

Short Term Effect of Organic Manure on the Physical & Chemical Properties of the Soil

¹M. M. Aysha Siddika, ²F.Jeyamangalam,
¹Scholar, ²Associate Professor

^{1,2}Department of Physics, Sarah Tucker College, Tirunelveli-627005, Tamil Nadu, India.

Abstract- This experiment was conducted at Pettai of Tirunelveli District of Tamil Nadu, South India to evaluate the effects of different organic manures with various combinations on physical, chemical and physico-chemical properties of the soils and their impact on Sorghum. The treatments of this study were Farmyard manure, Vermicompost and Goat manure. These manures were applied to the field at different concentration and combination. After 30 days, the disturbed soil samples were collected and the soil physical, chemical and physico-chemical properties were analysed. Then Sorghum seeds were sown. Again soil samples were collected and the soil properties were analyzed after three months of applying manure. The Bulk Density (BD) and Particle Density (PD) had decreased in all the combinations other than control. Percentage of Water Holding Capacity (WHC), Pore Space (PS) and Saturated Moisture (SM) had increased. Vermicompost has a high water holding capacity, ideal porosity, high cation exchange capacity and high stability. Total porosity and aeration porosity increase along with the increase in particle size. Vermi compost contains most nutrients in plant available forms such as phosphates, exchangeable calcium and soluble potassium (Marinari *et al.*, 2008). The soil available K increased significantly with raising the vermicompost rate.

Keywords: Farmyard manure, Vermicompost, Goat manure, amendment.

I. INTRODUCTION

Agriculture has been the basic source of subsistence for man over thousands of years. It is the backbone of our world. It provides a livelihood to half of the world's population even today. Major inorganic fertilizers contain balanced amount of nitrogen, potassium and phosphorous to feed plants and to faster growth. This fertilizer creates environment related problem and situation can be improved through the use of bio fertilizers (Saadatnia 2009). Inorganic fertilizer does not be decompose over time to supply nutrients to plants. Chemical fertilizer supplies the nutrients necessary to grow plants. The use of a chemical fertilizer which can be bought at most gardening supply stores, offers some convenience. The continued use of chemical fertilizers causes health and environmental hazards such as ground and surface water pollution by nitrate leaching.

A. Materials and methods

The experimental soil was obtained as fine tilt without stubbles and weeds. While adding organic manure, care was taken to see the individual treatments were mixed separately. By using different organic manures like farm yard manure (F), Vermicompost (VC) and Goat manure (GM) in different concentrations (7.5 t ha⁻¹, 12.5 t ha⁻¹ and 17.5 t ha⁻¹) and different combination the total treatment consists of 13 samples including control plot. The physical properties like BD, PD, WHC, SM & PS were calculated using KR box (Keen Roczkowski, 1921). The data were statistically analyzed using analysis of variance (ANOVA) and least significant difference

(LSD) to test the difference between individual treatments (Gomez and Gomez, 1984)

B. Physical properties

Bulk Density (BD) BD is defined as the mass (weight) per unit volume of a dry soil (volume of solid and pore spaces). It is also expressed in gm cm⁻³ (C.G.S. System). Generally, in normal soils bulk density ranges from 1-1.60 gm cm⁻³. In sand dominated soils, BD is about 1.7 gm cm⁻³.

Particle Density (PD) The weight per unit volume of the solid portion of soil is called particle density. It is also termed as true density. It is expressed in gm cm⁻³. Generally in the normal soils the particle density is 2.65 gm cm⁻³.

Maximum Water Holding Capacity (Whc) Maximum water holding capacity is defined as the capacity of the soil to retain water is exceeded. At this point all soil pore space (micro and macro spaces) are filled up with water and the drainage is restricted.

Pore Space (PS) Pore space (also called voids) in a soil consists of the portion of the soil volume not occupied by solids, either minerals or organic. The pore space under normal condition is occupied at times by air and water. Pore space directly control the amount of water and air in the soil and indirectly influence the plant growth and crop production.

Saturated Moisture (SM) At soil saturation, water fills completely in the pore spaces.

II. RESULT AND DISCUSSION

A. Physical Properties

Bulk density (BD): Bulk density decreased positively with increasing Vermicompost as an organic manure. After different combination of organic amendments the bulk density decreased to 1.1705 gm cm⁻³ with equal combination of VC+F@17.5 t ha⁻¹. This is in line with findings of Shirani *et al.*, (2002) who revealed the effect of balanced fertilizer and VC manure application, bulk density of surface soil (0-15cm) was significant. It was 18.09% less than control.

Particle Density (PD): The decrease in PD from the control was obvious with incorporation of organic manure. PD was the lowest as 1.7082 gm cm⁻³ @ 17.5t ha⁻¹ with VC. PD was the highest in control plot. Additions of manures have decreased the PD to the greater extent. Similar results were revealed by the studies of Melis *et al.*, (2008) using Farmyard manure.

Water holding capacity (WHC) Water holding capacity is increased due to the addition of organic manure. For VC+F+GM amended plot WHC increased as 35.510%, 38.281% and 39.283% @ 7.5, 12.5 and 17.5 t ha⁻¹ respectively. The control had the value of 25.071%. This was similar to the result of Jeyamangalam *et al.*, (2012a), the value of WHC increased as 23.4122%, 23.9746% and 26.8459% respectively than the control.

Table 1. Soil Physical Properties for VC along with F and GM (One Month after applying manure)

S.NO	Manure	Sample	BD gm cm ⁻³	PD gm cm ⁻³	WHC %	PS %	SM %	Yield kg/ha ⁻¹
1	VC	S1-A	1.1807e	1.7412j	39.838f	26.4581	22.377i	1475.0fg
2	VC	S1-B	1.1578e	1.7852h	44.657b	29.644f	25.238a	1575.0cde
3	VC	S1-C	1.2487d	1.7082k	27.904k	26.813k	28.804c	1400.0g
4	VC+F	S2-A	1.2856cd	2.1147c	39.443g	29.224d	23.848f	1700.0abc
5	VC+F	S2-B	1.2520d	2.2033b	45.613a	32.262a	23.168h	1725.0bcd
6	VC+F	S2-C	1.1705e	1.8273g	44.664b	39.631g	22.501e	1625.0ab
7	VC+GM	S3-A	1.3456b	2.0548e	42.126e	28.035e	23.246f	1750.0abc
8	VC+GM	S3-B	1.3035bc	2.0740d	43.010c	30.2760c	25.864b	1762.5a
9	VC+GM	S3-C	1.2542d	1.8810f	42.726d	33.468i	23.143g	1800.0bcd
10	VC+F+GM	S4-A	1.2905cd	1.7484j	35.510j	27.754b	24.782d	1600.0def
11	VC+F+GM	S4-B	1.1560e	1.7715i	38.281i	28.138j	19.433k	1550.0efg
12	VC+F+GM	S4-C	1.1437e	2.1099c	39.283h	35.068h	21.764j	1525.0fg
13	CONTROL	S5	1.3964a	2.2651a	25.0711	26.334m	19.2601	1500.0abc

Grand mean	1.2450	1.9434	39.0869	30.2389	23.3408	1607.8205
Significance	**	**	**	**	**	**
SED	0.0230	0.0059	0.0239	0.0434	0.0456	78.4260
CD (0.05)	0.0474	0.0122	0.0494	0.0896	0.0942	161.864
CV(%)	2.26	0.37	0.07	0.18	0.24	5.97

BD-Bulk Density, PD-Particle Density, WHC-Water Holding Capacity, PS-Pore Space
SM-Saturated Moisture, F-Farmyard manure, VC-Vermicompost, GM -Goat Manure
A-7.5 t ha⁻¹, B-12.5 t ha⁻¹, C-17.5 t ha⁻¹, ** -More significant,

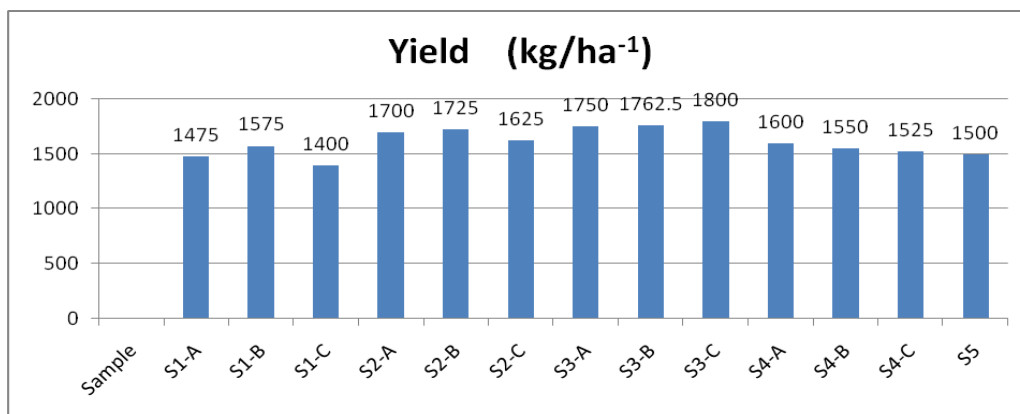


Figure 1: Yield in kg ha⁻¹ for sorghum in the organically amended pods

Pore space (PS) The pore space has increased as 28.035%, 30.276% and 33.468% @ 7.5, 12.5 and 17.5 t ha⁻¹ respectively. Vermicompost amended plot, PS was maximum as 29.644% @ 17.5 t ha⁻¹ which was higher than the control (26.344%).

According to Jeyamangalam et al.,(2012b) as quoted in literature depending on application of F and TS soil porosity has increased. It was 21.67 % higher than control plot.

Saturated Moisture(SM) It is a property which is endowed with the ability to retain soil moisture. The slow release in moisture enhances crop yields. The SM decreases as 22.500%, 23.168% and 23.848% @ 7.5, 12.5 and 17.5 t ha⁻¹ respectively. It has the maximum as 28.804% in VC amended plot @ 17.5 t ha⁻¹. SM was lowest in control plot with the value 19.260%. Sarkar *et al.*, (2003) reported that addition of organic materials had increased moisture-retention capacity and infiltration rate of the surface soil. Yield- In the present study the maximum yield of sorghum was noticed as 1800 kg ha⁻¹ in VC+GM @ 17.5 t ha⁻¹. It was 20% higher than control as shown in graph. Organic manures provide all the essential nutrients required for growth and yield of sorghum. According to Suganya (2006) addition of organic manure and chemical fertilizers brought out large scale improvement in the moisture retention and fertility of sandy soils ensuring better yield of crops.

CONCLUSION

It could be concluded that for the improvement of the soils, it is necessary to recycle organic wastes which in this study prove to have various positive effects on soil attributes and will increase the yield of Sorghum. 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 physico- chemical fertility over the inorganic, which in turn paved way for better yield and quality. Thus application of organic amendments in the proper combination may be a good strategy reclaims the soils.

References

- [1] Gomez, K.A and Gomez, A.A. (1984). Statistical procedures for agricultural research. New York. Wiley Inter Sciences, 2nd edn., P:95-109.
- [2] Hanway, J.J. and Heidal, H. (1952). Soil analysis methods as used in Iowa State College, Soil Testing Laboratory. Iowa agric, 57:1-31.
- [3] Jackson, M.C (1973). Soil chemical Analysis, Prentice Hall, New Delhi.
- [4] Jeyamangalam, F., Annadurai, B. Arunachalam, N. (2012 a). Impact of composte coirpith and other sources on physico-chemical and physical properties and yield of groundnut. J.Eco Friendly agric., 7(1):8-11.
- [5] Jeyamangalam, F., Annadurai, B. Arunachalam, N. (2012b) Effect of Tank silt as organic amendments on physical properties of Theri soil using groundnut (*Arachis Hypogea*) J. Soils and Crops, 22(1): 10-14.
- [6] Keen, B.A and Raczkowski, H (1921). Relation between the clay content and certain physical properties of a soil. Journal of Agricultural science, 11:441-449.
- [7] Marinari, S., Masciandaro, S.G, Ceccanti, B. and Grego, S. (2000). Influence of organic and mineral fertilizers on soil biological and physical properties, Bioresour. Technol., 72:9-17.
- [8] Melis Cerci Lu, Bulent Okur, Sezai Delibacak and Ali Riza Ongun (2008) Effects of composted tobacco waste and FYM on some physical properties and lettuce yield. International meeting on soil fertility land management and Aroclimatology, Turkey, P:647-654.
- [9] Saadatina and Riahi, (2009) Effect of integrated nutrient management on soil available micro nutrients in maize – soyabean cropping system. Journal of research ANGARU. 27:24-28.
- [10] Sarkar, S., Singh, S.R. and Singh, R.P. (2003). The effect of organic and inorganic fertilizers on soil physical condition and productivity of a rice-lentil cropping sequence Indian. J. Agric. Sci., 140:419-425.
- [11] Shirani, H., Ma Hajabbasi, Afyuni, M. and Hemmat, A. (2002). Effect of farmyard manure and tillage system on soil physical properties and corn yield in central Iran. Soil and Tillage Res, 68:101-108.
- [12] Subbiah, B.V and Asija, G.C (1956). A rapid procedure for determination of available nitrogen in soils. Current Science, 25:259-260.
- [13] Suganya, S. and Sivasamy, R. (2006). Moisture retention and cation exchange capacity of sandy soil as influenced by soil additives. J. Applied sci. Res. 2(11):949-951.