The Pharma Innovation Journal 2022; 11(5): 2393-2396

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 2393-2396

www.thepharmajournal.com
Received: 09-03-2022
Accepted: 29-04-2022

Keval Krishan
Research Scholar, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Arun Alfred David
Associate Professor, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Tarence Thomas
Professor and HOD, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Narendra Swaroop
Associate Professor, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Ram Bharose
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Amreen Hasan
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

I Srinath Reddy
Ph.D., Scholar, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Rohan Serawat
Ph.D., Scholar, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Anurag Kumar Singh
Ph.D., Scholar, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Keval Krishan
Research Scholar, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Influence of inorganic fertilizers Neem cake and rhizobium on soil health and yield attributes of green gram (*Vigna radiata* L.)

Keval Krishan, Arun Alfred David, Tarence Thomas, Narendra Swaroop, Ram Bharose, Amreen Hasan, I Srinath Reddy, Rohan Serawat and Anurag Kumar Singh

Abstract
An experiment conducted on "Influence of inorganic fertilizers, Neem cake and rhizobium on soil health and yield attributes of green gram (*Vigna radiata* L.) var. Samrat" at research farm of soil science and agricultural chemistry, SHUATS, Prayagraj, during the *Zaid* season of 2021, were laid out in randomized block design (RBD) 3 X 3 = 9 treatments, with three replications. Green gram was taken for study and the pre sowing soil sample analysis and soil is sandy loam in texture, medium to high nitrogen with deficiency of micro nutrients. The results revealed that the Yield (Grain and biological yield) and their attributing characteristics of green gram respond significantly with the different treatment combination. The highest grain yield (8.78 q ha^{-1}) was obtained in T_9-[NPK @ 100% + R @ 100% + NC @ 100%]. The treatment T_9 was found to be at par than any other treatment and recorded 40.0% increase in green gram grain yield as compared to control. The treatment combination T_9 [100% doses of Inorganic fertiliser, Neem cake and Rhizobium] gave the best result in terms of yield and their attributing characteristics.

Keywords: Soil parameters, green gram, yield attributes, grain, biological yield, nitrogen, micro nutrient, neem cake, etc.

Introduction
Pulses are the main source of protein particularly for vegetarians and contribute about 14% of the total protein of average Indian diet that is far below the requirement to meet even the minimum level per capita consumption. The per capita availability of pulses in India has been continuously decreasing which is 32.52 g day^{-1} against the minimum requirement of 80 g day^{-1} per capita prescribed by Indian Council of Medical Research (ICMR). Therefore, it is necessary for agricultural scientists to evolve strategy to increasing production of pulses to meet the protein requirements of increasing population of the country (Anonymous, 2009) [1]. Indian farmers have covered 134.02 lakh ha under kharif pulses as on 27th September 2019 as against 136.40 lakh hectare last year. Around 31.15 lakh ha was covered under green gram, while the same was 34.24 lakh hectare last year. The states of Rajasthan 18.30, Maharashtra 3.28, Karnataka 2.69, Madhya Pradesh 1.82, Odisha 1.63 lakh ha respectively are the major producers of green gram in India. According to Government 1st advance estimate, green gram production in kharif 2019- 20 is at 1.42 million tonnes, Directorate of Economics and Statistics (2019-20). It is not only playing an important role in human diet but also in improving the soil fertility by fixing the atmospheric nitrogen. Its seed is more palatable, nutritive, easily digestible and non–flatulent than other pulses. (Kumar *et al*., 2014) [12]. It is primarily a rainy season crop with high nutritive value. The grains (whole or split) are used as dal or to make flour. The grain contains iron 8.5 mg, mineral 3.5%, fat 0.5 - 4.33, fibers 4.0% and carbohydrates 59.9%, the straw and husk are used as fodder for cattle. The germinated grains are also used as sprouts (Afzal *et al.*, 2004) [5]. It is rich in protein and vitamin B. Green gram is an excellent source of protein 24.5% with high quality of lysine 460 mg g^{-1} N and tryptophan 60 mg g^{-1} N. It contains also remarkable quantity of ascorbic acid and riboflavin 0.21 mg 100^{-1} g and minerals 3.84 Mg 100 g^{-1} (Azadi *et al*., 2013) [3]. Green gram (*Vigna radiata* L.) commonly known as mung bean is the third most important pulse crop of the thirteen different food legumes grown in India. Green gram is a good source of vitamins, minerals, enzymes, complex carbohydrates and protein. Proteins are generally also industrially

costly, and with increasing world population and welfare the pressure on protein-availability for food purpose gives rise to some concerns in view of increasing production of Green gram protein globally, there is need for increased utilization especially the nutritious germinated (Anil *et al*., 2015) [4].

Soil is a medium for plant growth. Crop production is based largely on soils. Some of the soil properties affecting plant growth include soil texture (coarse fine), aggregate size, porosity, aeration (permeability), and water holding capacity, pH, bulk density, 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 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 measurement is useful tool in making management decisions concerning the type of plants suitable for location and a rough indicator of the plant 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, and are provided by the soil, or are added as fertilizers, and enter plants almost exclusively through the roots (Singh *et al.*, 2008) [15]. It is rich in protein and vitamin B. Green gram is an excellent source of protein 24.5% with high quality of lysine 460 mg g^{-1} N and tryptophan 60 mg g^{-1} N. It contains also remarkable quantity of ascorbic acid and riboflavin 0.21 mg 100^{-1} g and minerals 3.84 Mg 100 g^{-1}. Nitrogen is an important nutrient for all crops. It increases yield nutrition also increases the protein content. Deficient plants may have stunted growth and develop yellow-green colour. It accelerates photosynthetic behavior of green plants as well as growth and development of living tissues specially tiller count in cereals (Azadi *et al.*, 2013) [3]. Phosphorus is the second most important nutrient that must be added to the soil to maintain plant growth and sustain crop yield. It stimulates early root development and growth and there by helps to establish seedlings quickly. Large quantities of Phosphorus are found in seed and fruit and it is considered essential for seed formation. It enhances the activity of rhizobia and increases the formation of root nodules. Thus, it helps in fixing more of atmosphere nitrogen in root nodules (Patil *et al.*, 2011) [14]. Potassium is one of the seventeen essential elements. It 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 (Singh *et al.*, 2008) [15]. The nitrogen fixation potential of different pulses Faba bean, Lentil, Field pea, Urdbean, Mungbean is ranged between 82-174, 60-110, 85-166, 30-74, 58-109 kg ha^{-1} yr^{-1} respectively.

Materials and Methods

The design applied for statistical analysis was carried out with 3 x 3 factorial randomized block design having three factors with three levels of NPK @ 0, 50 and 100% ha^{-1}, three levels of Rhizobium @ 0, 50 and 100% ha^{-1} and three level of Neem Cake @ 0, 50 and 100% ha^{-1} respectively (Table 1).

Experimental site

The experiment was conducted at the crop Research farm of the Soil Science, which is located on the south of the Prayagraj city. It is situated at 250° SW, $25^0$24'23''N latitude and 81° 50'38''E longitude and 98 m above the mean sea level.

Climate condition in the experimental area

The area of Prayagraj district comes under subtropical belt in the South east Uttar Pradesh, which experience extremely hot summer and fairly winter. The maximum temperature of the location reaches up to 46 ^{0}C-48 ^{0}C and seldom falls as 4 ^{0}C-5 ^{0}C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually.

Table 1: Treatment combination of Green gram

Treatment	Description
T_1	[Farmers Recommended Dose of Fertilizer (N.P.K.)]
T_2	[NPK @ 0% + R (Seed inoculant) @ 50% + NC @ 50%]
T_3	[NPK @ 0% + R @ 100% + NC @ 100%]
T_4	[NPK @ 50% + R @ 0% + NC @ 0%]
T_5	[NPK @ 50% + R @ 50% + NC @ 50%]
T_6	[NPK @ 50% + R @ 100% + NC @ 100%]
T_7	[NPK @ 100% + R @ 0% + NC @ 0%]
T_8	[NPK @ 100% + R @ 50% + NC @ 50%]
T_9	[NPK @ 100% + R @ 100% + NC @ 100%]

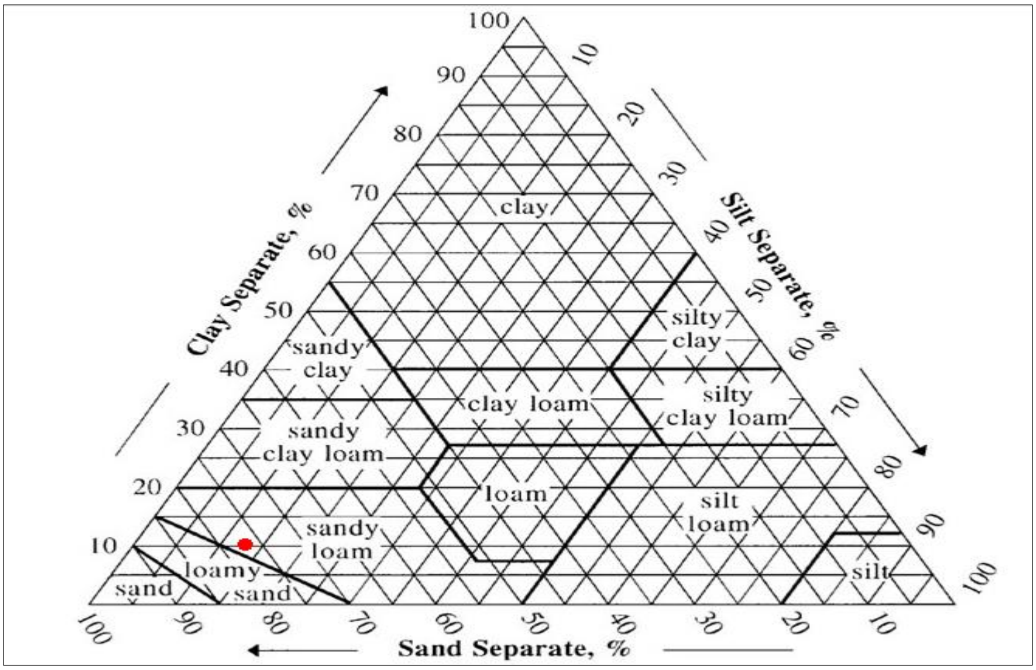

Fig 1: Soil Textural Triangle of research farm of soil science and agricultural chemistry, NAI, SHUATS, Prayagraj (Allahabad)

Table 2: Mechanical analysis of pre sowing soil

Parameter	Method employed	Values
Sand (%)	Bouyoucos, Hydrometer (1927)	65.67
Silt (%)		20.81
Clay (%)		13.52
Textural class		Sandy loam
Soil Colour	Munsell Soil colour chart, (1908)	Dry Soil - Pale brown
		Wet Soil - Olive brown
Bulk density (Mg m^{-3})	Muthuaval, (1992)	1.45
Particle density (Mg m^{-3})		2.51
Pore Space (%)	Black, (1965)	46.53

Table 3: Chemical analysis of pre sowing soil

Parameter	Method employed	Values
Soil pH (1:2)	Jackson, (1958) [11]	7.39
Soil EC (dS m^{-1})	Wilcox, (1950) [19]	0.37
Organic Carbon (%)	Walkley and Black's method, (1947) [20]	0.50
Available Nitrogen (Kg ha^{-1})	Subbaih and Asija, (1956) [16]	262.53
Available Phosphorus (Kg ha^{-1})	Olsen *et al.* (1954) [13]	19.86
Available Potassium (Kg ha^{-1})	Toth and Prince, (1949) [17]	202.56

Table 4: Response of inorganic fertilizers, neem cake and rhizobium on Bulk Density Particle, density and Pore space of green gram of Post-harvest Soil

Treatment	Bulk density (Mg m^{-3})	Particle density (Mg m^{-3})	Pore space (%)
T_1	1.02	2.27	49.32
T_2	1.04	2.32	50.75
T_3	1.08	2.38	51.72
T_4	1.03	2.40	52.31
T_5	1.08	2.43	53.45
T_6	1.06	2.45	53.74
T_7	1.09	2.47	54.44
T_8	1.14	2.47	55.10
T_9	1.18	2.50	56.30
F – test	S	S	S
SEM (±)	0.06	0.012	0.14
CD @ (5%)	0.23	0.038	0.41

Table 5: Response of inorganic fertilizers, Neem cake and rhizobium on pH, EC organic carbon, nitrogen, phosphorous and potassium of green gram of post-harvest soil

Treatment	pH (w/v)	EC (dS m^{-1})	Organic carbon (%)	Nitrogen (Kg ha^{-1})	Phosphorous (Kg ha^{-1})	Potassium (Kg ha^{-1})
T_1	7.0	0.04	0.46	211.08	15.13	108.13
T_2	7.0	0.12	0.48	215.19	15.4	111.46
T_3	7.1	0.15	0.52	220.15	15.86	112.4
T_4	7.3	0.18	0.58	252.13	26.36	131.16
T_5	7.3	0.09	0.61	262.12	27.23	134.53
T_6	7.2	0.19	0.62	265.15	27.83	141.26
T_7	7.5	0.20	0.65	285.06	28.9	183.06
T_8	7.4	0.21	0.68	290.13	30.96	184.43
T_9	7.5	0.22	0.72	315.7	32.1	188.6
F – test	S	SN	S	SN	SN	SN
SE. m (±)	0.016	0.0063	0.0124	1.85	0.17	0.08
CD @ (5%)	0.050	0.0160	0.03732	5.87	0.53	1.32

Response of Organic Carbon (%), Available Nitrogen, Phosphorus and Potassium (kg ha^{-1}) of soil after crop harvest: In table 5 it is depicted that the maximum OC (%), available Nitrogen, Phosphorus, Potassium (kg ha^{-1}) in soil were found in T_9-(NPK @ 100% + R @ 100% + NC @ 100%) which were 0.72, 315.7, 32.1, 188.6, followed by T_8-(NPK @ 100% + R @ 50% + NC @ 50%) having values 0.68, 290.13, 30.96, 184.43 respectively and minimum was found in T_1-(Absolute control) which were 0.46, 211.08, 15.13,108.13 respectively. The interaction effect of Rhizobium and Neem cake with NPK on available Nitrogen and Potassium was found significant and the interaction effect of Rhizobium and Neem cake with NPK on OC (%) and available phosphorus was found significant. Combined application of Rhizobium, Neem cake and NPK brings significantly increase in available nitrogen and available potassium. The result conformity with the finding of Upadhyay *et al.* (2016) [18].

Conclusion

It is concluded that Treatment combination T_9 (NPK @ 100% + R @ 100% + NC @ 100%) was to be best in pH, EC (dS m^{-1}), OC (%), available Nitrogen (kg ha^{-1}), Phosphorus (kg ha^{-1}) and Potassium (kg ha^{-1}) which were as 7.5, 0.22, 0.72, 315.7, 32.1, 188.6 kg ha^{-1} respectively. Soil chemical properties as pH, EC, available N and K were found to be significant. Soil physical properties as Bulk density (Mg m^{-3}), Particle density (Mg m^{-3}), and Pore space (%) were found to be significant.

Acknowledgement

I am grateful for inspired guidance, encouragement, keen interest, scholarly comments and constructive suggestions throughout the investigation by Dr. Arun Alfred David, guide (Associate Professor). Also express my gratefulness to all teaching and non-teaching staff gratefully acknowledged. Authors are also sincerely thankful to members of advisory committee for providing all necessary facilities and support for completion of research work.

References

1. Anonymous. Annual report for 2008. IRRI, Los Banos, Philippines, 2009.
2. Anonymous. FAO Bulletin of Statistics, Statistics Division of Eco and Social Department, 2014, 89.
3. Azadi E, Rafiee M, Hadis N. The effect of different nitrogen levels on seed yield and morphological characteristic of mung bean in the climate condition of Khorramabad. Annals of Biological Research. 2013;4(2):51-55.
4. Anil S, Kumar L. Studies on correlation and path analysis in mung bean [*Vigna radiata* (L.) Wilczek]. International journal of plant sciences. 2015;1(1):61-33.
5. Afzal MA, Bakr MA, Hamid A, Haque MM, Aktar MS. Green gram in Bangladesh. Lentil, black gram and green gram development pilot project. Pulses R. Centre, BARI, Gazipur, 2004, 1701.
6. Black CA. Methods of soil analysis. I. Am. Soc. Agron. Madison, Wisconsin, U.S.A., 1965.
7. Buoyoucos GJ. A recalibration of the hydrometer method for making mechanical analysis of soil. 1952;43:434.
8. Directorate of Economics and Statistics (2019-20).
9. GOI. Data base on Indian Agriculture, Department of Agriculture and Cooperation, 2017.
10. IIPR. Vision 2030 Document, Indian Institute of Pulse Research, Kanpur, India, 2011, 42p.
11. Jackson ML. Soil chemical analysis, Prentice Hall, Inc, Englewood Cliffe, N. J., 1958.
12. Kumar R, Singh VY, Singh S, Latare MA, Mishra PK, Supriya. Effect of phosphorus and sulphur nutrition on yield attributes, yield of Green gram (*Vigna radiata* L). Journal of chemical and pharmaceutical Research. 2014;4(5):2571-2573.
13. Olsen SR, Cole CV, Watnahe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate U.S. Deptt. Agr. Circ, 1954, 939.
14. Patil SC, Jagtap DN, Bhale VM. Effect of phosphorus and sulphur on growth and yield of moong bean. Internet J agric. Sci. 2011;**7** (2):348-351.
15. Singh RS, Yadav MK. Effect of phosphorus and biofertilizers on growth, yield and nutrient uptake of long duration mung under rainfed condition. J of Food L. 2008;21(1):46-48.
16. Subbiah BV, Asija CL. Arapid procedure for the estimation of available nitrogen in soils. Current sci. 1956;25:259-260.
17. Toth SJ, Prince AL. Estimation of Cation Exchange Capacity and exchangeable Ca, K and Na content of soil by Flame Photometer technique. Soil Sci. 1949;67:439-445.
18. Upadhyay Y, Swaroop N, Sahu YK, Dhruw SS, Verma PD. Interaction effects of different doses of Sulphur and Zinc with NPK on physico-chemical properties of soil in yellow mustrad (*Brassica compestris* L.), 2016.
19. Wilcox LV. Electrical conductivity, Amer. Water works Assoc. J. 1950;42:775-776.
20. Walkey A, Black IA. Critical examination of rapid method for determining organic carbon in soils, effect of variance in digestion conditions and of inorganic soil constituents. Soil sci. 1947, 632:251.