pH and Porosity.

The equation fitted is

$$Y = 0.4167 + 0.0137^{**} x ; R^2 = 0.920^{**}$$

### Hydraulic conductivity

This has negative association with Organic carbon (0.9082) and Water holding capacity (0.9629) and positive association with bulk density (0.9771), EC (0.9567), particle density (0.9781) pH (0.9790), and Porosity (0.9894)

The equations is

$$Y = 164.467 - 2.0388^{**} x ; R^2 = 0.966^{**}$$

**Table:1** Variation of the Properties with Percentage of Amendments added to the Theri Soil

Percentage	pH	EC dsm <sup>-1</sup>	Particle Density g/cm <sup>3</sup>	Bulk Density g/cm <sup>3</sup>	Porosity (%)	Water holding capacity (%)	Organic Carbon (%)	Hydraulic conductivity (mm/hr)

5	7.8	0.32	2.70	1.90	42.70	24.89	0.52	152
10	7.69	0.31	2.58	1.80	41.90	26.90	0.58	143
15	7.66	0.30	2.50	1.75	40.70	29.20	0.62	138
20	7.50	0.29	2.40	1.70	39.90	30.20	0.67	130
25	7.48	0.28	2.30	1.60	38.32	31.78	0.78	118
30	7.35	0.26	2.27	1.59	36.22	33.00	0.8	96
35	7.27	0.23	2.10	1.50	36.00	33.38	0.82	88
40	7.20	0.25	1.97	1.40	35.50	33.90	0.90	75
45	7.12	0.22	1.89	1.35	34.30	34.50	1.00	73
50	7.00	0.20	1.82	1.30	34.00	35.70	1.24	71

### 3. RESULTS AND DISCUSSION:

Addition of the amendment with Theri soil decreases the bulk density, particle density, pH, EC and hydraulic conductivity but increases porosity, water holding capacity and organic carbon. It is generally agreed that the bulk density of  $1.5 - 1.6 \text{ g/cm}^3$  is critical for root growth of most of the plants. (Ayres et al. 1973). In this study the convenient root growth condition for the plants is achieved for T+25%, T + 30% and T + 35% amendments. The total porosity varies in the neighborhood of 50% (Baver 1959). Here in all the treatments porosity ranges from 34% to 43%. The pH value beyond 9 is undesirable on account of alkali hazards. Neither is the pH value below 4.5 good as availability of nutrients of plants becomes a limiting factor. The value of pH for all the amendments is favorable for cultivation purpose. Crop yields generally do not significantly decrease until the salt concentration in the soil solution exceeds the threshold level which can differ for different crops and their varieties. The major soil physical constraints identified are low water retention and high permeability. The desired increase of water holding capacity will improve the ability to supply the nutrients to soil. The hydraulic conductivity is considerably controlled from very rapid stage to moderately rapid stage. This is because the applications of organic manures and pond sediments decrease the bigger pores and increase the smaller pores (Anonymous, 2002). Here in all the treatments water holding capacity increased and attained the maximum value of 36 % cent and the hydraulic conductivity reduced to the minimum value of 71 mm/hr. T + 25%, T + 30% and T + 35% combinations were better than the other combinations for the purpose of cultivation. Increase of organic carbon improves the growth condition of the crops. Giving more importance to the major soil physical constraint namely the water retention and the permeability T + 35% amendment treatment could be predicted as the best among all the treatments.

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