Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 09, pp.57060-57063, September, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

SOIL RECLAMATION USING TANK SILT AND NEEM COMPOST AMENDED THERI SOIL IN TUTICORIN DISTRICT

[1*]Sundaram, S. and [2]Dr. Annadurai, B.

[1]AssociateProfessor, Dept., of Physics, Thiruvalluvar, College, Vickramasingapuram, Papanasam-627425
[2]Associate Professor, Dept., of Physics (Retd), Aditanar College of Arts & Science, Tiruchendur-628216

ARTICLE INFO

Article History:
Received 03rd June, 2017
Received in revised form
25th July, 2017
Accepted 23rd August, 2017
Published online 29th September, 2017

Key words:
Theri soils,
Tank Silt,
Neem Compost.

ABSTRACT

A special type of Red sandy dunal soil [*Theri-soil*] of Tamil Nadu is called *Theri-soils.* (*Theri-soil*) are located in Tuticorin, Tirunelveli and Kanyakumari districts of Tamil Nadu. The Merits of Theri lands aredeep sand zone, good permeability and quality ground water. The Demerits of Theri lands are un suitable 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. Tank silt and neem compost are the materials 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.

Citation: Sundaram, S. and Dr. Annadurai, B. 2017. "Soil reclamation using tank silt and neem compost amended theri soil in tuticorin district", *International Journal of Current Research*, 9, (09), 57060-57063.

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 to700mm (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.

Corresponding author: **Sundaram, S.**
AssociateProfessor, Dept., of Physics, Thiruvalluvar, College, Vickramasingapuram, Papanasam-627425.

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.

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. Tank silt and neem compost mixed in equal proportions is the amendment used in the study. Tank silt was collected from nearby tanks. Neem compost 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^{-1}), Particle density (g/cm^3), Bulk density (g/cm^3), 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 Neem compost and Tank silt amended theri soil can be best represented by the linear model,

$Y= a+ b x$

1 pH

It is observed from the correlation table that pH has positive association with Bulk density (0.4769), Hydraulic conductivity (0.4869) and Particle density (0.5678), and negative association with Electrical Conductivity (0.5061), Organic carbon (0.5793), Porosity (0.5407) and Water holding capacity (0.5517).

The best three equations selected are

$y=8.4527 -0.0068^{**}x ; R^2 = 0.292^{**}$
$y=8.2385 +0.0146^{**}x -0.0004^{**}x^2 ; \quad R^2 = 0.443^{**}$
$y=8.0933 +0.0403**x-0.0015^{**}x^2 +0.000014^{**}x^3;$
$R^2 = 0.470**$

The sign of x in all the equations confirm the behaviour with the results obtained through simple correlation analysis. That is increase in amendment reduces the pH level. The R- Square value indicates that about 47.0 percent of the variations in pH is being determined by the amendment levels used in the equation.

Electrical conductivity (EC)

The correlation table reveals that the EC has positive association with Organic Carbon (0.9653), Porosity (0.9801) and Water holding capacity (0.9756) and negative association with Bulk density (0.9863), Hydraulic conductivity (0.9906), Particle density (0.9794) and pH (0.5061)

The best three equations in the case of EC are

$Y=0.1813 + 0.0042^{**}x; \quad R^2 = 0.979^{**}$
$y=0.1688 + 0.0054^{**}x -0.00002^{**}x^2 \quad R^2 = 0.983^{**}$
$y=0.1677 + 0.0056^{**}x-0.00003x^2 +0.00000011^{**}x^3;$
$R^2 = 0.983^{**}$

Where y is the EC and x is the level of amendments. Here R-Square is 0.983, which is significant at one percent level of probability indicating the fact that 98.3 percent of the variations in the EC level is being explained by the different levels of amendments added to the soil. This gives the EC level of the original *theri* soil. The negative and very small value in the coefficient of x^2 in the quadradic equation indicates the slow changes in the EC levels corresponding to the changes made in the amendments .The coefficient of x in the linear equation indicate that a unit increase in the level of amendment will increase the EC level of the soil by 0.0042 units. That is amendments help in increasing the level of EC in the original soil.

Particle density

The correlation table reveals that the particle density is positively related to bulk density (0.9867), Hydraulic conductivity (0.9848) and pH (0.5678) and negatively associated with Electrical conductivity (0.9794), Organic carbon (0.9831), porosity (0.9958) and water holding capacity (0.9829). Hence its behaviour must be similar to that of EC and Organic carbon.

The fitted equations are

$y=2.9393 - 0.0086^{**}x ; R^2 = 0.987^{**}$
$y=2.9268 - 0.0073^{**}x -0.00002^{**}x^2 ; R^2 = 0.988^{**}$
$y=2.9407 - 0.0098^{**}x +0.000084^{**}x^2 -0.000001^{**}x^3;$
$R^2 = 0.989^{**}$

The negative coefficient of x in all the equations confirm the behaviour expressed in simple correlation. That is increase in the amendment rate brings only decrease in the particle density. That is added compost brings a reduction in the particle density. The initial particle density of the original soil is nearly 2.94 units. The highly significant R- Square value expresses the fact that about 98.9 percent of the variations in the behaviour of particle density is explained by different amendment levels.

Bulk density

From the correlation table, we observe that the bulk density is positively related to Hydraulic conductivity (0.9964), Particle density (0.9867) and pH (0.4769) and negatively related to Electrical Conductivity (0.9863), Organic Carbon (0.9691), Porosity (0.9899) and Water holding capacity (0.9881).

In the case of Bulk density, the fitted best three equations along with the R-Square values and the significance of the coefficients are:

$Y=1.8460 - 0.0082^{**}x; \quad R^2 = 0.991^{**}$
$Y=1.8560 - 0.0092^{**}x + 0.000018^{**}x^2; R^2 = 0.992^{**}$
$Y=1.8393-0.0062^{**}x-0.0001^{**}x^2+0.0000016^{**}x^3; R^2= 0.993^{**}$
* - Significant at five percent level of probability.
**- Significant at one percent level of probability.

Where y is the bulk density and x is the level of amendment. Here, R- Square is almost near to one for the cubic equation. This shows that 99 percent of the variations in the bulk density in the soil is being explained by the levels of amendments made. The value of the constant term in all the equations are almost equal to two indicating the initial bulk density of the soil. The very low value of the coefficient of the second degree term indicates the slow response of the bulk density value with respect to the changes made in the amendment. That is the addition of amendment reduces the bulk density.

Percentage	pH	EC dsm^{-1}	Particle Density g/cm^3	Bulk Density g/cm^3	Porosity (%)	Water holding capacity (%)	Organic Carbon (%)	Hydraulic conductivity (mm/hr)
5	8.30	0.20	2.90	1.80	37.00	31.10	0.20	135
10	8.29	0.22	2.84	1.78	37.50	31.50	0.25	131
15	8.27	0.23	2.80	1.73	38.10	32.20	0.40	127
20	8.25	0.27	2.78	1.66	38.30	32.40	0.45	120
25	8.23	0.30	2.75	1.65	38.50	33.00	0.52	117
30	8.26	0.32	2.67	1.60	39.20	33.50	0.62	115
35	8.20	0.33	2.63	1.55	39.70	34.50	0.75	110
40	8.19	0.34	2.62	1.52	39.90	34.70	0.79	106
45	8.16	0.36	2.55	1.47	40.20	34.90	0.90	102
50	8.00	0.39	2.50	1.45	40.80	35.20	1.20	98

That is the amendment needed to get any desired level of bulk density can be obtained by substituting the desired bulk density level for y in the above equation. Thus the amendments help in fixing any desired level of bulk density in the soil.

Porosity

The porosity of the soil has got positive association with EC (0.9801), Organic Carbon (0.9818) and Water holding capacity (0.9907) and negative association with Bulk density (0.9899), Hydraulic conductivity (0.9884), Particle density (0.9958) and pH (0.5407)

The best three equations fitted in this case are

$y=36.6867 + 0.0812^{**}x$; $R^2 = 0.989^{**}$
$y=36.6367 + 0.0862*x -0.00009^{**}x^2$; $R^2 = 0.989^{**}$
$y=36.5200 + 0.1069^{**}x -0.0010^{**}x^2 +0.000011^{**}x^3$; $R^2= 0.989^{**}$

Water holding capacity

The correlation table reveals that the water holding capacity has negative association with Bulk density (0.9881), Hydraulic Conductivity (0.9846), Particle density (0.9829) and pH (0.5517) and positive association with EC (0.9756) and Organic carbon (0.9595) and Porosity (0.9907) . The best three equations fitted in this case are

$y=30.6333 + 0.0970**x$; $R^2 = 0.979**$
$y=30.3833 + 0.1220^{**}x -0.0005^{**}x^2$;$R^2 = 0.983^{**}$
$y=30.9500 +0.0214^{**}x+0.0039^{**}x^2 - 0.00005^{**}x^3$; $R^2 = 0.990^{**}$

The positive value of the coefficient of x agrees with the correlation results. The R-Square is 0.99 expressing the fact that 99 percent of the variations in the water holding capacity is being explained by the amendment levels.

Organic carbon

The organic carbon the Orgonica carbon has negative association with bulk density (0.9691), Hydraulic conductivity (0.9739) particle density (0.9831) and pH (0.5793) and positive association with EC (0.9653), Porosity (0.9818) and water holding capacity (0.9595).

The best three equations fitted are

$y=0.1580 + 0.0200^{**}x$; $R^2 = 0.960^{**}$
$y=0.1705 + 0.0087^{**}x +0.0002^{**}x^2$;$R^2 = 0.976^{**}$
$y=0.0247 + 0.0346^{**}x -.0009^{**}x^2 +0.000014^{**}x^3$ $R^2 = 0.986^{**}$

The R-Square is 0.986 which is significant at the highest level of probability indicating the fact that the amendments chosen could explain 96 percent of the variations in the organic carbon. The positive coefficient for x gives the confirmation of the fact derived from simple correlations. That is increase in the levels of amendments bring additional organic carbon content. The intercept term is almost consistent in the quadratic and cubic equations indicating the fact that the level of organic carbon present in the non-amended soil is nearly 0.1 units. Hydraulic conductivity is another important factor deciding plant growth in soil. This has negative association with Electrical Conductivity (0.9906), Organic Carbon (0.9739), Porosity (0.9884) and water holding capacity (0.9846) and positive association with Bulk density (0.9964), Particle density (0.9848) and pH (0.4869).

The best three fitted equations are

$y=138.533 – 0.8158^{**}x$; $R^2 = 0.994^{**}$
$y=139.617 – 0.9241^{**}x + 0.0020^{**}x^2$;$R^2 = 0.995^{**}$
$y=140.933 –1.1577**x + 0.0121^{**}x^2 -0.0001^{**}x^3$; $R^2 = 0.995^{***}$

The R - Square is 0.995 expressing the fact that 99.5 percent of the variations in the hydraulic conductivity of the soil is being decided by the amendment levels considered in the experiment.

RESULTS AND DISCUSSION

Addition of the amendment with Theri soil decreases the bulk density, porosity, particle density, pH and hydraulic conductivity but increases Electrical conductivity, water holding capacity and organic carbon. In this study, the convenient root growth condition for the plants is achieved for T + 30%, T + 35%, T + 40% and T + 45% amendments treatments. In all the treatments porosity values range from 32% to 43%. The value of pH for all amendments is favorable for cultivation purpose. 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. Here in all the treatments water holding capacity increased and attained the maximum value of 42 % cent and the hydraulic conductivity reduced to the minimum value of 60 mm/hr. T + 30%, T + 35%, T + 40% and T + 45% 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 constraints namely the root growth, the water retention and the permeability T + 45% amendment treatment could be predicted as the best among all the treatments.

REFERENCS

Anonymous., 2002. Fundamentals of Soil Science. Indian Agricultural Research Institute, New Delhi

Ayres, K.W., R.G.Button and E. De Jong, 1973. "Soil Morphology and soil physical properties. II. Mechanical Impedance and moisture retention and movement". *Can.J.Soil.Sci*., 53; p9-19

Baver, L.D. 1959. Soil Physics. Chapman & Hall, Limited, London

Janakiraman, M., G. Arunachalam and D. Jawahar, 1997. "Soil survey: Interpretation for land use Planning in the Theri –s oils of Tamil Nadu" *J.Indian Soc. Soil Sci*., 45. (2) pp.329-332.

Jawahar, D., G. Arunachalam and M.Janakiraman,1999a. "*Theries* –Red Coastal Sand Dunes of Tamil Nadu and characteristics" *J.Indian Soc. Soil Sci*., 47 (1) pp.125-128.

Jawahar,D., G.Arunachalam,V.Velu.and P.P. Ramaswami, 1999b. "Fertility Capability of *Theri* -soils of Tamil Nadu**"** *J.Indian Soc. Soil Sci*., 47 (3) pp 570-573.

Piper, C.S.1966. Soil and Plant analysis. Hans Publications, Bombay.

****