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 **"Influence of Organic Manure and Inorganic Fertilizer on Soil Health, Growth and Yield of Cowpea (*Vigna unguiculata* L.) var. Gomati."** during 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, 50and 100%. The resultobtainedwithtreatmentT_9 [NPK @ 100% + poultry manure @ 100% ha^{-1}] thatshowedpoultry manurer in combination resulted in a slight change in soil pH at 0-15 cm was found 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 indepth 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 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,gavethe best results with respect to plant height 73.28cm,numberofleavesplant^{-1}36.96.number of pod $plant^{-1}$ 10.72, weight of pod $plant^{-1}$ 38g,Itgavehighestyield71.58q ha^{-1}. It was also revealed that the application with organic manures was excellent source for fertilization than fertilizers.

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

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, addition of N, P, K organic manures are a potential source of micronutrients and improve soil structure by providing binding action

Comment [U1]: what is the formulation of the problem of this research, so that this research becomes important to do

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to soil aggregates, increases water holding capacity and improve buffering capacity of soils. Although release of nutrients is slow but steadily for longer duration thus preventing their losses by leaching and other means and improves nutrient use efficiency of the crop. The nutrients supplementation through organic sources also has been found to be a good carrier for flourishment of microbes resulting into 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 of organic manure alone or in combination with chemical fertilizers, helps in improving physico-chemical properties of the soil, improves the efficient utilization of applied fertilizers resulted 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 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 important role in formation of protein and chlorophyll and it provide much of osmotic "pull" that draw water into plant roots. Potassium produces strong stiff straw in maize and reduce lodging in maize. Potassium imparts increase vigor and disease resistance to plant **(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).**

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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."**comprise 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.

Comment [U8]: when was the research conducted?

The experiment was conducted at 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 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 altitude of 98 meter above the sea level, comes under subtropical belt in the South east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. 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 (dSm^{-1})	Wilcox, 1950
Organic Carbon (%)	Walkley and Black, 1947
Available Nitrogen (kg ha^{-1})	Subbiah and Asija, 1956
Available Phosphorus (kgha^{-1})	Olsen et al, 1954
Available Potassium (kg ha^{-1})	Toth and Prince, 1949

Comment [U9]:

Comment [U10]: use the latest sources of the last 5-10 years

RESULTS AND DISCUSSION

Soil parameters

The composition of NPK and Poultry manure have significant increasement on the soilparameters. The increasement of pore space %, water holding capacity %, organic carbon, available nitrogen, phosphorus andpotassium with the improvement of soil parameters,table 2.shown that application of different levels of NPK and Poultry manure have significant role on 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 $kgha^{-1}$, 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 0-15cm depth of soil.

Comment [U11]: How to express the increase if the initial characteristics or conditions are not available as a comparison?

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

In fig1. 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 beneficial effect on the soil, that will maintain the soil. T_1 shows that 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

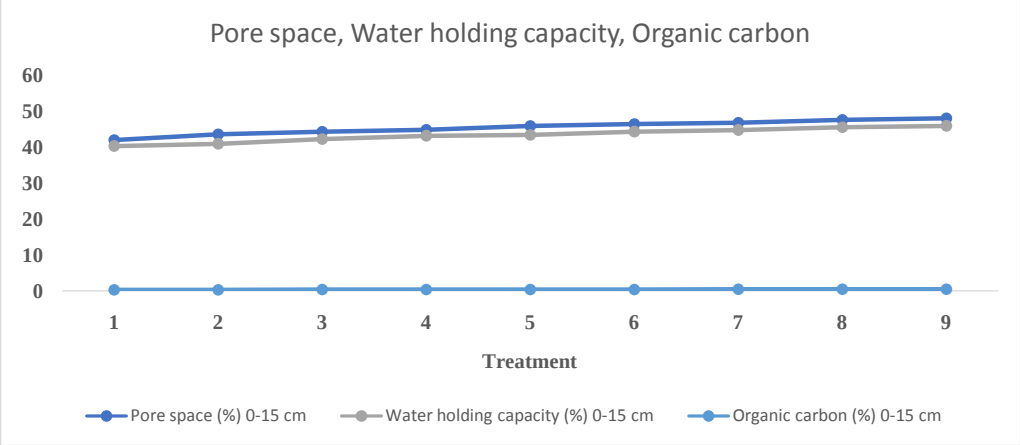

Fig 1. Effect of different levels of NPK and Poultry manure on pore space, water holding capacity and organic carbon

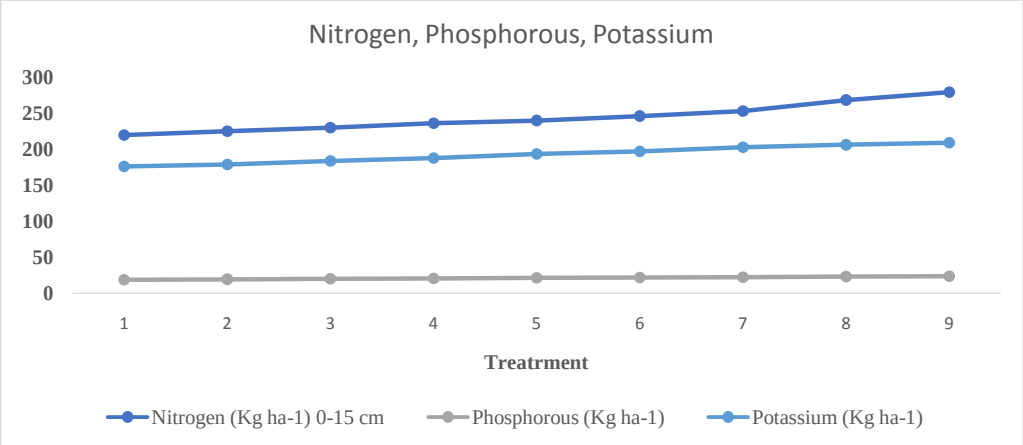

Fig 2. Effect of different levels of NPK and poultry manure on nitrogen, phosphorus andpotassium

kg ha^{-1}

Table 4. Influence of organic manure and inorganic fertilizers onyield 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 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%+ @ PM50%] and the minimum pod yield q ha^{-1} was found in T_1 which was 52.83q ha^{-1} respectively.

CONCLUSION

It revealed that the treatment combinationT_9 [NPK@100%+ PM @ 100%] shows best results with respect to in comparison to other treatment combinations and gave highest yield 71.58 q ha^{-1}. According to the T_9 if farmer apply integrated nutrients *i.e.*,NPK and poultry manure for profitable production of cowpea, economics and maintainsoilfertility and productivity.

Comment [U12]: why does the title mention soil health, while in the conclusion it mentions soil fertility. What is the basis for mentioning an increase in soil fertility and whether there has been a change in soil health, as well as what parameters are used as guidelines

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Comment [U13]: this literature is very old, use the latest 5-10 years

Comment [U14]: this literature is very old, use the latest 5-10 years