



International Journal of Research in Agronomy

E-ISSN: 2618-0618

P-ISSN: 2618-060X

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www.agronomyjournals.com

2024; 7(7): 560-563

Received: 03-04-2024

Accepted: 12-05-2024

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Effect of INM at growth, yield, and quality parameter on cluster bean (*Cyamopsis tetragonoloba* L. Taub.) c.v. Pusa Navbahar at Agra region

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DOI: <https://doi.org/10.33545/2618060X.2024.v7.i7g.1091>

Abstract

Background: cluster bean is important legume vegetable mainly grown under irrigated conditions during summer and rainy seasons. The crop also survives even at moderate salinity and alkalinity conditions. This investigation is intended to assess the integrated nutrient management effect on cluster bean c.v. Pusa Navbahar.

Methods: The experiment was carried out during two consecutive years (2021, and 2022) of Kharif season on cluster bean at Horticultural Research Farm RBS College Bichpuri Agra U.P. with the combination of eight treatments viz. T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈ and three replications laid out in randomized block design using the variety Novbahar of Pusa cluster bean for green pod production.

Result: The pooled results showed super imposition of 100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹ (applied in soil prior to seed sowing) resulted in significant improvement in growth, yield and quality characters i.e. plant height (cm), emergence of flowers, 50% flowering, days to first pod set, day to maturity, protein content of pod, (g/100 g) Yield of pod (q ha⁻¹). The combined effect of inorganic fertilizers (NPK), organic fertilizers (FYM, vermicompost) and bio fertilizers (Rhizobium, PSB) was significantly better than their individual effects in the present investigation observed on growth, yield and quality characters

Keywords: Cluster bean, INM, FYM, Vermicompost, Rhizobium, PSB, Growth, quality

Introduction

Cluster bean [*Cyamopsis tetragonoloba* L. Taub] popularly referred as “Guar” is vegetable crop of Indian origin belonging to the family leguminosae ^[1]. It is an important legume crop mainly grown under irrigated as well as un irrigated condition during summer and rainy season. There is no other legume crop so hardy and drought tolerant as guar, which is particularly suited for the soil and climate of Agra region. Its tender green pods are used for culinary purpose and whole plant is used a roughages for cattle. There is a big demand for Indian gum products, food additives, and food thickener, Guar seed endosperm gum is used in numerous industries, including textiles, confectioneries, medicines, and cosmetics ^[2]. The aim of integrated nutritional management is to integrate the use of natural and artificial soil nutrients to increase crop productivity and maintain soil fertility without impairing soil health for future generations. In long-term imbalanced use of inorganic fertilizers will not maintain higher yields over the years due to paucity of secondary nutrients will result deterioration physical and chemical properties. Increased use of fertilizer will undoubtedly increase the production of raw materials significantly, but in the sustainable fertility it will have a negative impact on soil health. In case of INM approach, careful application of all nutrients can sustainably improve soil fertility and economic yields ^[3]. This current study shows the actual impact of the integrated use of inorganic fertilizers combined with organic fertilizers and bio-fertilizers on the growth, and quality of cluster bean and sustainable soil fertility.

Materials and Methods

The study was conducted under irrigated condition during the year 2021 and 2022 cropping season in rainy season at R.B.S. College horticulture research farm, Bichpuri, Agra.

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The research farm is situated to the Agra-Bharatpur Road, 2 km away from Bichpuri, railway station, toward Bharatpur is located at a latitude of 27.20 North and longitude of 77.90 east with an elevation of 163.4 meters above means sea level. Agra has a semi arid and sub tropical climate with hot-dry summers and severe cold. The average annual maximum and minimum temperature is 36 °C and 4 °C respectively. The soil type in the area is light textured sandy loam.

The experiment was laid out randomized block design (RBD) with eight treatments, replicated three times this consist twenty four plots. The Pusa Novbahar variety of cluster bean planted at a 45×30 cm in flat plots consecutive both the years, Net plot size-2.25 m×1.5 m=3.375 mete².

Data analysis: All significant pairs of treatment means were compared using the critical difference (CD) at 5% level of significance, coefficient of variation (C.V.) and standard error of mean (SEM).

Treatment details: following treatment combination viz. T₁(100% RDF (25:60:60) N: P: K kg ha⁻¹), T₂ (100% RDF +FYM 20 t ha⁻¹), T₃ (100% RDF + Vermicompost 2.0 t ha⁻¹), T₄ (100% RDF +FYM 20 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment), T₅ (100% RDF + Vermicompost 2 t ha⁻¹ + Rhizobium

25 g kg⁻¹ seed treatment), T₆ (100% RDF +FYM 20 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment + PSB 5 kg ha⁻¹), T₇ (100% RDF + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹), T₈ (100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) made to assess the best treatment combination for maximization of production and net profit.

Results and Discussion

Growth, yield and quality parameters

The inorganic and organic fertilizers or manures along with bio-fertilizers alone or in combination were found to have significant effect on growth characters as compared to RDF treatment. It is evident from Table 1 and fig.1 that among all the eight treatments, T₈ (100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) recorded the highest plant height at 90 DAS(163.07 cm), minimum day to emerging of flowers (29.94 DAS), minimum day to 50% flowering (39.79 DAS, minimum day to first pod set (43.49DAS), minimum day to maturity (50.77),and maximum protein content (5.62 g/100 g) maximum Yield of pod T₈ 111.70(q ha⁻¹). The reason might be due to higher availability of nutrients as a result of integration of organic and inorganic sources with bio fertilizers.

Table 1: Integrated nutrient management effect cluster been c.v. Pusa Navbahar

Treatment	Plant height (cm)			Emergence of flowers			50% flowering			Day to first pod set			Day to maturity			Protein content of pods (g/100 g)			Yield of pod (q/ha ⁻¹)		
	Year 1	Year 2	Pooled	Year1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
T ₁	100.03	100.3	100.16	35.7	35.77	35.73	45.7	45.77	45.73	47.77	47.67	47.27	55.77	55.7	55.73	4.28	4.14	4.21	94.28	94.69	94.49
T ₂	121.09	122.22	121.65	33.88	34.21	34.05	43.88	44.21	44.05	46.88	46.55	46.71	55.22	54.36	54.79	4.57	4.55	4.56	98.90	98.88	98.89
T ₃	126.18	125.55	125.86	33.03	33.77	33.40	43.03	43.77	43.40	46.36	46.29	46.32	55.03	54.62	54.82	4.69	4.72	4.70	98.69	98.38	99.04
T ₄	132.14	132.96	132.55	32.14	32.22	32.18	42.14	42.22	42.18	45.81	45.88	45.85	54.48	53.22	53.85	4.96	5.21	5.09	100.10	100.06	100.08
T ₅	133.03	135.36	134.19	32.7	32.21	32.45	42.7	42.21	42.45	45.70	45.78	45.74	54.36	53.55	53.95	5.13	5.39	5.26	100.94	100.60	100.77
T ₆	141.21	139.45	140.33	30.88	30.88	30.88	40.88	40.88	40.88	44.88	44.84	44.86	53.21	52.51	52.86	5.34	5.43	5.39	102.34	102.70	102.52
T ₇	143.33	140.51	141.92	30.29	30.51	30.40	40.29	40.51	40.40	44.95	44.73	44.84	53.62	52.14	52.88	5.35	5.52	5.43	102.92	103.45	103.18
T ₈	163.77	163.81	163.79	29.77	30.11	29.94	39.77	39.81	39.79	43.77	43.81	43.79	50.77	50.77	50.77	5.55	5.7	5.62	111.55	111.85	111.70
C.V.	1.40	1.62	1.52	3.41	1.56	2.65	2.60	1.18	2.02	1.31	1.37	1.34	1.48	1.74	1.61	5.99	6.98	6.51	1.37	0.68	1.08
S.Em+/-	1.07	1.24	0.82	0.63	0.29	0.35	0.63	0.29	0.35	0.34	0.36	0.25	0.46	0.53	0.35	0.17	0.20	0.13	0.80	0.40	0.45
CD at 5%	3.26	3.77	2.38	1.93	0.88	1.01	1.93	0.88	1.01	1.05	1.09	0.72	1.40	1.63	1.02	0.52	0.62	0.38	2.44	1.22	1.30

Plant height (cm): Maximum height of plant in cluster bean crop c.v. PNB was observed 163.79 cm due to the application 100% RDF with 2 t/ha⁻¹ vermicompost 20 t/ha⁻¹ FYM along with bio-fertilizers Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹. Similar results were observed by [5, 6, 9].

Day to emergence of flowers: The early Emerging of flowers was observed in T₈ 29.94 DAS (100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) treatment which was at par with T₇ 30.40 DAS (100% RDF + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹). Similar results were observed by [8].

Day to 50% flowering: The early 50% flowering was observed in T₈ 39.79 DAS (100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) treatment which was at par with T₇ 40.40 DAS (100% RDF + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹). Similar results were observed by [8, 9].

Day to first pod set: examination of data in table1 shows that the 43.79 days taken to first pod set DAS (100% RDF+ FYM 20

t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) treatment which was at par with T₇ 44.84 DAS (100% RDF + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹). Similar results were observed by [8].

Day to maturity: The late Day to maturity was observed in T₈ 50.77 DAS (100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) treatment which was at par with T₆ 52.86 DAS (100% RDF + FYM 20 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹). Similar results were observed by [9].

Protein content of pod (g/100 g): The highest protein content was observed in T₈ 5.62 g/100 g (100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) treatment which was at par with T₇ 5.43 g/100 g (100% RDF + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹). similar results were observed by [8].

Yield of pod (q/ha): The maximum Yield of pod (q ha⁻¹) was observed in T₈ 111.70 (100% RDF+ FYM 20 t ha⁻¹ +

Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) treatment which was at par with T₇ 103.18 (100% RDF + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹). The finding agrees with the previous results of [7, 8, 9].

Conclusion

It is concluded that the application of T₈ (100% RDF+ FYM 20 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Rhizobium 25 g kg⁻¹ seed treatment+ PSB 5 kg ha⁻¹) resulted in best growth and quality parameters e.g. highest plant height at 90 DAS(163.07 cm), minimum day to emerging of flowers (29.94 DAS), minimum day to 50% flowering (39.79 DAS, minimum day to first pod set (43.79DAS), minimum day to maturity (50.77 DAS), and highest protein content of pod (5.62 g/100 g), maximum Yield of pod T₈ 111.70 (q ha⁻¹) in Pusa Navbahar Variety cluster bean. hence above treatment recommended to the farmers like agro climatic conditions of Agra.

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