

Original Research Article

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## Response of NPK and Neem Cake on Soil Properties, Growth and Yield of Cluster Bean (*Cymopsis tetragonoloba* L.) Var-Laxmi-50

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### ABSTRACT

#### Keywords

Cluster bean, NPK, Neem cake, Physical, Chemical properties of soil

#### Article Info

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A field study was conducted on the “Response of NPK and Neem Cake on Soil properties, Growth and yield of Cluster bean (*Cymopsis tetragonoloba* L.) Var-Laxmi-50” at the Soil Science & Agricultural Chemistry Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during Kharif season 2018. The soil of experimental area falls in order Inceptisol and soil texture was sandy loam. treatment was T8L2N2 (@ N20P40K40 NPK kg ha<sup>-1</sup> + 5 q Neem Cake ha<sup>-1</sup>) organic carbon 0.76 %, available nitrogen 324.26 kg ha<sup>-1</sup>, available phosphorus 32.93 kg ha<sup>-1</sup> and available potassium 203.03 kg ha<sup>-1</sup>, pore space (%) 49.87, bulk density 1.067 (Mg m<sup>-3</sup>) and particle density 2.612 (Mg m<sup>-3</sup>), pH 6.78, EC at 250C (dS m<sup>-1</sup>) 0.23 as compared to T0 L0N0 (control).

### Introduction

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] popularly known as “Guar” is an important legume crop mainly grown under rainfed condition in arid and semi-regions of Rajasthan during *kharif* season. It is very hardy and drought tolerant crop. Its deep penetrating roots enable the plant to utilize available moisture more efficiently and thus offer better scope for rainfed cropping. The crop also survives even at moderate salinity and alkalinity conditions. There is no other legume crop so hardy and drought tolerant as cluster bean (Kherawat *et al.*, 2013).

Among dry land crops, guar occupies an important place in the national economy because of its industrial importance mainly due to the presence of gum in its endosperm (35 to 40 %). Cluster bean is grown for different purposes from very ancient time viz., vegetable, green fodder, manure and feed. It provides nutritional concentrate and fodder for cattle and adds to the fertility of soil by fixing considerable amount of atmospheric nitrogen. Cluster bean seed is used as a concentrate for animal and for extraction of “gum”. Seed of cluster bean contain 28 to 33 % gum. Guar gum has its use in several industries viz., textiles, paper,

petroleum, pharmaceuticals, food processing cosmetics, mining explosives, oil drilling etc. Cluster bean is a leguminous crop and can fix 37-196 kg N ha<sup>-1</sup> year<sup>-1</sup>.

In India, cluster bean is mostly grown in Rajasthan, Haryana, Punjab, Uttar Pradesh and Madhya Pradesh. Rajasthan occupies first position in India both in area and production. It accounts for almost 82.1% area and 70% production in India. Haryana and Gujarat has second and third position respectively. Rajasthan has an area of 30 lakh ha, production of 15.46 lakh tonnes with a productivity of 515 kg ha<sup>-1</sup>. Rajasthan guar is mainly grown in Barmer, Churu, Sri ganganagar, Nagaur, Jalore, Sikar, Jaisalmer, Bikaner, Jaipur, Jhunjhunu and Alwar districts (Anonymous 2010-11).

The pods of cluster bean are as rich in food value as that of French bean. The composition of cluster bean is 81.0 (g) moisture, 10.8 (g) carbohydrate, 3.2 (g) protein, 1.4 (g) of fat, 1.4 (g) of minerals, 0.09 (mg) thiamine, 0.03 (mg) riboflavin, 47 I.U. vitamin C, 316 I.U. vitamin A (100 g<sup>-1</sup>) of edible portion).

**Nitrogen:** also plays an important role in synthesis of chlorophyll and amino acid, which contributes to the building units of protein and thus the growth of plants. Insufficient nitrogen may reduce yield drastically and deteriorates the quality of produce. Cluster bean being a legume crop which has the capacity to fix atmospheric nitrogen by its effective root nodules the major part of nitrogen is met through *rhizobium* present in the root nodules hence, crop does not require additional nitrogen for its initial growth and development stage. The nitrogen application increased crude protein, crude fibre contents, ash percentage, carbohydrates, leaf area per plant, dry matter and green fodder yield of cluster bean cultivars (Ayub *et al.*, 2010).

**Phosphorus:** The phosphorus is the second important plant nutrients. An application of phosphorus influences symbiotic nitrogen fixation yield and quality of cluster pods.

**Potassium:** The potassium activates more than 60 enzymes and enzymatically catalyzes the system involved in photosynthesis, metabolism and translocation of carbohydrates and proteins, membrane permeability, stomatal regulation and water utilization. Other benefits ascribed to K include resistance of plants against pests, disease and stresses caused by drought, frost, salinity, sodicity and in assuring improved crop quality characteristics (Kherawat *et al.*, 2013).

#### **Neem cake**

Neem cake known as non edible oil cake organic manure. The composition of Neem cake is 5.2 % N, 1.0 % P, 1.4 % K. Neem cake also act as a nematocide. Neem cake act as a nitrogen inhibitor means reduce the nitrification. It supplies the available nitrogen for a long time in the soil. Katyayan, A. (2012).

#### **Materials and Methods**

The investigation on “Response of NPK and Neem Cake on Soil properties, Growth and yield of Cluster bean (*Cymopsis tetragonoloba* L.) Var-Laxmi-50” was carried out at the Dept. of Soil Science Research Farm, of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj duration kharif season 2018. The details of experiments site, soil and climate is described in this chapter together with the experimental design, layout plan, cultural practice, particulars of treatments, planting material and techniques employed for the parameters

It is situated at 25°24'23" N latitude, 81°50'38" Elongitude and at the altitude of 98 meter above the sea level. The area of Prayagraj district 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°C – 48°C and seldom falls as low as 4°C – 5°C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually.

Experiment will be laid out in 3x3 factorial randomized block design with three levels of NPK and Neem cake plot size was 2x2 m<sup>2</sup> for crop seed rate is 15-20 kg ha<sup>-1</sup> (*Cymopsis tetragonoloba L.*) Var Luxmi-50. Cluster bean sowing was done on in 07-Aug-2018 and the source of NPK an Neem cake were Urea, SSP, MOP and Neem cake respectively. Dose of fertilizer was applied in respective plots according to treatment allocation uniform furrows opened by about 5 cm. All the agronomic practices were carried out uniformly to raise the crop. The crop was harvested on November 2018.

## Results and Discussion

### Bulk density (Mg m<sup>-3</sup>)

The data presented in shows the Bulk density (Mgm<sup>-3</sup>) of soil as influenced by NPK and Neem cake seed inoculation. The response Bulk density (Mgm<sup>-3</sup>) of soil was found to be non-significant in levels of NPK and Neem cake seed inoculation. The maximum Bulk density (Mg m<sup>-3</sup>) of soil was recorded 1.32 Mg m<sup>-3</sup> in treatment T<sub>0</sub> (control) and minimum Bulk density (Mgm<sup>-3</sup>) of soil was recorded 1.06 Mgm<sup>-3</sup> in treatment T<sub>8</sub> (@100%NPK+100% Neem cake). Similar results were also reported by Kumar *et al.*, (2008), Reddy *et al.*, (2005).

### Particle density (Mg m<sup>-3</sup>)

The data presented in shows the Particle density (Mg m<sup>-3</sup>) of soil as influenced by NPK and Neem cake seed inoculation. The response Particle density (Mg m<sup>-3</sup>) of soil was found to be non-significant in levels of NPK and Neem cake seed inoculation. The maximum Particle density (Mg m<sup>-3</sup>) of soil was recorded 2.61 Mg m<sup>-3</sup> in treatment T<sub>8</sub> (@100%NPK+100% Neem cake) and minimum Particle density (Mg m<sup>-3</sup>) of soil was recorded 2.26 Mg m<sup>-3</sup> in treatment T<sub>0</sub> (control). Similar results were also reported by Kumar *et al.*, (2008) and Reddy *et al.*, (2005) (Table 1 and Fig. 1).

### Pore space (%)

The data presented in shows the % Pore space of soil as influenced by NPK and Neem cake seed inoculation. The response of soil pore space was found to be significant in levels of NPK and Neem cake seed inoculation. The maximum soil pore space was recorded 49.87 % in treatment T<sub>8</sub> (@100%NPK+100% Neem cake) and minimum soil pore space was recorded 45.66 % in treatment T<sub>0</sub> (Control). Similar results were also reported by Kumar *et al.*, (2008) and Reddy *et al.*, (2005).

### Soil pH (1:2) w/v

The data presented in shows the pH of soil as influenced be NPK and Neem cake seed inoculation. The response of soil pH was found to be significant in levels of N P K and Neem cake seed inoculation. The maximum soil pH was recorded 7.33 in treatment T<sub>1</sub> (@ 0 % NPK @ +100% Neem cake) and minimum soil pH was recorded 6.77 in treatment T<sub>8</sub> (@100%NPK+100% Neem cake). Similar results were also reported by Takase *et al.*, (2011) and Cakmak *et al.*, (2010).

### EC (dS m<sup>-1</sup>)

The data presented in shows the EC (dS m<sup>-1</sup>) of soil as influenced by NPK and Neem cake seed inoculation. The response of EC (dS m<sup>-1</sup>) of soil was found to be non-significant in levels of NPK and Neem cake seed inoculation. The maximum EC (dS m<sup>-1</sup>) of soil was recorded 0.234 dS m<sup>-1</sup> in treatment T<sub>8</sub> (@100%NPK+100% Neem cake) and minimum EC (dS m<sup>-1</sup>) of soil was recorded 0.187 dS m<sup>-1</sup> in treatment T<sub>0</sub> (control). Similar results were also reported by Takase *et al.*, (2011).

### % Organic carbon

The data presented in shows the % Organic carbon in soil as influenced by NPK and Neem cake seed inoculation. The % Organic carbon in soil increased significantly with the increase in levels of NPK and Neem cake seed inoculation. The maximum % Organic carbon in soil was recorded 0.76 % in treatment T<sub>8</sub> (@100%NPK+100% Neem cake) which was significantly higher than any other treatment combination and the

minimum % Organic carbon in soil was recorded 0.48 % in treatment T<sub>0</sub> (control). Legumes have potential to improve soil nutrients status through biological nitrogen fixation and incorporation of biomass in to the soil as green manure. Similar findings were recorded by Kumar *et al.*, (2008) (Table 1 and Fig. 2).

### Available nitrogen (Kg ha<sup>-1</sup>)

The data presented in shows the available Nitrogen in soil as influenced by NPK and Neem cake seed inoculation. The available Nitrogen in soil increased significantly with the increase in levels of NPK and Neem cake seed inoculation. The maximum available Nitrogen in soil was recorded 324.26 (Kg ha<sup>-1</sup>) in treatment T<sub>8</sub> (@100%NPK+100% Neem cake) which was significantly higher than any other treatment combination and the minimum available Nitrogen in soil was recorded 251.86 (Kg ha<sup>-1</sup>) in treatment T<sub>0</sub> (control). Similar findings were also recorded by Mitra *et al.*, (2006) and Banerjee *et al.*, (2006).

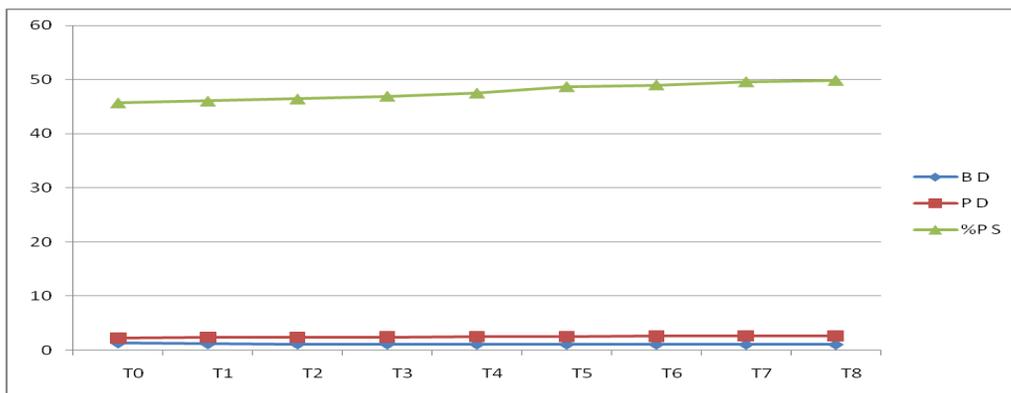
**Table.1** Response of NPK and neem cake on physical parameters of soil in cluster bean

Treatment	bulk density (Mgm <sup>-3</sup> )	Particle density (Mgm <sup>-3</sup> )	Pore space (%)
T <sub>0</sub>	1.32	2.27	45.66
T <sub>1</sub>	1.16	2.35	46.00
T <sub>2</sub>	1.12	2.39	46.40
T <sub>3</sub>	1.11	2.44	46.90
T <sub>4</sub>	1.09	2.49	47.50
T <sub>5</sub>	1.08	2.52	48.70
T <sub>6</sub>	1.07	2.57	49.01
T <sub>7</sub>	1.07	2.59	49.60
T <sub>8</sub>	1.06	2.62	49.87
F- test	NS	NS	S
S. Em±	0.008	0.05	0.044
C.D. (P= 0.05)	0.0017	0.011	0.095

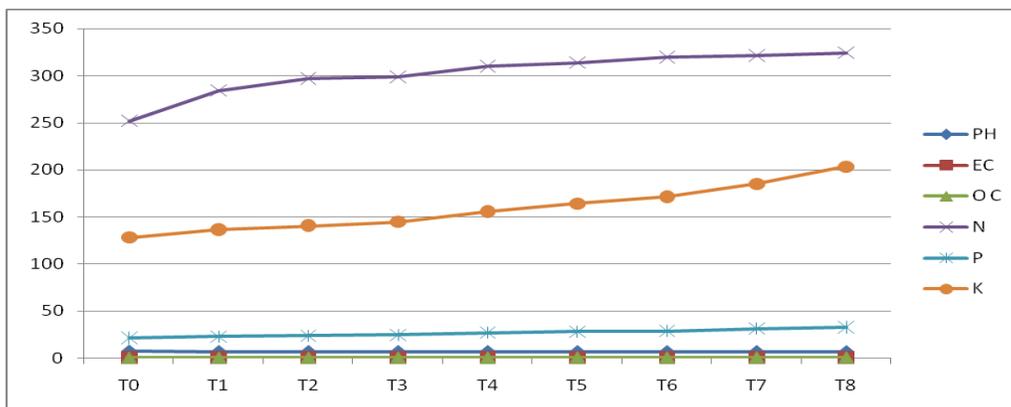
**Table.2** Response of NPK and neem cake on chemical parameters of soil in cluster bean

Treatment	pH (1:2) w/v	EC (dSm <sup>-1</sup> )	Organic carbon (%)	Nitrogen (Kg ha <sup>-1</sup> )	Phospho rus (Kg ha <sup>-1</sup> )	Potassi um (Kg ha <sup>-1</sup> )
T <sub>0</sub>	7.33	0.187	0.48	251.86	21.10	128.10
T <sub>1</sub>	6.96	0.187	0.54	284.16	22.56	136.40
T <sub>2</sub>	6.93	0.197	0.57	296.83	23.63	140.50
T <sub>3</sub>	6.90	0.213	0.60	298.76	24.60	144.73
T <sub>4</sub>	6.96	0.220	0.67	310.00	26.86	155.46
T <sub>5</sub>	6.83	0.227	0.71	313.83	28.06	164.10
T <sub>6</sub>	6.83	0.227	0.73	319.76	28.83	171.30
T <sub>7</sub>	6.86	0.237	0.74	321.43	31.56	185.10
T <sub>8</sub>	6.76	0.233	0.76	324.26	32.93	203.22
F- test	S	S	S	S	S	S
S. Em±	0.042	0.003	0.004	2.342	0.222	1.683
C.D. (P= 0.05)	0.090	0.006	0.009	5.007	0.474	3.598

**Fig.1** Response of NPK and neem cake on physical parameters of soil in cluster bean



**Fig.2** Response of NPK and neem cake on chemical parameters of soil in cluster bean



### Available phosphorus (Kgha<sup>-1</sup>)

The data presented in shows the available Phosphorus in soil as influenced by NPK and Neem cake seed inoculation. The available Phosphorus in soil increased significantly with the increase in levels of NPK and Neem cake seed inoculation. The maximum available Phosphorus in soil was recorded 32.93 (Kg ha<sup>-1</sup>) in treatment T<sub>8</sub> (@100%NPK+100% Neem cake) which was significantly higher than any other treatment combination and the minimum available Phosphorus in soil was recorded 21.10 (Kg ha<sup>-1</sup>) in treatment T<sub>0</sub> (control). Similar findings were also recorded by Hussain *et al.*, (2012).

### Available Potassium (Kgha<sup>-1</sup>)

The data presented shows the available Potassium in soil as influenced by NPK and Neem cake seed inoculation. The available Potassium in soil increased significantly with the increase in levels of NPK and Neem cake seed inoculation. The maximum available Potassium in soil was recorded 203.23 (Kgha<sup>-1</sup>) in treatment T<sub>8</sub> (@100%NPK+100% Neem cake) which was significantly higher than any other treatment combination and the minimum available Potassium in soil was recorded 128.10 (Kg ha<sup>-1</sup>) in treatment T<sub>0</sub> (control). Similar findings were also recorded by Beg *et al.*, (2012).

Hence concluded, in the present investigation, it was apparent that application of NPK and Neem cake fertilizer in treatment T<sub>8</sub> (20 Kg N, 40 Kg P, K 40 Kg and Neem cake 5 q ha<sup>-1</sup>) was found on physical and chemical parameters of soil such as bulk density, particle density, % pore space, EC, pH, Organic carbon, Available NPK than other treatment combinations. Bulk density, Particle density and EC are non-significant. Thus it can be concluded that different levels of NPK

and Neem cake fertilizer improved soil available nutrient, increased soil available nitrogen, phosphorus, potassium and electrical conductivity. However, pH of soil decreased and also among the treatments T<sub>8</sub> recorded the best treatment which increased the availability of nutrient and influenced on physical properties of soil as well.

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