Influence of Organic Manure and Inorganic Fertilizer on Soil Health, Growth and Yield of Cowpea (*Vigna unguiculata* L.) var. Gomati

ABSTRACT

An experiment was conducted on the **"Influence of Organic Manure and Inorganic Fertilizer on Soil Health, Growth and Yield of Cowpea (*Vigna unguiculata* L.) var. Gomati."** during the ~~kharif~~ Kharif season 2022 at the research farm, Department Of Soil Science And Agricultural Chemistry, NAINI, SHUATS, Prayagraj. The design applied was 3x3 RBD having three levels of poultry-manure @ 0%,50 % 100% h^{-1} and NPK @ 0, 50 and 100%. The result obtained with treatment T_9 [NPK @ 100% + poultry manure @ 100% ha^{-1}] that showed poultry manure~~r~~ in combination resulted in a slight change in soil pH at 0-15 cm which was found to be 7.56 and $EC_{e25}{}^{0}{}_{c}$ 0.25 dS m^{-1} respectively. In post soil of fertilizers observations were resulted in non-significant increase in depth 0-15 cm~~-~~, bulk density 1.254Mg m^{-3}, particle density 2.314 Mg m^{-3} and significant in pore space 48.12 %, Water holding capacity 43.99%, Organic Carbon 0.46 %, and Av. N 285.41 kg ha^{-1}, P 23.47 kg ha^{-1}, K 208.47 kg ha^{-1}, in the case of Nitrogen kg ha^{-1}, Phosphorus kg ha^{-1} and Potassium kg ha^{-1} was found to be significant among other treatments in cowpea cultivation and soil quality improvement. The maximum yield regarding, gave the best results with respect to plant height 73.28cm, and number of leaves $plant^{-1}$ 36.96. number of pod $plant^{-1}$ 10.72, weight of pod $plant^{-1}$ 38 g, It gave highest yield 71.58 q ha^{-1}. It was also revealed that the application with organic manures was an excellent source for fertilization than fertilizers.

Keywords: Soil properties, nutrients cowpea, poultry manure, morphological parameters *etc.*

Comment [A1]: Restructure sentence

INTRODUCTION

Pulses have long been recognized and valued as "Soil building" crops. Growing pulses improves soil quality through their beneficial effects on soil biological, chemical and physical conditions. Organic materials are intrinsic and essential components of all soils and it makes a living dynamic system in the soil that supports all life residing in soil. Organic matter plays a vital role in improving the physical, chemical, and biological condition of soil. Besides, the addition of N, P, K

organic manures ~~are~~ is a potential source of micronutrients and improves soil structure by providing binding action to soil aggregates, ~~increases~~ increasing water holding capacity and ~~improve~~ improving the buffering capacity of soils. Although the release of nutrients is slow but stead~~il~~y for a longer duration thus preventing their losses by leaching and other means and ~~improves~~ improving nutrient use efficiency of the crop. The nutrients supplementation through organic sources also has been found to be a good carrier for the flourishment of microbes resulting in~~to~~ sustained soil productivity and enhanced enzymatic activities of soil which play a vital role in the transformation of unavailable form of nutrient into available form and gives rise an organic recycling process along with improving soil health. ~~Use~~ The use of organic manure alone or in combination with chemical fertilizers~~,~~ helps in improving the physico-chemical properties of the soil, and improves the efficient utilization of applied fertilizers ~~resulted~~ resulting in higher seed yield and quality. The increasing use of NPK fertilizers generally devoid of micronutrients, had no doubt remarkably increased ~~the~~ food production but it brought ~~with~~ a host of problems related to micro~~-~~nutrient deficiencies by depleting their resources in the soil. For integrated nutrient management in maize cultivation, PM is usually applied to the prepared soil two weeks before planting **(Uwah *et al.*, 2011)** to allow the mineralization of the PM. Potassium plays an important role in formation of protein and chlorophyll and it ~~provide~~ provides much of the osmotic "pull" that ~~draw~~ draws water into plant roots. Potassium produces strong stiff straw in maize and ~~reduce~~ reduces lodging in maize. Potassium imparts increase vigor and disease resistance to ~~plant~~ plants **(Cobbinah *et al.*, 2011).** Urea may be applied to maize farms in different growing stages. Delaying or early application of urea to plants may have an implication on soil chemical properties, growth, and yield of the crop. Many researchers have suggested that N should be applied at the time it is needed by the crop **(Ogunboye *et al.* 2020 and Sitthaphanit *et al.*, 2010).**

MATERIAL AND METHODS

The investigation **"Influence of Organic Manure and Inorganic Fertilizer on Soil Health, Growth and Yield of Cowpea (*Vigna unguiculata* L.) var. Gomati."** comprises ~~of~~ a field experiment which was carried out at the Soil Science Research Farm, Sam Higginbottom University of Agriculture Technology, Prayagraj during Kharif season 2022. The details about the experiment site, soil and climate are described in this chapter together with the experimental design, layout plan, cultural practice, particulars of treatments, planting material and techniques employed for the parameters.

The experiment was conducted at the research farm of soil science at NAI, SHUATS, Prayagraj, the area is situated on the south of Prayagraj on the right side of the river Yamuna on the south of ~~rewa~~ Rewa road at a distance of about 6 km from Prayagraj city. It is situated at $25^{0}57^{"}$ N latitude, $81^{0}59^{"}$ E longitude and at ~~the~~ an altitude of 98 ~~meter~~ meters above ~~the~~ sea level, comes under the subtropical belt in the ~~South east~~Southeast of Uttar Pradesh, which ~~experience~~ experiences extremely hot ~~summer~~ summers and fairly cold ~~winter~~winters. The maximum temperature of the

location reaches up to 46^0C – 48^0C and seldom falls as low as 4^0C – 5^0C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually.

The soil samples were randomly collected from one site in the experiment plot prior to tillage operation from a depth of 0-15 cm. The volume of the soil sample was reduced by conning and quartering the composites soil sample will be air dried and passed through a 2 mm sieve by way of preparing the sample for physical and chemical analysis.

Table 1. Treatment combination of cowpea

Treatments	Treatment combinations
T_1	Absolute control
T_2	(RDF @ 0%+PM @ 50%)
T_3	(RDF @ 0%+PM @ 100%)
T_4	(RDF @ 50%+PM @ 0%)
T_5	(RDF @ 50%+PM @ 50%)
T_6	(RDF @ 50%+PM @ 100%)
T_7	(RDF @ 100%+PM @ 0%)
T_8	(RDF @ 100%+PM @ 50%)
T_9	(RDF @ 100%+PM @ 100%)

Source: ICAR (2010)

RDF = N = 20 kg ha^{-1}, P_2O_5 = 60 kg ha^{-1} & K_2O = 40 kg ha^{-1} (DAP & MOP)

Poultry manure = 4 t ha^{-1} (N = 3.0 %, P = 1.0 % & K = 1.5 %)

Table 2. Protocols for physical and chemical analysis of soil

Particular	Scientist, Year
Textural class (Sand, Silt, Clay) %	Bouyoucos, 1962
Bulk density (Mg m^3)	Muthuaval *et al*., 1992
Particle density (Mg m^3))	Muthuaval *et al*., 1992
Pore space (%)	Muthuaval *et al*., 1992
Water holding capacity (%)	Muthuaval *et al*., 1992
Soil pH (1:2.5) (w/v)	Jackson, 1958
Soil EC (dS m^{-1})	Wilcox, 1950
Organic Carbon (%)	Walkley and Black, 1947
Available Nitrogen (kg ha^{-1})	Subbiah and Asija, 1956
Available Phosphorus (kg ha^{-1})	Olsen et al, 1954
Available Potassium (kg ha^{-1})	Toth and Prince, 1949

RESULTS AND DISCUSSION

Soil parameters

The composition of NPK and Poultry manure ~~have~~ has a significant incr~~eas~~ement ~~on~~ in the soil parameters. The incr~~eas~~ement of pore space %, water holding capacity %, organic carbon, available nitrogen, phosphorus and potassium with the improvement of soil parameters, table 2. ~~shown~~ shows that application of different levels of NPK and Poultry manure ~~have~~ has a significant role on the soil. In treatment T_1 lowest data observed, pore space 42.02%, water holding capacity 40.37%, organic carbon 0.28%, nitrogen 258.97 kg ha^{-1}, phosphorus 18.62 kg ha^{-1}, potassium 175.62 kg ha^{-1} and T_9 shows the highest pore space 48.12, water holding capacity 45.99%, organic carbon 0.46%, nitrogen 285.41 kg ha^{-1}, phosphorus 23.47 kg ha^{-1} and potassium 208.47 kg ha^{-1}, in 0-15 cm depth of soil.

Effect of different levels of NPK and poultry manure on soil properties

In fig 1. and 2. the treatment T_9 is the maximum potential of soil parameters that improve the soil followed by T_8. It eventually shows that the NPK and poultry manure application is ~~the~~ a beneficial effect on the soil, that will maintain the soil. T_1 shows ~~that~~ the lowest effect on the soil.

Table 3. Effect of different levels of NPK and Poultry manure on soil properties

Treatments	Pore space (%)	Water holding capacity (%)	Organic carbon (%)	Nitrogen (Kg $ha^{-1)}$	Phosphorus (Kg ha^{-1})	Potassium (Kg ha^{-1})
	0-15 cm	0-15 cm	0-15 cm	0-15 cm	0-15 cm	0-15 cm
T_1	42.02	40.37	0.28	219.30	18.62	175.62
T_2	43.66	41.02	0.31	224.43	19.27	178.27
T_3	44.37	42.30	0.34	229.31	19.85	183.25
T_4	44.92	43.21	0.36	235.54	20.47	187.09
T_5	45.98	43.45	0.38	239.31	21.11	192.85
T_6	46.52	44.37	0.40	245.50	21.61	196.47
T_7	46.88	44.80	0.42	252.48	22.25	202.11
T_8	47.64	45.59	0.44	267.66	23.09	205.61
T_9	48.12	45.99	0.46	278.49	23.47	208.47

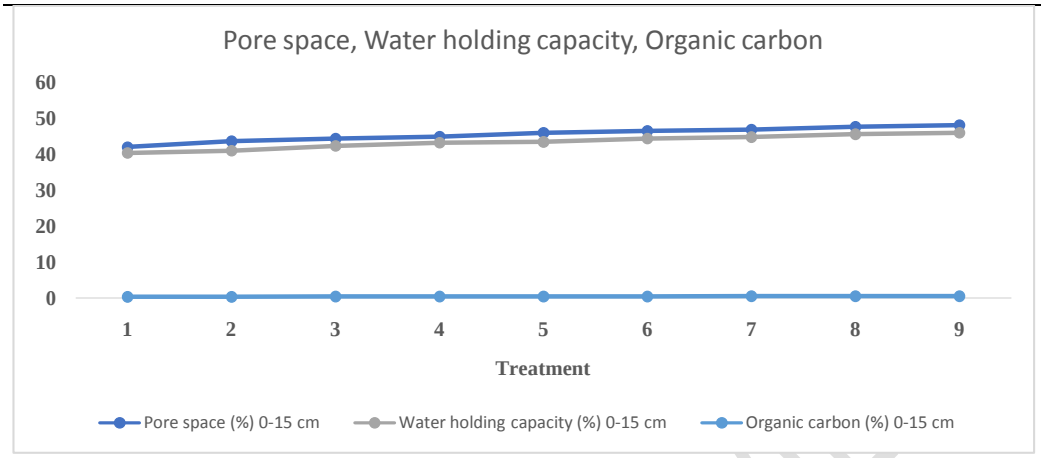

Fig 1. Effect of different levels of NPK and Poultry manure on pore space, water holding capacity and organic carbon

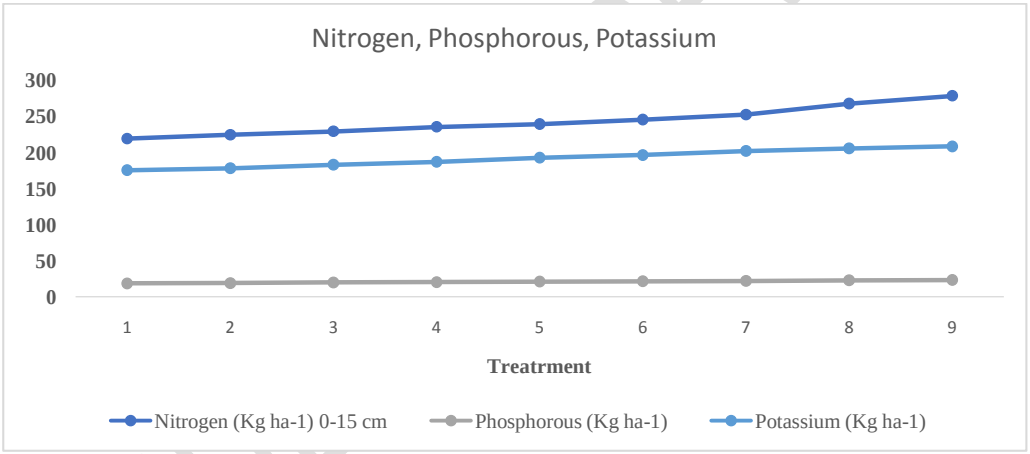

Fig 2. Effect of different levels of NPK and poultry manure on nitrogen, phosphorus and potassium

kg ha^{-1}

Table 4. Influence of organic manure and inorganic fertilizers on yield of cowpea

Treatment	Treatment Combination	Pod yield (q ha^{-1})
T_1	Absolute control	52.83
T_2	(RDF @ 0%+PM @ 50%)	54.58
T_3	(RDF @ 0%+PM @ 100%)	54.86
T_4	(RDF @ 50%+PM @ 0%)	56.66
T_5	(RDF @ 50%+PM @ 50%)	58.96
T_6	(RDF @ 50%+PM @ 100%)	63.67
T_7	(RDF @ 100%+PM @ 0%)	64.58
T_8	(RDF @ 100%+PM @ 50%)	67.63
T_9	(RDF @ 100%+PM @ 100%)	71.58

As depicted in ~~table~~ Table 4 that the maximum pod yield of cowpea was 71.58 q ha^{-1} found in T_9 [NPK @ 100 % + PM @ 100 %] followed by T_8 [NPK @ 100 %+ @ PM 50 %] and the minimum pod yield q ha^{-1} was found in T_1 which was 52.83 q ha^{-1} respectively.

CONCLUSION

It revealed that the treatment combination T_9 [NPK @ 100 % + PM @ 100 %] shows the best results with respect to in comparison to other treatment combinations and gave the highest yield 71.58 q ha^{-1}. According to the T_9 if farmers apply integrated nutrients *i.e.,* NPK and poultry manure for profitable production of cowpea, economics and maintain soil fertility and productivity.

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