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M Manohar
Department of Horticulture, RBS
College Bichpuri, Dr. B.R.
Ambedkar University Agra,
Paliwal Park, Uttar Pradesh, India

GK Singh
Department of Horticulture, RBS
College Bichpuri, Dr. B.R.
Ambedkar University Agra,
Paliwal Park, Uttar Pradesh, India

Effect of integrated nutrient management at growth and quality parameter on cluster bean (*Cyamopsis tetragonoloba* L. Taub.)

M Manohar and GK Singh

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Abstract

Background: cluster bean is important legume vegetable mainly grown under irrigated condition during summer and rainy season. The crop also survives even at moderate salinity and alkalinity conditions. This investigation is intended to assess the integrated nutrient management of organic, inorganic, and bio-fertilizer for higher productivity of cluster bean under condition in subtropical semi arid zone of up.

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 with the combination of twelve treatments. The experiment was laid out in randomized block design with three replications using the variety Pusa Novbahar.

Result: The pooled results of two years revealed that the highest growth, and quality parameters were observed in treatment T₁₀ (Vermicompost (10 t ha⁻¹+ Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) with maximum Germination count (89.05%), Fiber content of pod (3.25 gm/100 g and T₁₂ (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) maximum plant height at 90 DAS (143.01 cm), Fresh weight of plant (255.15 gm), spread of plant at 90 DAS (40.78 cm), Number of pods per cluster (8.01), length of pod (10.37 cm), Diameter of pod (0.98 CM), Dry weight of pods (21.35 gm)/100 g) and protein content of pod (3.67 g/100 g) of cluster bean which was found significantly superior over other treatments.

Keywords: Cluster bean, integrated nutrient management, RDF, FYM, vermicompost, rhizobium, PSB, growth, quality

Introduction

Cluster bean [*Cyamopsis tetragonoloba* L. Taub] popularly referred as “Guar” may be a vegetable crop of Indian origin belonging to the family leguminosae. Cluster bean is a self-pollinated crop with a chromosome number of 2n=14^[1].

It is an important legume crop mainly grown under irrigated condition during summer and rainy season. The crop also survives even at moderate salinity and alkalinity conditions. There is no other legume crop so hardy and drought tolerant as guar, which is particularly suited for the soil and climate of western Uttar Pradesh. 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, cosmetics, mining, drilling and water treatment^[2].

Nutrition value- Its tender pods are rich source of energy (16 Kcal), moisture (81 g), protein (3.2 g), fat (1.4 g), carbohydrate (10.8 g), vitamin A (65.3 IU), vitamin C (49 mg), calcium (57 mg) and iron (4.5 mg) for every 100 g of edible portion^[3], Being approximately 75% dietary fiber, it allows the fiber to be added to a food with a minimal effect on taste and texture. Cluster bean pods are rich in soluble fibre and lower blood cholesterol levels. The use of guar gum has increased tremendously, as it is a natural absorbent. In the plains, it is sown twice, from summer season and rainy season. It is one of the most popular beans grown in India. India accounts for about 80% production of guar gum in the world, remaining 20% is produced by countries like Pakistan, USA, Australia, South Africa, Sudan and Argentina^[4]. India produced 16.80 lakh tonnes of cluster bean vegetable pods on an area of 23.30 lakh hectares, with a productivity of 428 kg per hectare, in the year 2017-18^[61]. It is grown on a higher scale in Rajasthan (18.18 lakh ha), Gujarat (2.27 lakh ha),

Corresponding Author:
M Manohar
Department of Horticulture, RBS
College Bichpuri, Dr. B.R.
Ambedkar University Agra,
Paliwal Park, Uttar Pradesh, India

Haryana (1.27 lakh ha), and Punjab (0.14 lakh ha) ^[5]. Rajasthan accounts for 72% of the guar crop production in the country. 90% of the guar processed in the country is exported ^[6].

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 for future generations. In long-term crop studies, balanced use of inorganic fertilizers cannot maintain higher yields over the years due to lack of secondary and micronutrients and deterioration of soil physical 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 ^[7]. 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 irrigation during the year 2021 to 2022 cropping season in on rainy season at R.B.S. College

horticulture research farm, Bichpuri, Agra. The location of the experiment remained unaltered in both the years. The research farm is situated about 1 km to the near Bichpuri railway station Uttar Pradesh India. Bichpuri Agra is located latitude of 27.2° North and longitude of 77.9° east with an altitude of 163.4 meters above means sea level. Agra has a semi arid and sub tropical climate with hot and dry summers and severely 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 as a factorial randomized block design (FRBD) arrangement treatment twelve combination, three replication and thirty six total treatments. Trail others detail is following-Variety- Pusa Novbahar, Spacing - (row × pant) 45×30 cm, Net plot size-2.25 m×1.5 m=3.375 mete².

Data collection and analysis: Data on growth and development, yield components and quality variables were collected and subjected to analysis of variance (ANOVA) using the General Linear Model of the SAS statistical package (SAS, 2007). 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

Treatment	Treatment combination
T ₁	100% RDF (25:60:60) N: P: K kg ha ⁻¹
T ₂	Bio fertilizers (RDF + Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)
T ₃	FYM (25 ha ⁻¹)
T ₄	Vermicompost (10 t ha ⁻¹)
T ₅	75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers (Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)
T ₆	75% RDF through inorganic fertilizers + 25% RDF through FYM + Bio fertilizers (Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)
T ₇	50% RDF through inorganic fertilizers + 50% RDF through inorganic fertilizers FYM + Bio fertilizers (Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)
T ₈	50% RDF through inorganic fertilizers + 50% RDF through vermicompost + Bio fertilizers (Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)
T ₉	FYM (25 t ha ⁻¹) + Bio fertilizers (Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)
T ₁₀	Vermicompost (10 t ha ⁻¹) + Bio fertilizers (Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)
T ₁₁	100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM)
T ₁₂	100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers (Rhizobium 25 g kg ⁻¹ seed + PSB 5 kg ha ⁻¹)

Results and Discussion

• Growth 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 that among all the twelve treatments, T₁₂ (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) recorded the highest plant height at 90 DAS(143.01 cm), Fresh weight of plant (255.15 gm), spread of plant at 90 DAS(40.78 cm), Number of pods per cluster (8.01) which was statistically at par with T₁₁ (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM). The reason might be due to higher availability of nutrients as a result of integration of organic and inorganic sources with bio fertilizers.

• Germination count (per plot in%)

The maximum germination count (%) is observed in T₁₀ (89.05%) Vermicompost (10 t ha⁻¹) + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹), and the lowest germination count (%) is observed in T₁ 83.09% (100% RDF (25:60:60) N: P: K kg ha⁻¹). {Table 1.1}

Similarly, application of INM treatments, T₁₀ treatment at par with T₉ FYM (25 t ha⁻¹) + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹), T₁₂, T₁₁, T₃ and T₄ at germination percentage of seed during experimental years except T₁ treatment. It is noted that the treatments T₁₀, T₉, T₁₂, and T₁₁, proved significantly superior over rest of the treatments. As we know Vermicompost, FYM and bio-fertilizers help seed germinate so application of organic fertilizers along with bio fertilizers has great effect on the germination percentage of cluster bean. This finding is in conformity with those of ^[8, 9].

Table 1: Effect of integrated nutrient management on following growth parameters – (1) Germination count (per plot in%), (2) Plant height (cm) at 90 DAS (3) Fresh weight of plant (gm) at peak stage (4 Spread of plant (cm) 90 DAS), (5) Number of pods per cluster

Treatments	Germination count (per plot in%)			Plant height (cm) at 90 DAS			Fresh weight of plant (gm)			Spread of plant (cm)			Number of pods per cluster		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
T ₁	82.89	83.30	83.09	130.82	131.32	131.07	241.16	240.95	241.06	33.80	33.68	33.74	4.99	5.22	5.10
T ₂	83.35	83.88	83.62	131.65	131.62	131.67	241.75	241.18	241.47	34.46	34.36	34.41	5.22	4.94	5.08
T ₃	86.35	86.88	86.61	140.62	140.88	140.75	250.60	251.17	250.88	38.17	38.16	38.17	6.44	6.14	6.29
T ₄	85.91	86.62	86.26	141.37	141.84	141.60	251.06	251.41	251.24	38.30	38.28	38.29	6.25	6.11	6.18
T ₅	83.70	84.36	84.03	134.65	134.68	134.66	242.57	242.35	242.46	35.29	35.13	35.21	4.99	5.03	5.01
T ₆	84.26	84.45	84.36	135.87	136.05	135.96	243.31	243.38	243.34	36.23	36.44	36.33	5.22	5.11	5.16
T ₇	84.73	84.84	84.79	137.40	137.62	137.51	244.41	244.29	244.35	36.87	36.85	36.86	5.33	5.33	5.33
T ₈	84.97	85.48	85.22	138.07	138.15	138.11	245.22	245.72	245.47	37.08	37.55	37.31	5.14	5.36	5.25
T ₉	89.00	88.48	88.74	142.00	141.62	141.81	251.89	252.30	252.09	39.25	38.93	39.09	7.07	7.00	7.03
T ₁₀	89.11	89.00	89.05	140.85	141.09	140.97	252.05	253.20	252.62	39.26	38.76	39.01	7.21	7.11	7.16
T ₁₁	87.13	86.14	86.63	140.31	141.01	140.66	255.24	255.06	255.15	40.17	40.32	40.25	7.99	7.99	7.99
T ₁₂	87.19	86.99	87.05	143.21	142.81	143.01	255.88	255.93	255.15	40.92	40.82	40.78	8.00	8.03	8.01
C.V.	0.84	0.87	0.86	0.48	0.42	0.45	0.12	0.17	0.15	1.01	0.91	0.96	5.80	5.44	5.62
S.Em+/-	0.41	0.43	0.42	0.39	0.34	0.36	0.17	0.25	0.21	0.22	0.19	0.20	0.20	0.19	0.19
CD at 5%	1.27	1.22	0.86	1.14	0.99	0.73	0.51	0.74	0.62	0.64	0.58	0.42	0.60	0.56	0.40

Note-means followed by some letters within a row and Colum are not significantly different at a 5% level of significance. NS= not significantly, CD=critical difference, CV= coefficient of variation

• Plant height (cm) at 90 DAS

All the INM treatment produced significantly longer height then T₁ 131.07cm (100% RDF (25:60:60) N: P: K kg ha⁻¹) except T₂ 131.67 cm (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {Table 1.2}

The longest height was observed in T₁₂ 143.01 cm (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₁₁ (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM). Maximum height of plant in cluster bean crop is due to the application 50% RDF through vermicompost and 50% RDF through FYM along with bio-fertilizers. Similar results were observed by [10, 11].

• Fresh weight of plant (gm)

All the INM treatment produced significantly more Fresh weight of plant (gm) then T₁ 141.06 gm (100% RDF (25:60:60) N: P: K kg ha⁻¹) except T₂ 141.47gm (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {Table 1.3} The highest Fresh weight of plant (gm) was observed in T₁₂ 255.15 gm (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₁₁ 255.15 gm (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM). Similar results were observed by [12, 13].

• Spread of plant (cm)

All the INM treatment produced significantly more Spread of plant (cm) then T₁ 33.74 cm (100% RDF (25:60:60) N: P: K kg ha⁻¹) except T₂ 34.41cm (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {Table 1.4} The maximum Spread of plant (cm)) was observed in

T₁₂ 40.78 cm (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₁₁ 40.32 cm (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM). Similar results were observed by [14, 12].

• Number of pods per cluster

All the INM treatment produced significantly more Number of pods per cluster then T₂ 5.08 (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) except T₁ 5.10 (100% RDF (25:60:60) N: P: K kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {table 1.5}

The highest Number of pods per cluster was observed in T₁₂ 8.01 (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₁₁ 7.99 (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM) Similar results were observed by [15, 11, 16].

• Quality parameter

The inorganic and organic fertilizers or manures along with bio-fertilizers alone or in combination were found to have significant effect on quality characters as compared to RDF treatment. It is evident from Table 2 that among all the twelve treatments, T₁₂ (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) recorded the highest), length of pod (10.37 cm), Diameter of pod (0.98 CM), Dry weight of pods (21.35 gm)/100 g, and protein content of pod (3.67 g/100) which was statistically at par with T₁₁ 100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM) but maximum Fiber content of pod (3.25 gm/100 g) is T₁₀ Vermicompost (10 t ha⁻¹) + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg 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 2: Effect of integrated nutrient management on following pod quality parameters – (1) Length of pod (cm), (2) Diameter of pod (cm) (3) Dry weight of pods (g/100 g) (4) Fiber content of pod (g/100 g) (5) Protein content of pod (g/100 g)

Treatments	Length of pod (cm)			Diameter of pod (cm)			Dry weight of pods (gm/100 g)			Fiber content of pod (gm/100 g)			Protein content of pod (gm/100 g)		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
T ₁	7.13	7.13	7.13	0.76	0.75	0.75	17.44	17.34	17.39	1.67	1.56	1.62	3.34	3.38	3.36
T ₂	7.17	7.11	7.14	0.79	0.81	0.80	17.89	17.84	17.86	1.92	1.76	1.84	3.31	3.41	3.36
T ₃	9.04	9.22	9.13	0.93	0.923	0.93	20.31	20.34	20.32	2.84	2.88	2.86	3.45	3.44	3.44
T ₄	9.20	9.24	9.22	0.92	0.926	0.92	20.53	20.37	20.45	2.92	2.90	2.91	3.50	3.42	3.46
T ₅	7.43	7.60	7.52	0.77	0.84	0.81	18.36	18.24	18.30	2.04	2.04	2.04	3.37	3.36	3.36
T ₆	7.50	7.87	7.69	0.80	0.86	0.83	18.73	18.51	18.62	2.30	2.27	2.28	3.43	3.32	3.38
T ₇	8.16	8.09	8.13	0.82	0.87	0.84	18.88	18.68	18.78	2.60	2.73	2.66	3.42	3.41	3.42
T ₈	8.30	8.70	8.50	0.85	0.88	0.86	19.10	18.90	19.00	2.85	2.84	2.84	3.35	3.42	3.38
T ₉	9.80	9.53	9.67	1.07	1.09	1.08	20.78	20.59	20.68	3.22	3.27	3.24	3.54	3.68	3.62
T ₁₀	9.60	9.70	9.65	1.12	1.05	1.09	20.79	20.63	20.71	3.18	3.31	3.25	3.6	3.62	3.61
T ₁₁	9.93	9.89	9.91	0.99	0.99	0.99	21.26	21.06	21.16	2.89	2.87	2.88	3.63	3.72	3.67
T ₁₂	10.18	10.54	10.37	0.99	0.97	0.98	21.32	21.38	21.35	3.03	2.94	2.98	3.65	3.68	3.67
C.V.	3.02	3.84	3.46	4.85	3.49	4.19	1.70	1.19	1.47	5.26	4.63	4.96	2.13	1.66	1.91
S.Em+/-	0.15	0.19	0.17	0.025	0.01	0.0	0.19	0.13	0.16	0.07	0.07	0.07	0.04	0.03	0.03
CD at 5%	0.44	0.56	0.35	0.074	0.05	0.04	0.56	0.39	0.33	0.23	0.20	0.15	0.12	0.09	0.07

Note-means followed by some letters within a row and Column are not significantly different at a 5% level of significance. NS= not significantly, CD=critical difference, CV= coefficient of variation

• Length of pod (cm)

All the INM treatment produced significantly more length of pod (cm) then T₁ 7.13 cm (100% RDF (25:60:60) N: P: K kg ha⁻¹) except T₂ 7.14 cm (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {Table 2.1} The highest length of pod (cm) was observed in T₁₂ 10.37 cm (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₁₁ 9.91 cm (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM) which was similar to T₁₀ 9.65 cm (vermicompost 10 t ha⁻¹) + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). Similar results were observed by [17, 15, 18].

• Diameter of pod (cm)

All the INM treatment produced significantly more Diameter of pod (cm) then T₁ 0.75 cm (100% RDF (25:60:60) N: P: K kg ha⁻¹) except T₂ 0.80 cm (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {Table 2.2} The highest Diameter of pod (cm) was observed in T₁₀ 1.09 cm (vermicompost 10 t ha⁻¹ + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₉ 1.08 cm (FYM 25 t ha⁻¹ + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). Similar results were observed by [19, 18, 20].

• Dry weight of pods (gm/100 g)

All the INM treatment produced significantly more Length of raceme (cm) then T₁ 17.39 gram (100% RDF (25:60:60) N: P: K kg ha⁻¹) except T₂ 17.86 gram (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {Table 2.3} The highest Length of raceme (cm) was observed in T₁₂ 21.35 gram (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₁₁ 21.16 gram (100% RDF through organic fertilizers

(50% RDF through vermicompost+50% RDF through FYM) which was similar to T₁₀ (vermicompost 10 t ha⁻¹) + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). Similar results were observed by [18].

• Fiber content of pod (gm/100 g)

All the INM treatment produced significantly more Fiber content of pod (gm) then T₁ 1.62 gm (100% RDF (25:60:60) N: P: K kg ha⁻¹) except T₂ 1.84 gm (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹) which was similar to T₅ (75% RDF through inorganic fertilizers + 25% RDF through vermicompost + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). {Table 2.4} The highest Fiber content of pod (gm) was observed in T₁₀ 3.25 gm (vermicompost 10 t ha⁻¹ + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) treatment which was at par with T₉ 3.24 gm (FYM 25 t ha⁻¹ + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹). Similar results were observed by [12].

• Protein content of pod (g/100 g)

The maximum Protein content of pod (gram) was observed in T₁₁ 3.67gm (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM) and T₁₂ (100% RDF through organic fertilizers (50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) and the minimum Protein content of pod (gram) is observed in T₁ 3.36 gm (100% RDF (25:60:60) N: P: K kg ha⁻¹) and T₂ (Bio fertilizers (RDF + Rhizobium 25 g kg⁻¹ seed +PSB 5 kg ha⁻¹). {Table 2.5} similar results were observed by [21, 22, 19].

Conclusion

It can be concluded from the study that the variety, Pusa Novbahar as well as application of inorganic fertilizers with organic sources of FYM /Vermicompost with bio fertilizers when combined resulted in better growth and quality of cluster bean in sandy loamy soil of semi arid zone of Uttar Pradesh and Rajasthan, India. It is noted that the application of T₁₂ (100% RDF through organic fertilizers 50% RDF through vermicompost+50% RDF through FYM + Bio fertilizers Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹) resulted in best growth and quality parameters e.g. plant height, Fresh weight of plant, spread of plant, Number of pods per

cluster, length of pod, Diameter of pod, Dry weight of pods, Fiber content of pod and protein content of pod. However, it was observed that the integrated treatment of T₁₀ Vermicompost (10 t ha⁻¹) + Bio fertilizers (Rhizobium 25 g kg⁻¹ seed + PSB 5 kg ha⁻¹), Germination count (89.05%) is best in cluster bean under semi arid condition. Thus, as per availability of the source i.e., vermicompost FYM, and bio fertilizer in a given area or location, T₁₂ and T₁₀ may be recommended to the farmers of semi arid condition.

References

- Hymowitz T, Upadhyaya MD. The chromosome numbers of *Cyamopsis serrata* Schinz. Current Science. 1963;32:427-428.
- Baviskar VS, Shete PG, Daspute RA. Response of summer cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] to organic fertilizers and different levels of sulphur for vegetable purpose. International Journal of Agricultural Sciences. 2010;6(2):456-458.
- Kumar V, Ram RB, Yadav RK. Genetic diversity in cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] for morphological characters. Indian Journal of Science and Technology. 2014;7(8):1144-1148.
- Ashwini HW, Bagali AN, Babu P, Soregaon CD, Vijayalakshmi CL. Association study for seed yield and quality and their contributing traits in cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] genotypes. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):4150-4152.
- Balakumbahan R, Prabukumar G, Sivakumar V. The evaluation of cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) genotypes for fruit and gum yield. EJFOOD. 2020;2(5).
- Agricultural and Processed Food Products Export Development Authority. Guar gum. 2022.
- Masanta S, Biswas S. Effect of various nutrient management practices on productivity, soil fertility status and water use efficiency of French bean grown under homestead condition in Nadia district of West Bengal. Journal of Crop and Weed. 2009;5(2):50-52.
- Brahmbhatt JH, Acharya SK, Patel GS, Thakar C, Solanki NR. Effect of organic nutrient management on growth and yield of cluster bean (*Cyamopsis tetragonoloba* L.). Legume Research - An International Journal. 2021;44(3).
- Patel HS, Patel KD. Effect of organic fertilizers on growth and economics of cluster bean (*Cyamopsis tetragonoloba* L.) cv. Pusa Navbahar. International Journal of Chemical Studies. 2018;6(5):861-864.
- Dholariya ND, Acharya RR, Akbari VR, Delvadiya IR. Effect on growth, seed yield and quality of cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) seed cv. Pusa Navbahar through decapitation and PGRs. International Journal of Pure and Applied Biosciences. 2018;6(1):537-542.
- Jilen B, Pugalendhi L, Devi HUN, Swarna Priya R. Evaluation of cluster bean (*Cyamopsis tetragonoloba* L.) genotypes for vegetable pod yield and guar gum production. International Journal of Environment and Climate Change. 2022;12(12):29-37.
- Patel HB, Saravaiya SN, Patil SJ, Chhatrola HN, Vashi JM, Sravani V. Influence of PGRs on growth parameters and plant growth analysis of cluster bean cv. Pusa Navbahar. International Journal of Chemical Studies. 2018;6(3):922-926.
- Singh A, Vijayalakshmi A. Residual effects of integrated nutrient management with farmyard manure, coirpith and pressmud compost on cluster bean (*Cyamopsis tetragonoloba* L.). International Journal of Advanced Biological Research. 2013;4(3):405-407.
- Sharma P, Swaroop R, Meena, Kumar S, Gurjar DS, Yadav GS, et al. Growth, yield and quality of cluster bean (*Cyamopsis tetragonoloba*) as influenced by integrated nutrient management under alley cropping system. Indian Journal of Agricultural Sciences. 2019;89(11):1876-1880.
- Sharma U, Arun A, David, Singh U. Effect of integrated nutrient management on growth and yield of cluster bean (*Cyamopsis tetragonoloba*) var. Pusa Navbahar. International Journal of Current Microbiology and Applied Sciences. 2018;7(7):3503-3513.
- Nandini, Thomas T, Singh AK. Response of integrated nutrients on soil health and yield attributes of cluster bean (*Cyamopsis tetragonoloba* L.) cv. Neelam. International Journal of Plant and Soil Science. 2023;35(14):216-227.
- Desh SK, Ansaba V, Tripathy L, Pathak. Effect of integrated nutrient management on growth, yield and yield attributing parameters of French bean (*Phaseolus vulgaris* L.). The Pharma Innovation Journal. 2019;8(11):98-100.
- Muftuoglu NM, Toker C, Akyol M, Korkmaz M, Kizilkaya M. Yield and nutritional characteristics of edible cluster bean genotypes. Turkish Journal of Field Crops. 2019;24(1):91-97.
- Santhosha GR, Shashikanth E, Gasti VD, Prabhuling G, Rathod VD, Mulge R. Genetic variability studies in cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] for growth, yield and quality parameters. Legume Research. 2017;40(2):232-236.
- Association of Official Analytical Chemists. Official methods of analysis. 15th Ed. Arlington (VA): Association of Official Analytical Chemists; 1990. p.1028-1039.
- Amin HM. Effect of integrated nutrient management on growth, quality and yield of cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) var. Pusa Navbahar. Junagadh: Junagadh Agricultural University; 2009.
- Parmar SK, Satodiya BN, Thakur K. Effect of spacing and integrated nutrient management on yield attributes, yield and quality of cluster bean (*Cyamopsis tetragonoloba* L. Taub) cv. Pusa Navbahar. International Journal of Chemical Studies. 2019;7(5):2502-2505.