EFFECT OF VERMICOMPOST AS ORGANIC AMENDMENT ON SOIL PHYSICAL PROPERTIES WITH GREEN GRAM

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ABSTRACT

A field experiment was conducted at Mukuperi village in Thoothukudi district of Tamil Nadu, South India in 2018, which is situated at 8.5649º latitude and 77.9910º longitude, to study the effect of different organic amendments with various combinations on physical properties of the soil and the impact on green gram. The experiment was laid out in randomized block design with three replications. The treatments of this study were Vermicompost (VC), Farm yard manure(FYM), and Poultry manure (PM) and their combinations at three different concentrations 8.5, 12.5 and 16.5 t ha^{-1}. The organic amendments were applied and the soil samples were collected in each plot and analysed. The physical properties such as Bulk density(BD), Particle density(PD), water holding capacity(WHC), Pore space(PS) and Saturated moisture (SM) were determined. The yield was high in the treatment VC@ 12.5 t $ha^{-1}$and it was found as 1112 Kg ha^{-1} in which the control had 260 Kg ha^{-1}. The bulk density and particle density of the soil had decreased in all treatments other than control. The percentage of water holding capacity, pore space and saturated moisture had increased. Thus, the application of organic manure increases crop growth, yield and soil nutrient status without polluting the environment.

Key Words: Farm yard manure, Vermicompost, Physical properties, Organic amendments.

1. INTRODUCTION

Organic Farming involves various techniques which are eco friendly and by practicing it the fertility of soil is conserved for long time[1]. Organic manures play a vital role in maintenance of physical, chemical and biological conditions of soil and in supply of macro and micro nutrients to the crops.

Green gram (Vigna Radiata) alternatively known as Mung Bean, is a plant species in the legume family. Green gram is mainly cultivated today in India, China and South East Asia. Green gram is a healthy, low-fat, high fiber source of protein. Greengram is the third important pulse crop cultivated throughout India for its multipurpose uses as vegetable, pulse, fodder and green manure crop. It is a rich source of protein and by virtue of its nitrogen fixing ability it plays a vital role in sustaining soil fertility (Kanoja et.al.,2000).

2. MATERIALS AND METHODS:

The experiment was laid out in randomized block design with thirteen treatments in three replications. The treatment of this study were Vermicompost (VC), Farm yard manure(FYM), and Poultry manure (PM) and their combinations at three different concentrations 8.5, 12.5 and 16.5 t ha^{-1}. The organic manures were applied and after 30 days of drip irrigation, the soil samples were collected from each plot and analysed. Soil Physical properties such as Bulk density(BD), Particle density(PD), water holding capacity(WHC), Pore space(PS) and Saturated moisture (SM) for the soil samples were analysed in Laboratory and the physical properties were determined using Keen Roczkowski (KR)Box (1921).

3. PHYSICAL PROPERTIES OF THE SOIL:

3.1 BULK DENSITY (BD):

Bulk density is defined as the mass per unit volume of a dry soil inclusive of pore spaces. It is expressed in gm cm^{-3}. Generally the Bulk density of a normal soil is in the range of 1 to1.6 gm cm^{-3}. In sandy soil, the value of BD is about 1.7 gm cm^{-3} and in clayey soil, BD is about 1.1 gm cm^{-3}. Bulk density is of greater importance than particle density in understanding the physical behaviour of the soil.

3.2 PARTICLE DENSITY (PD):

Particle density is defined as the mass per unit volume of the solid portion of the soil. It is the true density of the soil. It is expressed in gm cm^{-3}. Generally the Particle density of a normal soil is 2.65 gm cm^{-3}.

3.3 MAXIMUM WATER HOLDING CAPACITY (WHC):

Water holding capacity is the total amount of water a soil can hold at field capacity. Sandy soils tend to have low water storage capacity.

3.4 PORE SPACE (PS):

The volume of soil which is not occupied by soil particles is known as pore space. The pore space is usually occupied by air and water. Pore spaces directly control the amount of water and air in the soil and indirectly influence the plant growth and crop production.

3.5 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. At soil saturation water fills completely in the pore spaces.

TABLE 1:

PHYSICAL PROPERTIES OF THE SOIL-BEFORE HARVEST-VC+(FYM+PM):

S. No	Manure	Plots	BD (gm cm^{-3})	PD (gm cm^{-3})	WHC (%)	PS (%)	SM (%)	Yield (Kg ha^{-1})
1.	VC	T1-A	1.3038	1.4993	11.4282	29.9662	36.8274	484
2.	VC	T1-B	0.8658	1.2662	54.5592	31.7773	53.4503	1112
3.	VC	T1-C	1.0045	1.3948	37.7725	28.1468	36.2096	768
4.	VC+FYM	T2-A	1.3002	1.4977	11.6246	29.8262	35.5736	514
5.	VC+FYM	T2-B	0.8712	1.3828	46.9621	37.1614	45.3415	1020
6.	VC+FYM	T2-C	0.9421	1.3616	43.7958	31.2258	42.7852	830
7.	VC+PM	T3-A	1.3005	1.4989	11.6723	30.0074	36.8445	488
8.	VC+PM	T3-B	0.8658	1.2637	48.2981	32.0902	47.5546	1048
9.	VC+PM	T3-C	0.9315	1.3603	45.3340	31.2834	42.971	840

10.	VC+FYM+PM	T4-A	0.8957	1.4022	42.2755	36.2229	38.7932	988
11.	VC+FYM+PM	T4-B	1.4215	1.5655	11.9759	23.6272	30.8962	332
12.	VC+FYM+PM	T4-C	1.3052	1.4944	11.0186	29.3899	35.7027	460
13.	CONTROL	T5	1.4567	1.5742	10.9805	22.5158	30.4070	260

BD-Bulk density **PD-Particle density** **WHC-Water holding capacity**

PS-Pore space **SM-Saturated moisture**

A - 8.5 t ha^{-1} **B - 12.5 t ha^{-1}** **C - 16.5 t ha^{-1}**

Figure 1

Yield (kg ha^{-1})

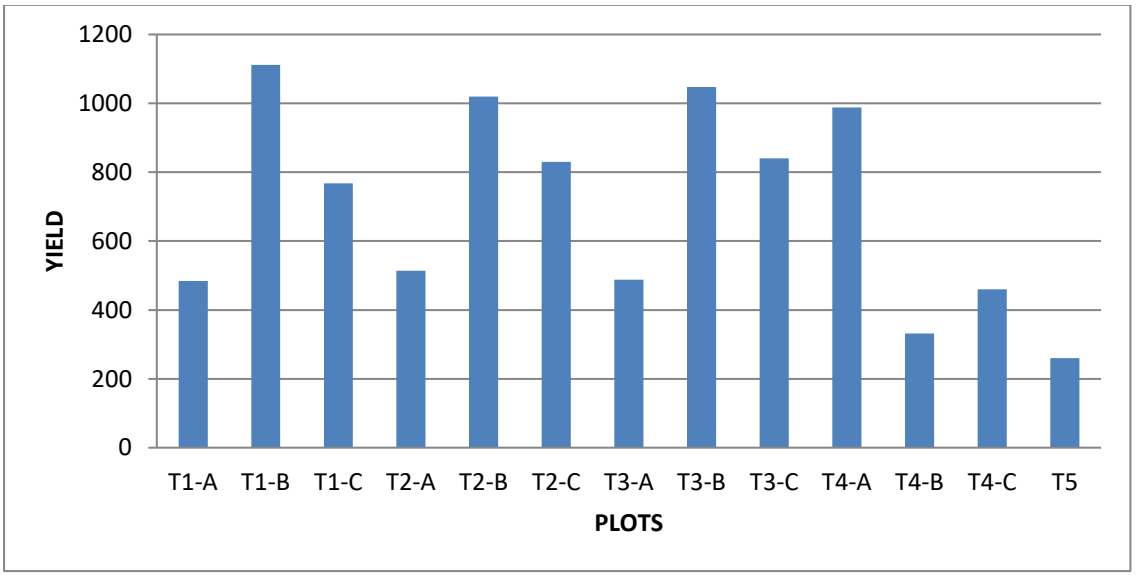

Figure 2

Field plots showing Green gram crop

4. RESULTS AND DISCUSSION

4.1 PHYSICAL PROPERTIES

4.1. BD:

The bulk density was lowest (0.8658 gm cm^{-3}) in plot amended with VC @12.5 t ha^{-1} and VC+PM @12.5 t ha^{-1}. The highest value(1.4567 gm cm^{-3}) was found in the control. The result is in close agreement with that of [3], who reported that the application of organic amendments significantly decreased bulk density.

4.2. PARTICLE DENSITY (PD):

The value of PD decreased in all the samples than the control. The plot amended with VC+PM @12.5 t ha^{-1} had the lowest value (1.2637 gm cm^{-3}) whereas the maximum value of (1.5742 gm cm^{-3}) was found in control. This is in line with the findings of [4], who reported

that high organic matter content of composted tobacco waste and FYM decreased particle density of soil.

4.3. MAXIMUM WATER HOLDING CAPACITY (WHC):

Water holding capacity increased due to the addition of organic amendment. For the plot amended with VC @ 12.5 t ha^{-1}, WHC increased as 54.5592% which was 79.87% more than the control plot with value 10.9805%. According to [5], the highest water holding capacity (54.67%) was also observed under continuous application of 100% NPK, FYM, bio fertilizer and lime.

4.4. PORE SPACE (PS):

The addition of organic manure increased the pore space of the soil. It was highest (37.1614%) in plot with VC@ 12.5 t ha^{-1} and the lowest value (22.5158%) was observed in control. Similar increase in Pore space was obtained by [6].

4.5. SATURATED MOISTURE (SM):

SM had increased as 53.4503 % in plot amended with VC @ 12.5 t ha^{-1} which was higher than the control with the value 30.4070%. This is similar to [7] who reported that addition of organic materials had increased moisture- retention capacity and infiltration rate of the surface soil.

5. CONCLUSION

Maximum number of pods were observed in plot amended with VC @ 12.5 t ha^{-1} (1112 Kg ha^{-1}) where as control showed the minimum yield. The bulk density was lowest in VC @ 12.5 t ha^{-1}. The plot with VC+PM in equal combinations @ 12.5 t ha^{-1} also recorded the lowest value in both bulk and particle densities. Water holding capacity and Saturated moisture were found to be maximum in VC @ 12.5 t ha^{-1}. Pore space was maximum in plot with VC+FYM in equal combinations @ 12.5 t ha^{-1}. Results revealed that application of organic manure influences the physical properties of the soil suggesting that the soil amendment with organic manure improves soil fertility, productivity and quality of the crop.

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