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Influence of Organic sources of Nutrients on Growth and Yield of Cluster Bean (*Cyamopsis tetragonoloba* L.) var. MDU 1

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ABSTRACT

A field experiment was conducted during *summer* season of 2023 to study the "Influence of organic sources of nutrients on growth and yield of cluster bean (*Cyamopsis tetragonoloba* L.) var. MDU1" at Research Institute on Organic Farming experiment block, University of Agricultural sciences, GKVK, Bengaluru. Thirteen treatments with different organic manures as sole source of nutrients and their combinations were tested. They were replicated thrice in a randomized blockdesign with a spacing of 45 cm × 30 cm. Standard practices were followed during the entire course of the investigation. Among different treatments, application of 100 percent N equivalent poultry manure recorded significantly higher in growth characters (*viz.,* plant height at 30 DAS (19.29 cm), 60 DAS (56.46 cm), 90DAS (104.72 cm), number of branches per plant at 30 DAS (6.06), 60 DAS (13.97), 90 DAS (20.62), leaf area at 60DAS (25.53 cm^2), plant spread per plant at 60 DAS (36.56 cm^2) and total chlorophyll content in leaves at 60 DAS (3.06 mg/g) and yield components (*viz.,* number days to first flower initiation (27.68), number of cluster per plant (19.95), pod length (13.45 cm), weight of pods per plant (201.30 g) and pod yield per hectare (149.11 q/ha) over all other treatments.

Key words : *Cluster bean, Growth and yield, Cyamopsis tetragonoloba*

Introduction

The world is currently dealing with food and agriculture challenges, primarily as a result of the indiscriminate use of synthetic chemicals in food production and its impact on both human and environmental health. For a safer and more sustainable way of living, organic farming is one of the greatest alternative food production systems. Organic farming is a revolutionary agricultural production strategy that uses locally and naturally accessible organic materials or agro-inputs to complete the process without depleting our valuable natural resources.

Vegetables are regarded as 'protective supplementary food' since they are rich in vitamins and minerals that are essential for the healthy operation of human metabolic processes (Shanmugavelu, 1989). The vegetable cluster bean (*Cyamopsis tetragonoloba* L.) commonly known by its vernacular name "guar", is a significant leguminous crop that originated in Hindustan, specifically in India and Pakistan. Tropical Asia, Africa and America are the

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main growing regions for cluster beans. The main countries that grow cluster beans are India, Pakistan and the United States, with minor acreages in Australia and Africa (Patel *et al.*, 2018). India contributes around 80 per cent of the world's guar production, making it the top producer in the world. The crop is largely grown in kharif season in arid and semi-arid regions of India. But it can be grown in diverse range of environmental conditions because of its deep tap rooting system and high capacity to recover from water stress. Rajasthan, Haryana, Gujarat, Uttar Pradesh, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu are the primary states in India where it is grown. India's top state by both area and production is Rajasthan with an area of 30.33 lakh hectare and production of 17.16 metric tonnes with a productivity of 566 kg per hectare (Anon., 2020). Haryana and Gujarat have second and third position in area and production, respectively.

Cluster bean is a good source of essential nutrients such as vitamins, minerals, proteins and dietary fiber, making them an important part of a healthy diet. It exhibits antiulcer, antisecretory, cytoprotective, hypoglycemic, hypolipidemic, and antihyperglycemic properties (Mukhtar *et al.*, 2006). Organic manures are an unavoidable activity for long-term sustainability agriculture because they improve soil physical, chemical, and biological qualities while protecting soil moisture holding capacity, resulting in higher crop output while maintaining crop quality. Despite having less plant nutrients than synthetic fertilizers, organic manures are still crucial for increasing soil fertility and crop productivity since they also contain growth-promoting elements like enzymes and hormones (Premsekhar and Rajshree, 2009).

Materials and Methods

A fields experiment was conducted for one season during *summer*, 2023 on Research Institute on Organic Farming, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bangalore, to evaluate the influence of organic sources of nutrients on growth and yield parameters of vegetable cluster bean. The soil texture at the experimental site wasred sandy loam soil with slightly acidic to neutral pH(6.53), low EC (0.10dS/m), medium in organic carbon (0.56 %), nitrogen (298.34 kg/ha), phosphorous (17.02 kg/ha) and potassium (244.54 kg/ha). The experiment was laid out in the Randomized Complete Block Design with thirteen treatments and three replications. The treatment details are: T_1 –100 per cent N equivalent FYM, T_2– 100per cent Nequivalent vermicompost, T_3 – 100 per cent N equivalent poultry manure, T_4– 100 percent N equivalent bio digester liquid manure, T_5 –75 per cent N equivalent FYM + 25per cent N equivalent vermicompost, T_6– 50 per cent N equivalent FYM + 50per cent N equivalent vermicompost, T_7–75per cent N equivalent FYM + 25per cent N equivalent poultry manure, T_8– 50 per cent N equivalent FYM + 50per cent N equivalent poultry manure, T_9 – 75per cent N equivalent FYM + 25per cent N equivalent biodigester liquid manures, T_{10}–50per cent N equivalent FYM + 50 per cent N equivalent biodigester liquid manure, T_{11}– 25 per cent N equivalent FYM + 25 per cent vermicompost + 25per cent poultry manure + 25per cent N equivalent biodigester liquid manures, T_{12}- Absolute control and T_{13}–RDF (25:75:60 kg N: P_2O_5: K_2Oha^{-1}).

The organic manures (farmyard manure, vermicompost, poultry manure and biodigester liquid manure) were applied as per the required quantity and scheduled time. Well dried FYM (3 weeks before sowing), vermicompost (1 week before of sowing), poultry manure (2 weeks before sowing) were applied as basal dose and incorporated in soil manually in allocated beds as per treatment but biodigester liquid manure was applied in two split doses *i.e.,* before flower initiation (20 DAS) and at pod setting initiation stage (40 DAS). Variety MDU 1 was sown at a spacing of 0.45 m x 0.30 m in a total net plot area (2.1 m x 1.5 m). The crop was irrigated timely and the optimum plant population was maintained by gap filling. Normal cultural operations were carried out as per requirement. The data on plant height (cm), number of branches per plant, leaf area (cm^2), plant spread per plant (cm^2), chlorophyll content in leaves, number of days taken for flower initiation, number of clusters per plant, pod length, weight of pods per plant (g) and pod yield per hectare recorded from randomly selected 5 plants in each plot. The data were analyzed statistically by adopting the standard procedures described by Panse and Sukhatme (1985).

Results and Discussion

Growth characters

A perusal of data presented in Table 1 clearly indi-

cates that, the growth parameters of cluster bean were significantly influence by different organic manures. Among all the treatments the treatment with the application of 100 per cent N equivalent poultry manure showed the best results in all the growth characters *viz.,* plant height 30 DAS (19.29 cm), 60 DAS (56.46 cm), 90 DAS (104.72 cm), number of branches per plant at 30 DAS (6.06 cm), 60 DAS (13.97 cm), 90 DAS (20.62 cm), leaf area (25.53 cm^2), plant spread per plant (36.56 cm^2) and total chlorophyll content in leaves (3.06 mg/g) which was on par with treatment RDF= 25:75:60 kg N: P_2O_5: K_2O ha^{-1} and 75 per cent N equivalent FYM + 25 per cent N equivalent poultry manure.

The notable influence of poultry manure on plant height may be attributed to its higher nitrogen content, since plant vegetative growth is determined by the availability of nutrients, particularly nitrogen. As a key component of protoplasm, nitrogen promotes cell division, elongation, metabolic rate, and photosynthesis, all of which increase plant growth and the number of branches per plant. The results are in conformity with findings of Kamble *et al*. (2016) in French bean, Jaipaul *et al*. (2011) in garden pea and Onwu *et al.* (2018) in okra and Sitinjak and Purba (2018) in green beans.

A considerable increased in leaf area was observed with 100 per cent poultry manure. This might be ascribed to increased nutrient availability and uptake by the plant, which might have favored higher cell division and elongation, amino acid and protein synthesis and assimilation in producing greater leaf area, resulting in increased plant spreading. These findings are similar to those reported by Kamble *et al.* (2016) in French bean, Adeoye *et al.* (2011) in cowpea, Jagadeesh *et al.* (2018) in beetroot, Oliveira *et al.* (2001) in cabbage, Shashidhar *et al.* (2009) in garlic and Kankam *et al.* (2015) in carrot.

Organic manure treatment boostleaf chlorophyll content during the reproductive phase, because of the slow and consistent release of mineral nutrients from organic manure during the growing season according to Geng *et al.* (2019). Similar results were in accordance with the findings of Khandaker *et al.* (2017) in okra, Al-Gaadi *et al.* (2019) in cabbage, Amujoyegbe *et al.* (2007) in sorghum and Imoro *et al.* (2012) in drumstick.

Yield parameters

An assessment of data Table 2 indicated that yield parameters *viz.,* number of days taken for flower initiation, number of pods per plant, pod length, weight of pod per plant and pod yield per hectare of cluster bean are affected by various levels of organic manures.

Plants received 100 per cent N equivalent poultry manure took least number of days after sowing to initiation of flowering (27.68). This finding could be

Table 1. Effect of organic manures on growth characters of cluster bean

Treatments	Plant height (cm)			Number of branches per plant			Leaf area (cm^2)	Plant spread per plant (cm^2)	Total Chlorophyll content in leaves (mg/g)
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	60 DAS	60 DAS	60 DAS
T_1	16.30	53.94	97.12	5.67	11.78	18.63	21.56	32.67	2.75
T_2	16.68	53.45	96.04	5.71	12.05	18.25	20.75	31.69	2.70
T_3	19.29	56.46	104.72	6.06	13.97	20.62	25.53	36.56	3.06
T_4	14.95	46.63	84.67	5.07	10.19	16.24	20.63	31.36	2.46
T_5	15.49	49.76	89.57	5.33	10.80	16.82	19.64	30.81	2.56
T_6	15.24	47.45	87.74	5.27	10.57	16.65	19.18	30.12	2.52
T_7	17.07	54.84	101.01	5.83	12.97	19.76	23.03	34.66	2.88
T_8	15.59	50.86	90.52	5.42	11.02	17.15	20.06	31.01	2.62
T_9	15.96	51.85	94.65	5.53	11.65	17.84	20.87	32.08	2.67
T_{10}	18.22	54.24	99.45	5.91	13.03	19.31	22.53	33.55	2.81
T_{11}	16.27	51.42	92.21	5.59	11.41	17.56	19.41	30.52	2.78
T_{12}	13.59	35.05	64.01	4.44	7.45	12.48	17.53	26.74	2.31
T_{13}	19.07	55.74	102.56	5.95	13.63	20.32	24.69	35.79	2.92
S.Em ±	0.72	2.61	2.41	0.20	0.78	0.94	0.94	1.54	0.05
CD @ 5 %	2.11	7.63	7.03	0.58	2.28	2.75	2.75	4.49	0.15

attributed to a higher nutritional status and increased release of organic acid from the soil to the plants via poultry manures, as compared to the other organic materials utilized as treatments, which were responsible for more vegetative development (*i.e.*, an increased number of leaves). Increased leaf production may have aided in the generation of additional photosynthates and stimulated flowering stimuli, resulting in the early initiation of flower buds. The findings are in agreement with the results of Baswana and Rana (2007) in garden pea.

In the current study, a significant improvement in yield was obtained with the sole application of 100per cent poultry manure. The possible reason could be the positive influence of all yield components, *viz.*, number of clusters per plant, number of pods per cluster, pod length, weight of pod and pod yield per hectare. This might be due to the greater rate of accumulation of carbohydrates in reproductive parts of the plant, applied manures increased the root volume through better root development, nodulation, more nutrient availability resulting in vigorous plant growth and dry matter production which in turn resulted in better flowering, pod formation, slow release of nutrients from organic manures and their better utilization by cluster bean throughout the growing period, which might have resulted in higher cluster bean pod yield. The enhanced pod yield might also be pertaining to the increased N supply in soil from poultry manure, which improved the synthesis of chlorophyll, proteins and amino acids in cluster bean plants. Similar findings were found by Bhathal and Kumar (2018) in cluster bean, Adeoye *et al*. (2011) in cowpea and Gopinath and Mina (2011) in garden pea and Veerabhadraiah *et al.* (2006) in French bean, Kamble *et al*. (2016) in French bean, Mankar *et al*. (2020) in garden pea and Ujjwal *et al*. (2022) in brinjal.

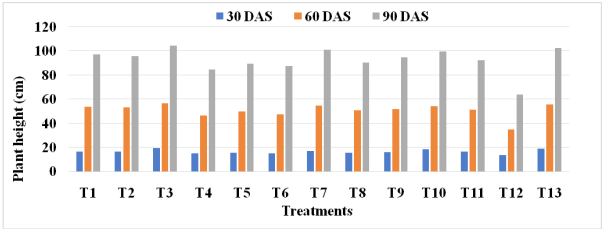

Fig. 1. Effect of organic manures on plant height

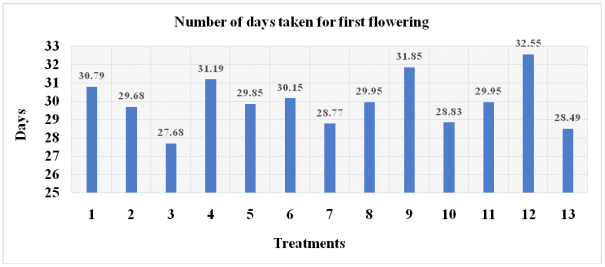

Fig. 2. Effect of organic manures on number of days taken for first flowering

Conclusion

Cluster bean growth and yield parameters were considerably higher by the application of 100 per

Table 2. Effect of organic manures on yield parameters of cluster bean

Treatments	Number of days to initiation of flowering	Number of clusters per plant	Pod length (cm)	Weight of pods per plant (g)	Pod yield per hectare (q)
T_1	30.79	17.94	11.93	173.91	128.82
T_2	29.68	17.67	11.81	169.56	125.60
T_3	27.68	19.95	13.45	201.30	149.11
T_4	31.19	15.52	10.61	138.26	102.41
T_5	29.85	16.03	11.01	148.69	110.14
T_6	30.15	15.82	10.87	143.47	106.28
T_7	28.77	19.01	12.72	190.86	141.38
T_8	29.95	16.53	11.29	151.73	112.39
T_9	31.85	17.01	11.64	162.17	120.12
T_{10}	28.83	18.65	12.35	184.78	136.87
T_{11}	29.95	16.85	11.49	155.65	115.29
T_{12}	32.55	10.54	10.21	91.30	67.63
T_{13}	28.49	19.58	12.98	198.26	146.85
S.Em ±	0.32	0.74	0.40	1.31	7.27
CD @ 5%	0.93	2.17	1.19	3.82	21.23

cent N equivalent poultry manure, without affecting soil fertility management which was on par with RDF = 25:75:60 kg N: P_2O_5: K_2Oha^{-1} and 75 per cent N equivalent FYM + 25 per cent N equivalent poultry manure. But more investigation is required to confirm these early findings before providing a definite suggestion to the farmers.

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