

### Original Research Article

Effect of Inorganic fertilizers, FYM and ~~Nano Urea Slow Release Nitrogen by Nano Urea~~ on Soil Health, Growth and Yield of Cluster bean (*Cyamopsistetragonoloba*L.) Cv. HGS

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#### ABSTRACT

An experiment was conducted ~~on to study the~~“Effect of different level of NPK, FYM and Nano urea on soil health, growth and yield of cluster bean (*Cyamopsistetragonoloba* L.) Cv. HGS 563” at research farm of Soil Science and Agricultural Chemistry. ~~the experiment~~ design laid out in randomized block design (RBD) with three replications. Cluster bean 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). The variety of cluster bean is HGS 563 was taken for research trial. Bulk density (Mg m<sup>-3</sup>) and particle density was maximum in T<sub>1</sub> - [NPK@0% + NU @0% + FYM@0%], soil pore space, water holding capacity, pH, EC, organic carbon, nitrogen, phosphorus and potassium were recorded maximum in T<sub>9</sub> - [NPK @ 100% + NU @ 100% + FYM @ 100%] respectively. In treatment T<sub>9</sub>, the highest pod yield of Cluster bean 55.12 q ha<sup>-1</sup> was obtained with C:B ratio of 1:2.48. To solve the problem of farmers that are facing leaching of Nitrogen due to direct apply of inorganic fertilizers in granule form for that use of Nano Urea can help in reducing leaching and get maximum yield. Use of different level of Nano Urea on crop and analyzing the effect of nano urea on soil physical as well as chemical properties of soil.

**Keywords:** Soil properties, FYM, Nano urea, Cluster bean, Yield, 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), 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 till), and the amount of vegetative cover on the soil surface.

Organic matter tends to increase the ability of all soil to retain water, and also increases infiltration

rates of fine textured soils (Singh *et al.*, 2008). Cluster bean is an important crop having high nutritive value. It is a ~~drought-tolerant~~ ~~drought-sufferance~~ leguminous crop because of tap rooting system and has high capacity to recover from water stress. The root "Guar" represents it's originated from Sanskrit word "Gauaahar" which mean cow fodder of the livestock. It is a drought tolerant crop mainly cultivated in arid and semi- arid regions of the world. In India, it is mainly cultivated area under Uttar Pradesh and Maharashtra. The cultivated area under beans in India during 2018-2019 was 229 lakh ha with the production of 2324 MT. The cultivated area of gaur in Gujrat is 35.82 thousand ha with a production 365.11 thousand. In Rajasthan, cluster bean is commonly grown in Barmer, Churu, Sriganganagar, Nagaur, Jalore, Sikar, Jaisalmer, Bikaner, Jaipur and Alwar districts. Rajasthan occupies first position in India both in area and production. It accounts nearly 82.1 per cent area and 70 per cent production in India. Guar gum is also used in various medical applications such as treatment of atherosclerosis, osteoarthritis, diabetics and diarrhea. Guar gum has an important role as anticancer medicine in treatment of colorectal cancer because it has an excellent property of retarding drug release and sensitivity to microbial degradation in large intestine (Mudgilet *al.*, 2014). 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 (Azadiet *al.*, 2013). 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 increased the formation of root nodules. Thus, it helps in fixing more of atmosphere nitrogen in root nodules (Patilet *al.*, 2011). Potassium is one of the seventeen elements which are essential for 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 for making the balance between protein and carbohydrates (Singh *et al.*, 2003). Farm yard manure from cattle and other livestock is an important source of nutrient in the livestock intensive regions. Farmyard manures are 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 (Sharma *et al.*, 2011). Nano Urea is a nanotechnology based revolutionary Agri-input which provides nitrogen

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to plants. When compared to conventional urea prill, it has a desirable particle size of about 20-50 nm and more surface area (10,000 times over 1 mm urea prill) and number of particles (55,000 nitrogen particles over 1 mm urea prill). In order to improve the N use efficiency by crops, several strategies have been suggested in the past few decades. Nano Urea is a source of nitrogen which is a major essential nutrient required for proper growth and development of a plant. Nitrogen is a key constituent of amino acids, enzymes, genetic materials, photosynthetic pigments and energy transfer compounds in a plant. Typically, nitrogen content in a healthy plant is in the range of 1.5 to 4%. Foliar application of Nano Urea at critical crop growth stages of a plant effectively fulfils its nitrogen requirement and leads to higher crop productivity and quality in comparison to conventional urea (Sharma *et al.*, 2022).

## MATERIALS AND METHODS

The experiment was conducted at the Soil Science Research Farm of SHUATS, Prayagraj, U.P., which is situated at 25°24'46.14" N latitude, 81°50'49.95" E longitude and 98 m over the mean ocean level. The soil of test region falls under Inceptisol and the plots is alluvial soil in nature. The samples were haphazardly gathered 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 soil test diminishes by coning and quartering the composites the composites soil test is air dry and pass through a 2mm strainer via setting up the example sample for physical and synthetic analysis. Agro climatically, Prayagraj addresses the subtropical belt of the south East of Uttar Pradesh, and is supplied with Tincredibly blistering summer and genuinely cool winter. The Maximum temperature of the area comes to up to 46°C-49°C and only occasionally falls as low as 4°C. The general moistness ranges between 20-94%. The midpoints precipitation of this area is around 1100mm annually. It goes under subtropical environment getting the mean yearly precipitation of around 1100mm, significant precipitation from March to end May. Be that as it may, intermittent precipitation was additionally normal during winter. The cold weather months were cold while 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 most extreme was to be 96.85%.

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**Table 1: Physical parameters**

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Particulars	Method
Soil Colour	Munsell <a href="#">soil</a> Colour Chart, 1971
Soil Texture (Sandy loam)	Bouyoucos, 1927
Bulk density ( $\text{Mg m}^{-3}$ )	Muthuava <i>et al.</i> 1992
Particle density ( $\text{Mg m}^{-3}$ )	Muthuava <i>et al.</i> 1992
Water Holding Capacity (%)	Muthuava <i>et al.</i> 1992
Pore Space (%)	Muthuava <i>et al.</i> 1992

**Table 2: Chemical parameters**

Particulars	Methods
Soil pH (1:2)	Jackson, 1967
EC ( $\text{dSm}^{-1}$ )	Wilcox, 1950
Organic carbon (%)	Walkley and Black, 1947
Available Nitrogen ( $\text{kg ha}^{-1}$ )	Subbaihand Asija, 1956
Available Phosphorus ( $\text{kg ha}^{-1}$ )	Olsen <i>et al.</i> , 1954
Available Potassium ( $\text{kg ha}^{-1}$ )	Toth and Prince, 1949

Comment [H6]: 1958 or 1967???

## RESULT AND DISCUSSION

### Physical and Chemical properties

In this finding research Bulk thickness, Particle thickness, pH and EC was found Non-significant. The critical varieties were seen in the event of pore space (%). The greatest (%)

pore space of soil was found in T<sub>9</sub> [NPK @ 100 % + NU @ 100 % + FYM @ 100 %] and least was found in T<sub>1</sub> [NPK @ 0 % + NU @ 0 % + FYM @ 0 %] separately. The huge varieties were seen in the event of Water holding capacity (%). The most extreme water holding capacity limit of soil was found in T<sub>9</sub> [NPK @ 100 % + NU @ 100 % + FYM @ 100 %] and least was found in T<sub>1</sub> [NPK @ 0 % + NU @ 0 % + FYM @ 0 %] separately. In the event of soil properties, we see that there was tremendous distinction between Organic carbon (%). The greatest Organic carbon was kept in T<sub>9</sub> [NPK @ 100 % + NU @ 100 % + FYM @ 100 %] and least was found in T<sub>1</sub> [NPK @ 0 % + NU @ 0 % + FYM @ 0 %] separately. In the event of soil properties, we see that there was critical difference between Nitrogen (kg ha<sup>-1</sup>) and Phosphorus (kg ha<sup>-1</sup>). The greatest Nitrogen and Phosphorus was kept in T<sub>9</sub> [NPK @ 100 % + NU @ 100 % + FYM @ 100 %] and least was found in T<sub>1</sub> [NPK @ 0 % + NU @ 0 % + FYM @ 0 %] separately. In the event of soil properties, we see that there was massive contrast between Potassium (kg ha<sup>-1</sup>). The greatest Potassium was kept in T<sub>9</sub> [NPK @ 100 % + NU @ 100 % + FYM @ 100 %] and least was found in T<sub>1</sub> [NPK @ 0 % + NU @ 0 % + FYM @ 0 %] separately.

**Table 3: Effect of Inorganic fertilizers, FYM and Nano urea on physical-chemical properties of Soil**

Treatments	Depth (cm)	BD (Mg m <sup>-3</sup> )	PD (Mg m <sup>-3</sup> )	Pore Space (%)	WHC (%)	pH	EC (dS m <sup>-1</sup> )	OC (%)	N (kg ha <sup>-1</sup> )	P (kg ha <sup>-1</sup> )	K (kg ha <sup>-1</sup> )
T <sub>1</sub>	0-15	1.39	2.35	44.81	42.81	7.55	0.23	0.48	179.96	18.61	207.57
	15-30	1.47	2.42	42.00	40.35	7.52	0.20	0.32	148.22	15.73	175.79
T <sub>2</sub>	0-15	1.28	2.25	47.16	44.16	7.44	0.25	0.48	191.88	22.65	211.28
	15-30	1.38	2.32	44.24	42.99	7.48	0.22	0.39	160.92	18.17	179.45
T <sub>3</sub>	0-15	1.26	2.15	48.95	46.95	7.35	0.25	0.51	193.65	21.93	213.51
	15-30	1.39	2.21	45.22	43.86	7.39	0.22	0.51	151.36	18.79	176.61
T <sub>4</sub>	0-15	1.33	2.29	44.17	42.17	7.42	0.24	0.51	196.55	26.26	217.77
	15-30	1.39	2.46	42.39	40.68	7.42	0.21	0.45	156.76	22.18	184.61
T <sub>5</sub>	0-15	1.25	2.25	46.98	43.98	7.39	0.25	0.53	221.08	26.04	228.55
	15-30	1.39	2.31	43.32	41.09	7.55	0.23	0.45	181.37	21.96	182.62
T <sub>6</sub>	0-15	1.11	2.15	47.18	45.18	7.30	0.26	0.57	242.55	28.77	230.60
	15-30	1.23	2.42	44.56	43.19	7.30	0.23	0.51	184.58	23.99	187.22

<b>T<sub>7</sub></b>	0-15	1.30	2.34	45.01	43.01	7.18	0.24	0.52	278.69	27.17	249
	15-30	1.41	2.40	43.37	41.34	7.10	0.21	0.44	244.20	23.18	171.76
<b>T<sub>8</sub></b>	0-15	1.28	2.24	46.18	43.18	7.16	0.24	0.52	288.42	30.07	252.45
	15-30	1.33	2.41	44.66	41.63	7.17	0.21	0.53	257.38	26.69	185.40
<b>T<sub>9</sub></b>	0-15	1.17	2.18	48.20	45.20	7.13	0.27	0.54	314.22	30.72	262.65
	15-30	1.28	2.20	46.68	42.44	7.07	0.24	0.56	268.98	27.25	196.20
<b>F-Test</b>		NS	NS	S	S	NS	NS	S	S	S	S
		NS	NS	S	S	NS	NS	S	S	S	S
<b>S.Em.</b>		-	-	0.40	0.59	-	-	0.01	5.43	0.62	4.44
<b>(±)</b>				0.65	0.38			0.03	5.04	0.44	2.80
<b>C.D.</b> at 5%		-	-	1.17	1.73	-	-	0.02	16.29	1.84	13.32
		-	-	1.95	1.10	-	-	0.07	15.11	1.32	8.40

Comment [H7]: Where are the details of treatments?????

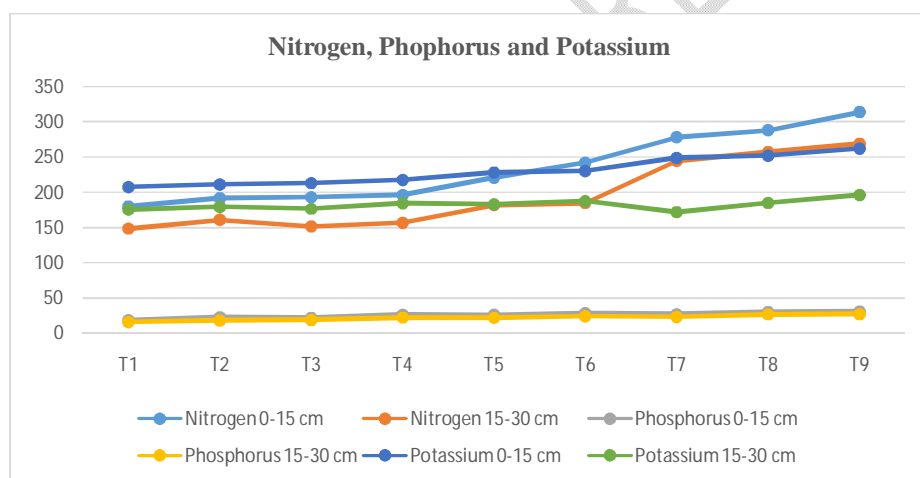
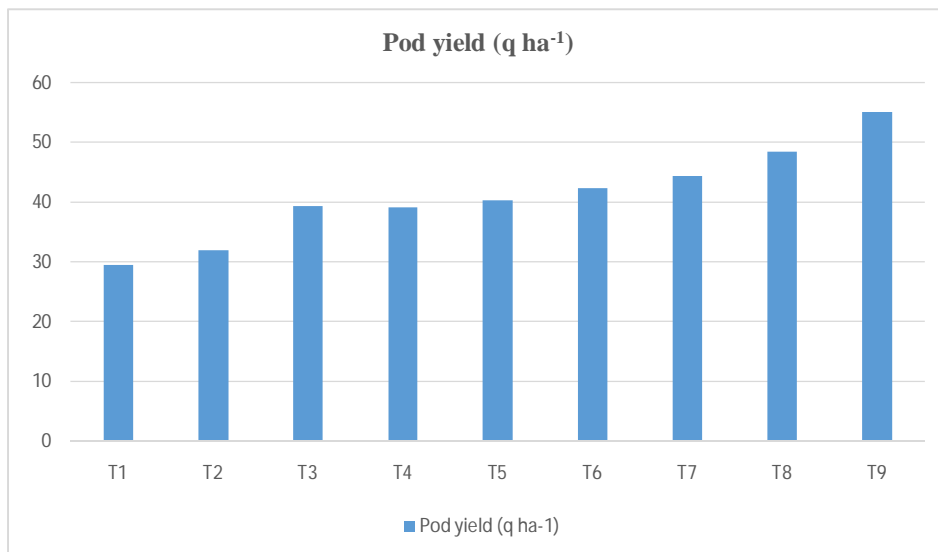


Fig 1:Effect of Inorganic fertilizers, FYM and Nano urea on different treatments on post-harvest Soil

Table 4:Effect of Inorganic fertilizers, FYM and Nano urea on growth and yield parameters of cluster bean

Treatments	Plant height (cm)	No. of Branches	Pods plant <sup>-1</sup>	No. of leaves plant <sup>-1</sup>	podyield( qha <sup>-1</sup> )

				plant <sup>-1</sup>					
	30 DAS	60 DAS	90 DAS			30 DAS	60 DAS	90 DAS	
<b>T<sub>1</sub></b>	13.39	40.85	48.15	4.06	38.19	7.71	16.09	21.18	29.45
<b>T<sub>2</sub></b>	16.35	53.25	58.83	4.97	40.57	7.78	17.47	21.98	31.95
<b>T<sup>3</sup></b>	17.62	54.62	60.44	5.20	42.59	7.91	17.62	23.11	37.29
<b>T<sub>4</sub></b>	19.19	58.33	66.05	6.11	45.71	8.09	17.78	23.60	39.12
<b>T<sub>5</sub></b>	20.77	57.77	66.81	6.35	57.81	8.13	18.04	23.85	40.29
<b>T<sub>6</sub></b>	21.84	60.98	71.76	6.35	60.38	8.16	18.14	23.91	42.29
<b>T<sub>7</sub></b>	23.72	67.86	77.74	6.44	74.97	8.20	18.31	24.44	44.37
<b>T<sub>8</sub></b>	24.62	66.76	78.54	6.73	78.11	8.22	18.53	24.91	48.45
<b>T<sub>9</sub></b>	26.10	68.44	80.24	6.93	78.44	8.33	18.62	25.18	55.12
<b>F-Test</b>	S	S	S	S	S	S			S
<b>S. Em. (±)</b>	0.53	0.94	2.01	0.32	2.23	0.13	0.24	0.41	1.96
<b>C.D. at 5%</b>	1.58	2.82	6.03	0.96	6.68	0.39	0.72	1.22	5.86



**Fig 2: Total pod yield (q ha<sup>-1</sup>)**

### CONCLUSION

It concluded from trail that treatment T<sub>9</sub> - [NPK @100 % +NU @100 % +FYM@100 %] was best in all soil health parameters. T<sub>9</sub> also provide significantly highest vegetative growth as well as yield attributes and positive effect on net return up to ₹80,760 ha<sup>-1</sup> with C:B ratio of 1:2.48 of cluster bean therefore, it is suggested that T<sub>9</sub>- found most suitable for sustainable soil health parameters, cluster bean to obtain higher yield and economic of the farmers, the trail was based on one season, so that the findings can be substantiated before recommendation.

### Reference:

**Azadi, E., Rafiee, M. and Hadis, N. (2013)** 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*, **4**(2):51-55

~~**Mudgil, D., Barak, S., and Khatkar, B.S. (2014)** Guar gum: processing, properties and food applications. *Journal of food science and technology*, **51**, 409-418.~~

~~**Patil, S.C., Jagtap, D.N. and Bhale, V.M. (2011)** Effect of phosphorus and sulphur on growth and yield of moong bean. *Internet J. agric. Sci.*, **7**(2):348-351.~~

~~Singh R.S. and Yadav M.K. (2008) Effect of phosphorus and biofertilizers on growth, yield and nutrient uptake of long duration mung under rainfed condition. *Journal of Food Legumes*, 21 (1):46-48.~~

Black, C.A. (1965) Methods of soil analysis 2, Am. Soc. Agron. Madison, Wisconsin, U.S.A.

Comment [H8]: Not include in text.

Jackson, M. L. (1958). Soil chemical analysis, Second edition Indian Reprint, prentice hall of India, New Delhi. Pp-498.

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Mudgil, D., Barak, S., and Khatkar, B.S. (2014) Guar gum: processing, properties and food applications. *Journal of food science and technology*, 51, 409-418.

Munsell, A. H. (1971). A Color Notation. Baltimore, MD: Munsell Color Company. ed.; 1(2):65.

Muthuval, P., Udaysoorian, C., Natesan, R., Ramaswami, P. P. (1992) Introduction to Soil analysis, Tamil Nadu Agricultural University, Coimbatore, 641002.

Patil, S.C., Jagtap, D.N. and Bhale, V.M. (2011) Effect of phosphorus and sulphur on growth and yield of moongbean. *Internet J. agric. Sci.*, 7(2):348-351.

Singh, B. and Pareek, R. G. (2003) Effect of phosphorus and biofertilizers on growth and yield of mungbean. Indian J. Pulses Res., 16 (1): 31 -33. status of clusterbean. Legume Research, 35 (1): 32-35.

Singh R.S. and Yadav M.K. (2008) Effect of phosphorus and biofertilizers on growth, yield and nutrient uptake of long duration mung under rainfed condition. *Journal of Food Legumes*, 21 (1):46-48.

Sharma, P., Majumdar, S.P., and Sharma, S.R., (2011) Impact of vermicompost, potassium and iron on physico-chemical properties of Typic Ustipsamment. Environment and Ecology, 31: 1980-1983.

Sharma, S. K., Sharma, P. K., Mandeewal, R. L., Sharma, V., Chaudhary, R., Pandey, R. & Gupta, S. (2022). Effect of foliar application of nano-urea under different nitrogen levels on growth and nutrient content of pearl millet (*Pennisetum glaucum* L.). *International Journal of Plant & Soil Science*, 34(20), 149-155.

Subbiah, B. V. and Asija, G. L. (1956) A rapid procedure for the estimate of available nitrogen in soil. *Current Sciences*, 2(5): 259-260.

Toth, S. J., Prince, A. L. (1949) Estimation of Cation Exchange Capacity and exchangeable Ca, K and Na Content of Soil by Flame Photometer technique. *Soil Sci.*, 6(7): 439-445.

**Walkley, A. and Black, I. A. (1947)** Critical examination of rapid method for determining organic carbon in soils, effect of variance in digestion conditions and of inorganic soil constituents. *Soil scipp.* 632-251.

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