

Influence of city waste manure with different levels of inorganic fertilizers on soil health parameter, growth and yield attributes of black gram (*Vigna mungo* L.) inceptisols

ABSTRACT

The objective of the experiment was to evaluate the Influence of city waste manure with different levels of inorganic fertilizers on soil health of black gram. The design applied was FRBD. The study consisted of 16 combination of treatments in which was replicated thrice. The lowest bulk density and particle density recorded in F₃ and it was observed that treatment F₃ improved the soil WHC, OC, available N, P and K due to effect of fertilizer levels. Due to effect of city waste manure lowest value of bulk density and particle density of soil was recorded in treatment M₃ and it was observed that treatment F₃ improved the soil WHC, OC, available N, P and K. The various level of NPK and City Waste Manure with different soil health parameter used from in the experiment, the treatment combination T₁₀ (RDF NPK @ 80% + City Waste manure @ 2.5t ha⁻¹) was found to be the best treatment for Black gram (*Vigna mungo* L.) Var. Shekhar-2.

Keywords: city waste, inorganic fertilizer, soil health, black gram

1. Introduction

Leave aligned for paragraphs! Soil plays a crucial role in supporting plant growth, providing habitats for numerous organisms, filtering water, and storing and cycling nutrients. Soil is a natural resource that forms the uppermost layer of the Earth's crust. It is a complex mixture of minerals, organic matter, water, air, and various organisms. Organic matter in the soil comes from decomposed plants, animals, and microorganisms.

Black gram (*Vigna mungo* L), also known as urad dal or black lentil, is a warm-season legume crop that is widely cultivated for its nutritious seeds. It is primarily grown in India, Pakistan, Nepal, and other Asian countries. Black gram is a versatile crop used for various culinary purposes, including making dal, soups, curries, and sweets. It is well adapted to tropical and subtropical climates. It thrives in warm weather with temperatures ranging between 25°C to 35°C (77°F to 95°F). The crop requires a frost-free growing season. It can tolerate a wide range of rainfall, but a well-distributed rainfall of 600 to 800 mm (24 to 32 inches) is ideal.

City waste manure, is a waste type consisting of everyday items that are discarded by the public. "Garbage" can also refer specifically to food waste, as in a garbage disposal; the two are sometimes collected separately. Although the waste may originate from a number of sources that has nothing to do with a municipality, the traditional role of municipalities in collecting and managing these kinds of waste have produced the particular etymology 'municipal'. The application of City Waste Manure 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. [1] (Taimuretal.2015).

Nitrogen plays a crucial role in the growth and development of black gram plants. It is an essential nutrient that is required in relatively large quantities by plants, and its availability directly influences the yield and quality of black gram crops. [32] (Meenaetal.,2014).

Phosphorus plays a vital role in the growth and development of black gram plants. It is one of the essential macronutrients required by plants, and its availability directly impacts the yield and quality of black

gram crops. Here are the key roles of phosphorus in black gram cultivation like Energy transfer and storage, Root development and nutrient uptake, Photosynthesis and carbohydrate metabolism, Protein synthesis and nucleic acid formation, Flowering and reproduction. [43] (Garg *et al.*, (2019).

Potassium is one of these seventeen elements which are essential for growth and development of plants. Potassium is required for improving the yield and quality of different crops because of its effect on photosynthesis, water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between protein and carbohydrates. [54] (Singh *et al.*, 2017).

2. METHODOLOGY

Leave aligned for paragraphs! The present experiment was conducted during winter season (2022-2023) 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°47'69" N latitude and 81°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. 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 chemical analysis (pH, EC, organic carbon, available nitrogen, phosphorus, and potassium, as well as physical analysis (bulk density, particle density, pore space%, water holding capacity %). **(Please use the Justify alignment in your paper!)**

Table 1. Treatment combination of black gram.

Treatment Combination	Treatment
T1	NPK@0% +CityWaste@0 t ha ⁻¹
T2	NPK@0% +CityWaste@2.5tha ⁻¹
T3	NPK@0% +CityWaste@5.0tha ⁻¹
T4	NPK@0% +CityWaste@7.5tha ⁻¹
T5	NPK@40% +CityWaste@0 t ha ⁻¹
T6	NPK@40% +CityWaste@2.5tha ⁻¹
T7	NPK@40% +CityWaste@5.0tha ⁻¹
T8	NPK@40% +CityWaste@7.5tha ⁻¹
T9	NPK@80% +CityWaste@0 t ha ⁻¹
T10	NPK@80% +CityWaste@2.5tha ⁻¹
T11	NPK@80% +CityWaste@5.0tha ⁻¹
T12	NPK@80% +CityWaste@7.5tha ⁻¹
T13	NPK@120% +CityWaste@0 t ha ⁻¹
T14	NPK@120% +CityWaste@2.5tha ⁻¹
T15	NPK@120% +CityWaste@5.0tha ⁻¹
T16	NPK@120% +CityWaste@7.5tha ⁻¹

3. RESULTS AND DISCUSSION

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

Effect of Fertilizer levels

Leave aligned for paragraphs! Data presented in table 2, fertilizer levels had a substantial impact on the bulk density of the soil during the harvest of black gram crops. This was seen in two different ranges: 1.242 to 1.302 Mg m^{-3} at 0-15 cm and 1.291 to 1.326 Mg m^{-3} at 15-30 cm. Treatment F_3 (120 % RDF) had the lowest reported values of bulk density of soil (1.242 Mg m^{-3} at 0–15 cm and 1.291 mg m^{-3} at 15–30 cm). Similar result reported by the [65] Ozlu and Kumar (2018) and [76] Brichi et al., (2023). (Please use the justify alignment in your paper!)

Table 2. Effect of city waste manure (Please use the appropriate table arrangement on the page!)

	0-15cm					15-30cm				
	CWM					CWM				
	0 t ha ⁻¹	2.5 t ha ⁻¹	5 t ha ⁻¹	7.5 t ha ⁻¹	Mean	0 t ha ⁻¹	2.5 t ha ⁻¹	5 t ha ⁻¹	7.5 t ha ⁻¹	Mean
NP K0	1.3034	1.305	1.2963	1.292	1.291	1.303	1.302	1.297	1.293	1.309
NP K40	1.3034	1.283	1.303	1.323	1.303	1.303	1.303	1.303	1.314	1.308
NP K80	1.3034	1.277	1.292	1.273	1.284	1.303	1.321	1.303	1.322	1.317
NP K120	1.3034	1.262	1.296	1.242	1.277	1.303	1.313	1.291	1.291	1.319
Mean	1.3034	1.281	1.299	1.282		1.303	1.31	1.303	1.303	

The result regarding effect of city waste manure on bulk density of soil after harvest of black gram crop was presented in table 2. The various levels of municipal waste manure had a substantial impact on the bulk density of the soil. The bulk density of the soil changed with varying levels of municipal waste manure (0.0, 2.5, 5.0, and 7.5 t ha⁻¹) from 1.242 to 1.323 Mg m^{-3} at 0–15 cm and 1.291 to 1.322 Mg m^{-3} at 15–30 cm. The treatment M_3 (city waste manure 7.5 t ha⁻¹) had the lowest bulk density of 1.291 Mg m^{-3} at 0–15 cm and 1.322 mg m^{-3} at 15–30

cm, whereas treatment M₀ (control) had the greatest bulk density of 1.334 mg m⁻³ at 0–15 cm and 1.327 mg m⁻³ at 15–30 cm. Similar results were also reported by [87] Sharma *et al.*, (2013), [98]

Kansotia *et al.*, (2015) and [49] Jat *et al.*, (2015). (Please use the justify alignment in your paper!)

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Factors	C · D ·	SE(m)	F-test	Factors	C. D.	SE(m)	F-test
NPK(A)	N / A	0.01 9	N S	NPK(A)	N/ A	0.01 5	NS
CWM(B)	0 · 0 2 2	0.01 9	S	C.W.M(B)	N/ A	0.01 5	NS
Factor(AXB)	N / A	0.03 7	N S	Factor(AXB)	N/ A	0.03	NS

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

Effect of Fertilizer levels

Leave aligned for paragraphs! The study results presented in Table 3 clearly show that the amount of fertilizer used has a substantial impact on the particle density of the soil following black gram crop harvest. The particle density ranged between 2.606 and 2.666 Mg m^{-3} at 0-15 cm and 2.642 and 2.661 Mg m^{-3} at 15-30 cm. Treatment F₃ (120 percent RDF) had the lowest reported values of soil particle density (2.606 mg m^{-3} at 0-15 cm and 2.666 mg m^{-3} at 15-30 cm). Comparable outcomes were reported by [146] Brichiet al. (2023) and [125] Ozlu and Kumar (2018). (Please use the justify alignment in your paper!)

Effect of city waste manure

The data in presented in table 3 that particle density of soil influenced significantly by different level of city waste manure. The soil's particle density changed with varying amounts of municipal waste manure from 2.467 to 2.666 Mg m^{-3} at 0-15 cm and 2.641 to 2.668 Mg m^{-3} at 15-30 cm. The treatment M₃ (city waste manure 7.5 t ha⁻¹) had the lowest value of soil particle density (2.606 Mg m^{-3} at 0-15 cm and 2.641 Mg m^{-3} at 15-30 cm), whereas treatment M₀ (control) had the greatest value (2.666 Mg m^{-3} at 0-15 cm and 2.668 Mg m^{-3} at 15-30 cm). [1310] Abadiet al. (2012), [147] Sharma et al. et al. (2013), and [159] Jat et al. et al. (2015) all reported findings that were similar. (Please use the justify alignment in your paper!)

Table 3. Influence of NPK fertilizers and City waste manure on Bulk Density (Mg m^{-3}) of soil.

Please use the appropriate table arrangement on the page!

	0-15cm					15-30cm				
	CWM					CWM				
	0 t ha ⁻¹	2.5t ha ⁻¹	5 t ha ⁻¹	7.5t ha ⁻¹	Mean	0 t ha ⁻¹	2.5t ha ⁻¹	5 t ha ⁻¹	7.5t ha ⁻¹	Mean
NP K0	2.606	2.611	2.616	2.621	2.626	2.631	2.636	2.641	2.646	2.651
NP K40	2.656	2.661	2.666	2.671	2.676	2.681	2.686	2.691	2.696	2.701
NP K80	2.656	2.661	2.666	2.671	2.676	2.681	2.686	2.691	2.696	2.701
NP	2.656	2.661	2.666	2.671	2.676	2.681	2.686	2.691	2.696	2.701

K120	. 6 3 7	6 4 4	. 6 0 6	6 6 6	. 6 3	. 6 4 2	6 6 1	. 6 6 1	6 6 1	625
Mean	2 .6 3	2. 6 2	2 .6 2	2. 6 1		2 .6 6	2. 6 6	2 .6 6	2. 6 6	

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Factors	C · D ·	SE(m)	F - te st	Factors	C · D ·	SE(m)	F-test
NPK(A)	N / A	0.0 31	N S	NPK(A)	N / A	0.0 28	NS
CWM(B)	N / A	0.0 31	N S	C.W.M(B)	N / A	0.0 28	NS
Factor(AXB)	N / A	0.0 63	N S	Factor(AXB)	N / A	0.0 56	NS

3.3 Porespace(%)

Effect of Fertilizer levels

Leave aligned for paragraphs! Data presented in table 4 indicated that pore space of soil influence by fertilizer levels and it was varied from 47.69 to 48.87 % at 0-15 cm and 46.14 to 47.74 % at 15-30 cm. The lowest pore space of soil (47.64 % at 0-15 cm and 46.09 % at 15-30 cm) after harvest of black gram crop was recorded in treatment F₀ (0% RDF) however, highest pore space of soil (48.87 % at 0-15 cm and 47.74 % at 15-30 cm) was recorded in the treatment of F₃ (120 % RDF). Similar result reported by the [1611] Singh et al., (2015). (Please use the justify alignment in your paper!)

Effect of city waste manure

Leave aligned for paragraphs! Data presented in table 4 showed that soil pore space is impacted by the amount of municipal waste manure applied. After the black gram crop was harvested, the soil's pore space was expanded by the application of municipal waste manure. At 0–15 cm and 15–30 cm, the soil pore space ranged from 47.77 to 48.87 % and 46.54 to 45.95 %, respectively. The treatment M₃ (city waste manure @ 7.5 t ha⁻¹) had the largest pore space values (48.87 % at 0–15 cm and 47.74 % at 15–30 cm), whereas the treatment M₀ (Control) had the lowest values (47.64 % at 0–15 cm and 46.09 % at 15–30 cm). Similar results were also reported by [1710] Abadiet al., (2012) and [187] Sharma et al., (2013). (Please use the justify alignment in your paper!)

Table 4. Influence of NPK fertilizers and City waste manure on pore space (%) of soil.

	0-15cm					15-30cm				
	CWM					CWM				
	0 t h a - 1	2.5 t h a - 1	5 t h a - 1	7.5 t h a - 1	Me a n	0 t h a - 1	2.5 t h a - 1	5 t h a - 1	7.5 t h a - 1	Me a n
NP K0	47.64	47.85	47.8	47.5	47.37	46.14	47.3	46.4	47.5	46.947
NP K40	48.87	47.6	48.3	47.4	48.05	47.2	46.7	47.1	46.8	46.907
NP K80	47.69	48.0	48.3	48.8	48.22	47.7	47.5	46.9	47.9	47.193
NP	47.64	47.6	47.6	47.6	47.6	46.09	46.0	46.0	46.0	46.09

K120	7 .6 9	7. 7 2	8 .7 3	8. 8 7	8 .1 1 5	6 .1 4	6. 2 8	7 .7 1	7. 7 4	68
Mean	4 7 .9 4 5	4 7. 7 2	4 8 .4 8	4 7. 9 6 5		4 6 .8 6	4 6. 9 4 7	4 7 .0 6 7	4 7. 1 4	

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Factors	C . D .	SE(m)	F-test	Factors	C. D.	SE(m)	F-test
NPK(A)	N / A	0.44 8	N S	NPK(A)	N/ A	0.50 8	NS
CWM(B)	N / A	0.44 8	N S	C,W.M(B)	N/ A	0.50 8	NS
Factor(AXB)	N / A	0.89 5	N S	Factor(AX B)	N/ A	1.01 7	NS

3.4 Water Holding Capacity(%):-

Effect of Fertilizer levels

Leave aligned for paragraphs! A perusal of data Table 5 revealed that the amount of fertilizer applied had an impact on the soil's ability to store water. This capacity ranged between 45.54 and 45.95% at 0–15 cm and 44.05 and 44.76 % at 15–30 cm. Following the harvest of the black gram crop, treatment F₀ (0% RDF) had the lowest water holding capacity of the soil (44.19% at 0–15 cm and 40.84 % at 15–30 cm); treatment F₃ (120 % RDF) had the maximum water holding capacity of the soil (45.95 % at 0–15 cm and 44.76 % at 15–30 cm).

[1911] Singh *et al.* (2015) reported a similar outcome. (Please use the justify alignment in your paper!)

Effect of city waste manure

Leave aligned for paragraphs! It is evident from the data of research given in table 5 showed that after the harvest of the black gram crop, the application of municipal waste manure boosted the soil's capacity to store water. The percentage of soil water that could be held ranged from 44.7 to 45.95% at 0–15 cm and 42.2 to 44.76% at 15–30 cm. The treatment M₃ (city waste manure @ 7.5 t ha⁻¹) had the best water holding capacity (45.95 % at 0–15 cm and 44.76 % at 15–30 cm), whereas the treatment M₀ (Control) had the lowest water holding capacity (44.19 % at 0–15 cm and 42.14 % at 15–30 cm). (Please use the justify alignment in your paper!)

Table 5: Influence of NPK fertilizers and City waste manure on Water Holding Capacity (%) in soil:-

	0-15cm					15-30cm				
	CWM					CWM				
	0 t ha ⁻¹	2.5 t ha ⁻¹	5 t ha ⁻¹	7.5 t ha ⁻¹	Mean	0 t ha ⁻¹	2.5 t ha ⁻¹	5 t ha ⁻¹	7.5 t ha ⁻¹	Mean
NP K0	44.19	44.31	44.69	44.7	44.8	42.14	42.81	42.99	42.2	42.98
NP K40	44.74	44.66	44.79	44.81	44.75	42.74	43.25	43.31	43.23	43.23
NP K80	44.92	45.2	45.24	45.6	45.73	43.69	43.7	43.88	43.73	43.73
NP K120	45.54	45.56	45.94	45.95	45.88	44.05	44.06	44.08	44.76	44.68

Mean	44.69	44.58	45.18		43.31	43.55	43.32	43.68	
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Factors	C · D ·	SE(m)	F-test	Factors	C · D ·	SE(m)	F-test
NPK(A)	N / A	0.566	N S	NPK(A)	N / A	0.505	S
CWM(B)	N / A	0.566	N S	C.W.M(B)	N / A	0.505	NS
Factor(AXB)	N / A	1.131	N S	Factor(AXB)	N / A	1.01	NS

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3. CONCLUSION

The treatment combination T₁₀ (RDF NPK @ 80% + City Waste manure @ 2.5t ha⁻¹) was determined to be the optimum treatment for Black gram (*Vigna mungo L.*), despite the varying levels of NPK and City Waste Manure utilized in the experiment with diverse soil health parameters. Treatments with municipal waste manure are superior in terms of soil health and black gram yield. The optimum treatment combination for yield was T₁₂ -RDF NPK @ 80% + City Waste manure @ 7.5 t ha⁻¹. Any additional organic manure should be put in addition to the treatment combination indicated above in order to increase its feasibility and make it more physico-chemically and economically optimal for the soil.

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