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Effect of fertility levels and panchagavya on yield, quality and economics of clusterbean (*Cyamopsis tetragonoloba* L.)

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Abstract

An experiment was carried out entitled “Effect of fertility levels and panchagavya on growth, yield and quality of clusterbean (*Cyamopsis tetragonoloba* L.)” at College Farm, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India during Summer 2022. The experiment was laid out in Randomized Block Design with three replications. Total thirteen treatments were evaluated in the study viz., 100% RDF (N:P:K @ 25:40:00 kg/ha and FYM 15 t/ha) (T₁); 80% RDF + Foliar spray of panchagavya @ 4% at 20 DAS (T₂); 80% RDF + Foliar spray of panchagavya @ 4% at 40 DAS (T₃); 80% RDF + Foliar spray of panchagavya @ 4% at 20 and 40 DAS (T₄); 80% RDF + Foliar spray of panchagavya @ 6% at 20 DAS (T₅); 80% RDF + Foliar spray of panchagavya @ 6% at 40 DAS (T₆); 80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS (T₇); 60% RDF + Foliar spray of panchagavya @ 4% at 20 DAS (T₈); 60% RDF + Foliar spray of panchagavya @ 4% at 40 DAS (T₉); 60% RDF + Foliar spray of panchagavya @ 4% at 20 and 40 DAS (T₁₀); 60% RDF + Foliar spray of panchagavya @ 6% at 20 DAS (T₁₁); 60% RDF + Foliar spray of panchagavya @ 6% at 40 DAS (T₁₂) and 60% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS (T₁₃). The results revealed that the treatment T₇ (80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS) was found to be superior in the terms of number of clusters per plant (14.93), number of pods per cluster (8.56), average pod weight (1.67 g), pod yield per plant (152.12 g), pod yield per plot (1.77 kg), pod yield per hectare (109.46 q), length of green pod (12.85 cm) as compared to the other treatments. With reference to the economics, among all the treatments maximum benefit cost ratio (2.77) was obtained with the treatment T₇ i.e. 80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS.

Keywords: Economics, fertility levels, foliar spray, panchagavya, quality, yield

Introduction

Clusterbean or guar (*Cyamopsis tetragonoloba* L.) belongs to the leguminosae family. It is also known as *gavar*, *gawar* or *guvar* bean. The word “guar” represents its derivation from Sanskrit word *Gauaahar* which means cow fodder or otherwise fodder of the livestock. The tender green pods are used as a vegetable. They are good source of protein, vitamin A and vitamin C. Clusterbean contains (per 100 g of edible portion) 81 g moisture, 10.8 g carbohydrate, 3.2 g protein, 0.4 g fat, 1.4 g minerals, 316 I.U. vitamin A, 47 I.U. Vitamin C, 0.03 mg riboflavin, 0.09 mg thiamine and dry seed contain 33.3% protein (Aykroyd, 1963) [4]. The cultivated area of *guar* in Gujarat is 44.58 thousand ha with the production of 441.37 thousand metric tonnes having 9.67 MT/ha productivity. Clusterbean is mainly cultivated in each district of Gujarat state (Anonymous, 2022) [3].

In Sanskrit, panchagavya refers to the blend of five products obtained from cow namely dung, urine, milk, curd and ghee. The presence of naturally occurring, beneficial, effective microorganisms (EMOs) in panchagavya predominantly lactic acid bacteria, yeast, *Actinomyces*, photosynthetic bacteria and certain fungi besides beneficial and proven fertilizers such as *Acetobacter*, *Azospirillum* and *Phosphobacterium* were detected which have the beneficial effect especially in improving soil quality, growth and yield of crops (Xu and Xu., 2000) [8]. Panchagavya, an organic product is a potential source to play great role for promoting growth and providing immunity to the plant system. Bio-chemical properties of panchagavya revealed that it possesses almost all the major nutrients like N, P, K and micro nutrients essential for plant and growth hormones like IAA and GA required for crop growth (Selvaraj *et al.*, 2007) [7].

Materials and Methods

A field experiment on clusterbean var. Pusa Navbahar was conducted at College Farm, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India during Summer 2022. The experiment was laid out in Randomized Block Design with total thirteen treatments. The treatments contain 100% RDF (N: P: K 25:40:00 kg/ha and FYM 15 t/ha) (T₁), 80% RDF + Foliar spray of panchagavya @ 4% at 20 DAS (T₂), 80% RDF + Foliar spray of panchagavya @ 4% at 40 DAS (T₃), 80% RDF + Foliar spray of panchagavya @ 4% at 20 and 40 DAS (T₄), 80% RDF + Foliar spray of panchagavya @ 6% at 20 DAS (T₅), 80% RDF + Foliar spray of panchagavya @ 6% at 40 DAS (T₆), 80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS (T₇), 60% RDF + Foliar spray of panchagavya @ 4% at 20 DAS (T₈), 60% RDF + Foliar spray of panchagavya @ 4% at 40 DAS (T₉), 60% RDF + Foliar spray of panchagavya @ 4% at 20 and 40 DAS (T₁₀), 60% RDF + Foliar spray of panchagavya @ 6% at 20 DAS (T₁₁), 60% RDF + Foliar spray of panchagavya @ 6% at 40 DAS (T₁₂), 60% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS (T₁₃) replicated three times.

The experimental soil was loamy sand, with good drainage condition. The recommended dose of Farm Yard Manure (FYM) 15 t/ha and fertilizer 25:40:00 kg/ha was applied at the time of field preparation as per the treatment. Urea and Single Super Phosphate (SSP) were used as the source of nitrogen and phosphorus, respectively. Where, half dose of nitrogen along with full dose of phosphorus were given as per the treatments in the field and remaining half dose of nitrogen was applied at thirty days after sowing as top dressing. The experimental field was irrigated fully after applying fertilizers and sowing. The various foliar applications of panchagavya as per the treatments were given at 20 and 40 days after sowing during the morning hours with plastic hand sprayer. The panchagavya moistened both; the surface of leaves and apical meristems. The planting operation was carried out at the spacing of 45 cm x 30 cm with plot size of 2.25 m x 1.80 m. The observations were recorded on yield attributing parameters viz., number of clusters per plant, number of pods per cluster, average pod weight, pod yield per plant, pod yield per plot, pod yield per hectare along with quality parameters viz., length of green pod (with the help of measuring scale) and protein content (micro kjeldhal's method). Each yield parameter except average pod weight was counted at each and after all harvestings. However, average pod weight was weighed at 5th picking and averaged out.

Results and Discussion

Yield parameters

The mean data on yield parameters such as number of clusters per plant, number of pods per cluster, average pod weight (g), pod yield per plant (g), pod yield per plot (kg) and pod yield per hectare (q) are depicted in Table 1.

1. Number of clusters per plant

The mean data presented in table 1 showed significant influence of different treatments on number of clusters per plant during cropping period. The maximum number of

clusters per plant (14.93) were received with the treatment T₇ (80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS) over other treatments. This could have occurred as a result of the increased amount of nutrient uptake which might have promoted roots enabling them to absorb more nutrients, thereby enhancing the yield and yield attributes of cluster bean. The present findings are in line with Aier *et al.* (2019)^[1] in clusterbean.

2. Number of pods per cluster

An appraisal of the data due to various fertility levels and panchagavya treatments were found significant variation for number of pods per cluster. The significantly maximum number of pods per cluster (8.56) was achieved with the treatment T₇ (80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS), which was statistically at par with the treatments T₄ (8.12), T₆ (7.88), T₃ (7.86), T₁ (7.83) and T₅ (7.76). This may have happened of the amounts of IAA and GA in panchagavya stimulated the plant system and boosted the production of growth regulators in the cell system, which in turn promoted the growth and development of crops. The results concurred with Patel *et al.* (2013)^[6] in cow pea.

3. Average pod weight (g)

The data mentioned in Table 1 revealed that effect of fertility levels and panchagavya on average pod weight was found significant. The maximum average pod weight (1.67 g) was achieved with the treatment T₇ (80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS), which was statistically at par with the treatments T₄ (1.63), T₆ (1.59), T₃ (1.56), T₁ (1.55), T₅ (1.52) and T₂ (1.50). The panchagavya is responsible for increasing pod weight which might be due to plant's improved mineral use, which is accompanied by improved photosynthesis, other metabolic activity, and increased food material diversion to pods. This result was consistent with in capsicum.

4. Pod yield per plant (g), per plot (kg) and per hectare (q)

The mean values for pod yield per plant (g), per plot (kg) and per hectare (q) was influenced by various treatments are shown in table 1. The statistical analysis demonstrated the significant impact of various treatments during the cropping period on this trait. The treatment T₇ (80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS) produced the highest pod yield per plant (152.12 g), per plot (1.77 kg) and per hectare (109.46 q) as compared to other treatments. Increased yield might be due to the increased amount of nutrient uptake which might have promoted roots enabling them to absorb more nutrients, thereby enhancing the yield and yield attributes of cluster bean. Similar observations were recorded earlier by Aier *et al.* (2019)^[1] in clusterbean. Higher yield might be due to the high nutritional content, plant growth stimulators and other microbial activities. This yield improvement may be attributable to kinetin, a component of coconut water that enhances biomass and yield. Amiry *et al.* (2017)^[2] and Devanda *et al.* (2021)^[5] in okra made similar observations earlier.

Table 1: Effect of fertility levels and panchagavya on different yield parameters of clusterbean (*Cyamopsis tetragonoloba* L.)

Tr. No.	Treatment details	Number of clusters per plant	Number of pods per cluster	Average pod weight (g)	Pod yield per plant (g)	Pod yield per plot (kg)	Pod yield per ha (q)
T ₁	100% RDF	13.77	7.83	1.55	131.23	1.50	92.59
T ₂	80% RDF + panchagavya @ 4% at 20 DAS	13.11	7.45	1.50	129.31	1.44	88.89
T ₃	80% RDF + panchagavya @ 4% at 40 DAS	13.83	7.86	1.56	133.67	1.53	94.44
T ₄	80% RDF + panchagavya @ 4% at 20 and 40 DAS	14.67	8.12	1.63	143.73	1.67	102.88
T ₅	80% RDF + panchagavya @ 6% at 20 DAS	13.40	7.76	1.52	129.93	1.47	90.74
T ₆	80% RDF + panchagavya @ 6% at 40 DAS	14.23	7.88	1.59	141.66	1.65	101.85
T ₇	80% RDF + panchagavya @ 6% at 20 and 40 DAS	14.93	8.56	1.67	152.12	1.77	109.46
T ₈	60% RDF + panchagavya @ 4% at 20 DAS	11.47	7.03	1.37	107.59	1.28	79.01
T ₉	60% RDF + panchagavya @ 4% at 40 DAS	12.13	7.22	1.41	117.98	1.35	83.54
T ₁₀	60% RDF + panchagavya @ 4% at 20 and 40 DAS	12.80	7.31	1.46	122.91	1.40	86.42
T ₁₁	60% RDF + panchagavya @ 6% at 20 DAS	11.83	7.13	1.40	113.19	1.31	80.86
T ₁₂	60% RDF + panchagavya @ 6% at 40 DAS	12.47	7.26	1.44	121.18	1.37	84.57
T ₁₃	60% RDF + panchagavya @ 6% at 20 and 40 DAS	13.03	7.47	1.48	126.57	1.42	87.65
S.Em. ±		0.62	0.30	0.06	7.11	0.08	4.92
C.D. (P = 0.05)		1.80	0.87	0.17	20.76	0.23	14.36
C.V.%		8.08	6.81	6.65	9.59	9.37	9.37

Quality Parameters

The observations on the different quality parameters *viz.*, length of green pod (cm) and protein content (%) were recorded and analyzed to evaluate the treatments. Length of green pod (cm) produced significant variation whereas protein content (%) was unable to produce significant variation. The mean data are depicted in Table 2.

1. Length of green pod (cm)

It is clear from the data that the impact of different fertility levels and panchagavya treatments were found significant variation on length of green pod (cm) which is presented in Table 2. Significantly maximum pod length (12.85 cm) was found with the application of T₇ (80% RDF + Foliar spray of panchagavya @ 6% at 20 and 40 DAS), which was

statistically at par T₄ (12.28 cm). It might also be due to the amounts of IAA and GA in panchagavya stimulated plant systems, raised the production of growth regulators in cell systems, and stimulated the necessary growth and development of clusterbean pod through the action of growth regulators in plant systems. Similar observation was recorded earlier by Aier *et al.* (2019)^[1].

2. Protein content (%)

The results in table 2 demonstrated that there was no statistically significant relationship between fertility levels and panchagavya on protein content. Although T₇ (80% RDF + Foliar Spray of panchagavya @ 6% at 20 and 40 DAS) recorded the highest protein level (8.73%).

Table 2: Effect of fertility levels and panchagavya on different quality parameters of clusterbean (*Cyamopsis tetragonoloba* L.)

Tr. No.	Treatment details	Length of green pod (cm)	Protein content (%)
T ₁	100% RDF	10.82	8.51
T ₂	80% RDF + panchagavya @ 4% at 20 DAS	10.78	8.31
T ₃	80% RDF + panchagavya @ 4% at 40 DAS	11.01	8.60
T ₄	80% RDF + panchagavya @ 4% at 20 and 40 DAS	12.28	8.68
T ₅	80% RDF + panchagavya @ 6% at 20 DAS	10.82	8.46
T ₆	80% RDF + panchagavya @ 6% at 40 DAS	11.05	8.66
T ₇	80% RDF + panchagavya @ 6% at 20 and 40 DAS	12.85	8.73
T ₈	60% RDF + panchagavya @ 4% at 20 DAS	9.29	7.79
T ₉	60% RDF + panchagavya @ 4% at 40 DAS	10.30	8.11
T ₁₀	60% RDF + panchagavya @ 4% at 20 and 40 DAS	10.58	8.21
T ₁₁	60% RDF + panchagavya @ 6% at 20 DAS	9.35	7.95
T ₁₂	60% RDF + panchagavya @ 6% at 40 DAS	10.35	8.59
T ₁₃	60% RDF + panchagavya @ 6% at 20 and 40 DAS	10.65	8.25
S.Em. ±		0.33	0.22
C.D. (P = 0.05)		0.97	NS
C.V.%		5.32	4.62

Economics

The details of economics *i.e.*, cost of cultivation, gross returns, net returns and Benefit Cost Ratio (BCR) on data basis for different treatments have been calculated and presented in Table 3. From the economics point of view,

highest yield (109.46 q/ha), gross return (328380 ₹/ha), net return (209853 ₹/ha) and Benefit Cost Ratio (2.77) were recorded with the application of 80% RDF + Foliar Spray of panchagavya @ 6% at 20 and 40 DAS *i.e.* (T₇) as compared to the other treatments

Table 3: Effect of fertility levels and panchagavya on economics of clusterbean (*Cyamopsis tetragonoloba* L.)

Tr. No.	Yield/hectare (q)	Total cost (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	BCR
T ₁	92.59	107876	277770	169894	2.57
T ₂	88.89	111462	266670	155208	2.39
T ₃	94.44	111462	283320	171858	2.54
T ₄	102.88	115527	308640	193113	2.67
T ₅	90.74	112962	272220	159258	2.41
T ₆	101.85	112962	305550	192588	2.70
T ₇	109.46	118527	328380	209853	2.77
T ₈	79.01	110983	237030	126047	2.14
T ₉	83.54	110983	250620	139637	2.26
T ₁₀	86.42	115048	259260	144212	2.25
T ₁₁	80.86	112483	242580	130097	2.16
T ₁₂	84.57	112483	253710	141227	2.26
T ₁₃	87.65	118048	262950	144902	2.23

Conclusion

The results obtained from the investigation, it can be concluded that the application of 80% RDF along with the foliar spray of panchagavya @ 6% at 20 and 40 DAS in summer clusterbean is beneficial for obtaining higher yield with better quality along with maximum economic returns.

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