



# Influence of Different Levels of N, P, K and Organic Manures on Soil Health, Growth and Yield of Green Gram (*Vigna radiata* L.) cv. Samrat

Arpit Chaudhary<sup>+++\*</sup>, Arun Alfred David<sup>a#</sup>, Tarence Thomas<sup>a†</sup>,  
Anil Kumar<sup>+++</sup>, Rohan Serawat<sup>+++</sup>, Iska Srinath Reddy<sup>+++</sup>,  
Neha Toppo<sup>+++</sup> and Aashish Kumar<sup>+++</sup>

<sup>a</sup> Department of Soil Science and Agricultural Chemistry, NAI, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj – 211 007 (U.P.), India.

## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

An experiment was conducted on Influence of different level of N P K and organic manures on soil health, growth and yield of green gram (*Vigna radiata* L.) cv. Samrat at the research farm of soil Science and Agricultural Chemistry, design laid out in randomized block design (RBD) with three replications. Green gram was taken for study with recommended doses of fertilizers (N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O @ 20, 40 and 20 kg ha<sup>-1</sup>) was applied with organic manure (FYM, and Vermicompost). A variety of green gram Samrat was taken for a research trial. Bulk density (mg m<sup>-3</sup>) and Particle

<sup>++</sup> Research Scholar;

<sup>#</sup> Associate Professor;

<sup>†</sup> Professor;

\*Corresponding author: E-mail: 21msassac044@shiats.edu.in, Arpitchaudhary470@gmail.com;

density ( $\text{mg m}^{-3}$ ) was maximum in  $T_1$  (NPK @ 0% + FYM @ 0% + VC @ 0%). Pore space (%), Water holding capacity (%), pH (1:2) w/v, EC ( $\text{dS m}^{-1}$ ), Organic carbon (%), Nitrogen ( $\text{kg}^{-1}$ ), Phosphorus ( $\text{kg}^{-1}$ ) and Potassium ( $\text{kg}^{-1}$ ) was maximum in  $T_9$  (NPK @ 100% + FYM @ 100% + VC @ 100%). In treatment  $T_9$  the highest grain yield ( $15.58 \text{ q ha}^{-1}$ ) was obtained with C:B ratio of 1:3.26.

**Keywords:** Soil properties; FYM; vermicompost; green gram; yield.

## 1. 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), 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” (Singh et al., 2002). “Green gram is an important pulse crop having high nutritive value. It is not only playing an important role in the human diet but also in improving soil fertility by fixing atmospheric nitrogen. The grain (whole or split) is used as dal or to make flour. It is an excellent source of high-quality protein, the grain contains protein 24.5 %, iron 8.5 mg, mineral 3.5 %, fat 0.5 - 4.33, fibers 4.0 % and carbohydrates 59.9 %. Nutrient management is one of the most important factors that greatly affect the growth, development and yield of green gram. It is one of the popular short-duration grain legumes in India and occupies third place after the green gram to assess the influence of Sulphur and Phosphorus on yield attributes, yield and nutrient uptake by green gram” [1]. “Nitrogen is an important nutrient for all crops. It increases yield nutrition and also increases the protein content. Deficient plants may have stunted growth and develop yellow-green color. It accelerates the photosynthetic behavior of green plants as well as the growth and development of living tissues specially tiller count in cereals” [2]. “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 thereby 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 increased the formation of root nodules. Thus, it helps in fixing more

atmosphere nitrogen in root nodules” [3]. “Potassium is one of the seventeen elements which are essential for the growth and development of plants. Potassium 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 as for making the balance between protein and carbohydrates” [4-7]. “Farmyard manure from cattle and other livestock is an important source of nutrients in livestock-intensive regions. Farmyard manures a major source of nutrient supply also on small farm holdings Manure has long been considered a desirable soil amendment, and reports of its effects on soil properties are numerous. Different animal manure has been used as a source of nutrients for crops cultivated” [8]. “Vermicompost is an environmentally friendly technique that is used for organic solid waste management. Waste crop pulp blended with cow dung and office paper was vermicomposted over 30 days to produce vermicompost which is a solid bio with peas at the planting phase every four weeks. The impacts of vermicompost on the soil were quantified. Application of vermicompost resulted in a 33%, 40%, and 67% increase in the soil nitrogen potassium content respectively. The intensive cropping coupled with imbalanced nutrition supplementation has resulted in a deficiency of certain essential nutrient elements in the soil. To improve productivity, balanced plant nutrition has an imminent role for which the use of organic sources of nutrition can be an option” [9].

## 2. MATERIALS AND METHODS

“The exploratory led at the Soil Science Research Farm of SHUATS, Prayagraj, U.P., which is situated at  $25^{\circ}24'46.14''$  N scope,  $81^{\circ}50'49.95''$  E longitude and 98 m over the mean ocean level. The soil of the test region falls arranged by Inceptisol and in exploratory plots is alluvial soil in nature. The dirt examples haphazardly gather from five distinct locales in the trial plot before culturing activity from a profundity of 0-15 cm and 15-30 cm. The size of

the soil test diminishes by conning and quartering the composites the composites soil test is air dry and passes through a 2mm strainer via setting up the example for physical and synthetic analysis. Agro climatically, Prayagraj addresses the subtropical belt of the South East of Uttar Pradesh is supplied with Tincredibly blistering summer and genuinely cool winter" [10]. "The Maximum temperature of the area comes to up to 46°C-49°C and only occasionally falls as low as 4° c-5°C. The general moistness ranges between 20-94%. The midpoints precipitation of this area is around 1100mm annually. It goes under a subtropical environment getting a mean yearly precipitation of around 1100mm, with significant precipitation from March to the end of May. Be that as it may, intermittent precipitation was additionally normal during winter. The cold weather months were cold while the late spring months were extremely sweltering and dry. The base temperature during the harvest season was to be 21.38°C and the greatest is to be 37.82°C. The base moistness was to be 46.42% and the most extreme was to

be 96.85%" [10]. The data recorded during the course of the investigation will be subjected to statistical analysis by 3 x 3 RBD, as per the method "Analysis of Variance (ANOVA) technique". Experiment was laid out in RBD and the treatment was replicated three times. The significant and non-significant effect was judged with the help of "F" (variance ratio) table.

### 3. RESULTS AND DISCUSSION

#### 3.1 Physical and Chemical Properties

The results showed that the treatment T<sub>9</sub> (NPK @ 100 % + FYM @ 100 % + Vermicompost @ 100 %) was recorded maximum physio-chemical characters such as pore space (%), water holding capacity (%), pH, EC (ds m<sup>-1</sup>), organic carbon (%), available nitrogen (kg ha<sup>-1</sup>), available Phosphorus (kg ha<sup>-1</sup>) and available potassium (kg ha<sup>-1</sup>). While bulk density (Mg m<sup>-3</sup>) and particle density was recorded maximum in T<sub>1</sub> (NPK @ 0 % + FYM @ 100 % + Vermicompost @ 100 %).

**Table 1. Influence of N, P, K and organic manures on physical-chemical properties of soil**

Treatments	Depth (cm)	BD (mg m-1)	PD (mg m-1)	Pore Space (%)	WHC (%)	pH	EC (ds m-1)	OC (%)	N (kg/ha-1)	P (kg/ha-1)	K (kg/ha-1)
T <sub>1</sub>	0-15	1.323	2.507	46.29	43.30	7.15	0.30	0.39	251.50	21.08	181.38
	15-30	1.389	2.514	44.29	41.64	7.20	0.32	0.29	230.84	17.72	151.38
T <sub>2</sub>	0-15	1.321	2.503	47.22	43.88	7.20	0.32	0.46	273.88	22.65	189.39
	15-30	1.347	2.508	45.22	41.55	7.21	0.34	0.35	239.88	20.98	164.72
T <sub>3</sub>	0-15	1.315	2.444	47.40	42.22	7.21	0.36	0.48	274.65	23.76	190.33
	15-30	1.316	2.500	45.40	41.42	7.24	0.37	0.38	235.55	20.74	168.67
T <sub>4</sub>	0-15	1.312	2.446	47.19	43.40	7.19	0.35	0.45	279.19	24.44	196.11
	15-30	1.362	2.490	45.11	41.06	7.21	0.33	0.34	258.92	21.88	169.11
T <sub>5</sub>	0-15	1.306	2.438	47.40	45.46	7.22	0.34	0.49	281.32	26.18	202.17
	15-30	1.315	2.484	45.41	42.51	7.22	0.36	0.39	261.33	22.01	171.17
T <sub>6</sub>	0-15	1.314	2.430	47.82	45.47	7.24	0.37	0.53	283.85	27.84	206.22
	15-30	1.308	2.477	45.80	42.45	7.27	0.38	0.43	265.88	22.47	176.15
T <sub>7</sub>	0-15	1.317	2.442	47.19	44.22	7.23	0.35	0.47	291.19	29.17	209.67
	15-30	1.335	2.463	45.20	44.22	7.47	0.35	0.37	276.84	24.12	178.84
T <sub>8</sub>	0-15	1.309	2.434	47.50	45.42	7.26	0.38	0.51	293.41	31.65	214.87
	15-30	1.311	2.457	45.50	42.39	7.49	0.39	0.41	280.92	25.77	188.87
T <sub>9</sub>	0-15	1.294	2.428	47.90	46.10	7.28	0.40	0.54	298.00	33.65	218.31
	15-30	1.301	2.443	45.90	43.60	7.59	0.42	0.44	282.88	26.41	198.31
F-Test		NS	NS	S	S	NS	NS	S	S	S	S
		NS	NS	S	S	NS	NS	S	S	S	S
S.Em. (±)		-	-	0.23	0.47	-		0.01	5.53	0.75	3.40
				0.23	0.09			0.01	9.75	0.98	3.53
C.D. at 5%		-	-	0.68	1.40	-		0.04	16.57	2.26	10.19
		-	-	0.68	0.28	-		0.02	29.22	2.94	10.59

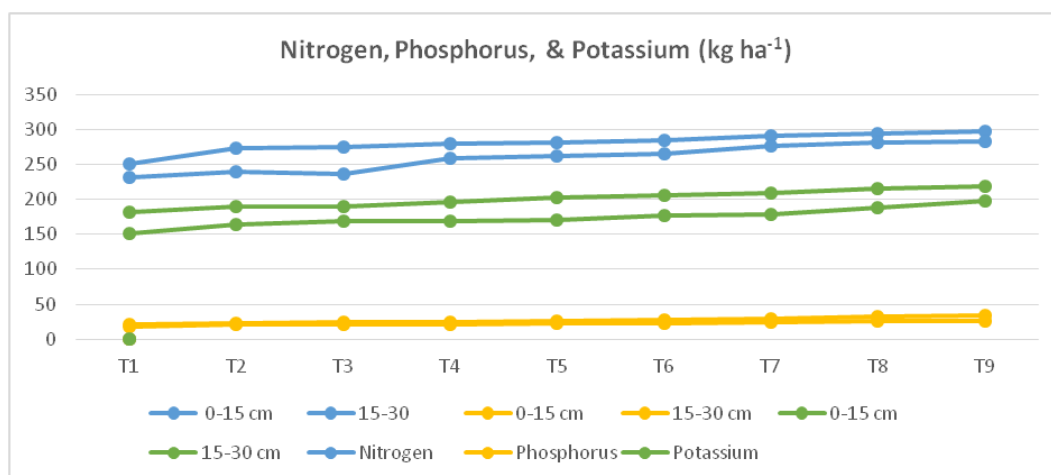


Fig. 1. Influence of N, P, K and organic manures on different treatments on post-harvest soil properties

Table 2. Influence of N, P, K and organic manures on growth and yield parameter of green gram

Treatments	Plant height (cm)			Number of branches		Pods plant <sup>-1</sup>	Seeds pod <sup>-1</sup>	Yield (kg ha <sup>-1</sup> )
	20 DAS	40 DAS	60 DAS	30 DAS	60 DAS			
T <sub>1</sub>	15.5	22.1	30.0	2.9	6.7	11.03	6.20	5.10
T <sub>2</sub>	16.5	23.6	31.9	3.2	6.8	14.98	7.09	8.05
T <sub>3</sub>	18.2	26.4	35.2	3.6	6.9	14.77	7.15	11.16
T <sub>4</sub>	16.5	23.4	31.5	3.2	6.9	14.93	7.03	6.16
T <sub>5</sub>	19.3	29.6	39.6	3.5	7.0	15.80	7.16	9.61
T <sub>6</sub>	19.6	33.4	44.5	3.8	7.4	16.20	7.90	9.94
T <sub>7</sub>	18.5	25.7	35.7	3.5	6.8	15.01	7.10	7.80
T <sub>8</sub>	19.2	30.5	40.4	3.7	7.2	16.68	8.01	11.46
T <sub>9</sub>	25.5	38.1	48.2	3.9	7.5	20.40	8.80	15.58
F-Test	S	S	S	S	S	S	S	S
S. Em. (±)	1.01	1.28	1.11	0.32	0.04	0.55	0.26	36.23
C.D. at 5%	3.03	3.83	3.34	0.96	0.13	1.66	0.77	108.61

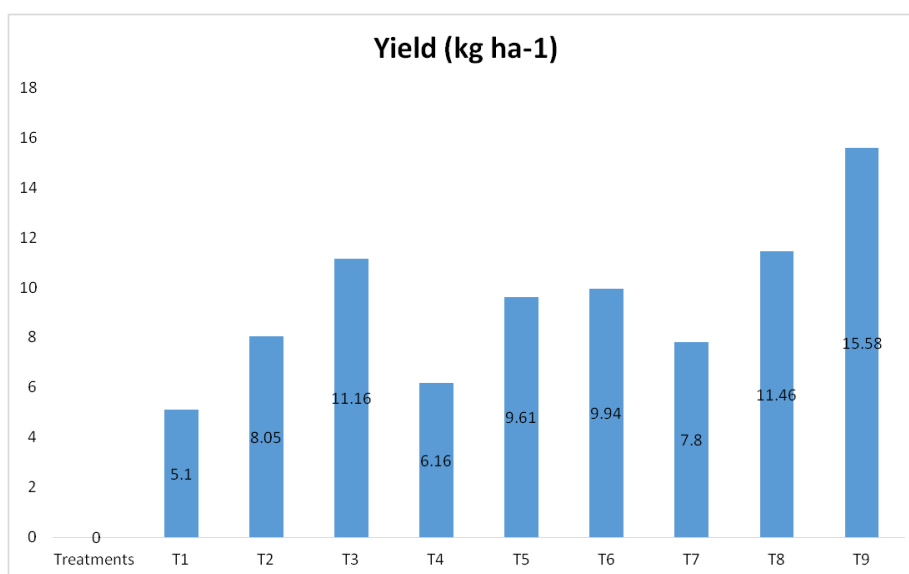


Fig. 2. Influence of N, P, K and organic manures on yield (kg ha<sup>-1</sup>) of green gram

#### 4. CONCLUSION

It is revealed from the trail that treatment T<sub>9</sub> [NPK @ 100 % + FYM @ 100 % + VC @ 100 %] was best for all soil health parameters, significantly highest vegetative growth as well as yield attributes and positive effect on the net return up to ₹86,511.07 ha<sup>-1</sup> with C:B ratio of 1:3.26 of green gram has a positive effect with inorganic fertilizers and manures to obtain higher yield and economic of the farmers.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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