Influenceofcitywastemanurewithdifferentlevelsofinorganic fertilizers on soil healthparameter, growthand yieldattributesofblack gram(*Vigna mungoL.)* ininceptisols

ABSTRACT

The objective of the experiment was to evaluate the Influenceofcitywastemanurewithdifferentlevelsof 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 F_3 and it was observed that treatment F_3 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 M_3 and it was observed that treatment F_3 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 T_{10}(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

Soil plays a crucial role in supporting plant growth, providing habitats for numerousorganisms, filtering water, and storing and cycling nutrients. Soil is a natural resource that formstheuppermostlayeroftheEarth'scrust.Itisacomplexmixtureofminerals,organicmatter,water,air, and various organisms. Organic matter in the soil comes fromdecomposedplants,animals,andmicroorganisms.

Black gram (*Vigna mungo* L), also known as urad dal or black lentil, is a warm-seasonlegume 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 variousculinary purposes, including making dal, soups, curries, and sweets. It is well adapted to tropicaland subtropical climates. It thrives in warm weather with temperatures ranging between 25°C to35°C (77°F to 95°F). The crop requires a frost-free growing season. It can tolerate a wide rangeofrainfall,but awell-distributedrainfallof600to800 mm(24to 32inches)isideal.

City waste manure, is a waste type consisting of everyday items that are discarded bythe public. "Garbage" can also refer specifically to food waste, as in a garbage disposal; the twoare sometimes collected separately. Although the waste may originate from a number of sourcesthat has nothing to do with a municipality, the traditional role of municipalities in collecting andmanagingthesekindsofwastehaveproducedtheparticularetymology'municipal.The application of City Waste Manure led to increased crop yields in various crops,includingrice,wheat,andvegetables.Thenutrient-richcompositionofthemanurecontributedtoimproved plant nutrition and growth, translating into higher yields. [1] **(Taimur*etal.*2015)**.

Nitrogenplaysacrucialroleinthegrowthanddevelopmentofblackgramplants.Itisanessential nutrient that is required in relatively large quantities by plants, and its availabilitydirectly influences the yield and quality of black gram crops. [3] **(Meena*etal.*,2014)**.

Phosphorus plays a vital role in thegrowth and development of black gram plants. It is one of the essential macronutrients requiredbyplants,and itsavailabilitydirectlyimpactstheyield and qualityofblack gramcrops.Herearethe key roles of phosphorus in black gram cultivation like Energy transfer and storage, Rootdevelopmentandnutrientuptake,Photosynthesisandcarbohydratemetabolism,Proteinsynthesisand nucleic acid formation, Flowering and reproduction.[4](**Garg *et al.*, (2019)**.

Potassiumisoneoftheseventeenelementswhichareessentialforgrowthanddevelopmentofplants.Potassiumisrequiredforimprovingtheyieldandqualityofdifferentcropsbecause 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.[5] (**Singh *etal.*,2017**).

2. METHODOLOGY

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^{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.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 %).

Table1.Treatmentcombinationof black gram.

TreatmentCombination	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 ofFertilizerlevels

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). Similarresultreportedbythe[6] **OzluandKumar(2018)and[7] Brichi*etal.*,(2023).**

Table 2. Effectofcitywastemanure

	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**
NPK0	1.334	1.305	1.263	1.292	1.291	1.327	1.302	1.317	1.293	1.309
NPK40	1.314	1.28	1.305	1.323	1.312	1.324	1.30	1.316	1.314	1.308
NPK80	1.321	1.277	1.297	1.273	1.284	1.321	1.321	1.312	1.322	1.317
NPK120	1.302	1.262	1.265	1.242	1.276	1.326	1.313	1.315	1.291	1.319
Mean	1.316	1.281	1.29	1.282		1.32	1.31	1.31	1.303	

Theresultregardingeffectofcitywastemanureonbulkdensityofsoilafter harvestofblack 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 M_0 (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. Similarresultswerealsoreportedby[8] **Sharma*etal*.,(2013),[9] Kansotia*etal*.,(2015)**and**[10]Ja*tetal*., (2015).**

Factors	C.D.	SE(m)	F-test	Factors	C.D.	SE(m)	F-test
NPK(A)	N/A	0.019	NS	**NPK(A)**	N/A	0.015	NS
CWM(B)	0.022	0.019	S	**C.W.M(B)**	N/A	0.015	NS
Factor(AXB)	N/A	0.037	NS	**Factor(AXB)**	N/A	0.03	NS

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

Effect ofFertilizerlevels

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 F_3 (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 [11] **Brichi*et al.* (2023)** and [12] **Ozlu and Kumar (2018).**

Effectofcitywastemanure

The data in presented in table 3 that particle density of soil influencedsignificantlybydifferentlevelofcitywastemanure.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 M_3 (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 M_0 (control) had the greatest value (2.666 Mg m^{-3} at 0-15 cm and 2.668 Mg m^{-3}at 15-30 cm). **[13]Abadi*et al.* (2012),**[14] **Sharma et al. (2013),** and [15] **Jat *et al*. (2015)** all reported findings that were similar.

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

	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
NPK0	2.633	2.611	2.667	2.661	2.64	2.662	2.660	2.662	2.641	2.65625
NPK40	2.622	2.615	2.626	2.667	2.63	2.662	2.662	2.661	2.652	2.65925
NPK80	2.635	2.638	2.620	2.467	2.58	2.660	2.661	2.664	2.668	2.663
NPK120	2.637	2.644	2.606	2.666	2.63	2.642	2.661	2.661	2.661	2.65625

Mean	2.63	2.62	2.62	2.61		2.66	2.66	2.66	2.66	

Factors	**C.D.**	**SE(m)**	**F-test**	**Factors**	**C.D.**	**SE(m)**	**F-test**
NPK(A)	N/A	0.031	NS	**NPK(A)**	N/A	0.028	NS
CWM(B)	N/A	0.031	NS	**C.W.M(B)**	N/A	0.028	NS
Factor(AXB)	N/A	0.063	NS	**Factor(AXB)**	N/A	0.056	NS

3.3 Porespace(%)

Effect ofFertilizerlevels

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 F_3 (120 % RDF). Similar result reported by the **[16] Singh et al., (2015).**

Effectofcitywastemanure

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 M_3 (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 M_0 (Control) had the lowest values (47.64 % at 0–15 cm and 46.09 % at 15–30 cm). Similar results were also reported by **[17]Abadi *et al.*, (2012) and [18] Sharma*etal*.,(2013).**

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

	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
NPK0	47.64	47.85	47.85	47.85	47.737	46.09	47.3	46.45	47.95	46.947
NPK40	48.6	47.67	48.34	47.77	48.095	47.2	46.71	47.18	46.54	46.907
NPK80	47.69	48.06	48.32	48.08	48.162	47.15	47.5	46.93	47.19	47.193
NPK120	47.6	47.72	48.7	48.87	48.1	46.1	46.28	47.7	47.74	46.968

	9		3		15	4		1		
Mean	47.945	47.72	48.48	47.965		46.86	46.947	47.067	47.14	

Factors	**C.D.**	**SE(m)**	**F-test**	**Factors**	**C.D.**	**SE(m)**	**F-test**
NPK(A)	N/A	0.448	NS	**NPK(A)**	N/A	0.508	NS
CWM(B)	N/A	0.448	NS	**C.W.M(B)**	N/A	0.508	NS
Factor(AXB)	N/A	0.895	NS	**Factor(AXB)**	N/A	1.017	NS

3.4 WaterHoldingcapacity(%):-

Effect ofFertilizerlevels

A perusal of data Table 5revealed 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 F_0 (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 F_3 (120 % RDF) had the maximum water holding capacity of the soil (45.95 % at 0–15 cm and 44.76 % at 15–30 cm)**. [19] Singh *et al.* (2015)** reported a similar outcome.

Effectofcitywastemanure

Itisevidentfromthedataofresearchgiven intable5 showedthatafter 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 M_3 (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 M_0 (Control) had the lowest water holding capacity (44.19 % at 0–15 cm and 42.14 % at 15–30 cm).

Table5:InfluenceofNPKfertilizersandCitywastemanureonWaterHoldingCapacity(%)insoil:-

	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
NPK0	44.19	44.31	44.69	44.7	44.498	42.14	42.81	42.19	42.2	42.498
NPK40	44.74	44.76	44.79	44.81	44.775	42.74	43.25	43.31	43.023	43.023
NPK80	44.29	45.2	45.24	45.26	44.973	43.69	43.7	44.48	43.973	43.973
NPK120	45.54	45.56	45.94	45.95	45.748	44.05	44.06	44.08	44.76	44.168

Mean	44.69	44.958	45.165	45.18		43.193	43.455	43.325	43.668	

Factors	**C.D.**	**SE(m)**	**F-test**	**Factors**	**C.D.**	**SE(m)**	**F-test**
NPK(A)	N/A	0.566	NS	**NPK(A)**	N/A	0.505	S
CWM(B)	N/A	0.566	NS	**C.W.M(B)**	N/A	0.505	NS
Factor(AXB)	N/A	1.131	NS	**Factor(AXB)**	N/A	1.01	NS

3. CONCLUSION

The treatment combination T_{10} (RDF NPK @ 80% + City Waste manure @ 2.5tha^{-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 T_{12} -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.

REFERENCES

TaimurN.,Maria.,Muhammad,A.K.,Muhammad W.,Tariq,K.,MuhammadA.andSherN.K. 2015. Effect of city waste compost applied alone and in combination withchemicalfertilizerontheyieldandnutrientuptakeofwheatandsubsequentmaizecrop.*SocietyforPureandAppliedBiology*,4(4):471-479.

Meena,M.C.,Pat**e**l,K.P.andRathod,D.D.(2006).EffectofzincandironenrichedFYMon mustardyieldandmicronutrientavailabilityinloamysandsoil(TypicHaplusted)ofAnand. *JournaloftheIndian Society ofSoilScience*,**54:**495-499.

Garg,V.K.,&Yadav,R.(2019).Assessmentofnutrientcontentandheavymetalconcentrationsincitycompostsandpotentialimpactsonagriculturalsoils.EnvironmentalMonitoring andAssessment,191(2),115

Singh,R.P.,Bisen.J.S.,Yadav,P.K.,Singh,S.N.Singh,R.K.andSingh,J.(2017).Integrateduse of sulphur and molybdenum on growth, yield and quality of black gram.*LegumeResearch*,31:214-217.

Ozlu, E. and Kumar, S. (2018). Response of soil organic carbon, pH, electrical conductivityand water stable aggregates to long–term annual manure and inorganic fertilizer.SoilScienceSocietyofAmericaJournal.

Brichi,L.,Fernandes,J.V.,Silva,B.M.,Vizú,J.D.F.,Junior,J.N.,&Cherubin,M.R.(2023). Organicresiduesandtheirimpactonsoilhealth,cropproductionandsustainableagriculture:Areviewincludingbibliographicanalysis.*SoilUseandManagement*,*39*(2),686-706.

Sharma,P.,Majumdar, S.P.andSharma,S. R.2013.Impactofvermicompost,potassiumandiron on physico-chemical properties of Typic Ustipsamment. *Environment andEcology*,**31**:1980-1983.

Kansotia,B.,Meena,R.andMeena,V.(2013).Effectofvermicompostandinorganicfertilizers on Indian mustard (*Brassica juncea*L.). *AsianJournal of Soil Science*,**8**:136-139.

Jat, G., Sharma, K. K. and Jat, N. K. 2015. Effect of FYM and mineral nutrients on physio-chemical properties of soil under mustard in western arid zone of India. *AnnalsofPlantandSoilResearch*,**14**:167-170.

Abadi,Z.A., Sepanlou,M.G.andAlashti, S.R.2012.Effectofvermicompostonphysicalandchemicalpropertiesofsoil.*JournalofScienceandTechnologyofAgricultureandNaturalResources*,**15**,58(B):125-137.

Singh, B. S., Singh, J., Singh, G. and Kaur, G. (2015). Effects of long term application ofinorganicandorganicfertilizersonsoilorganiccarbonandphysicalpropertiesinmaize–wheatrotation.Agronomy.5(2):220–238.

Sharma,P.,Majumdar, S.P.andSharma,S. R.2013.Impactofvermicompost,potassiumandiron on physico-chemical properties of Typic Ustipsamment. *Environment andEcology*,**31**:1980-1983

Singh, B. S., Singh, J., Singh, G. and Kaur, G. (2015). Effects of long term application ofinorganicandorganicfertilizersonsoilorganiccarbonandphysicalpropertiesinmaize–wheatrotation.Agronomy.5(2):220–238.