

## The Effect of Integrated Nutrient Management on Various Growth Parameters of Cluster Bean (*Cyamopsis tetragonoloba* L.):

### Abstract

The present investigation, entitled “The effect of integrated nutrient management on various growth parameters of cluster bean (*Cyamopsis tetragonoloba* L.)” was carried out at the Horticultural Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut – 250110, during 2022–23. In this study for integrated nutrient management (INM), farmyard manure (FYM), vermicompost, and phosphate solubilizing bacteria (PSB) were used within different combinations. The entitled experiment was conducted in a completely randomized block design (RCBD) with three replications. Application of INM dose @ 75% recommended dose of fertilizer (RDF) + Vermicompost (1.5 t ha<sup>-1</sup>) + Rhizobium (2 kg ha<sup>-1</sup>) + PSB (1 kg ha<sup>-1</sup>) was found to be the most effective in terms of growth parameters, viz., plant height (89.90 cm), number of branches plant<sup>-1</sup> (9.73), number of clusters plant<sup>-1</sup> (27.83), and number of leaves plant<sup>-1</sup> (37.98). Therefore, it was suggested that a dose of 75% RDF + Vermicompost (1.5 t ha<sup>-1</sup>) + Rhizobium (2 kg ha<sup>-1</sup>) + PSB (1 kg ha<sup>-1</sup>) suitable for the commercial cultivation of vegetable cluster bean in the Western Plane Zone of Uttar Pradesh.

**Key words:** *Cyamopsis tetragonoloba* L. Taub Cluster bean, INM, Vermicompost, Rhizobium, FYM.

### Introduction

Cluster bean, or guar (*Cyamopsis tetragonoloba* L. Taub), is one of the hardiest among legume vegetable. It is being successfully cultivated in the north-west and southern parts of India. It is well grown in those areas where low precipitation is occurs. The green, tender pods are consumed as vegetables. It is also grown as green manuring due to its dense plant canopy, which overcomes the objective of organic cultivation. Seeds contain gum like mucilaginous substances called guar gum or galactomannan, which is commercially used in textiles, the paper industry, and the cosmetic industry. Tender green pods are rich in iron and vitamin A.

In India, it is being commercially cultivated in Maharashtra, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, and Kerala for its tender green pods and consumption as a vegetable. However, the states like Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh, and Bihar are the leading producers of green pod, fodder, and seed to feed the cattle (Frageria et al., 2019).

Nutrients play an important role in the growth, development, and yield of crop plants. Among the nutrients required by the vegetable crops, nitrogen is the most deficient plant nutrient. The availability of nitrogen throughout the growing season is important for plants as it is a major and indispensable constituent of protein and nucleic acid. An adequate supply of nitrogen is associated with vigorous vegetative growth and more efficient use of available inputs, leading to higher productivity. The application of different doses of nitrogen improves plant growth and their yield.

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The physical and chemical properties of soil ~~and~~ deteriorate ~~its the~~ fertility status ~~of the soil~~. Due to this reason, ~~that~~ crop plants may not be able to assimilate essential plant nutrients at optimum levels from the soil, ~~and~~ which affects their yield directly. ~~For To~~ overcoming the deficiency of different plant nutrients, soil will be needed to replenishment of nutrients ~~by using through~~ the judicious application of fertilizers. ~~Now a days~~ Nowadays, an improved practice like INM is very popular for ~~the~~ judicious use of different sources of nutrients in ~~an~~ integrated manner for ~~the~~ sustainability of ~~fertility of soil~~ ~~fertility~~ and crop yield. ~~An~~ Integrated ~~N~~utrient ~~M~~anagement (INM) system refers to the balanced use of chemical fertilizers in combination with organic manure, crop residues, biofertilizers, and other biological sources (Thrivani *et al.*, 2015).

INM maintains soil as ~~a~~ 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~~ (Maruthi *et al.*, 2014).

### Material and Method

The present investigation, entitled “The effect of integrated nutrient management on various growth parameters of cluster bean (*Cyamopsis tetragonoloba* L.)” was conducted at ~~the~~ Horticultural Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut - 250110, Uttar Pradesh, during 2022–23. ~~The~~ Pusa Navbahar variety of ~~C~~cluster ~~B~~bean was ~~taken used~~ as a planting material to conduct ~~the~~ present investigation. The experiment was comprised of ten treatment combinations, viz., T<sub>1</sub> - 100% ~~recommended doses of fertilizer (RDF)~~ (NPK @ 50:60:60), T<sub>2</sub> - 100% RDF + FYM (1.5 t/ha), T<sub>3</sub> - 100% RDF + Vermicompost (1 t/ha), T<sub>4</sub> - 75% RDF + FYM (3 t/ha), T<sub>5</sub> - 75% RDF + Vermicompost (1.5 t/ha), T<sub>6</sub> - 75% RDF + FYM (3 t/ha) + Rhizobium (2 kg/ha) + PSB (2 kg/ha), T<sub>7</sub> - 75% RDF + Vermicompost (1.5 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha), T<sub>8</sub> - 50% RDF + FYM (5 t/ha) + Rhizobium (3 kg/ha) + PSB (2 kg/ha), T<sub>9</sub> - 50% RDF + Vermicompost (2 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha), T<sub>10</sub> - Control. The experiment was laid out in ~~a completely R~~andomized ~~B~~block ~~D~~esign (RCBD) with three replications. All the recommended cultural practices were done regularly during crop growth. The plot size for each treatment was 2 m × 3 m. The field cluster bean crop was analyzed in various treatments for key characters, i.e., plant height (cm), number of branches plant<sup>-1</sup>, number of clusters plant<sup>-1</sup>, ~~and~~ number of leaves plant<sup>-1</sup>.

### Result and Discussion

The result of different combinations of organic and inorganic origins of nutrients ~~gave had~~ a momentous effect on ~~the~~ height of ~~the~~ plant at ~~each~~ successive stage of growth at harvest. The maximum height of ~~the~~ plant was reported with treatment 75% RDF + Vermicompost (1.5 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha) with ~~a~~ value of 89.90 cm appropriately. ~~Whereas~~, the minimum average value in terms of plant height was recorded under ~~the~~ control (75.69 cm) (Table 1). This might be due to the nitrogen-fixing and phosphate-solubilizing bacteria, ~~which~~ secrete certain organic acids and some biochemical compounds and act as growth-promoting substances. The physical and chemical properties of soil ~~is have~~ might be improved by the application of vermicompost and biofertilizers, i.e., Rhizobium and PSB, leading to ~~a~~ competent supply of nutrients to the plants with enough water holding capacity and ~~might show a possible~~ effect on plant height. The mixed application of vermicompost with rhizobium, PSB, and chemical fertilizers ~~which~~ leads to increased absorption of nutrients, most likely nitrogen, which helps ~~to~~ enhance ~~the~~ cell

elongation and cell division. These results are in conformity with the findings of **Mishra *et al.* (2014) and Sharma *et al.* (2019)**.

During the time of experimentation, there was a remarkable increase in the number of branches plant<sup>-1</sup> when plots were supplied with INM combinations of organic and inorganic sources of nutrients. An application of 75% RDF + Vermicompost (1.5 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha) gave a significant effect in terms of the maximum number of branches plant<sup>-1</sup>, viz., 9.73 at harvest stage, respectively, whereas meanwhile the minimum number of branches plant<sup>-1</sup> were reported in the T<sub>10</sub> (control) with a value of 7.08 at each successive stage of crop growth. A higher number of auxiliary buds were noticed, which is due to the optimum dose of nitrogen, phosphorus, and potassium in the soil. The combined application of nitrogen as chemical fertilizer along with biofertilizers increased the number of branches plant<sup>-1</sup>. The maximum number of branches plant<sup>-1</sup> was recorded due to the additional supply of plant nutrients as well as improvement in the physical, chemical, and biological properties of the soil. Similar results were earlier reported by **Dutta *et al.* (2003), Mishra *et al.* (2014), and Singh *et al.* (2016)**.

The result of the present study of experiment reported indicated that the combined application of organic, inorganic, and biofertilizers acted as a source of nutrients and had a positive effect on the number of clusters plant<sup>-1</sup> as compared to the control. A dose of 75% RDF + Vermicompost (1.5 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha) had the maximum number of cluster plant<sup>-1</sup> (27.83). However, the minimum number of clusters were recorded under the control treatment (19.61) at the harvest stage of crop growth. The number of cluster plant<sup>-1</sup> was increased due to the application of vermicompost, which helps to increase the water holding capacity; the use of rhizobium, helped to fulfil the nitrogen deficiency; and PSB, which helps to increase the yield of the crop, as we know that the role of PSB is to make soluble phosphorus available to plants. Similar findings were also acquired by **Reddy *et al.* (2014) and Patel *et al.* (2018)**.

The number of leaves was increased by with the help of various INM applications, which significantly improved the number of leaves plant<sup>-1</sup> at the harvest stage. The maximum number of leaves more was recorded under the treatment T<sub>7</sub> [75% RDF + Vermicompost (1.5 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha)] with a value of 37.98, while the minimum number of leaves plant<sup>-1</sup> were reported under control T<sub>10</sub> (23.72). The number of leaves may be increased for optimum availability of nutrients to the plants with organic, inorganic, and biofertilizers, respectively, to promote proper metabolic activities and releasing a good amount of photosynthates, and accumulation of carbohydrates in the plants. Rhizobium plays a vital role in root development and proliferation, resulting in better nodules formation and nitrogen fixation by supplying nutrients to the roots. PSB may also increase the phosphate availability in soil, thus providing a better environment for the growth and development of cluster bean. These findings are also in consonance with the findings of **Chavan *et al.* (2015), Sharma *et al.* (2019), and Selvarani *et al.* (2021)**.

Table-1: Effect of integrated nutrient management on various growth parameters.

S.No	Treatments	Symbol	Plant height (cm)	No of Branches/ Plant	No of cluster/ plant	No. of Leaves / Plant
1	100% RDF (NPK @ 50:60:60)	T <sub>1</sub>	83.50	8.16	22.07	30.36
2	100 % RDF + FYM (1.5 t/ha)	T <sub>2</sub>	87.47	9.31	27.16	36.10
3	100 % RDF % + Vermicompost (1 t/ha)	T <sub>3</sub>	86.96	9.15	26.72	34.10
4	75 % RDF + FYM (3 t/ha)	T <sub>4</sub>	82.06	7.53	21.59	28.60
5	75 % RDF + Vermicompost (1.5 t/ ha)	T <sub>5</sub>	86.06	8.85	24.95	33.82
6	75 % RDF + FYM (3 t/ha) + Rhizobium (2 kg /ha) + PSB (2kg/ha)	T <sub>6</sub>	87.55	9.56	27.74	37.34
7	75 % RDF + Vermicompost (1.5t/ha) + Rhizobium (2 kg/ha) PSB(1kg/ha)	T <sub>7</sub>	89.90	9.73	27.83	37.98
8	50 % RDF + FYM (5t/ha) + Rhizobium (3kg/ha) + PSB (2kg/ha)	T <sub>8</sub>	83.83	8.21	23.25	32.47
9	50 % RDF + Vermicompost (2t/ha) + Rhizobium (2kg/ha) + PSB (1kg/ha)	T <sub>9</sub>	84.29	8.24	24.60	32.69
10	Control	T <sub>10</sub>	75.69	7.08	19.61	23.72
	Mean		<b>84.73</b>	<b>8.58</b>	<b>24.55</b>	<b>32.71</b>
	SE(m) ±		1.39	0.14	0.41	0.55
	C.D. at 5%		4.01	0.40	1.17	1.59
	C.V. (%)		2.83	2.79	2.86	2.90

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## Conclusion

In this study, the results obtained from the present experiment entitled “Effect of Integrated Nutrient Management on Growth of Vegetable Cluster Bean (*Cyamopsis tetragonoloba* L. Taub)” concluded that an application of INM dose @ 75% RDF + Vermicompost (1.5 t ha<sup>-1</sup>) + Rhizobium (2 kg ha<sup>-1</sup>) + PSB (1 kg ha<sup>-1</sup>) was found to be most effective in terms of growth parameters. Therefore, it was suggested that a dose of 75% RDF + Vermicompost (1.5 t ha<sup>-1</sup>) + Rhizobium (2kg ha<sup>-1</sup>) + PSB (1 kg ha<sup>-1</sup>) be suitable for the commercial cultivation of vegetable cluster bean in the Western Plane Zone of Uttar Pradesh.

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