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Groundnut cultivation using theri soil in Tamil Nadu by organic amendment and enhancement of its physical properties

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ABSTRACT

Biometric measurements were carried out in a field experiment at Puchikadu village in Thuthukudi district of Tamil Nadu, South India. The effect of different organic amendments and their combination on growth parameters and favourable change in physical properties were evaluated. The treatments of this study were farm yard manure (FYM), composted coir pith (CP) and tank silt (TS). The experiment was laid out in Randomized Block Design with three replications. All the amendments were applied after 30 days of irrigation. The soil samples were collected in each plot and analyzed. Groundnuts were grown and the soil was again analyzed after the harvest of the crop. The yield of pods was high with the combination of composted coir pith and tank silt in equal combinations with 12.5 t ha^{-1} which was 40.51% higher than control. The biometric observations like height, number of branches and leaves, dry biomass and yield of the plants were taken. The bulk density (BD) and particle density (PD) had negative effect. Percentage of water holding capacity (WHC), pore space (PS) and saturated moisture (SM) had positive effect. Thus organic farming is not a destination to reach, but it is a journey to a mission in ameliorating the soil.

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Key Words : Biometric observation, Bulk density, Organic amendment, Amelioration

INTRODUCTION

Theri soil, a typical red sand dune soil occurs on an area of 11,000 ha in Tamil Nadu, which is presently considered as wasteland. This sand dune ecosystem is formed as sand deposits under a semi arid climate. As the soil texture is sandy, it is subjected to severe wind erosion and characterized with poor nutrient status. Water holding capacity of the soil is very low owing to the low clay content as explained by Rakesh *et al*. (1998). Walia *et al.* (1999) put forth poor organic carbon content and single grain structure.

Organic farming conserves soil fertility and prevents soil erosion through implementation of appropriate conservation principles which leads to live in harmony with nature. Organic farming is a method of farming which avoids or largely excludes the use of harmful chemicals such as chemical fertilizers, pesticides and herbicides and use of natural resources such as organic matter, minerals and microbes to maintain the environment clean without polluting soil, water and air.

The farm yard manure seems to act directly by increasing crop yields either by acceleration of respiratory process by cell permeability or by hormone growth action. It supplies nitrogen, phosphorus and sulphur in available forms to the plants through biological decomposition. Indirectly, it improves physical properties of soil such as aggregation, aeration, permeability and water holding capacity as experimented by Malathesh (2005).

Coir is the name given to the fibrous material that constitutes the thick mesocarp (middle layer) of the coconut fruit (*Cocos nucifera*). The short fibers (10 mm or less) and dust (collectively referred to herein as "pith") traditionally have accumulated in large piles or dumps as a waste product resulting from the processing of coconut husks to obtain the industrially valuable long fibers. Coconut coir pith has many physical and horticultural characteristics that make it an excellent growing medium for plants. It has high water holding capacity, ideal porosity, high cation exchange capacity and high stability (US.2009/ 0113791 A1).

Tanks serve as a good trap for eroded soil generating large quantities of accumulated sediment. Invariably tank sediments have higher nutritive value over their respective cultivated catchment soil (Anonymous, 2003). Addition of tank sediments to cultivated fields improves the physico-chemical properties of the soil which results in good crop growth and higher yields.

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Among all the oilseed crops, groundnut (*Arachis hypogaea* L.) has the first place in India accounting for more than 28 per cent and 32 per cent production in the country (Anonymous, 2004). The physical condition of theri soils is not so congenial for groundnut cultivation. The theri soils being low organic carbon and available nutrient content require supply of essential nutrients through the organic sources. Therefore, the present investigation was undertaken to study the effect organic manures like FYM, CCP and TS on the favourable changes in physical properties of theri soil, the growth and yield of groundnut crop.

RESEARCH METHODOLOGY

In the year 2010 field experiment was conducted at Puchikadu village which lies in 8°516' latitude and 78°052' longitude in Thuthukudi district of Tamil Nadu. Groundnut (*Arachis hypogaea* L.) is grown best in sandy loam and loam soil as light soil helps in easy penetration of pegs, their development, and their harvesting. The variety chosen for cultivation was TMV-7 with duration of 105 days.

The disturbed soil samples were obtained using V shaped cut at the depth of 15 cms, air-dried, ground, mixed, passed through 2 mm sieve and analyzed for their physico-chemical and physical properties. The experiment was laid down according to randomized block design with three replications. All the amendments were applied and after 30 days of drip irrigation, the soil samples were collected in each plot and analyzed. Groundnuts were grown and the biometric observations like plant height, number of branches, number of leaves and dry biomass per plant were taken. Also yield of the plant in kg ha^{-1} was observed.

Regarding the physical properties of control without applying organic manure BD and PD was 1.6014 and 2.4995 gm cm^{-3}. Its WHC was 22.21 with PS of 35.55 per cent . The saturated moisture content calculated was 23.15 per cent . The experimental area received an annual rain fall of 650 mm.

The physical properties like PD, BD, WHC, PS and SM were analyzed by Keen Raczkowski (KR) box given by Keen *et al.* (1921). The data were statistically analyzed using analysis of variance (ANOVA) as applicable to complete the Randomized Block Design, and least significant difference (LSD) at P= 0.05 was used to test the differences between means of individual treatments (Gomez and Gomez, 1984).

RESEARCH FINDINGS AND ANALYSIS

The findings obtained from the present investigation as well as relevant discussions have been summarized below:

Physical properties:

BD:

In the present study the detrimental effect of BD due to addition of organic matter was shown in the Table 1. BD was the minimum as 1.4310 gm cm^{-3} in the plot T7 with F+CP+TS at equal combinations with 12.5t ha^{-1}. It was 10.64 per cent lower than control. BD was maximum in the control plot with the value 1.6014 gm cm^{-3}. Barzegar *et al.* (2002) out lined that both rate and type of organic materials in?uence the soil bulk density. Higher rates of organic material addition resulted in lower bulk densities and hence higher soil porosities which is similar to the present study. According to the study of Maragatham *et*

Table 1: Physical properties of their soil after applying organic amendments

Sr. No.	Manure	Plots	BD	PD	WHC	PS	SM
	12.5 t ha^{-1}		g cm^{-3}	g cm^{-3}	%	%	%
1.	F	T_1	1.5874	2.4610	25.4371	38.2115	24.1843
2.	CP	T_2	1.5596	2.5832	25.3672	42.2907	28.9420
3.	TS	T_3	1.5076	2.4546	26.7195	39.8986	27.2059
4.	F+CP	T_4	1.4328	2.4904	30.5381	43.6790	31.0897
5.	CP+TS	T_5	1.4932	2.3728	26.7688	39.5723	27.7612
6.	F+TS	T_6	1.5264	2.3430	23.9751	36.9504	25.1407
7.	F+CP+TS	T_7	1.4310	2.2532	25.8507	37.5752	26.5408
8.	Control	T	1.6014	2.4995	22.2104	35.5537	23.1482
	S. E. ±		0.2583	0.2292	3.0472	3.6390	3.4847
	C.D. (P =0.05)		0.5540	0.4917	6.5364	7.8057	7.4747

F-Farm yard manure
CP-Composted coirpith
TS-Tank silt
BD- Bulk density
PD- Particle density
PS- Pore space
SM- Soil moisture
WHC-Water holding capacity

al. (2010) it was observed that the coir pith particles are highly heterogeneous. The bulk density and particle size are negatively correlated since the bigger particles are less dense.

PD:

The decrease in PD from the control was obvious with incorporation of organic manure. PD was the lowest as 2.2532 gm cm^{-3} in T_7 plot with F+CP+TS and was 10.64 per cent less than control. PD was the highest the control plot with the value of 2.4995 gm cm^{-3}. The combination of manures have decreased the PD to the greater extent. Similar results were revealed by the studies of Melis *et al.* (2008) using composted tobacco waste and FYM.

WHC:

It is one of the important property that governs the soil. WHC was maximum as 30.5381 per cent in T_4 plot with F+CP combination and minimum as 22.2104 per cent in control plot. The maximum increase in WHC over control was 27.27 per cent. The findings of Wassan (2002) was in conformity with the present result who confirmed that the application of tank silt increased water holding capacity, clay content and nutrient availability in the soil. It also enhanced the soil moisture content.

PS:

The value of PS was 43.6790 per cent as the maximum value in T_4 plot with F+CP and it was 18.6 per cent above the control. The minimum value was seen in the control plot with 35.5537 per cent. The investigations of Maragatham *et al.* (2010) revealed similar findings that porosity and bulk density of soilless medium were strongly linked. The increase in bulk density reduced the porosity of the medium which ultimately hamper the growth and distribution of roots of the plants grown in it.

SM:

It is a property which is endowed with the ability to retain soil moisture. The slow release in moisture enhances crop yields. The slow release in moisture enhances crop yields. SM was maximum as 31.0897 per cent in T_4 with F+CP. T_4 treatment increased SM 25.54 per cent than

Table 2: Biometric observations of groundnut plant with organic manure (12.5 t ha^{-1})

Sr. No.	Manure	Plots	Height (cm)	No. of branches	No. of leaves	Biomass (dry)g	Yield kg ha^{-1}
1.	F	T_1	49.83 a	4.93	44.67 bcd	31.277 a	2773 bc
2.	CP	T_2	50.81 a	5.03	47.44 bcd	24.633 bc	3065 ab
3.	TS	T_3	51.31 a	4.97	48.77 bc	27.986 ab	2833 abc
4.	F+CP	T_4	47.97 a	4.87	58.44 a	29.791 a	2945 ab
5.	CP+TS	T_5	48.87 a	5.23	50.56 ab	31.051 a	3135 a
6.	F+TS	T_6	36.71 c	4.81	40.22 d	24.583 bc	2498 c
7.	F+CP+TS	T_7	40.23 bc	5.11	46.67 bcd	29.311 a	2868 ab
8.	Control	T	44.41 ab	4.51	41.22 cd	21.611 c	1865 d
	Significance		**	NS	**	**	**
	S. E. ±		3.3508	0.2390	3.8713	1.8569	160.16
	C.D. (P=0.05)		7.1876	0.5126	8.3039	3.9831	343.55
	CV %		8.87	5.92	10.03	8.25	7.14

Table 3 : Plant height (cm) in various days after sowing (DAS)

Sr. No.	Manure	Plots	Plant height (cm)					
	12.5 t/ha		15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
1.	F	T_1	7.01	8.95	15.54	28.96	36.35	49.83
2.	CP	T_2	6.63	9.58	16.35	31.95	38.13	50.81
3.	TS	T_3	6.63	9.15	13.71	28.14	38.99	51.31
4.	F+CP	T_4	6.97	9.24	14.37	24.83	45.11	47.97
5.	CP+TS	T_5	6.99	8.99	12.84	28.48	43.54	48.87
6.	F+TS	T_6	6.92	8.74	14.51	31.85	35.05	46.70
7.	F+CP+TS	T_7	6.72	8.42	13.45	28.51	37.63	47.23
8.	Control	T	6.26	7.26	12.02	22.57	34.16	44.41

control. Experiment of Mishra (2002) showed similar results that application of soil amendments *i.e.* tank silt which will improve the soil moisture conservation in the soil profile as compared to un-amended soils at Targhadia. Rangaraj *et al.* (2007) studies revealed that the application of press mud and composted coir pith registered comparable population of soil microbes. Increase in microbial population due to addition of organics might have regulated soil temperature and continuous available soil moisture and the humus content of soil.

Biometric observations:

Height:

The height of the plant was 49.83, 50.81 and 51.31cms in T_1, T_2 and T_3 , respectively. The percentage increase was 10.88, 12.6 and 13.45 per cent than control with 12.5 t ha^{-1}as shown in Table 2. The heights of the groundnut plant (cms) in every two weeks time was shown in Table 3. Similar increased plant height was with increasing amount of CP addition compared to the control as recorded by Prince *et al*. (2000).

Branches:

An average of 5.23 branches per plant was recorded in T_5 with CP+TS combination. It was 13.77 per cent higher than the control. Kadwe *et al.* (2003) explained the beneficial effect of FYM was due to the fact that the plant growth might be accelerated by assimilation of more amounts of nutrients made available through FYM which might be the reason for increased number of leaves and branches.

Leaves:

Number of leaves per plant was observed at the maximum in F+CP with T_4 as 58.44 which were 29.47 per cent higher than control. Next higher number of leaves recorded was 50.56 in CP+TS for T_5 treatment. Okwuagwu *et al*. (2003) finding showed that the highest mean plant height, leaf number and mean fruit number was present in the treatment with combined cow dung and NPK similar to the present study.

Dry biomass:

The dried biomass was observed as 31.051 gms in T_5 with CP+TS at 12.5 t ha^{-1} which was 30.40 per cent higher than control. Sharma and Dayal, (2005) outlined that application of tank silt has resulted in significant increase in dry matter production with crop growth. This could be attributed to higher availability of nutrients particularly nitrogen which is being supplied through the addition of silt.

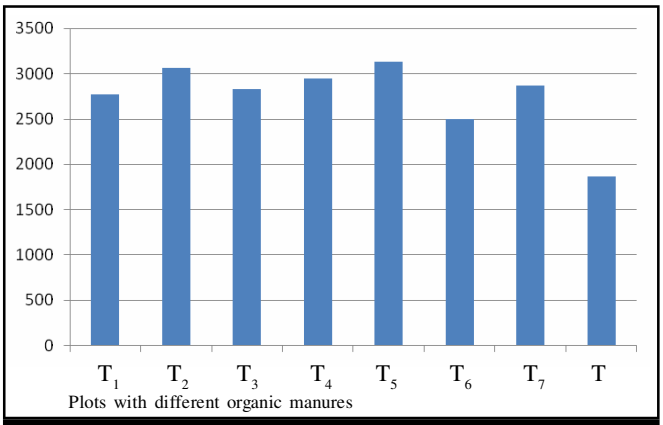

Fig. 1: Yield of pods in various organic amended soil in kg ha^{-1}

Yield:

The highest yield was recorded in CP+TS with T_5 in equal combinations with 12.5 t ha^{-1} as 3135 kg ha^{-1} as shown in the graph. It was 40.51 per cent more than control. The second highest yield was 3065 kg ha^{-1} in T_2 with CP. The lowest yield was recorded in the control plot without applying organic manure. Similar increase in crop yields was recorded by Krishnappa *et al.* (1998) on application of tank silt with 60 per cent increase in groundnut as compared to un-amended plots. Binitha, (2006) recorded a consistent finding that the level of tank silt at the rate of 20 t ha^{-1} recorded significantly superior number of pods, pod yield and haulm yield .

Conclusion:

The above findings revealed that organic farming would be able to sustain the soil fertility for a longer period by meeting the demands of present and future generation. Considering the salient findings in perspective, organic farming favourably influenced the soil physical, chemical and biological fertility over the inorganic, which in turn paved way for better crop yield and quality. When compared to control, yield parameters such as pod yield and plant height, number of branches, and leaves per plant, dry biomass were increased in organically treated field. Increased yield of 3135 kg ha^{-1} in CP+TS with 12.5 t ha^{-1} as 40.51 per cent more than control in the present study may be associated with the supply of essential nutrients by continuous mineralization of organic manures, enhanced inherent nutrient supplying capacity of the soil and its favourable effect on soil physical properties.

REFERENCES

Anonymous (2003). Economic assessment of desilted sediment in terms of plant nutrients equivalent. *A case study* in the medak district of Andhra Pradesh.

Anonymous (2004). *Agricultural statistics at a glance-2004.* Department of agriculture and cooperation. Ministry of agriculture. Govt. of India. *Http://Agricoop.Nic.In/ Statatglance2004/ Atglance.Pdf.*

Barzegar, A.R., Yousefi, A. and Daryashenas, A. (2002). The effect of addition of different amounts and types of organic materials on soil physical properties and yield of wheat. *Plant & Soil,* **247**: 295–301.

Binitha, N.K. (2006). Characterization of tank silt of north Karnataka and evaluation of its effect on the growth and yield of groundnut. Ph.D. (Ag.) Thesis, University of Agricultural Sciences, DHARWAD, KARNATAKA (India).

Gomez, K. A. and Gomez, A. A. (1984). *Statistical procedures for agricultural research*. New York: Wiley Inter Science, 2nd edn., **95-109.**

Kadwe, S. N., Hatmode, C.N., Deotale, R. D., Chore, C.N. and Thorat, A. (2003). Effect of different levels of fertilizers and pressmud on morpho-physiological parameters and yield of groundnut. *J. Soils & Crops,* **13**(2):305- 308.

Keen, B.A. and Raczkowski, H. (1921). Relation between the clay content and certain physical properties of a soil. *J. Agric. Sci.,* **11**:441-449.

Krishnappa, A. M., Ranganna, B., Aramanagouda, P. and Arun Kumar, Y. S. (1998). Karnataka Rajyada Dakshina Zillegalalli Kere Hoolettuva Karyakramada Upayuktate Matthu Arthikathe, Kolar Zilleya Anubava.

Malathesh, G.H. (2005). Nutrient substitution through organics in maize. *M.Sc. Thesis*, University of Agricultural Sciences, DHARWAD, KARNATAKA (India).

Maragatham Jeyaseeli, D. and Samuel Paul Raj (2010). Physical characteristics of coir pith as a function of its particle size to be used as soilless medium. *American–Eurasian J. Agric. & Environ.Sci*., **8**(4): 431-437.

Melis Çerçio_Lu, Bülent Okur, Sezai Delibacak and Ali Rýza Ongun. (2008). Effects of composted tobacco waste and farm yard manure on some soil physical properties and lettuce yield. *International Meeting on Soil Fertility Land Management And Agroclimatology. Turkey,* pp. 647-654.

Mishra, P.K. (2002). Indigenous technical knowledge on soil and water conservation in Semi-Arid India, Published By *Agro-Ecosystem Directorate (Rainfed), Natp, Crida, Hyderabad,* pp. 1-150.

Okwuagwu, M.I., Alleh, M.E. and Osemwota, I.O. (2003). The effects of organic and inorganic manure on soil properties and yield of Okra in Nigeria, *African Crop Science Conference Proceedings*, **6**: 390-393, African Crop Science Society.

Prince, W., Sivakumar,S., Ravi, V. and Subburam, V. (2000). The effects of coir pith compost on the growth and quality of leaves of the mulberry plant (*Morus alba* L.) *Bioresource Technol.,* **72**: 95-97.

Rakesh, A.P., Singh, J.P., Sinha, B.K. and Prasad, R. (1998). Physical characterization of soils in command area in Jian Minor under Gandak Project for soil and water management. *Indian J. Soil Cons.,***26**: 252-257.

Rangaraj, T., Somasundaram, R., Mohamed Amanullah, M., Thirumurugan, V., Ramesh, S. and Ravi, S. (2007). Effect of agro-industrial wastes on soil properties and yield of irrigated finger millet (*Eleusine Coracana* L. Gaertn) In Coastal Soil. *Research J. Agric. & Biological Sci.,* **3**(3): 153-156.

Sharma, V.K. and Dayal, B. (2005). Effect of organic and inorganic source of nitrogen on growth, yield and nutrient uptake under cowpea, linseed cropping system. *Legume Res.,* **28**(2) : 79-80.

US 2009/0113791 A1 Compressed coconut coirpith granules and methods for the production and use thereof. pp. 1-6.

Walia, C.S., Rao, Y.S. and Bobade, S.V. (1999). Water retention characteristics of some sedentary and alluvial soils of Bundelkhand region. *Agropedology*, **9**:105-112.

Wassan (2002). Voices for the ground: Issues in tank desiltation under 'Neeru-Meeru', Secundrabad: Watershed Support Services and Activities Network.

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