International Journal of Plant & Soil Science

Volume 36, Issue 7, Page 523-528, 2024; Article no.IJPSS.118464
ISSN: 2320-7035

Influence of Municipal Solid Waste Manure with Different Levels of Inorganic Fertilizers on Soil Health Parameters, Growth, and Yield Attributes of Green Gram (*Vigna radiata* L.) In Sub-humid Climate Condition in Prayagraj, (U.P.) India

Surbhi Singh [a++*], Narendra Swaroop [a#], Tarence Thomas [a†], Taniya Mistry [a‡] and Ashima Thomas [b]

[a] Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute (NAI), SHUATS, India.
[b] Department of Agro-Food Sciences and technology, University of Bologna, Italy.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ijpss/2024/v36i74761

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/118464

Original Research Article

Received: 11/04/2024
Accepted: 15/06/2024
Published: 20/06/2024

[++] M.Sc. Student;
[#] Associate Professor;
[†] Professor;
[‡] Ph. D Scholar;
**Corresponding author: E-mail: singhsurbhi98.uk@gmail.com;*

Cite as: Singh, Surbhi, Narendra Swaroop, Tarence Thomas, Taniya Mistry, and Ashima Thomas. 2024. "Influence of Municipal Solid Waste Manure With Different Levels of Inorganic Fertilizers on Soil Health Parameters, Growth, and Yield Attributes of Green Gram (Vigna Radiata L.) In Sub-Humid Climate Condition in Prayagraj, (U.P.) India". International Journal of Plant & Soil Science 36 (7):523-28. https://doi.org/10.9734/ijpss/2024/v36i74761.

ABSTRACT

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 the lowest bulk density and particle density recorded in treatment T10 (NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha-1). It was observed that treatment T10 (NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha-1) have also influence the soil pore space and WHC. It was also recorded that bulk density and Particle Density maximum in T1 (control). Pore space and WHC also recorded minimum in T1 (control). T9 NPK@100% + Municipal Solid Waste Manure @5 t ha-1) which is almost the best treatment combination in all aspects proven to be economically optimal, based on the current study work.

Keywords: Green Gram; inorganic; soil; municipal solid waste manure etc.

1. INTRODUCTION

"Soil is a finite, dynamic, and fragile living resource with differential physical, chemical, and biological properties in time and space" [1]. "Soil degradation, together with climate change and population growth pose a grave risk to global food security and environmental quality" [2]. "Soil degradation is generally attributed to poor soil and nutrient management, overgrazing, excessive crop residue removal, and large-scale non-agricultural activities" [3]. "The fundamental concept of soil health is the idea that soil is a living system, and well-being of soil is essential for achieving ecosystem services, including high quality air and water, promoting a diverse biotic and microbial community structure, supporting a high level of crop productivity, and promoting human health" [4-6].

"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" [7].

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. [8] 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. [9] found that "Municipal solid waste compost had appreciable levels of nitrogen, phosphorus, and potassium, along with micronutrients like zinc and copper". "The application of Municipal solid waste manure positively influences soil pH", as demonstrated by research from Kumar et al. [10]. "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.

Table 1. Treatment combination

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 @ 5.0 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

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%).

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 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. [11], Kansotia et al. [12] and Jat et al. [13].

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 2.65 to 2.67 mg m-3, and in soil depth from 15 to 30 cm 2.61 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 [14], Sharma et al. [15] and Jat et al. [13].

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.*) In Sub – Humid Climate Condition in Prayagraj, (U.P.) India

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	2.65	2.61	47.43	46.34	43.29	42.19
NPK@0% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}	1.30	1.31	2.65	2.60	47.54	46.09	43.31	42.79
NPK@0% + Municipal Solid Waste Manure @ 5.0 t ha^{-1}	1.29	1.31	2.67	2.62	47.72	46.30	43.69	42.81
NPK@0% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}	1.29	1.31	2.67	2.62	47.98	46.45	43.70	42.84
NPK@50% + Municipal Solid Waste Manure @	1.28	1.30	2.67	2.62	47.60	46.71	43.76	42.92

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
2.5 t ha^{-1}								
NPK@50% + Municipal Solid Waste Manure @ 5.0 t ha^{-1}	1.27	1.30	2.66	2.61	47.84	47.18	43.79	43.29
NPK@50% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}	1.27	1.29	2.67	2.62	48.04	47.54	43.81	43.31
NPK@100% + Municipal Solid Waste Manure @ 2.5 t ha^{-1}	1.28	1.32	2.66	2.61	48.02	47.65	44.20	43.70
NPK@100% + Municipal Solid Waste Manure @ 5.0 t ha^{-1}	1.27	1.31	2.65	2.60	48.12	47.72	44.24	43.74
NPK@100% + Municipal Solid Waste Manure @ 7.5 t ha^{-1}	1.26	1.29	2.64	2.62	48.28	47.79	44.26	43.76
S.E (d) ±	0.02	0.02	0.05	0.05	1.11	0.92	0.95	0.75
C.D. at 5%	0.04	0.05	0.11	0.10	2.32	1.94	2.00	1.56
F-test	NS	NS	NS	NS	NS	NS	NS	NS

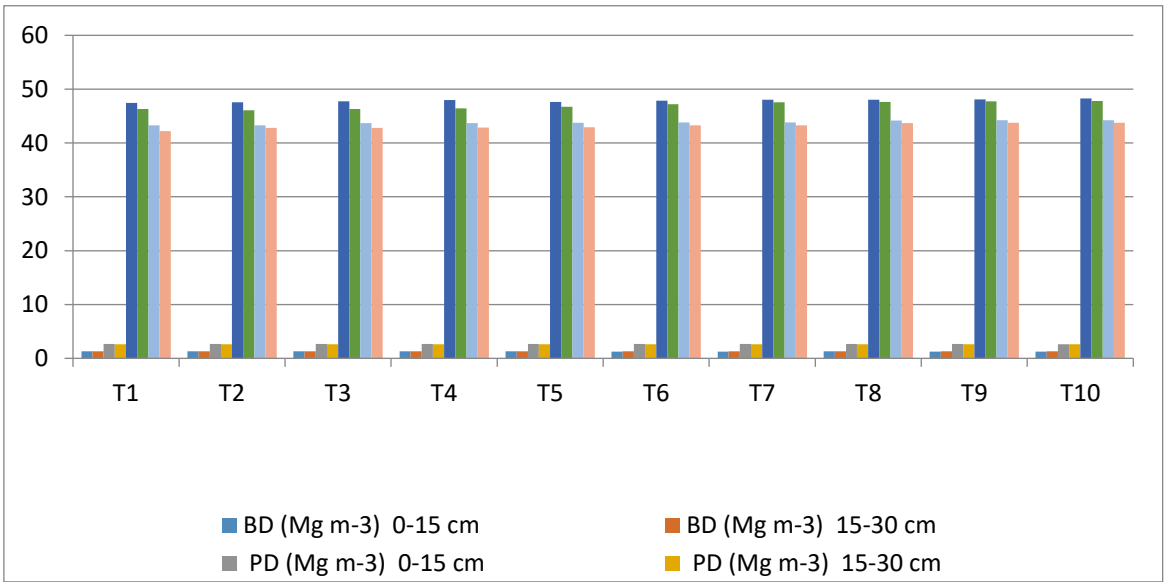

Fig. 1. Influence of municipal solid waste manure with different levels of inorganic fertilizer on physical properties of soil in cultivation of green gram (*Vigna radiata L.*) In Sub-Humid Climate Condition in Prayagraj, (U.P.) India

3.3 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 46.34% and 47.79%. Pore space ranged between 47.43 % and 48.28% in 0–15 cm soil depth. Similar results were also reported by Abadi et al. [14] and Sharma et al. [15].

3.4 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 42.19% to 43.76%. Similar results were also reported by Sharma et al. [15].

4. 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.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

ACKNOWLEDGEMENT

I am grateful to the Head and staff of the Department of Soil Science and Agricultural Chemistry, Sam Higginbottom Agricultural University, for their inspiring guidance, constant encouragement, keen interest and scientific comments and constructive suggestions during my studies and research. Engineering and Sciences, Prayagraj, Uttar Pradesh.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Lal R. Laws of sustainable soil management. Sustainable Agriculture. 2009;9-12.
2. Oliver MA, Gregory PJ. Soil, food security and human health: a review. European Journal of Soil Science. 2015;66(2):257-276.
3. Karlen DL, Rice CW. Soil degradation: Will Humankind Ever Learn Sustainability. 2015;7(9):12490-12501.
4. 13 Sindhu V, Chatterjee R, Santhoshkumar GM, Sinha T. Enrichment of organic manures and their utilization in vegetable crops. Curr. J. Appl. Sci. Technol. 2020;39(32):10-24.
   Available:https://journalcjast.com/index.php/CJAST/article/view/2931
   [Accessed on 2024 May 31].
5. Jain SK, Kumar A, Singh O, Dwarka, Patel R, Jain D, Ahirwar SK, Chandel LPN. Effect of continuous application of fertilizer and manure on distribution of sulphur fractions in a vertisol. AJSSPN. 2024;10 (2):174-81.
   Available:https://journalajsspn.com/index.php/AJSSPN/article/view/273
   [Accessed on 2024 May 31].
6. Du Y, Cui B, Wang Z, Sun J, Niu W. Effects of manure fertilizer on crop yield and soil properties in China: A meta-analysis. Catena. 2020;193:104617.
7. Nair AK, Subrahmanyam K, Verma BS, Singh DV. Response of Japanese Mint to Fe and Zn at two fertility levels Journal of Indian Society of Soil Science. 2019;40:873-875.
8. Eriksson M, Strid I, Hanssen OJ, Sundqvist JO. Household food waste in Nordic urban areas: Composition, generation and implications for urban waste management. Waste Management. 2020;104:149-158.
9. Kumar A, Chopra AK, Pathak H. City waste compost as a potential source of nutrients for crops. Journal of the Indian Society of Soil Science. 2017;65(4):396-400.
10. Kumar A, Chopra AK, Pathak H. City waste compost as a potential source of nutrients for crops. Journal of the Indian Society of Soil Science. 2019;65(4):396-400.
11. Sharma P, Majumdar SP, Sharma SR. Impact of Vermicomposting, Potassium and Iron on Physico-Chemical properties of Typic-Ustipsamments. Environment and Ecology. 2013;31:1980-1983.
12. Kansotia B, Meena R, Meena V. Effect of vermicompost and inorganic fertilizers on Indian mustard (*Brassica junce*aL.). Asian Journal of Soil Science. 2013;8:136-139.
13. Jat G, Sharma KK, Jat NK. Effect of FYM and mineral nutrients on physio- chemical properties of soil under mustard in western arid zone of India. Annals of Plant and Soil Research. 2015;14:167-170.
14. Abadi ZA, Sepanlou MG, Alashti SR. Effect of vermicompost on physical and chemical properties of soil. Journal of Science and Technology of Agriculture and Natural Resources. 2012;15:58(B):125-137.

15. Sharma P, Majumdar SP, Sharma SR. Impact of Vermicomposting, potassium and iron on Physico-Chemical properties of Typic-Ustipsamment. Environment and Ecology. 2013;31:1980-1983.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/118464