TITLE

Response of Different Levels of NPK and FYM on Growth and Yield of Cluster bean (*Cyamopsis tetragonoloba* L.) *var.* Neelam-61

Article type: Original Research Article

ABSTRACT

Today, with the advancement of environment pollution and health that is obtained from the improper use of inorganic fertilizer, production and use of organic fertilizer is considered as an important approach in the field of soil science in the world's interest to investors. A research was conducted during *Zaid* season 2022-23 on central research farm of department of soil science and agricultural chemistry,(NAI) SHUATS,Prayagraj. Field trial was designed on Randomized Block Design with three replications and nine treatments.It may be concluded from the trial that the different level of NPK and FYM in the experiment gave the highest value.The best results were obtained with T_9 treatmentwhich included ($N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}).This treatment resulted in the maximum plants heightwith the most leaves,no. of clusters $plant^{-1}$, no. of pod $cluster^{-1}$, no of pod $plant^{-1}$,length of pod (cm)and highest pod yield. In contrast, the control treatment (T_1) had the lowest results in all categories.The availableNPK and FYM with the treatment combination of T_9($N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}) was found to be the best for the improvement of growth and yield of cluster bean.Therefore,farmers of Prayagraj region can adopt this combination to give the highest yield of cluster bean.

INTRODUCTION

The term "Guar" derives from the Sanskrit word "Gauahar," which means cow fodder or other livestock fodder. An annual legume plant known as the cluster bean (*Cyamopsis tetragonoloba* L.) (2n=14) is cultivated for its edible, fodder, gum, and green fertilizer qualities. An important legume crop, the cluster beanis primarily grown under rainfed conditions in arid and semi-arid areas of India during the *Zaid* season.It has everincreasing demand in thenational as well as international market.Green and tenderpods are nutritionally rich in energy 16 Kcal, moisture81%, protein 3.2g, fat 1.4g, carbohydrate 10.8g,vitamin A 65.31 IU, vitamin C 49mg, calcium 57mgandiron 4.5mg in 100 g of edible portion (Kumar and Singh,2002). Cluster beans are the only legume product that is as resistant and drought-tolerant, and they are particularly well-suited to the soil climate of Rajasthan(Porter *et al*., 1996).In the recent years, this crop has assumedgreat significance in industrial sector due to thepresence of good quality of gum in the endosperm of itsseed and also having 28 to 33% gum. The naturalpolysaccharide water-soluble polymer found in theendosperm (Reddy *et al*., 2011).

Nitrogen is necessary for the production of chlorophyll and amino acids, which serve as the building blocks for proteins and, as a result, promote plant growth. Nitrogen-applied cluster bean varieties produced more crude protein, crude fibre, ash percentage, carbohydrates, leaf area per plant, dry matter, and green fodder(Ayub *et al*., 2012). Cluster bean is a legume crop with the ability to fix atmospheric nitrogen through its efficient root nodules. The nitrogen application boosted the yield of cluster bean cultivars in terms of dry matter, crude protein, crude fiber, ash content, carbohydrates, leaf area per plant and crude protein (Ayub *et al.*,2010).The second-most crucial nutrient that must be added to the soil in order to maintain plant development and crop yield is phosphorus(Singh *et al.*,2000).Almost all of a plant's primary metabolic functions, such as photosynthesis, energy transfer, signal transduction, macromolecular biosynthesis, and respiration, depend on phosphorus (Rashmitha *et al.*, 2021). Following nitrogen and phosphorus, potassium is the third most significant necessary nutrient. The mechanism involved in photosynthesis, the metabolism and translocation of carbohydrates and proteins, membrane permeability, stomata regulation and water utilization is enzymatically catalyzed by the potassium, which also activates more than 60 enzymes. Other advantages of K include better crop quality actions and plant resistance to pests, diseases, and stresses from drought, frost, salinity and solidity (Kherawat *et al.*, 2013).Farmyard manure refers to the decomposed mixture of dung and urine of farm animals along with litter and left-over material from roughages or

fodder fed to the cattle. It supplies nitrogen, phosphorus, potassium and micronutrients like Fe, S, Mo, Zn etc. in available from to the plants through biological decomposition and improves physical-chemical properties of soil such as aggregation, aeration, permeability, water holding capacity, slow release of nutrients, increasing in cation exchange capacity, stimulation of soil flora and fauna *etc.*

Materials and Methods

The course of present investigation entitled "Response of Different Levels of NPK and FYM on Growth and Yield of Cluster bean (*Cyamopsis tetragonoloba* L.) *var.* Neelam-61"comprise of a field experiment which was carried out at the research farm of soil science and agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during in*Zaid* season 2022. All pots were fertilized with the basal dose of 20 kg N/ha, 40 kg P_2O_5/ha and 20 kg K_2O/ha in the form of Urea, SSP and Muriate of Potash, respectively.A well decomposed FYM contains 0.5%N, 0.2%P_2O_5 and 0.5%K_2O (Hand book of Agriculture by ICAR, 2010).The maximum temperature of the location ranges between 46-48^{0}C and seldom falls below 4-5^{0}C. The relative humidity ranges between 20-94%. The average rainfall of this area is around 1100mm annually.In interculture operations one hand weeding was done manually with *Khurpi* at 25 DAS followed by second manual weeding was done at 45 DAS to minimize the crop weed competition.Experiment was laid out in randomized block design (RBD) with 9 treatments. The treatments have been replicated three times. The different treatments were employed randomly in each replication. The details of the treatment combinations are given below.

Table 1. Treatment combinations

Treatments	Treatment Combinations
T_1	[Absolute Control]
T_2	@$N_0P_0K_0$kg ha^{-1} + @FYM_5 t ha^{-1}
T_3	@$N_0P_0K_0$kg ha^{-1} + @FYM_{10} t ha^{-1}
T_4	@$N_{10}P_{20}K_{20}$kg ha^{-1} + @FYM_0 t ha^{-1}
T_5	@$N_{10}P_{20}K_{20}$ kg ha^{-1} + @FYM_5t ha^{-1}
T_6	@$N_{10}P_{20}K_{20}$ kg ha^{-1} + @FYM_{10} t ha^{-1}
T_7	@$N_{20}P_{40}K_{40}$kg ha^{-1} +@FYM_0 t ha^{-1}
T_8	@$N_{20}P_{40}K_{40}$ kg ha^{-1} + @FYM_5 t ha^{-1}
T_9	@$N_{20}P_{40}K_{40}$kg ha^{-1} + @FYM_{10} t ha^{-1}

Results and discussions

Plant height (cm)

Thesignificantly maximum plant height was recorded as 21.04, 68.80, and 121.62 cm in $T_9[N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}]and the minimum plant height was recorded as 13.52, 50.45 and 82.53 cmin T_1 (Absolute Control) at 30, 60 and 90 DAS respectively. Increase in plant height due to increase in NPK and FYM may be due to adequate supply of nutrients which in turn helps in vigorous vegetative growth of plants and subsequently increase the plant through cell elongation, cell division, photosynthesis and turbidity of plant cell.Similar findings were reported by, Chavan *et al.* (2015), Banti *et al*., (2023), Deshmukh *et al.*(2014).

Number of leaves plant^{-1}

Thesignificantly maximumnumber of leaves plant^{-1} was recorded 20.11, 37.95 and 46.88 in treatment $T_9[N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}]and the minimum number of leaves plant^{-1} was recorded as 4.75, 10.59 and 17.87in T_1 [Absolute Control] at 30, 60 and 90 DAS respectively. Increase in number of leaves may be due to adequate nutrients supply which enhanced the vegetative growth of plant and subsequently the number of leaves. Similar findings were reported by,Chavan *et al.*(2015), Ayub *et al.*(2012).

Number of cluster plant^{-1}

The significantlymaximum number of cluster plant^{-1} was recorded 25.54 in treatment $T_9[N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}]respectivelywhich was superior all overother treatment combination. The minimum number of cluster plant^{-1}was recorded 11.55 in treatment T_1[Absolute Control] respectively.Similar results were also reported byChavan *et al.*(2015), Ayub *et al.* (2012).

Number of pod cluster^{-1}

Thesignificantly maximum number of pod cluster^{-1} was recorded 12.12 in treatment $T_9[N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}]respectivelywhich was superiorallover other treatmentcombination. The minimum number of pod cluster^{-1}was recorded 4.64 in treatment T_1[Absolute Control] respectively. Increased in number of pods may be due to adequate

availability of nutrients during reproductive stage of crop results in the formation of more pods cluster. Similar results were also reported byChavan *et al.*(2015), Deshmukh *et al.*(2014).

Number of pod plant^{-1}

The significantlymaximum number of podplant^{-1} was recorded 87.79 in treatment T_9[$N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}]respectively and minimum number of pod plant^{-1}was recorded 33.06 in treatment T_1[Absolute Control] respectively. Increased in number of pods may be due to adequate availability of nutrients during reproductive stage of crop results in the formation of more pods. Similar results were also reported byChavan *et al.*(2015), Deshmukh *et al.*(2014).

Length of pod (cm)

The significantlymaximum length of pod (cm) was recorded 12.77cm in treatment T_9[$N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}]respectivelywhich was superior all over other treatment combination. The minimum length of pod (cm)was recorded 9.92cm in treatment T_1[Absolute Control] respectively.Similar findings were reportedDeshmsukh *et al.* (2014), Sajid *et al*. (2009), Singh *et al*. (2007).

Total pod yield (qha^{-1})

The significantlymaximum pod yield (qha^{-1}) was recorded 60.88 qha^{-1} in treatment T_9[$N_{20}P_{40}K_{40}$kg ha^{-1} + FYM_{10} t ha^{-1}]respectively, which was higher than pod yield any other treatment combination. The minimum of pod yield (qha^{-1})was recorded 32.38 qha^{-1} in treatment T_1(Absolute Control) respectively.Similar results were also reported byDeshmukh *et al.*(2014), Ayub *et al.* (2012), Sajid *et al.*(2009).

CONCLUSION

On the basis of findings it is concluded that the treatment combination $N_{20}P_{40}K_{40}$ + FYM_{10} t ha^{-1}*i.e,* Treatment T_9 shows significantly maximum plant height, no. leaves, no. of clusters $plant^{-1}$, no. of pod $cluster^{-1}$, no of pod $plant^{-1}$,length of pod (cm)and pod yieldof cluster bean as comparison to all over other treatment combinations.

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Table 1. Response of Different Levels of NPK and FYM on Plant height and No. of leaves per plant of Cluster bean.

S. No.	Treatment combination	Plant height (cm)			No. of Leaves plant^{-1}		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_1	[Absolute Control]	13.52	50.45	82.53	4.75	10.59	17.87
T_2	@$N_0P_0K_0$kg ha^{-1} + @FYM_5 t ha^{-1}	15.47	52.28	87.56	7.86	14.94	22.01
T_3	@$N_0P_0K_0$kg ha^{-1} + @FYM_{10} t ha^{-1}	18.28	56.72	91.11	10.17	17.78	29.05
T_4	@$N_{10}P_{20}K_{20}$kg ha^{-1} + @FYM_0 t ha^{-1}	15.83	53.26	86.33	9.03	17.01	27.16
T_5	@$N_{10}P_{20}K_{20}$ kg ha^{-1} + @FYM_5t ha^{-1}	17.59	57.00	94.67	12.84	20.71	32.47
T_6	@$N_{10}P_{20}K_{20}$ kg ha^{-1} + @FYM_{10} t ha^{-1}	19.20	60.38	100.93	15.03	25.96	38.37
T_7	@$N_{20}P_{40}K_{40}$kg ha^{-1} +@FYM_0 t ha^{-1}	16.76	57.80	98.96	14.29	23.33	36.77
T_8	@$N_{20}P_{40}K_{40}$ kg ha^{-1} + @FYM_5 t ha^{-1}	18.23	63.15	109.66	17.89	30.72	41.64
T_9	@$N_{20}P_{40}K_{40}$kg ha^{-1} + @FYM_{10} t ha^{-1}	21.04	68.80	121.62	20.11	37.95	46.88
F- test		S	S	S	S	S	S
SEm(±)		0.2562	0.8838	1.6017	0.1822	0.3159	0.4326
CD(p= 0.05)		0.7681	2.6496	4.8020	1.5462	0.9472	1.2970

Table 2. Response of Different Levels of NPK and FYM on No. of cluster per plant, No. of pods per cluster, No. of pods per plant, length of pods and total yield of Cluster bean

S.No.	Treatment combinations	No. of cluster plant^{-1}	No. of pod cluster^{-1}	No. of pod plant^{-1}	Length of pod (cm)	Total pod yield (q ha^{-1})
T1	[Absolute Control]	11.55	4.64	33.06	9.92	32.38
T2	@$N_0P_0K_0$kg ha^{-1} + @FYM_5 t ha^{-1}	14.78	6.55	45.51	10.39	41.67
T3	@$N_0P_0K_0$kg ha^{-1} + @FYM_{10} t ha^{-1}	16.95	7.60	56.63	10.55	47.85
T4	@$N_{10}P_{20}K_{20}$kg ha^{-1} + @FYM_0 t ha^{-1}	13.81	6.85	49.04	10.49	36.46
T5	@$N_{10}P_{20}K_{20}$ kg ha^{-1} + @FYM_5t ha^{-1}	17.68	8.29	70.39	11.48	44.67
T6	@$N_{10}P_{20}K_{20}$ kg ha^{-1} + @FYM_{10} t ha^{-1}	20.91	10.36	80.12	11.77	51.54
T7	@$N_{20}P_{40}K_{40}$kg ha^{-1} +@FYM_0 t ha^{-1}	18.74	8.86	64.34	11.50	47.99
T8	@$N_{20}P_{40}K_{40}$ kg ha^{-1} + @FYM_5 t ha^{-1}	21.08	10.54	75.75	12.16	56.54
T9	@$N_{20}P_{40}K_{40}$kg ha^{-1} + @FYM_{10} t ha^{-1}	25.54	12.12	87.89	12.77	61.43
F- test		S	S	S	S	S
S. Em. (±)		0.3617	0.1172	0.9108	0.1740	0.8845
C.D. (P= 0.05)		1.0845	0.3515	2.7306	0.5218	2.6518