Effect of Nano urea FYM and Rhizobium on Soil Properties after harvest crop of green gram. (*Vigna radiata* L.) var.PDM139

ABSTRACT

An experiment was conducted to study the "Effect of different levels of nano urea FYM and rhizobium on soil properties and yield attributes of green gram (*Vignaradiata*. L) var. PDM 139" at the research farm of soil science and agricultural chemistry. The experiment design was laid out in a randomized block design (RBD) with three replications. Green gram was taken for study with the recommended dose [nano urea mix2-4 ml 4%N + FYM 12.5 t/ha + rhizobium 200 g 10 kg^{-1} seed] showed a slight decrease in pH, bulk density, and particle density; there was a significant increase in pore space, water holding capacity, EC, organic carbon, available nitrogen, phosphorus, potassium, and plant growth. In contrast to all other treatments, joint use of T_9 [NU at 100% + RZ at 100% + FYM at 100%] shows the most significant impact on green gram growth.

Keywords: Green gram, Soil, Nano urea, Rhizobium, FYM, *etc*.

INTRODUCTION

Soil is a medium for plant growth. Crop production is largely based on soils. Some of the soil properties affecting plant growth include: soil texture (coarse fine), aggregate size, porosity, aeration (permeability), water holding capacity, pH, bulk density, and particle density. The rate of water movement into the soil (infiltration) is influenced by its texture, physical condition (soil structure and tilth), and the amount of vegetative cover on the soil surface. Organic matter tends to increase the ability of all soils to retain water and also increases the infiltration rates of fine-textured soils. Bulk density reflects the soil's ability to function for structural support, water and solute movement, and soil aeration.

Soil pH directly affects the solubility of many of the nutrients in the soil needed for proper plant growth and development. Soil pH measurement is useful because it is a predictor of various chemical activities within the soil. As such, it is also a useful tool in making management decisions concerning the type of plants suitable for location, the possible need to modify soil pH (either up or down), and a rough indicator of the plant's availability of nutrients in the soil. Three elements, carbon, oxygen, and hydrogen, are essential to plant growth and are supplied by air and water. The other essential elements are referred to as plant nutrients, are provided by the soil or added as fertilizers, and enter plants almost exclusively through roots **(Singh *et al.*, 2016).** Green gram, commonly known as mung bean, is the third most important pulse crop of the thirteen different food legumes grown in India. The functional behavior of a protein is inherently susceptible to physical and chemical conditions such as soil pH, ionic strength, temperature, or pressure, making it an unpredictable and, at the same time, opportune component in food production. Proteins are generally also industrially costly, and with increasing world population and welfare, the pressure on protein availability for food purposes gives rise to some concerns. In view of the increasing production of green gram protein globally, there is a need for increased utilization of green gram, especially the nutritious germinated green gram **(Suryavanshi *et al.*, 2018).**

Green gram also improves the soil's physical properties. Moong bean has low productivity because it is cultivated on marginal and submarginal lands with inadequate fertilization and poor management practices. Moong bean yields were low at farmer fields due to a lack of awareness among farmers about the optimum date of sowing, responsive weed control, balanced use of fertilizers, pest management practices, and proper planting patterns. Moong bean in delayed planting results in a reduction in the number of pods or plants, the number of grains or pods, the grain weight, and ultimately the grain yield. The time of sowing is the most important agronomic factor for realizing the yield potential of improved varieties; it helps in achieving complete harmony between the vegetative and reproductive stages of the crop. Therefore, sowing the crop at the optimum time plays a key role in obtaining high seed yields (**Rathore *et al*., 2019**).

Liquid Nano-urea as a foliar spray on leaves Nanourea easily enters through stomata and other openings and is assimilated by the plant cells. It is easily distributed through the phloem from source to sink inside the plant as per its needs. Unutilized nitrogen is stored in the plant vacuole and is slowly released for the proper growth and development of the plant. Nano-urea (liquid) does not involve any government subsidy and will be made available to farmers at a 10% lower price than a bag of subsidized urea. Transportation would be easier and more economical, as one 500-ml bottle would be equivalent to one bag of regular urea fertilizer. Nanourea (liquid) is completely safe for humans, animals, birds, rhizosphere organisms, and the environment at the recommended levels of application. In comparison to pilled urea or neem-coated urea, the uptake efficiency of nanourea is more than 80%. Thus, there are fewer requirements compared to conventional urea fertilizer to fulfill the plant nitrogen requirement. Foliar application of nanourea at critical crop growth stages of a plant effectively fulfills its nitrogen requirement and increases the efficiency of fertilizer, leading to higher crop productivity and quality in comparison to conventional urea. Nano-urea (liquid) increases crop productivity and can reduce the requirement for conventional urea by 50% (**Subramani *et al.*, 2023)**.Rhizobium is a genus of gram-negative soil bacteria that fix nitrogen. *Rhizobium* species have an endosymbiotic nitrogen-fixing association with the roots of legumes and other flowering plants. Farmyard manure (FYM) is known to play an important role in improving the fertility and productivity of soils through its positive effects on soil physical, chemical, and biological properties and balanced plant nutrition. Fertilizers play a vital role in maintaining and improving soil fertility, as they are the sources of readily available nutrients for plants. It is thus imperative to evaluate the effects of FYM application in conjunction with chemical fertilizers on the growth and yield of post-rainy season green gram **(Kumar *et al.,* 2017).**

Materials and Methods

Experimental Site

The experiment was conducted at the Research Farm of Soil Science and Agricultural Chemistry, which is nearly 6 km away from Prayagraj city. It is situated at 23°52' N and 31°28 N latitudes and 77°3' and 84°28' E longitudes, and at an altitude of 98 meters above sea level.

Climatical conditions in the experimental area

The area of Prayagraj district comes under the subtropical belt in south-east Uttar Pradesh, which experiences extremely hot summers and fairly cold winters. The maximum temperature of the location reaches up to 460–480 °C and seldom falls to 40–50 °C. The relative humidity ranged from 20 to 94 percent. The average rainfall in this area is around 1100 mm annually.

Table:1Physical Parameters

Particulars	**Method employed**
Sand(%)	Bouyoucos(1927)
Silt(%)	Bouyoucos(1927)
Clay(%)	Bouyoucos(1927)
Textural class	Bouyoucos(1927)
Bulk density(Mg m^{-3}	Muthuval (1992)
Particle density(Mg m^{-3})	Muthuval(1992)
Pore space(%)	Muthuval(1992)
Water holding capacity(%)	Black (1965)

Table:2 chemical parameters

Parameters	**Method employed**	**Range**
Soil P^H (1:2)	(Jackson 1958)	(0-14 PH)
Soil EC (ds m^{-1})	(Wilcox 1950)	(< 0.75 ds m^{-1})
Organic Carbon (%)	(Walkley and Black, 1947)	(0.5-0.75 %)
Available Nitrogen (kg ha^{-1})	(Subbiah and Asija, 1956)	(240-480 kg ha^{-1})
Available Phosphorus (kg ha^{-1})	(Olsen *et al.*, 1954)	(11.0 -22 kg ha^{-1})
Available Potassium (kg ha^{-1})	(Toth and Prince., 1949)	(110 -280 kg ha^{-1})

Table3:TreatmentCombinations

Treatment	Treatment combination
T1	(Absolut control)
T2	NU @ 0% + RZ @ 50% + FYM @ 50%

T3	NU @ 0% + RZ @ 100% + FYM @ 100%
T4	NU @ 50% + RZ @ 0% + FYM @ 0%
T5	NU @ 50% + RZ @ 50% + FYM @ 50%
T6	NU @ 50% + RZ @ 100% + FYM @ 100%
T7	NU @ 100% +RZ @ 0% + FYM @ 0%
T8	NU @ 100% +RZ @ 50% + FYM @ 50%
T9	NU @ 100% +RZ @ 100% + FYM @ 100%

Table 4 Recommended dose of fertilizer

NU 50% = NU @ 0.5 ml ha^{-1}

NU 100% = NU @ 0.25 ml ha^{-1}

FYM 0% = FYM 0 g per ha^{-1}

FYM 50% = FYM 50 g per ha^{-1}

FYM 100% = FYM 100 g per ha.

Rhizobium0% = RZ 0 g Kg^{-1} seed

Rhizobium50% = RZ 10 g Kg^{-1} seed

Rhizobium100% = RZ 20 g Kg^{-1} seed

RESULTS AND DISCUSSION

5.1 Effect of Nano Urea, FYM, and Rhizobium on the Physical Properties of Soil After Harvest of Green Gram.

The data showed that the treatment T1 (absolute control) non-significantly influenced the bulk density of soil (1.31), particle density of soil (2.50) at 0–15 cm depth and significantly influenced percentage pore space (48.90), and water holding capacity (46.51) of soil were found to be optimal in treatment T9 (NU @ 100% + RZ @ 100% + FYM @ 100%) over T1 (absolute control) treatment at 0–15 cm and 15–30 cm depth.

5.2 Effect of Nano Urea, FYM, and Rhizobium on Chemical Properties of Soil After Harvest of Green Gram.

The data showed that the treatment T1 (absolute control) non-significantly influenced the soil P^H at its maximum (7.05) at 0–15 cm depth, respectively (Table 6). There was a significantly influenced maximum build-up of electrical conductivity (0.20), percentage organic carbon (0.58), available N (320), available phosphorus (21.4), and available potassium (195.12) observed under the treatment T_9 (NU @ 100% + RZ @ 100% + FYM @ 100%) content in soil; however, minimum values were detected in the treatment T_1 (absolute control) at 0–15 cm depth and at 15–30 cm depth.

Table 5: Effect of Nano Urea, FYM, and Rhizobium on Bulk Density, Particle Density, Pore Space, and Water Holding Capacity

S.NO.	TREATMENT	Bulk Density (Mg m^{-3})	Particle Density (Mg m^{-3})	Pore Space (%)	Water Holding Capacity (%)
T1	(Absolut control)	1.31	2.50	46.21	43.30
T2	NU @ 0% + RZ @ 50% + FYM @ 50%	1.30	2.50	47.35	44.38
T3	NU @ 0% + RZ @ 100% + FYM @ 100%	1.28	2.48	48.71	45.18
T4	NU @ 50% + RZ @ 0% + FYM @ 0%	1.31	2.49	46.38	43.40
T5	NU @ 50% + RZ @ 50% + FYM @ 50%	1.29	2.49	47.50	44.58
T6	NU @ 50% + RZ @ 100% + FYM @ 100%	1.28	2.47	48.82	45.61
T7	NU @ 100% +RZ @ 0% + FYM @ 0%	1.31	2.49	47.22	44.21
T8	NU @ 100% +RZ @ 50% + FYM @ 50%	1.29	2.48	47.65	45.11
T9	NU @ 100% +RZ @ 100% + FYM @ 100%	1.27	2.46	48.90	46.51
	F TEST	**NS**	**NS**	**S**	**S**
	S. Em. (±)	**0.015**	**0.029**	**1.13**	**0.54**
	C.D (P =0.05)	**0.047**	**0.087**	**3.39**	**1.62**

Table 6: Effect of Nano Urea, FYM, and Rhizobium on EC, Organic Carbon, Available Nitrogen, Phosphorus, and Potassium

S.N.	TREATMENT	PH	ElectricalConductivity (ds m-3)	Organic Carbon (%)	Nitrogen (Kg ha-1)	Phosphorus (Kg ha-1)	Potassium (Kg ha-1)
T1	(Absolut Control)	7.05	0.17	0.38	282	17.2	180.21
T2	NU @ 0% + RZ @ 50% + FYM @50%	7.03	0.16	0.42	292	18.7	182.41
T3	NU @ 0% + RZ @ 100% + FYM @100%	6.99	0.18	0.54	298	19.3	189.26
T4	NU @ 50% + RZ @ 0% + FYM @0%	7.04	0.15	0.39	283	16.3	180.31
T5	NU @ 50% + RZ @ 50% + FYM @50%	7.03	0.17	0.46	294	18.6	183.61
T6	NU @ 50% + RZ @ 100%+FYM @100%	6.97	0.19	0.56	310	20.2	190.11
T7	NU @ 100% +RZ @ 0% + FYM @0%	7.04	0.15	0.40	284	16.4	181.11
T8	NU @ 100% +RZ @ 50% + FYM @50%	7.02	0.17	0.48	296	18.5	186.16
T9	NU @100% +RZ @100% +FYM @100%	6.96	0.20	0.58	320	21.4	195.12
	F TEST	**NS**	**S**	**S**	**S**	**S**	**S**
	S. Em. (±)	**0.12**	**0.013**	**0.042**	**4.9**	**0.30**	**3.02**
	C.D (P =0.05)	**0.37**	**0.25**	**0.126**	**14.8**	**0.92**	**9.06**

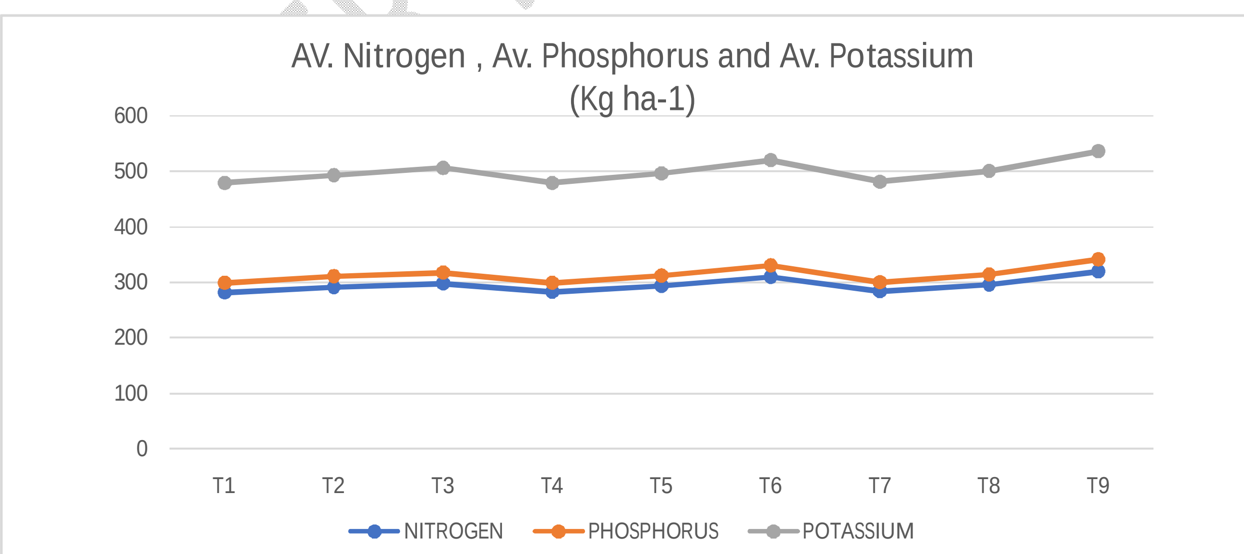

Fig 1. Graph representation of Av Nitrogen, Av. Phosphorus, Av. Potassium vs Treatment combination.

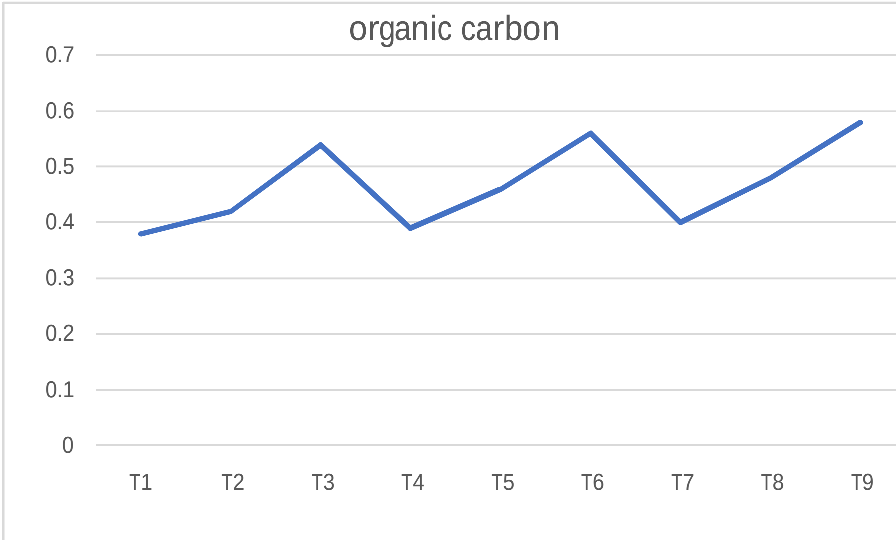

Fig2. graph of representation of organic carbon

CONCLUSION

The conclusion based on the result. The application of liquid inorganic fertilizer and organic fertilizer was found a significant impact on the soil healthin references to green gram. Application of T_9(@100% NU + @100% RZ+ @100% FYM) was found to improve soil structure and microbial activity. Consequently, soil properties are positively impacted. nano urea provides efficient nitrogen delivery, FYM improves organic matter content and soil texture, while rhizobium inoculation boosts nitrogen fixation, collectively leading to a soil health.

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