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

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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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 Horticultural Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut – 250110 during 2022-23. In this study integrated nutrient management (INM), farmyard manure (FYM), vermicompost and phosphate solubilizing bacteria (PSB) were used with different combinations. The entitled experiment was conducted in Randomized Block Design (RBD) with three replications.

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Application of INM dose @ 75% RDF + Vermicompost (1.5 t ha^{-1}) + Rhizobium (2 kg ha^{-1}) + PSB (1 kg ha^{-1}) was found to be the most effective in terms of growth parameters *viz*., plant height (89.90 cm), number of branches $plant^{-1}$(9.73), number of clusters $plant^{-1}$(27.83) and number of leaves $plant^{-1}$(37.98). Therefore, it can be suggested that a dose of 75% RDF + Vermicompost (1.5 t ha^{-1}) + Rhizobium (2kg ha^{-1}) + PSB (1 kg ha^{-1}) suitable for the commercial cultivation of vegetable cluster bean in the Western Plane Zone of Uttar Pradesh.

Keywords: Cluster bean; INM; vermicompost; rhizobium; FYM.

1. INTRODUCTION

Cluster bean or guar (*Cyamopsis tetragonoloba* L. Taub) is one of the hardiest 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 occurs. The green, tender pods are consumed as vegetables. It is also grown as green manuring due to its dense plant canopy to overcome the objective of organic cultivation. Seeds contain gum like mucilaginous substances called guar gum or galactomannan, which is commercially used in textiles, paper industry and cosmetic industry. Tender green pods are rich in iron and vitamin A.

In India, it is commercially cultivated in Maharashtra, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala for its tender green pods and consume as vegetable. However, the states like Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh and Bihar are the leading producer of green pod, fodder and seed to feed the cattle [1].

Nutrients play an important role in 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.

The physical and chemical properties of soil deteriorate its fertility status. Due to this reason crop plants may not be able to assimilate essential plant nutrients at optimum levels from the soil and affects their yield directly. To overcome, the deficiency of different plant nutrients, soil will be needed to replenishment of nutrients through the judicious application of fertilizers. Nowadays, an improved practice like INM is very popular for judicious use of different sources of nutrients in an integrated manner for sustainability of fertility of soil and crop yield. Integrated Nutrient Management (INM) system refers to the balanced use of chemical fertilizers in combination with organic manure, crop residues, biofertilizers and other biological sources [2].

INM 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 [3].

2. MATERIALS AND METHODS

The present investigation entitled “The effect of integrated nutrient management on various growth parameters of cluster bean (*Cyamopsis tetragonoloba* L.)” was conducted at Horticultural Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut - 250110, Uttar Pradesh during 2022-23. Pusa Navbahar variety of Cluster Bean was used as a planting material to conduct the present investigation. The experiment was comprised of ten treatment combinations viz., T_1- 100% RDF (NPK @ 50:60:60), T_2- 100% RDF + FYM (1.5 t/ha), T_3- 100% RDF + Vermicompost (1 t/ha), T_4- 75% RDF + FYM (3 t/ha), T_5- 75% RDF + Vermicompost (1.5 t/ha), T_6- 75% RDF + FYM (3 t/ha) + Rhizobium (2 kg/ha) + PSB (2 kg/ha), T_7- 75% RDF + Vermicompost (1.5 t/ha)+ Rhizobium (2 kg/ha) + PSB (1 kg/ha), T_8- 50% RDF + FYM (5 t/ha)+ Rhizobium (3 kg/ha) + PSB (2 kg/ha), T_9- 50% RDF + Vermicompost (2 t/ha)+ Rhizobium (2 kg/ha) + PSB (1 kg/ha), T_{10}- Control. The experiment was laid out in Randomized Block Design (RBD) with three replications. All the recommended cultural practices were done regularly during crop

growth. The plot size for each treatment was 2m x 3m. The field cluster bean crop was analyzed in various treatments for key characters i.e. plant height (cm), number of branches plant^{-1}, number of clusters plant^{-1} and number of leaves plant^{-1}.

3. RESULTS AND DISCUSSION

The result of different combination of organic and inorganic origin of nutrients had a momentous effect on height of plant at successive stage of growth at harvest. The maximum height of plant was reported with treatment 75% RDF +Vermicompost (1.5 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha) with 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 might be improved by the application of vermicompost and biofertilizers i.e. Rhizobium and PSB leading to competent supply of nutrients to the plants with enough water holding capacity and might shown effect on plant height. The mixed application of vermicompost with rhizobium, PSB and chemical fertilizers which leads to increase absorption of nutrients most likely nitrogen which help to enhance the cell elongation and cell division. These results are in conformity with the findings of Mishra et al., [4] and Sharma et al., [5].

During the time of experimentation there was a remarkable increase in the number of branches plant^{-1} when plots 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 maximum number of branches plant^{-1}*viz*. 9.73 at harvest stage, respectively, meanwhile the minimum number of branches plant^{-1} were reported in the T_{10} (control) with a value of 7.08 at the successive stage of crop growth. More number of auxiliary buds were noticed which is due to the optimum dose of nitrogen, phosphorous and potassium from the soil. Combined application of nitrogen as chemical fertilizer along with biofertilizers increased the number of branches plant^{-1}. Maximum number of branches plant^{-1} was recorded due to additional supply of plant nutrients as well as improvement in physical, chemical and biological properties of soil. The similar results were earlier reported by Dutta et al., [6], Mishra et al., [4] and Singh et al., [7].

The result of the present study reported that combined application of organic, inorganic and biofertilizers acts as a source of nutrients were gave positive effect on number of clusters plant^{-1} as compared to 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^{-1} (27.83). However, the minimum numbers of clusters were recorded under the control (19.61) at harvest stage of crop growth. The number of cluster plant^{-1} were increased due to the application of vermicompost which helped to increase the water holding capacity, use of rhizobium helps to fulfil the nitrogen deficiency and PSB 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., [8] and Patel et al., [9].

The number of leaves was increased with the help of various INM applications which significantly improved the number of leaves plant^{-1} at harvest stage. The maximum number of leaves more recorded under the treatment T_7 [75% RDF + Vermicompost (1.5 t/ha) + Rhizobium (2 kg/ha) + PSB (1 kg/ha)] with the value37.98, while the minimum number of leaves plant^{-1} were reported under control T_{10} (23.72). Number of leaves may be increased optimum availability of nutrients to the plants with organic, inorganic and biofertilizers respectively proper metabolic activities and released a good amount of photosynthates, 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 be increases the phosphate availability in soil thus providing a better environment for growth and development of cluster bean. These findings are also in consonance with the findings of Chavan et al., [10], Sharma et al., [5] and Selvarani et al., [11].

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_1	83.50	8.16	22.07	30.36
2	100 % RDF + FYM (1.5 t/ha)	T_2	87.47	9.31	27.16	36.10
3	100 % RDF % + Vermicompost (1 t/ha)	T_3	86.96	9.15	26.72	34.10
4	75 % RDF + FYM (3 t/ha)	T_4	82.06	7.53	21.59	28.60
5	75 % RDF + Vermicompost (1.5 t/ ha)	T_5	86.06	8.85	24.95	33.82
6	75 % RDF + FYM (3 t/ha) + Rhizobium (2 kg /ha) + PSB (2kg/ha)	T_6	87.55	9.56	27.74	37.34
7	75 % RDF + Vermicompost (1.5t/ha) + Rhizobium (2 kg/ha) PSB(1kg/ha)	T_7	89.90	9.73	27.83	37.98
8	50 % RDF + FYM (5t/ha) + Rhizobium (3kg/ha) + PSB (2kg/ha)	T_8	83.83	8.21	23.25	32.47
9	50 % RDF + Vermicompost (2t/ha) + Rhizobium (2kg/ha) + PSB (1kg/ha)	T_9	84.29	8.24	24.60	32.69
10	Control	T_{10}	75.69	7.08	19.61	23.72
	Mean		84.73	8.58	24.55	32.71
	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

Here, SE is standard error, C.D. is critical differences and C.V. is coefficient of variation

4. 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^{-1}) +Rhizobium (2 kg ha^{-1}) + PSB (1 kg ha^{-1}) 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^{-1}) + Rhizobium (2kg ha^{-1}) + PSB (1 kg ha^{-1}) suitable for the commercial cultivation of vegetable cluster bean in Western Plane Zone of Uttar Pradesh.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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