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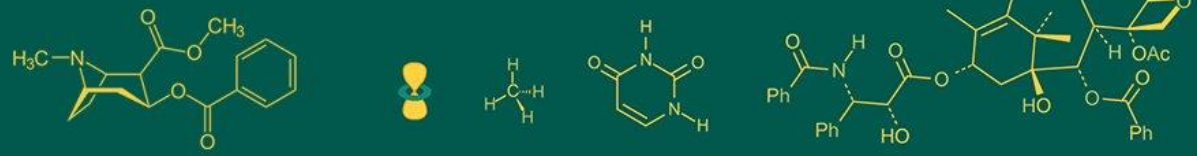

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Effect of organic and inorganic on yield of cluster bean (*Cyamopsis tetragonoloba*) var. Pusa Navbahar under Chhattisgarh plains

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Abstract
The present investigation entitled "Effect of organic and inorganic on yield of Cluster Bean (*Cyamopsis tetragonoloba*) Var. Pusa Navbahar under Chhattisgarh plains.**"**was carried out at summer season of year 2024-25 at the research farm Village-Khudmudi under College of Horticulture and Research Station, Mahatma Gandhi University of Horticulture & Forestry, Durg (C.G.), In this study integrated nutrient management (INM), farmyard manure (FYM), vermicompost, and rhizobium were use with different combination. The entitled experiment was conducted in Randomized Block Design (RBD) with three replications and eleven treatments. Application of INM dose 75% RDF + FYM (25 t/ha) + Vermicompost (5 t/ha) + rhizobium (2 kg/ha) was found to be the most effective in term yield parameter viz. number of cluster plant^{-1} (6.15), number of pod cluster^{-1} (5.50), number of pod plant^{-1} (33.29), average pod weight in (g) (2.35), length of pods (cm)(14.1), total yield (q/ha) (70.43). Therefore, it can be suggested that the dose of 75% RDF + FYM (25 t/ha) + Vermicompost (5 t/ha) + Rhizobium (2 kg/ha) suitable for the commercial cultivated of vegetable cluster bean in the Chhattisgarh plains.

Keywords: Cluster bean, INM, farmyard manure, vermicompost, rhizobium

Introduction
Vegetable cultivation is a key branch of Horticulture. Various vegetables have significantly contributed to the nation's economy and have played a crucial role in ensuring food and nutritional security for the country's growing population. Their demand is especially high in India, where a large portion of the population follows a vegetarian diet. Vegetables are highly nutritious and are regarded as protective foods because they are rich in essential vitamins, minerals, and amino acids. They provide important minerals such as calcium, phosphorus, and iron-which are often deficient in cereal-based diets-while vegetables offer them in substantial amounts. Among them, leguminous vegetables are particularly notable for being excellent sources of protein.

Cluster bean (*Cyamopsis tetragonoloba* L.)**,** a member of the Fabaceae (Leguminosae) family, is a hardy, upright, and bushy summer annual legume known for its drought tolerance. It is cultivated both for human consumption and as fodder for livestock. Traditionally grown in kitchen gardens as a summer vegetable, guar is now also being cultivated commercially, especially around urban areas. Native to India and Pakistan, cluster bean is also grown across tropical regions of Asia, Africa, and the Americas**.** The main global producers are India, Pakistan, and the United States**,** with smaller-scale cultivation in Australia and parts of Africa**.**

In India, cluster bean is commercially grown in states like Maharashtra, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, and Kerala for its tender green pods**,** which are consumed as a vegetable. Meanwhile, states such as Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh, and Bihar are the major producers of green pods, fodder, and seeds**,** primarily used as cattle feed. (Gamit *et al*. 2022) [2]

The total area under beans cultivation in India estimated to be 311 (000 ha.) with an annual production of 2898 (000 MT). (Department of Agriculture & Farmers Welfare, 2023-24) [1]. The total area of beans in Chhattisgarh is 9.26 (000 ha.) and production is 94.16 (000MT).

(Department of Agriculture & Farmers Welfare, 2023-24) [1] Nutrients are essential for the growth, development, and yield of vegetable crops. Among these, nitrogen is often the most limiting nutrient. Continuous availability of nitrogen during the growing season is crucial, as it is a key component of proteins and nucleic acids. A sufficient nitrogen supply promotes strong vegetative growth and enhances the efficiency of input use, ultimately leading to increased crop productivity. Applying varying levels of nitrogen has been shown to improve both plant growth and yield.

The physical and chemical degradation of soil reduces its fertility, which in turn hinders crop plants from efficiently absorbing essential nutrients, negatively impacting their yield. To address nutrient deficiencies, it is necessary to replenish the soil through the careful and balanced use of fertilizers. Today, practices like organic and inorganic have gained popularity for their sustainable approach to maintaining soil fertility and crop productivity. INM involves the balanced application of chemical fertilizers alongside organic manures, crop residues, biofertilizers, and other biological sources. (Solanki *et al*. 2022) [9].

Organic and inorganic maintains soil as store house of plant nutrients that are essential for vegetative growth the goal of INM is to integrate the use of all natural and artificial substances as sources of plant nutrients, so that crop productivity is increased in an efficient manner without foregoing soil productivity for future-generations.

Materials and Methods

The present investigation entitled "Effect of organic and inorganic on yield of Cluster Bean (*Cyamopsis tetragonoloba*) Var. Pusa Navbahar Under Chhattisgarh plains." was carried out at summer season of year 2024-25 at the research farm Village-Khudmudi under College of Horticulture and Research Station, Mahatma Gandhi University of Hortculture & Forestry, Durg (C.G.), The experimental area is located in the central part of the Chhattisgarh Plains, between 20°54′ to 21°32′ N latitude and 81°10′ to 81°36′ E longitude at an altitude of 317 meters above mean sea level. The entitled experiment was conducted in Randomized Block Design (RBD) with three replications. In all there were different eleven treatments viz.

Notation	Treatment
T_0	Control
T_1	100% NPK (RDF 50:60:60)
T_2	100% FYM
T_3	100% Vermicompost
T_4	100% Rhizobium
T_5	75% NPK + FYM 12.5% + Vermicompost 12.5%
T_6	75% NPK + Vermicompost 12.5% + Rhizobium 12.5%
T_7	75% NPK + FYM 9% + Vermicompost 8% + Rhizobium 8%
T_8	50% NPK + FYM 25% + Vermicompost 25%
T_9	50% NPK + Vermicompost 25% + Rhizobium 25%
T_{10}	50% NPK + FYM 18% + Vermicompost 16% + Rhizobium 16%

The seeds of the Cluster bean var. Pusa Navbahar were directly sown in soil on March 30, 2025, maintaining a spacing of 45cm x 20cm (Row to Row and Plant to Plant). The plot size for each treatment was 2m × 1.5m. The field cluster bean crop was analyzed in various treatments for key characters i.e. number of cluster plant^{-1}, number of pod cluster^{-1}, number of pod plant^{-1}, average pod weight in (g), length of pods (cm) and total yield (q/ha).

Results and Discussion

Number of cluster plant^{-1}

The findings of the present study indicate that the combined application of organic, inorganic, and biofertilizer sources of nutrients had a positive effect on the number of clusters per plant compared to the control. The highest number of clusters per plant (6.15) was recorded with the treatment of 75% RDF + FYM (25 t/ha) + vermicompost (5 t/ha) + rhizobium (2 kg/ha), while the lowest number (4.98) was observed in the control at the harvest stage. The increase in cluster number can be attributed to the beneficial effects of FYM, vermicompost, which improves soil water retention; rhizobium, which helps address nitrogen deficiency, which enhances crop yield by making phosphorus more readily available to plants. These results are in agreement with the findings reported by Singh *et al*. (2023) [8] and Patel *et al*. (2018) [4].

Number of pod cluster^{-1}

Among all the treatments, the highest number of pods per cluster (5.50) was observed with the application of 75% RDF + FYM (25 t/ha) + vermicompost (5 t/ha) + rhizobium (2 kg/ha). In contrast, the control plants recorded the lowest number of pods per cluster (4.35). The notable increase in pod formation can be attributed to the balanced nutrient availability provided by this organic and inorganic treatment, which likely enhanced the plant's internal metabolic functions. These findings are in close agreement with the results reported by Kumar *et al*. (2023) [3] and Patel *et al*. (2018) [4].

Number of pod plant^{-1}

The highest number of pods per plant (33.29) was recorded with the application of 75% RDF + FYM (25 t/ha) + vermicompost (5 t/ha) + rhizobium (2 kg/ha), while the lowest number was noted in the control treatment (21.66). This increase can be attributed to the enhanced plant growth resulting from the balanced supply of essential nutrients-namely NPK along with organic inputs like FYM, vermicompost and biofertilizers such as rhizobium. Phosphorus, in particular, plays a crucial role in pod formation and root development. The readily available nutrients from inorganic sources, along with improved nitrogen fixation, balanced carbohydrate-to-nitrogen ratio, and the synthesis of growth hormones like auxins, likely

contributed to the increase in pod production. The beneficial effects of rhizobium in enhancing pod number per plant are also supported by earlier studies by Singh *et al*. (2023) [8] and Patel *et al*. (2018) [4].

Average pod weight in (g)

The highest pod weight (2.35g) was obtained with the application of T_7 (75% RDF + FYM (9%) + Vermicompost (8%) + Rhizobium (8%)), followed by T_{10} (50% RDF + FYM 18% + Vermicompost 16% + Rhizobium16%) with (2.33g) pod weight, whereas the lowest pod weight (2.08g) was recorded under the control T_0. The increase in average pod weight may be attributed to improved nucleic acid synthesis, higher phosphorus content in plant tissues, and enhanced cell division. In addition, the incorporation of organic manures ensured a gradual and sustained release of nutrients throughout the crop growth period, which further contributed to better pod development. Similar results were also supported by Kumar *et al*. (2023) [3].

4.2.5 Length of pods (cm)

The experimental results revealed that the treatment comprising T_7 (75% RDF + FYM (9%) + Vermicompost (8%) + Rhizobium (8%)), produced the maximum pod length (14.1 cm), followed by T_{10} (50% RDF + FYM (18%) + Vermicompost (16%) + Rhizobium (16%)) with (13.4) length, whereas the minimum pod length (6.2 cm) was recorded under the control T_0. This improvement may be attributed to the balanced and continuous supply of nutrients from inorganic fertilizers, organic sources, and biofertilizers. Adequate nutrient availability enhances photosynthesis, promotes chlorophyll synthesis, and increases the production of photoassimilates, which collectively contribute to greater pod elongation. Similar results were also supported by Sharma *et al*. (2019) [6].

Total yield (q/ha)

The application of various combinations of organic and inorganic nutrient sources had a significant impact on pod yield (q/ha). The highest pod yield (70.43 q/ha) was observed with the treatment involving 75% RDF + FYM (25 t/ha) + vermicompost (5 t/ha), rhizobium (2 kg/ha), while the lowest yield (40.43 q/ha) was recorded under the control. This improvement in yield may be attributed to balanced nutrient availability and improved nutrient uptake, which supported better pod development and overall productivity. The superior yield in cluster bean in this study can be linked to the synergistic effect of FYM, vermicompost, and rhizobium, when combined with inorganic fertilizers. These inputs likely enhanced photosynthate production through increased levels of growth hormones and amino acids, thereby contributing to improved pod yield. These findings are supported by the results of Kumar *et al*. (2023) [3] and Patel *et al*. (2018) [4].

Table 1: Effect of integrated nutrient management on various yield parameters

Symbol	Treatments	Number of cluster/plant	Number of pod/cluster	Number of pod/plant	Average pod weight in (g)	Length of pods (cm)	Total yield (q/ha)
T_0	Control	4.98	4.35	21.66	2.08	6.2	40.43
T_1	100% NPK (RDF 50:60:60)	5.60	4.94	27.16	2.17	8.5	53.20
T_2	100% FYM (25 t/ha)	5.46	4.76	25.27	2.11	8.3	49.03
T_3	100% Vermicompost (5 t/ha)	5.53	4.85	26.32	2.13	8.2	50.42
T_4	100% Rhizobium (2 kg/ha)	5.35	4.63	23.27	2.10	6.4	44.19
T_5	75% NPK + FYM 12.5% + VC 12.5%	5.93	5.23	30.56	2.26	11.3	62.42
T_6	75% NPK + VC 12.5% + Rhizobium 12.5%	6.00	5.32	31.38	2.28	10.5	64.34
T_7	75% NPK + FYM 9% + VC 8% + Rhizobium 8%	6.15	5.50	33.29	2.35	14.1	70.43
T_8	50% NPK + FYM 25% + VC 25%	5.79	5.05	28.60	2.20	9.6	53.24
T_9	50% NPK + VC 25% + Rhizobium 25%	5.85	5.15	29.54	2.23	9.2	58.54
T_{10}	50% NPK + FYM 18% + VC 16% + Rhizobium 16%	6.08	5.45	32.29	2.33	13.4	67.55
	SE(m)±	0.36	0.31	1.17	1.26	0.37	2.18
	C.D. at 5%	1.09	0.93	3.46	3.73	1.10	6.43

Conclusion

Based on the findings of the present study titled "Effect of organic and inorganic on yield of Cluster Bean (*Cyamopsis tetragonoloba*) Var. Pusa Navbahar Under Chhattisgarh plains." it can be concluded that the application of 75% RDF along with FYM (25 t/ha), Vermicompost (5 t/ha) and Rhizobium (2 kg/ha) proved to be the most effective treatment for enhancing yield parameters. Therefore, this combination is recommended as a suitable nutrient management practice for the commercial cultivation of vegetable cluster bean in the Chhattisgarh Plain.

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