Original Research Article

Characteristics of organic manures and its effect on physical properties of soil in Pearl millet.

ABSTRACT

Organic manures are rich in essential plant nutrients such as nitrogen, phosphorus, and potassium, as well as micronutrients such as calcium, magnesium, and sulfur. It also contains organic matter that improves soil structure, water-holding capacity, and aeration. The study focused on evaluating two types of organic manures, i.e. FYM and vermicompost. Results showed that vermicompost had higher nutrient content them FYM.A field experiment was conducted at an Agronomy farm, S.K.N. College of Agriculture Jobner (Rajasthan) during *kharif* season 2018 on loamy sand soil. The experiment was laid out in a factorial randomized block design with three replications. The experiment comprised ~~of~~ four treatments of fertility levels (Control, 50 per cent RDF, 75 per cent RDF and 100 per cent RDF) and five treatments of organic manures (Control, vermicompost @ 2.5 t ha^{-1}, vermicompost @ 5 t ha^{-1}, FYM @ 5 t ha^{-1} and FYM @ 10 t ha^{-1}) were applied to the pearl millet var. RHB-173. Results showed that the application of FYM @ 10 t ha $^{-1}$ significantly decreased the bulk density and increased the saturated hydraulic conductivity over control. The maximum water retention of soil (12.86 per cent and 3.28 per cent) at 33kPa and 1500 kPa were recorded under the treatment vermicompost @ 5 t ha^{-1}. Conclusion?

Key words: Vermicompost, FYM (Farm Yard Manure), Bulk Density, Moisture Retention, Saturated Hydraulic Conductivity.

INTRODUCTION

Increased uses of chemical fertilizers without adequate organic recycling ~~had~~ not only aggravated multi-nutrient deficiencies in soil plant system but also deteriorated soil health and created ~~environment~~ environmentalpollution. Moreover, chemical fertilizers are becoming costlier input in Agriculture. Therefore, it is the right time to evaluate the feasibility and efficiency of organic waste not only for improving and building up ~~of~~ soil fertility but also increasing the efficiency of chemical fertilizers. Integration of chemical fertilizer with organic manures has been found quite promising not only in sustaining ~~the~~ soil health and productivity but also in stabilizing ~~the~~ crop production in comparison to the use of each component, separately [1].Organic manure is formed by the decomposition of organic matter, such as animal waste, crop residues, food waste, and other plant materials. During the decomposition process, microorganisms such as bacteria and fungi break down the organic matter into simpler compounds and release nutrients into the soil.

In recent years, because of a renewed awareness of the relationship between the human population and the Earth's capacity to produce enough food to sustain the world's burgeoning population much has been written about soil quality in relation to food security [2]. In the context of this brief discussion of organic fertilizers and soil health, it is pertinent to put the global situation with respect to food in perspective.

Several studies have reported that full name (FYM) applications in irrigated systems resulted in reduced bulk density, higher SOC and hydraulic conductivity and improved soil structure and microbial communities [3]. Vermicompost ~~as~~ isan organic fertilizer enriched with all beneficial soil microbes and also contains all the essential plant nutrients like N, P and K. In organic manureproduction, vermicomposting is referred to the production of compost through the action of ~~earth worm~~earthworm. It is an eco-biological process that transforms energy-rich and complex organic substances into stabilized humus-like product vermicompost. Preparation of vermicompost is

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an efficient as well as easily adoptable technique of compost preparation. This composting system can not only decompose a huge amount of organic ~~wastes~~ waste but also help to maintain higher nutrient status in composted materials. Vermicomposting technology using earthworms (as versatile natural bioreactors for effective recycling of organic wastes to the soil) is an environmentally acceptable means of converting waste into nutritious composts for crop production [4]. Moreover, by processing ~~of~~ garbage, this technology converts the problem into a resource and provides good manure which can be used to enhance the quality of the soil [5].

Organic materials such as FYM have traditionally been used by farmers. FYM supplies all major nutrients (N, P, K, Ca, Mg, S,) necessary for plant growth, as well as micronutrients (Fe, Mn, Cu and Zn). Hence, it acts as a multi-nutrient fertilizer. FYM improves soil physical, chemical and biological properties. Improvement in the soil structure due to FYM application leads to a better environment for root development. FYM also improves soil water holding capacity. The fact that the use of organic fertilizers improves soil structure, nutrient exchange, and maintains soil health has raised ~~interests~~ interest in organic farming. In general, the application of organic amendments such as crop residues and/or farmyard manure increases ~~significantly~~ soil organiccarbon (SOC)significantly. ~~Sustaining soil organic carbon (~~SOC~~)~~ is of primary importance in terms of cycling plant nutrients and improving the soil's physical, chemical and biological properties. SOC is an important index of soil quality because of its relationship with crop productivity [6]. A decrease in SOC leads to a decrease in the soil's structural stability [7]. Also, restoration of SOC in arable lands represents a potential sink for atmospheric CO_2 [8]. Agricultural utilization of organic materials, particularly farmyard manure (FYM), has been a rather common traditional practice [9]. As it enhances the ~~soil~~ soil's organic C level, which has a direct and indirect effect on the soil physical properties. The current study aims to better understand the properties of organic manures and their effect on soil physical properties.

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MATERIAL AND METHODS

The experiment was laid out at an Agronomy farm, SKN College of Agriculture, Jobner during "*kharif*", 2018 to find out the "Characteristics of organic manures and its effect on physical properties of soil in Pearl millet".Agronomy farm is situated at 75^0 28' East longitude and 26^0 05' North latitude at an altitude of 427 m above mean sea level (MSL) in Jaipur district of Rajasthan. This region falls under agro-climatic zone- III A (Semi-Arid Eastern Plain) of the state. The experiment ~~comprising~~ comprised four ~~level~~ levels of full name (RDF) (control, 50%, 75% and 100%) and five treatments of organic manure (Vermicompost @ 2.5 t ha^{-1}, Vermicompost @ 5.0 t ha^{-1}, FYM @ 5.0 t ha^{-1} and FYM @ 10.0 t ha^{-1}).

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Organic manure ~~were~~ was analysed for chemical and physical properties. The analysis ~~include~~ included pH [10]; Electrical conductivity [11]; Bulk density, Moisture content (Gravimetric method) and~~;~~ Organic Carbon [12].~~;~~ Total macronutrients (N, P and K) micronutrients were digested and measured as described by [13]. Soil ~~sample~~ samples were analysed for Bulk density [14], Water retension [15] and Hydraulic conductivity [16]. Statistical analysis method?

RESULTS AND DISSCUSION

Properties of FYM

The results present in table 1 showed that pH of FYM is 6.84 indicating the neutral nature of the amendment. ~~Bulk~~ The bulk density is 0.91g per cm^{-3} which will improve soil physical condition. The organic carbon content is 14.71 %, indicating a good supply of organic carbon for the soil. The total nitrogen, phosphorus and potassium content was found to be 0.50 percent, 0.25 percent and 0.50 percent. This result ~~indicate~~ indicates that the farm yard manure can also be used as a source of nutrient for the crop plant.

Properties of Vermicompost

In Table 1, it was depicted that the pH of Vermicompost obtained from Agronomy farm,~~,~~ S.K.N. College of Agriculture Jobner (Rajasthan), was recorded to be 7.09, while its organic carbon content was 19.45 percent, slightly higher than FYM. The total nitrogen, phosphorus and potassium content was found to be 1.64 percent, 0.89 percent and 1.07 percent. This result ~~indicated~~ indicatesthat the Vermicompost can also be used as a source of ~~nutrient~~ nutrientsfor the crop plant. These all results ~~indicated~~ confirmthat the Vermicompost can act as a source of ~~nutrient~~ nutrientsas well as a good source of organic matter to the soil. These results are in agreement with those obtained by [17].

Table 1: Chemical Characterization of FYM and Vermicompost.

Properties	FYM	Vermicompost
pH	6.84	7.09
EC (dS m^{-1})	3.17	3.98
Bulk Density (g per cm^{-3})	0.91	0.79
Moisture content (%)	15.13	16.51
OC (%)	14.71	19.45
N (%)	0.50	1.64
P_2O_5 (%)	0.25	0.89
K_2O (%)	0.50	1.07

Effect of fertility levels

Data presented in table 2 showed that bulk density decreased and saturated hydraulic conductivity increased ~~non~~ insignificantly? with increasing ~~level~~ levelsof fertility.Meanwhile, the application of F_3 (100 per cent RDF) significantly? increased the water retention of soil at 33 kPa and 1500kPa as compared to the control.

The application of fertilizer caused an increase in water retention of soil. Similar results were also reported by Selvi *et al.* (2005) [18] and Verma *et al.* (2010) [19].

Effect of organic manures:

Data further revealed that the application of FYM @ 10 t ha^{-1}significantly? decreased the bulk density of soil and significantly increased the saturated hydraulic conductivity of soil after harvest. The application of FYM @ 10 t ha^{-1} and vermicompost @ 5 t ha^{-1} was equally effective in reducing the bulk density of the soil over control. It is apparent from the data (Table 2) that there was a significant increase in water retention at 33 kPa and 1500 kPa after the harvest of pearl millet with the application of organic manures. The maximum water retention of soil (12.86 per cent and 3.28 per cent) at 33kPa and 1500 kPa were recorded under the treatment vermicompost @ 5 t ha^{-1}.

The role of organic manure in improving ~~the~~ physical properties is well known. Soil organic manure impacts the desirable physical environment to the soil by favourably affecting soil structure expressed through soil porosity, aggregation, bulk density and water storage capacity (Benbi *et al.,* 1998) [20]. Decomposition of organic manure improved soil permeability and increased water soluble aggregates as a result of complex series of polysaccharides synthesized by the bacteria flourishing in the composing organic manure and by their secondary products which acted on soil building material. Thus, the increase in aggregation and improvement in soil structure brought significant? reduction in bulk density and the application of organic manures could be attributed to the fixing of low density material with dense mineral fraction of soil. The findings corroborate with ~~result~~ resultsof Prakash *et al*

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(2002) [21], Selvi *et al*. (2005) [18] and Singh *et al.* (2012) [22], who observed a decrease in bulk density due to an increase in organic carbon content of the soil.

The water retention in soil by application of FYM and vermicompost treatments showed little variation at particular suction (Table 2), possibly due to lighter? texture of soil. This is explained by the fact that water retention at lower tension depends primarily upon the pore size distribution. The increase in water retention as a result of organic manure is expected from the aggregation resulting in favourable pore geometry of soil ~~(Acharya *et al*., 1988)~~ [23].

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Table 2. Effect of different fertility level and organic manures on bulk density, saturated hydraulic conductivity and water retention at 33 and 1500 kPa

Treatments	Bulk density (Mg m^{-3})	Saturated hydraulic conductivity (cm h^{-1})	Water retention at 33 kPa (%)	Water retention at 1500 kPa (%)
Fertility Levels				
F_0 (Control)	1.55	7.00	10.16	2.66
F_1 (50% RDF)	1.53	7.25	11.29	2.88
F_2 (75% RDF)	1.51	7.33	12.11	3.03
F_3 (100% RDF)	1.49	7.37	12.59	3.15
SEm±	0.02	0.10	0.16	0.04
CD (P=0.05)	NS	NS	0.47	0.12
Organic manures				
M_0 (Control)	1.61	6.02	10.09	2.54
M_1 (Vermicompost @ 2.5 t ha^{-1})	1.52	6.87	11.51	2.93
M_2 (Vermicompost @ 5 t ha^{-1})	1.44	7.83	12.86	3.28
M_3 (FYM @ 5 t ha^{-1})	1.55	7.25	10.96	2.78
M_4 (FYM @ 10 t ha^{-1})	1.46	8.21	12.26	3.12
SEm±	0.02	0.11	0.18	0.05
CD (P=0.05)	0.06	0.32	0.52	0.13

Not show the comparison which is better in improving soil characteristics

CONCLUSION - rewrite

Characterization of organic manures helps in understanding the behavior of organic manure in soil and the way it will ~~affects~~ affectthe soil fertility status. Application of organic manures improved soil physical properties by lowering soil bulk density, increasing total porosity, water holding capacity. Application of FYM @ 10 t ha^{-1} and vermicompost @ 5 t ha^{-1} significant improvement in soil physical properties.

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