Original Research Article

Influence of Organic Nutrient Sources on Yield and Economics of Vegetable Clusterbean

ABSTRACT

Aims: To investigate the impact of various organic nutriet sources on the yield and economics of the Vegetable Clusterbean.
Study design: The experiment was conducted in randomized complete block design with 12 treatments and three replications.
Place and Duration of Study: Wet land Farm, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, between July to october, 2018.
Methodology: The yield parameters were collected after each picking from five tagged plants and averaged for statistical analysis. The length of pods was measured from the calyx base to pod tip, the Width of the pod on the broadside of the pod was measured with help of vernier calipers and The weight of a single pod was collected using an electronic weighing balance. The yield of vegetable clusterbean from the net plot area at each picking was noted. The harvest index, gross returns, net returns, and the benefit-cost ratio was calculated per hectare for each of the treatment.
Results: Significantly higher pod length, pod weight, yield, harvest index and gross returns (11.6 cm, 2.4 g, 11084 kg/ha, 2.4, Rs. 1,66,254/ha, respectively) were recorded under recommended dose of fertilizer (50:50:40-N:P: K) in addition to the foliar spray of TNAU pulse wonder. However, all these parameters were statistically on par with treatments such as organic farmer's practice and 25 tons/ha of Farm yard manure (FYM) along with a foliar spray of 3 percent *Panchagavya*. Regarding economics net returns and benefit-cost ratio were higher with humic acid @ 6 l/ha along with banana pseudostem sap @ 2% followed by Humic acid @ 6 l/ha along with *Panchagavya* @ 3% and organic farmers practice.

Conclusion: Considering the safer environment, human health, and economic feasibility the farmer's practice of applying FYM @ 10 t/ha in addition with *Jeevamruth* @ 500l/ha and foliar spray of *Panchagavya* @ 3 percent is found to provide higher yields and profits in vegetable clusterbean.

Keywords: Yield, Economics, vegetable Clusterbean, Organic manures and recommended dose of fertilizers.

1. INTRODUCTION

Today, the world has been facing problems headed by food and agriculture, mainly due to the indiscriminative use of synthetic chemicals for food production and their consequences on the health of humans and the environment [1]. Organic farming is one of the best alternatives food production systems for safer and sustainable life, as it promotes and enhances agroecosystem health by following principles of health, ecology, fairness, and care for all including soil [2]. With a land area of 10.2 million hectares, India ranks second in vegetable output behind China (175 million tonnes). However, in comparison to worldwide production, we continue to trail behind in the output of numerous vegetables [3]. As a result, there is a pressing need to boost vegetables yield in a long-term manner.

Comment [KS1]: Scientific name and variety name of the crop can be given

Comment [KS2]: Cluster bean

Comment [KS3]: Cluster bean

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Comment [KS5]: Abstract can be of single paragraph with out sub headings. Please remove all the sub headings of the abstract and correct the sentences accordingly. Pls once verify and correct typographical errors.

Comment [KS6]: Key words can be in alphabetical order

Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.] is a fabaceae plant that is native to the Indian subcontinent [4]. It is popularly known as 'Guar', and it is a very good social and commercially important legume crop in India's arid and semiarid regions, valued for its high yield and drought tolerance. Tender pods are vegetables that are high in protein (3.2 g), vitamin C (49 mg), vitamin A (65.31 IU), energy (16 KCal), iron (4.5 mg), calcium (57 mg), fat (1.4 g), carbohydrate (10.8 g), and moisture (8.1 g) per 100 g edible piece [5]. It also treats a variety of ailments, including stomach ulcers, high blood pressure, obesity, plague, arthritis, inflammation, sprains, and liver enlargement [6].

Vegetable clusterbean require an abundant supply of nutrients for good growth and development. Organic manures like vermicompost, farm yard manure, *Panchagavya,* and humic acid can be used as substitutes for inorganic fertilizers in clusterbean to maintain soil productivity and environmental quality. Organic manures not only enhance the soil's chemical properties by providing macro and micronutrients, but they also reduce the chances of crop failure by providing growth-promoting substances and also improve the soil's physical properties like structure and soil moisture retention capacity [7].

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2. MATERIAL AND METHODS

An experiment was conducted from July to October, 2018 on irrigated wetland farms of Tamil Nadu Agricultural University, Coimbatore to evaluate the influence of organic manures on yield parameters and economics of vegetable clusterbean. The experimental site has clay loam soil with alkaline p*H*(8.6), low EC (0.28 dS/m), medium in organic carbon (0.62%), low in nitrogen(252 kg/ha), medium in phosphorous (18.2kg/ha) and high in potassium (402kg/ha). The experiment was carried out in randomized complete block design with twelve treatments and three replications. The following are the treatment details: T1: Organic farmer's practice (farm yard manure (FYM) @10 t/ha + Jeevamruth@ 500 l/ha along with irrigation on 3rd days after sowing (DAS), 30 DAS and 60DAS + Panchagavya @ 3% as foliarspray (FS) on 30, 45 and 60 days after sowing (DAS), T2: FYM @ 25 t/ha + Panchagavya @ 3% as FS on 30, 45 and 60DAS, T3: FYM @ 12.5 t/ha + Panchagavya@ 3% as FS on 30, 45 and 60 DAS, T4: FYM @ 12.5 t/ha + banana pseudostem sap @2% as FS on 30, 45 and 60 DAS, T5: Vermicompost @ 5 t/ha + Panchagavya @ 3% as FS on 30, 45 and 60 DAS, T6: Vermicompost @5t/ha + banana pseudostem sap @ 2% as FS on 30, 45 and 60 DAS, T7: Ganajeevamruth @ 500 kg/ha + Panchagavya @ 3% as FS on 30, 45 and 60DAS, T8: Ganajeevamruth @ 500 kg/ha +banana pseudostem sap @ 2% as FS on 30, 45 and 60 DAS, T9: Humic acid @ 6 l/ha+ Panchagavya @ 3% as FS on 30, 45and 60 DAS, T10: Humic acid @ 6 l/ha + banana pseudostem sap @ 2% as FS on 30,45 and 60 DAS, T11: RDF of NPK fertilizers (50:50:25) + TNAU pulse wonder @ 1%as FS, T12: Absolute control.

Comment [KS8]: please explain the detail procedure for banana sap extraction and its dilution. Did you extract the sap from standing tree or harvested/uprooted tree?

The FYM, vermicompost, Ganajeevamruth, and humic acid were basal applications, whereas Panchagavya, banana pseudostem sap were foliar spray applications on 30, 45, and 60 DAS. Jeevamruth was given along with irrigation water on the 3rd day after sowing (DAS), 30th, and 60th DAS. To achieve excellent tilth, the field was ploughed twice with a cultivator and once with a rotovator. Using a bullock-drawn ridge former, 45cm width ridges were created. The net dimension of the plots was 4.95 × 2.55 m. Prior to sowing, organic manures were applied to the soil and irrigated. Clusterbean MDU 1 of TNAU was utilized in this experiment. Seeds were treated with *Rhizobium* at a concentration of 80 g/kg and then dried in the shade for 12 hours. Seeds were sowed 15 cm apart on one side of the ridge. The first irrigation was on the day of sowing, the second on the third DAS, and then further irrigations were scheduled based on available soil moisture content. As per the treatments, organic liquid manures were administered as a foliar spray on 30, 45, and 60 DAS. Except for the use of synthetic chemicals, all other cultural practices were followed as recommended by the TNAU agro site. (http://agritech.tnau.ac.in/horticulture/horti vegetables cluste.html).

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Length of a pod (cm) was measured from the calyx base to pod tip, Width of a pod in (mm) was measured on broadside of the pod with help of Vernier calipers, the weight of individual single green tender pods was noted. Mean values were recorded for each picking from five pods in each tagged plant. Vegetable green tender pods/plant were weighed using an electronic weighing balance after each picking and pooled. Yield of vegetable clusterbean from net plot area of each treatment,

leaving border lines and sampling rows were recorded at each picking. The final yield was attained by summing up all the pickings and expressed in kilograms. The dry weight of the shoot portion/net plot at harvest was logged after sun drying the plants. The straw yield is the dry weight of shoot portion without pod weight in a net plot and expressed in kg/ha. The harvest index was calculated using the formula was given by Watson in 1952 [7].

$$\text{Harvest index (HI)} = \frac{\text{Economic yield (kg/ha)}}{\text{Biological yield (kg/ha).}}$$

The experimental yield parameters data were statistically analyzed by analysis of variance using Agres software. The level of significance was kept at 5% (P =0.05). The cost of cultivation was worked out for all 12 treatments individually. The cost of all the operations from the land preparation to the final picking of green pods along with the input costs were taken into consideration. The prevailing market prices of vegetable clusterbean at the harvest time in Coimbatore market was taken into consideration for computing profit amount. The gross returns (Rs./ha) were calculated by taking into account the green pod yield of each treatment. The net returns (Rs./ha) was calculated by deducting the total cost of cultivation from gross returns per hectare for each of the treatment. The BC ratio was also computed by dividing gross return with cost of cultivation for each treatment. The detailed cost of cultivation for each treatment was given in appendix I.

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3. RESULTS AND DISCUSSION

Effect of organic nutrient source on yield parameters and yield of vegetable clusterbean.

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The recommended dose of fertilizer (RDF) with TNAU pulse wonder registered 56% higher yield than absolute control. Whereas, organic farmers' practice (T1) and FYM @ 25 t/ha in addition to the foliar spray of 3% Panchagavya (T2) scored 43% and 42% higher yield, respectively than absolute control (T12).

Yield parameters are the ultimate output in nutrient experiments to be observed in order to attain food security. Table 1 shows statistically evaluated mean data on yield parameters of vegetable clusterbean, such as pod length, pod breadth, single pod weight, and pod yield. A review of the data revealed that RDF in addition to TNAU pulse wonder (T11) produced significantly longer pods (11.6 cm), higher single pod weight (2.4 g), pod yield (11084 kg/ha) and harvest index (2.4) among the treatmets, which was comparable to organic farmers' practice (T1) and FYM @ 25 t/ha in addition to foliar spray of 3 percent Panchagavya (T2). The yield of RDF with TNAU pulse wonder was 56 percent higher than the yield of absolute control. Organic farmers practice (T1) and FYM @ 25 t/ha with a foliar spray of three percent Panchagavya (T2) outperformed the absolute control by 43 percent and 42 percent, respectively (T12).

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Table 1. Effect of organic manures on yield parameters of vegetable clusterbean

Treatments	Pod length (cm)	Pod width (mm)	Pod weight (g)	Stover yield (kg/h)	Harvest index
T1 - Organic farmers' practice (FYM @ 10 t/ha + Jeevamruth @ 500 l/ha + Panchagavya @ 3%)	10.7	7.7	2.2	2284	0.47
T2 - FYM @ 25 t/ ha + Panchagavya @ 3%	10.6	8.0	2.2	2443	0.45
T3 - FYM @ 12.5 t/ha + Panchagavya @ 3%	9.6	7.6	2.0	2167	0.46
T4 - FYM @ 12.5 t/ha + banana pseudostem sap @ 2%	9.7	8.0	2.0	2344	0.44
T5 - Vermicompost @ 5 t/ha + Panchagavya @ 3%	9.5	7.2	1.9	2192	0.45
T6 - Vermicompost @ 5 t/ha + banana pseudostem sap @ 2%	9.7	7.7	2.0	2360	0.44
T7 - Ganajeevamruth @ 500 kg/ha + Panchagavya @ 3%	8.4	7.9	1.7	1890	0.46
T8 - Ganajeevamruth @ 500 kg/ha + banana pseudostem sap @ 2%	8.5	7.7	1.7	2013	0.45
T9 - Humic acid @ 6 l/ha + Panchagavya @ 3%	8.5	7.6	1.7	1907	0.46
T10- Humic acid @ 6 l/ha + banana pseudostem sap @ 2%	9.5	7.8	1.9	2076	0.47
T11- Recommended dose of NPK fertilizers + TNAU pulse wonder @ 1%	11.6	7.7	2.4	2351	0.49
T12 -Absolute control (No fertilizers/ No manures)	7.4	6.5	1.5	1859	0.43
SEd	**0.6**	**0.4**	**0.1**	**117**	**0.02**
CD (P = .05)	**1.2**	**NS**	**0.2**	**242**	**NS**

*FYM: Farm yard manure

Comment [KS15]: For pod length, weight, stover yield-indicate the significant level as *-significant (at 5%) or **-highly significant (at1%)

The faster accessible form of nutrients from inorganic fertilizers was responsible for the better production value [8],[9], and [10]. The yield attributes and yield obtained from organic farmers' practice treatment and FYM @ 25 t/ha along with Panchagavya foliar spray was because of farm yard manure application. FYM adds great value to soil by changing the bulk density, improving soil aeration, enriching soil microbial life along with supply of plant nutrients. In addition to this Jeevamruth act like biofertilizer, as it has N fixers and P solubilize [11]. As a composite result, vegetable clusterbean had higher uptake of nutrients from the soil. Besides this Panchagavya and FYM application also might had boosted plant vegetative growth with this higher photosynthate production and good partitioning of food material and translocation might have contributed to increase in yield attributes and yield, the composite effect of all above discussed parameters had made organic treatments statically on par with inorganic treatment [12], [13] and [14].

Comment [KS16]: Few more recent references can be discussed here. Also the treatments those fall on on par can be discussed.

Effect of organic manures on economics of vegetable clusterbean.

Comment [KS17]: Cluster bean

Any technology developed by scientists or farmers will be adopted based on economic viability and feasibility. The economics in terms of net return and benefit-cost ratio of a crop cultivation technology will have a greater impact on practical utility and acceptance by farmers. The economics of different organic manures application in vegetable clusterbean had been computed and exhibited in Figure 1. Net returns (Rs. 1,11,235/ha) and benefit cost ratio (2.02) were higher with RDF in addition with TNAU pulse wonder (T11), followed by humic acid @ 6 l/ha with banana pseudo stem sap foliar spray (T10) and organic farmers' practice (T1) due to better crop growth, physiological activity, nutrient uptake and higher yield. The lower net returns (Rs. 35,273/ha) and benefit cost ratio (0.3) were obtained with vermicompost @ 5 t/ha in addition Panchagavya foliar spray (T5) followed by vermicompost @ 5 t/ha with 2% banana pseudostem sap as a foliar spray (T6) and FYM @ 25 t/ha along with 3% Panchagavya as a foliar spray (T2) because of higher cost incurred to FYM and vermicompost. The results are in conformity with [15], [16] and [17].

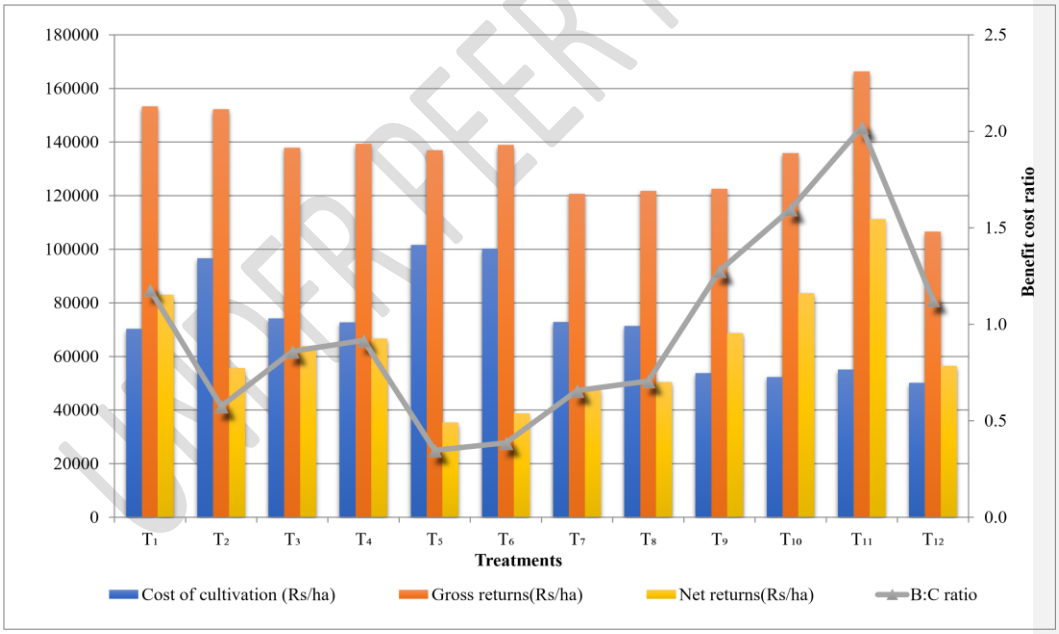

Figure. 1. Effect of organic manures on economics of vegetable clusterbean

4. CONCLUSION

Along with food security, it is necessary to consider the safety of the environment, human health and economic feasibility in agriculture and food production systems. So, it is concluded that the farmer's practice of applying FYM @ 10 t/ha in addition along with Jeevamruth @ 500l/ha and foliar

spray of Panchagavya @ 3 percent is found to provide higher yields and better profits in vegetable clusterbean.

Comment [KS18]: TNAU pulse wonder combination recorded maximum.

Comment [KS19]: Journals names can be abbreviated

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APPENDIX

Comment [KS20]: Appendix can be removed and the detail given here can be incorporated with the result chapter, so that the benefit cost ratio can be well explained by table format with expenditure, gross income, net income etc.,

I. UNITS OF INPUTS USED AND PRODUCE (RS.)

S. No.	Input particulars	Unit	Price (Rs.)
1.	Chisel plough	1 h	350
2.	Tractor drawn Cultivator	1 h	350
3.	Bullock pair	Pair/day	300
4.	Clusterbean seeds	1 kg	1200
5.	Cow urine	1 l	5
6.	FYM	1 t	1800
7.	Vermicompost	1 kg	7
8.	Jaggary	1kg	53
9.	Bengalram flour	1kg	40
10.	Cow dung	1 kg	3
11.	Humic acid	1 l	360
12.	*Panchagavya*	1 l	100
13.	Banana pseudostem sap	1 l	10
14.	Pulse wonder	1 kg	200
15.	Urea	1 kg	5.94
16.	SSP	1 kg	7.56
17.	MOP	1 kg	13.3
18.	Pseudomonas liquid	1 l	300
19.	Copper oxy chloride	1 kg	740
20.	Azardactin	1 l	512
21	Men labour	Man/day	360
22.	Women labour	Man/day	360

II. Cultural operations and their schedule during cropping period

Particulars	Frequency	Date
A. Land preparation		
1. Cross cultivation by a tractor	Two	02.07.2018 and 08.07.2018
2. Harrowing by a tractor	One	16.07.2018
3. Rotovator operation with tractor propelled rotovator	One	26.07.2018
4. Ridges (45 cm) formation with bullock drawn ridger	One	26.07.2018
5. Rectification of bunds and water channels and plot layout manually	One	26.07.2018
B. Manuring		
1. Application of biofertilizers and neem cake manually	One	26.07.2018
2. Basal application of organic treatments to respective plots manually along the length of ridges	One	27.07.2018
3. Inoculation of seeds with biofertilizers and biocontrol agents	One	26.07.2018
C. Sowing of seed (manually)	One	27.07.2018
D. After care		
1. Gap filling	One	03.08.2018
2. Thinning	One	13.08.2018
3. Hand weeding (manual)	Two	21.08.2018, 31.09.2018 and 17.09.2018
4. Irrigation – 3 times Supplemental flood irrigation in ridges and furrows		

First	One	01.08.2018
Second	One	03.09.2018
Third	One	20.09.2018
5. Field drainage	Two	20.08.2018 and 24.09.2018
Particulars	**Frequency**	**Date**
6. Plant protection		
a. *Azadirachtin* 1% foliar spray	One	14.08.2018
b. Vermi wash foliar spray	One	03.09.2018
c. *Pseudomonas* soil drenching	One	14.08.2018
d. Bordeaux mixture 1% solution soil drenching	Two	11.09.2018 and 19.09.2018
E. Picking of pods		
First picking	One	18.09.2018
Second picking	One	25.09.2018
Third picking	One	03.10.2018
Fourth picking	One	15.10.2018