Influence of municipal solid waste manure with different levels of inorganic fertilizer on physical properties of soil in cultivation of green gram (*Vigna radiata L.*)

The objective of the experiment was to evaluate influence of municipal solid waste manure with different levels of inorganic fertilizer on physical properties of soil in cultivation of green gram. The design applied was randomized block design. It was observed that treatment T_{10} (NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}) improved the soil WHC, OC, available N,P,K. Bulk density and particle density reduced in T_{10} and recorded maximum in T_1 (control).

Keywords*: Green Gram, inorganic, soil, manure etc.*

1. INTRODUCTION

Soil is a finite, dynamic, and fragile living resource with differential physical, chemical, and biological properties in time and space (**Lal, 2009**). Soil degradation, together with climate change and population growth pose a grave risk to global food security and environmentalquality (**Oliver and Gregory, 2015**). Soil degradation is generally attributed to poor soil andnutrient management, overgrazing, excessive crop residue removal, and large-scale non-agricultural activities (**Karlen and Rice, 2015**). Fundamental to the soil health concept is the idea that soil is a living ecosystem, and well-being of soil is essential for achieving ecosystem services, including high quality air and water, promoting a diverse biotic and microbialcommunity structure, supporting a high level of crop productivity, and promoting human health.

Among pulses Green gram is one of the most important pulse crops of India ranks third after chickpea and pigeon pea. In recognition of this, the Food and Agriculture Organization has chosen 2016 as the International Year of Pulses to increase awareness about the relevance of pulses in human and animal nutrition. It is a self-pollinated leguminous crop which is grown in arid and semi-arid regions of country. It is tolerant to drought and can be successfully grown on well drained loamy to sandy loam soils in areas of erratic rainfall. Green gram consumption on a daily basis has been shown to help people lose weight and battle obesity (**Nair, 2019**).

Urban areas are significant contributors to the generation of organic waste due to population

density, consumer practices, and economic activities. The composition of urban organic waste is diverse and includes a range of materials such as food scraps, yard trimmings,paper, and sewage sludge. These materials contain valuable nutrients that, if properly managed,can be transformed into nutrient-rich manure for agricultural applications. Food waste constitutes a substantial portion of urban organic waste, with a study by **Eriksson et al. (2020)**estimating that up to 40% of municipal solid waste in urban areas comprises organic matter, much of which is edible food.

Studies conducted by **Kumar et al. (2017)** found that Municipal solid waste compost had appreciable levels of nitrogen, phosphorus, and potassium, along with micronutrients likezinc and copper. The application of Municipal solid waste manure positively influences soil pH, as demonstrated by research from **Kumar et al. (2019).** The application of Municipal solid waste compost led to increased crop yields in various crops, including rice, wheat, and vegetables. The nutrient-rich composition of the manure contributed to improved plant nutrition and growth, translating into higher yields (**Kumar et al. (2020).**

2. METHODOLOGY

The present experiment was conducted during winter season (2023) at Department of Soil Science and Agricultural Chemistry Crop Research Farm of the Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh. Prayagraj is located at $25^0$47’69” N latitude and $81^0$85’74” E longitude at an elevation of 98 m from the mean sea level. This region has a sub-tropical climate prevailing in the South-East part of UP with both the extreme in temperature i.e., the winter and the summer.

The soil of the experimental site is alluvial and falls under Inceptisol order. The soil samples were randomly collected from five different sites in the experimental plot prior to tillage operation from a depth of 0-15 cm (furrow slice layer). The soil sample will be reduced in volume by quartering and canning the composites. The soil sample will then be air dried and run through a 2 mm sieve in order to prepare it for physical analysis (bulk density, particle density, pore space%, water holding capacity%).

Table 1. Treatment combination of green gram Var. PDM-139

S. No.	Treatment combination
T_1	Absolute Control,
T_2	NPK@0% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}
T_3	NPK@0% + Municipal Solid Waste Manure @ 5.0 t ha^{-1}
T_4	NPK@0% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}
T_5	NPK@50% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}
T_6	NPK@50% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}
T_7	NPK@50% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}
T_8	NPK@100% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}
T_9	NPK@100% + Municipal Solid Waste Manure @ 5.0 t ha^{-1}
T_{10}	NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}

3 RESULTS AND DISCUSSION

3.1 Bulk Density (Mg m^{-3})

"The data presented in Table 2 shows that bulk density of soil is influenced by various treatments" At both soil levels (0–15 cm and 15–30 cm), the application of municipal solid waste manure resulted in a reduction in bulk density. At a depth of 0–15 cm and 15–30 cm, respectively, the bulk density varied from 1.31 Mg m^{-3} to 1.26 Mg m^{-3} and 1.32 Mg m^{-3} to 1.29 Mg m^{-3}. T_{10}, which used NPK@100%+municipal solid waste manure @7.5 t ha^{-1}, had the lowest bulk density. In contrast, the control (T_1), which did not receive any fertilizer, had the highest bulk density. Similar results were also reported by **Sharma *et al*., (2013), Kansotia *et al*., (2015)** and **Jat *et al*., (2015).**

3.2 Particle Density (Mg m^{-3})

"The data presented in Table 2 shows that the density of soil particles is considerably altered by the application of NPK fertilizer and municipal solid waste manure. It ranges in soil depth from 0 to 15 cm (2.66 to 2.67 mg m-3), and in soil depth from 15 to 30 cm (2.60 to 2.62 mg m-3). The lowest particle density was seen in T_{10}, or NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha-1. This indicates that Municipal Solid Waste Manure has a favourable influence on particle density. Similar results were also reported by Abadi *et al.,* (2012), Sharma *et al*., (2013) and Jat *et al.,* (2015).

3.3 Water Holding Capacity (%)

"The data presented in Table 2 shows that Water holding capacity varied between 43.29 % to 44.26 % in 0-15 cm soil depth and when depth increase water holding also decreased i.e. at 15-30 cm soil depth water holding capacity vary between 42.29 % to 43.76 %. Similar results were also reported by Sharma *et al*., (2013).

3.4 **Pore Space (%)**

"The data presented in Table 2 shows that when soil depth increased, pore space decreased; that is, at 15–30 cm soil depth, pore space varied between 46.09 % and 47.19 %. Pore space ranged between 47.85% and 48.87 % in 0–15 cm soil depth. Similar results were also reported by Abadi *et al.,* (2012) and Sharma *et al*., (2013).

Table. 2. Influence of municipal solid waste manure with different levels of inorganic fertilizer on physical properties of soil in cultivation of green gram (*Vigna radiata L.*)

Treatment	**BD (Mg m^{-3})**		**PD (Mg m^{-3})**		**Pore space (%)**		**WHC (%)**	
	0-15 cm	**15-30 cm**	**0-15 cm**	**15-30 cm**	**0-15 cm**	**15-30 cm**	**0-15 cm**	**15-30 cm**
Absolute control	1.31	1.32	2.67	2.62	47.85	46.34	43.29	42.79
NPK@0% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}	1.3	1.3	2.65	2.6	47.43	46.09	43.31	42.81
NPK@0% + Municipal Solid Waste Manure @ 5.0 t ha^{-1}	1.29	1.3	2.67	2.62	47.98	46.3	43.69	42.19
NPK@0% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}	1.29	1.31	2.67	2.62	47.69	46.45	43.7	42.2
NPK@50% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}	1.28	1.29	2.67	2.62	47.67	46.71	43.76	42.25
NPK@50% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}	1.27	1.29	2.66	2.61	48.34	47.18	43.79	43.29
NPK@50% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}	1.27	1.32	2.67	2.62	48.77	47.54	43.81	43.31
NPK@100% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}	1.28	1.31	2.66	2.61	48.06	47.65	44.2	43.7
NPK@100% + Municipal Solid Waste Manure @ 5.0 t ha^{-1}	1.27	1.3	2.65	2.6	48.08	47.72	44.24	43.74
NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}	1.26	1.32	2.67	2.62	48.87	47.19	44.26	43.76
S.Em+	0.003	0.003	0.06	0.07	0.95	1.13	1.06	0.74
C.D. at 5%	0.005	0.006	0.13	0.14	1.99	2.36	2.22	1.55
F-test	NS	NS	NS	NS	NS	NS	NS	NS

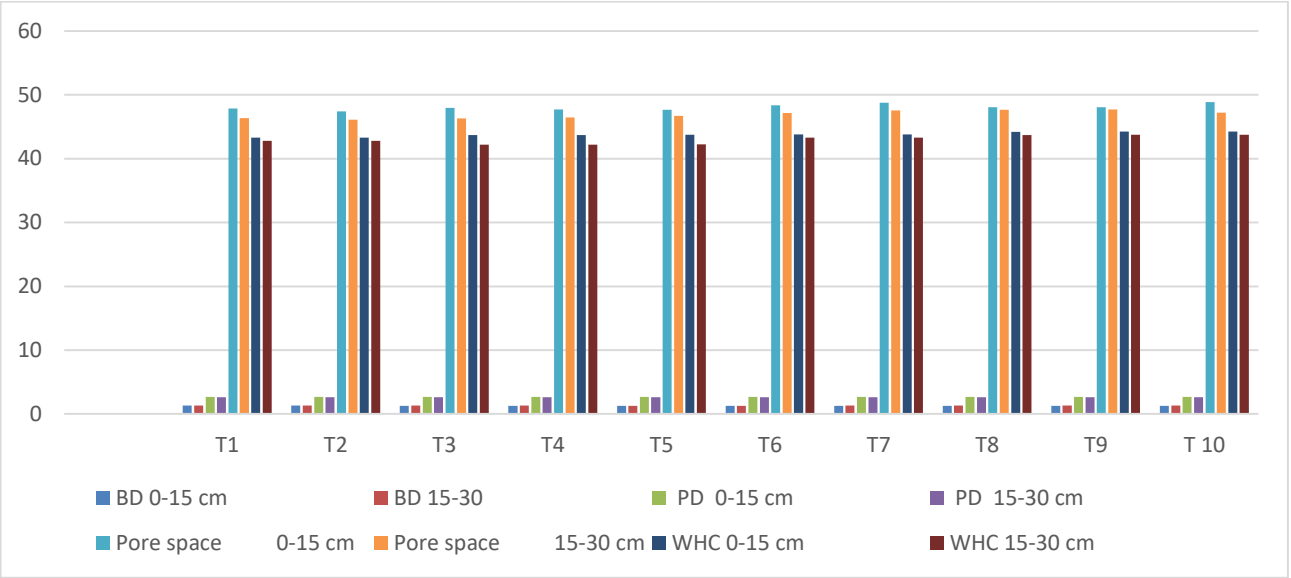

Fig. 1. Influence of municipal solid waste manure with different levels of inorganic fertilizer on physical properties of soil in cultivation of green gram (*Vigna radiata L.*)

CONCLUSION

Use of municipal solid waste manure with different levels of inorganic fertilizer in the field can improve soil physical parameters and crop production. The implementation of treatment T_{10} (NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}) has increases pore space, water holding capacity and bulk density and particle density decreased in T_{10}. It also contributes to soil fertility and soil resource management.

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