RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF CLUSTER BEAN (*Cyamopsistetragonoloba*L.)UNDER SEMI ARID TRACTS OF ANDHRA PRADESH

ABSTRACT

An experiment entitled "Studies on integrated nutrient management in cluster bean under SAT regions" was carried out during rabi season of 2022-23 at college Farm, Sri Krishnadevaraya College of Horticultural Sciences, Ananthapuramu. The experiment was conducted in Randomized Block Design with three replications using cv. PusaNavbahar, with seventeen treatments. The combination of organic manures, chemical fertilizers and reduced doses of chemical fertilizers along with organic manures were tested in comparison with RDF. The yield attributes viz., number of clusters plant^{-1}, number of pods in a cluster, length and diameter of pod differed significantly due to the different INM treatment. The treatment 75% of recommended dose of inorganic fertilizers and 25% RDF through vermicompost recorded significantly highest pod yield (14.93 t ha $^{-1}$). For optimum growth, higher pod yield and high monetary returns from the crop should be supplied with the 75% of recommended dose of fertilizers and 25% RDF through vermicompost.

Key words: Cluster bean, Integrated nutrient management, Manure, Fertilizer and Yield

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1. INTRODUCTION

Cluster bean [*Cyamopsistetragonoloba* (L.) Taub] is hardy and drought tolerant vegetable crop having deep root system which enables to utilize the available moisture and nutrients more effectively which sustain under rainfedconditions. It is locally known as "guar" annual legume crop grown as vegetable, as green manure and as a forage crop for cattle. It is one of the best vegetable legume crop suitable for semi aridclimatic conditions of Andhra Pradesh. In the recent years, this crop has assumed great significance in industrial sector due to the presence of good

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quality of gum in the endosperm of its seed and also having 28 to 33 per cent gum. The natural polysaccharide water-soluble polymer found in the endosperm (Reddy *et al*., 2011), as galactomannan gum, is the chief product used in many industries (Amin *et al*., 2007). In spite of huge potential, it is being cultivated in limited area due to its low productivity levels and can be attributed mainly due to inadequate fertilization. Minimize the use of chemical fertilizers by addition of organic manures (Gandhi and Sivakumar, 2010 and Subbiah*et al*., 1982). Usage of Organic manures like farm yard manure, vermicompost and poultry manure showed an increased growth in terms of height and yield of the plant, it could be a better alternative to inorganic fertilizers (Tamilselvi and Devi, 2009 and Indirabai*et al*., 2009). In such conditions integrated approach by using both organic and inorganic nutrient sources seems to be a viable alternative method to produce higher yields in cluster bean with acceptable quality. The integrated nutrient management system has become an accepted strategy to study the effect of different organic, inorganic sources of nutrients alone and in combinations of both on growth, yield and quality of cluster bean to sustain the soil fertility and the environment in SAT regions of Andhra Pradesh.

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2. MATERIALS AND METHODS

The field trail was carried out in Sri Krishnadevaraya College of Horticultural Sciences, Ananthapuramufarm (Orchard A- block) during *rabi* – 2023 with Pusanavbahar variety which was released from IARI having 65-80 days duration suitable for all seasons. The experimental site was sandy clay loam having pH of 7.4 and organic carbon of 0.46 per cent. The available nitrogen, phosphorus and potassium contents were 272.29, 17.93, and 309.24 kg ha^{-1} respectively. The experiment was laidout in randomized block design comprising of 17 treatments replicated thrice. Seventeen treatments were formed by considering different organic, inorganic nutrient sources alone and combinations by decreasing the inorganic nutrient sources i.e.,Control (T_1), 100 per cent NPK through fertilizers(25 kg N, 50 kg $P_2O_5$and 50 kg K_2O ha^{-1}) (T_2), and 100 per cent NPK through FYM (T_3),100 per cent NPK through vermicompost (T_4), 100 per cent NPK through sheep manure (T_5), 100 per cent NPK through poultry manure (T_6), 75 per cent NPK through fertilizers (T_7), 75per cent NPK through fertilizers + 25 per cent NPK through FYM (T_8), 75per cent NPK through fertilizers + 25 per cent NPK through vermicompost (T_9), 75per cent NPK through fertilizers + 25 per cent NPK through sheep manure

(T_{10}), 75per cent NPK through fertilizers + 25 per cent NPK through poultry manure (T_{11}), 50 per cent NPK through fertilizers (T_{12}), 50 per cent NPK through fertilizers + 50per cent NPK through FYM (T_{13}), 50 per cent NPK through fertilizers + 50per cent NPK through vermicompost (T_{14}), 50 per cent NPK through fertilizers + 50per cent NPK through sheep manure (T_{15}), 50 per cent NPK through fertilizers + 50per cent NPK through poultry manure (T_{16}) and 100 per cent NPK through FYM, vermicompost, sheep manure and poultry manure (T_{17}).

Cyamopsistetragonolobavar.Pusanavbaharvarietywasusedforsowingwhichtakesaround95-100daystomature.Seedsweresowninlinemanuallywith the spacing of plant to plant 15 cm and row to row 45 cm with depth of 3-4 cm. Well decomposed manures were applied to respective treatment plots before fortnight of sowing date and fertilizers were applied on the day of sowing. During the Crop growing period, the weekly mean maximum temperature ranged from 29.18˚C to 38.11˚C with an average of 33.66˚C and weekly mean minimum temperature ranged from 16.69˚C to 26.82˚C with an average of 21.75˚C. The weekly mean relative humidity ranged from 46.71 to 83.49per cent with an average of 65.10per cent. A total rainfall of 321.52 mm was received in 19 rainy days. The weekly mean bright sunshine hours ranged from 0.93 to 7.86 hours day^{-1} with an average of 4.40 hours day^{-1}. All the data was recorded in the by selecting randomly five plants in each treatment. The destructive samples like LAI and DMP are collected in gross plot, then the non-destructive samples are recorded by tagging plants and also for post harvest parameters. All the data recorded in the study were subjected to statistical analysis using ANOVA for RBD suggested by Panse and Sukkhatme (1985).

3. RESULTS

3.1. Growth parameters

The integrated nutrient management exhibited marked significant difference on growth parameters(Table 1). The integration of inorganic sources with inorganic sources of nutrients significantly influenced the growth characters viz. plantheight (100.83 cm), number of branches (15.78), leaf area index (3.21), dry matter production (13.57 g $plant^{-1}$), days to 50 per cent flowering (29.10) and days to maturity (129.01)with application of 75 per cent NPK through inorganic fertilizers + 25 per centNPK through vermicompost(T_9). Ramana *et*

al.,(2011)alsoindicatedthatapplicationof75per centRDF+ vermicompostsignificantlyincreasethe plant height and branches per plant. Thefindings agrees with the previous results ofChoudhary*etal.*,(2006),Rathore*etal.*,(2007) and Deshmukh *et al.,* (2014). The application of 100 per cent NPK through inorganic fertilizers (25 kg N, 50 kg $P_2O_5$and 50 kg K_2O ha^{-1}) (T_2) performed better next to T_9 and the rest of treatments are at par each other. Ayub*etal.* (2010) found the application of 100 per cent Nof recommended dose significantly increased thegrowth parameters.The lowest plantheight (100.83 cm), number of branches (15.78), leaf area index (3.21), dry matter production (13.57 g $plant^{-1}$), days to 50 per cent flowering (29.10) and days to maturity (129.01) these findings were similar to the results of Anuradha *et al.,* (2017).

3.2. Yield and yield parameters

The significant difference was observed with integrated nutrient management on yield and yieldattributes (Table 2). The application of 75 per cent NPK through inorganic fertilizers + 25 per cent NPK through vermicompost (T_9) recorded highest number of clusters $plant^{-1}$(25.86), number of pods $plant^{-1}$(8.05), pod length (13.28 cm), pod diameter (5.98 cm), number of pods $plant^{-1}$(182.31), number of seeds $plant^{-1}$(10.20), 1000 seed weight (29.82), pod yield (14.93 t ha^{-1}) and seed yield (13.15 q ha^{-1}). The lowest yield and yield attributes was observed in control treatment recording lowest number of clusters $plant^{-1}$(12.93), number of pods $plant^{-1}$(3.49), pod length (8.05 cm), pod diameter (3.02 cm), number of pods $plant^{-1}$(45.13), number of seeds $plant^{-1}$(4.02), 1000 seed weight (22.12), pod yield (4.11 t ha^{-1}) and seed yield (4.78 q ha^{-1}). The application of 100 per cent NPK through inorganic fertilizers (25 kg N, 50 kg $P_2O_5$and 50 kg K_2O ha^{-1}) (T_2) performed better next to the treatment with application of 75 per cent NPK through inorganic fertilizers + 25 per cent NPK through vermicompost (T_9) and the treatments of 75 per cent NPK with organic manures and 50 per cent NPK with organic manures are at par with each other.Increaseinthenumberofpodsplant^{-1},seedspod^{-1} andseedyieldwiththeapplicationof20kgNand40kgP_2O_5 inclusterbeanwasreportedbyRathore*etal.* (2007),

Increaseintheyieldandyieldcontributingparameterinclusterbeanwasreportedby Ayub*etal.*,(2013). Highestnumberofpodsplant^{-1},1000seedweight,seedyieldandstoveryieldofclusterbeanweremaximumwith100 per centRDNthroughurea+Rhizobium+PSB (Kumar *et al.,* 2012). Significantly higher yield with

application of NPK was also reported by Singh (2002).Saxena *et al*. (2003) also reported that application of different levels of nitrogen, helps to increase the yield ofcluster bean significantly over control. Naggar and Meena (2004) reported that the seed yield wassignificantlyandpositivelycorrelatedwithyieldattributingcharactersofclusterbean.

Table .1 : Effect of integrated nutrient management on growth parameters of cluster bean

Treatments	Plant height at 90DAS	No. of branches plant^{-1} at 90DAS	LAI at 90DAS	DMP at 90DAS	Days to 50 percent flowering	Days to maturity
T_1 : Control	76.83	6.13	2.02	6.92	32.66	106.71
T_2 : RDF through fertilizers	97.50	15.02	2.93	11.21	30.1	126.16
T_3 : 100 per cent NPK through FYM	88.83	13.78	2.64	9.04	30.46	123.22
T_4 : 100 per cent NPK through vermicompost	94.97	14.45	2.80	10.37	30.33	124.23
T_5 : 100 per cent NPK through sheep manure	87.83	10.12	2.64	8.77	31.55	117.98
T_6 : 100 per cent NPK through poultry manure	86.83	8.45	2.53	8.51	31.62	113.79
T_7 :75 per cent NPK through fertilizers	87.17	9.78	2.60	8.67	31.56	115.65
T_8 : 75 per cent NPK through fertilizers + 25 per cent NPK through FYM	92.17	11.78	2.83	10.71	31.11	122.04
T_9 : 75 per cent NPK through fertilizers + 25 per cent NPK through vermicompost	100.83	15.78	3.21	13.57	29.10	129.01
T_{10} : 75 per cent NPK through fertilizers + 25 per cent NPK through sheep manure	90.12	13.12	2.73	9.87	30.99	123.34
T_{11}: 75 per cent NPK through fertilizers + 25 per cent NPK through poultry manure	85.17	7.78	2.42	8.27	31.67	113.67
T_{12} : 50 per cent NPK through fertilizers	81.64	6.64	2.25	7.73	32.17	109.43
T_{13} : 50 per cent NPK through fertilizers + 50 per cent NPK through FYM	88.62	11.12	2.66	9.61	31.36	119.08
T_{14} : 50 per cent NPK through fertilizers + 50 per cent NPK through vermicompost	89.83	11.45	2.70	9.64	31.21	121.23
T_{15} : 50 per cent NPK through fertilizers + 50 per cent NPK through sheep manure	85.17	7.46	2.38	8.11	31.71	113.01
T_{16}: 50 per cent NPK through fertilizers + 50 per cent NPK through poultry manure	82.31	7.23	2.33	7.82	32.01	110.87
T_{17}: 100 per cent NPK through FYM, vermicompost, sheep manure and poultry manure	84.82	7.54	2.36	7.99	31.89	112.90
SEm±	0.81	0.25	0.10	0.21	0.36	0.61
CDat5per cent	2.37	0.72	0.26	0.57	1.04	1.78

Table .2 : Effect of integrated nutrient management on Yield attributes of cluster bean

Treatments	No. of clusters plant^{-1}	No. of pods cluster^{-1}	Pod length (cm)	Pod diameter (mm)	No. of pods plant^{-1}	No. of seeds pod^{-1}	1000 seed weight (g)	Pod yield (t ha^{-1})	Seed yield (q ha^{-1})
T_1 : Control	12.93	3.49	8.05	3.02	45.13	4.02	22.12	4.11	4.78
T_2 : RDF through fertilizers	22.59	6.32	12.93	5.20	142.77	8.71	29.01	11.69	11.7
T_3 : 100 per cent NPK through FYM	18.59	5.54	11.59	4.74	102.99	6.50	27.90	8.43	9.98
T_4 : 100 per cent NPK through vermicompost	20.83	6.25	12.42	5.01	124.16	7.90	28.30	10.17	10.36
T_5 : 100 per cent NPK through sheep manure	18.24	5.36	11.28	4.74	97.77	6.30	27.25	8.01	7.87
T_6 : 100 per cent NPK through poultry manure	17.75	5.34	11.05	4.61	94.79	6.20	26.73	7.76	7.08
T_7 :75 per cent NPK through fertilizers	18.06	5.35	11.10	4.70	96.62	6.30	26.96	7.91	7.54
T_8 : 75 per cent NPK through fertilizers + 25 per cent NPK through FYM	19.93	6.23	12.63	5.14	130.19	6.00	28.77	10.66	9.06
T_9 : 75 per cent NPK through fertilizers + 25 per cent NPK through vermicompost	25.86	8.05	13.28	5.98	182.31	10.20	29.82	14.93	13.15
T_{10} : 75 per cent NPK through fertilizers + 25 per cent NPK through sheep manure	19.66	6.01	12.31	5.01	118.16	6.70	28.20	9.68	9.26
T_{11}: 75 per cent NPK through fertilizers + 25 per cent NPK through poultry manure	17.62	5.16	10.90	4.44	90.92	6.02	26.50	7.45	6.99
T_{12} : 50 per cent NPK through fertilizers	15.28	4.25	9.16	3.63	64.94	5.33	24.91	4.80	6.13
T_{13} : 50 per cent NPK through fertilizers + 50 per cent NPK through FYM	18.76	5.67	11.63	4.81	106.37	6.60	28.10	8.71	8.14
T_{14} : 50 per cent NPK through fertilizers + 50 per cent NPK through vermicompost	19.18	5.75	12.13	4.94	110.29	7.63	28.20	9.03	8.97
T_{15} : 50 per cent NPK through fertilizers + 50 per cent NPK through sheep manure	17.43	4.8	10.72	4.01	83.66	6.91	26.50	6.85	6.78
T_{16}: 50 per cent NPK through fertilizers + 50 per cent NPK through poultry manure	16.65	4.55	9.83	3.65	75.76	6.70	25.44	5.32	6.65
T_{17}: 100 per cent NPK through FYM, vermicompost, sheep manure and poultry manure	16.99	4.65	9.91	3.99	45.13	5.76	26.33	6.20	6.72
SEm±	1.11	0.57	0.24	0.22	9.97	0.45	0.29	1.02	0.48
CDat5per cent	2.63	1.12	0.71	0.63	29.76	1.33	0.81	3.01	1.46

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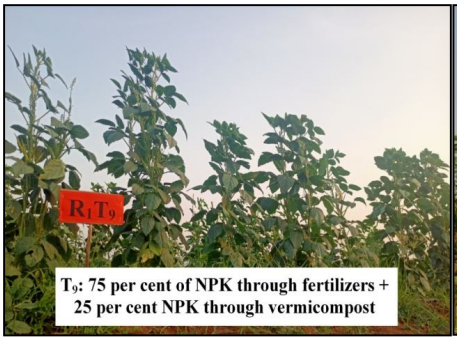

Fig. 1: Best treatment plot

Fig. 2: RDF treatment plot

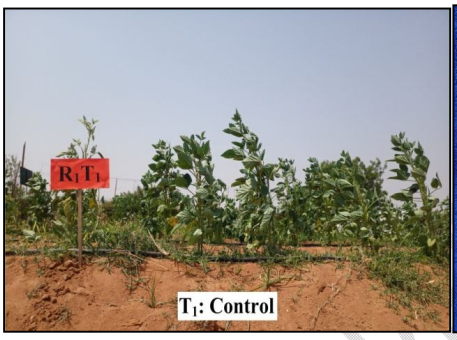

Fig. 3: Control treatment plot

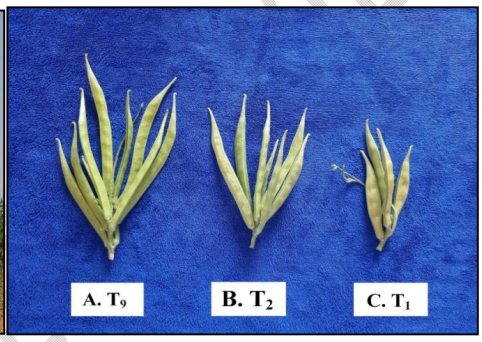

Fig. 4: Clusters ofvarious treatments

Fig. 5 : Pods of cluster bean in various treatments

3.3. Economics

The cost of cultivation was lowest in control plot treatment (₹ 44,000.00 ha^{-1}), and it was highest in treatment with application of 100 per cent NPK through vermicompost (T_4) (₹ 51,800.00 ha^{-1}). The maximum net return (₹ 79,455.00 ha^{-1}), and cost benefit ratio (2.67) was recorded with 75 per cent NPK through inorganic fertilizers + 25 per cent NPK through vermicompost (T_9) whereas the treatment with alone application of NPK through inorganic fertilizers (25 kg N, 50 kg P2O5 and 50 kg K_2O ha^{-1}) (T_2) was remunerative with higher benefit: Cost ratio (2.16) than other combinations and sole application of organic and inorganic sources of nutrients. The results were similar finding by Kumar *et al.,* (2012) recorded that the highest net return and Benefit Cost ratio (BCR) with the application of 100 per cent RDN through fertilizers. The application of recommended dose of fertilizers and vermicompost achieved higher monetary returns in cluster bean (Siddeswarareddy*et al.,* 2014) and similar findings was recorded by Sandeep Bhathal and Rakesh Kumar (2016).

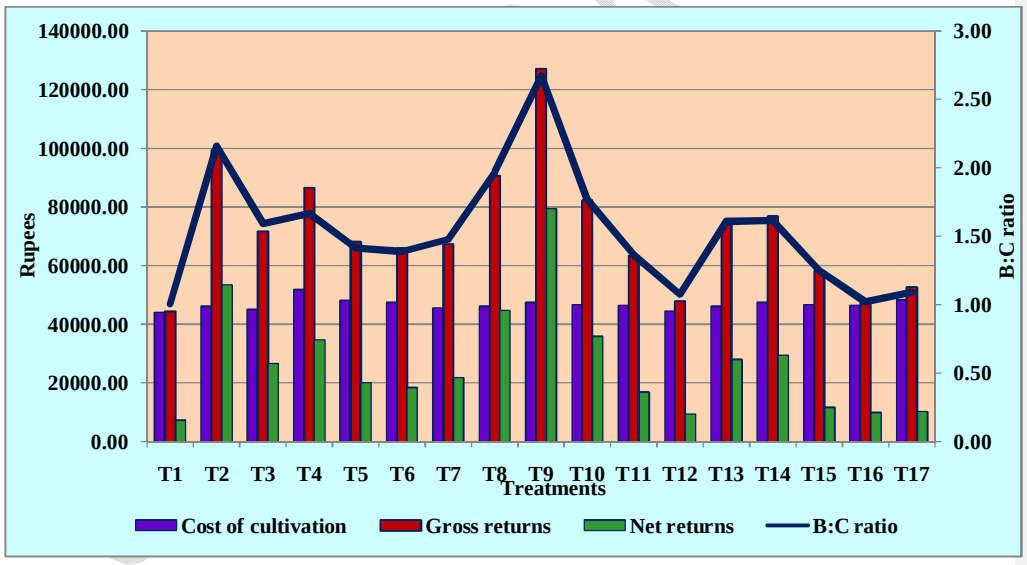

Fig .6 : Effect of integrated nutrient management on economics of cluster bean

4. DISCUSSION

The selected sole and combinations of organic and inorganic sources of nutrients markedly influenced the growth parameters of cluster bean. The findings from the present investigation revealed that the maximum mean plant height, more number of branches per plant,

high LAI , higher dry weight and other parameters throughout the phases of crop growth was observed in the treatment with application of 75 per cent NPK through inorganic fertilizers + 25 per cent NPK through vermicompost. Pronounced influence of organic manures and fertilizers mightbeduetoimprovementinphysico-chemicalandbiologicalpropertiesofsoilwithconstant and optimum supply of nutrients to the plant enhanced yield attributing characters (Tarafdarand Rao 2001).

Application of vermicompost attributed to better growth of plant and yield by slow release of nutrients for absorption with making available additional nutrients like gibberellins, cytokinins and auxins and it also promote humification, increased microbial activity and enzyme production, which in turn, bring about the aggregate stability of soil particles resulting in better aeration and a property of binding mineral elements like Ca, Mg and Potash in the form of stable aggregates of soil particles for desired porosity to sustain the plant growth. Soil microbial biomass and enzyme activity improved as a result of vermicompost addition, which favored the total increase in plant produce (Ansari, 2008). Higher availability of all plant nutrients resulted in the improved plant characters like height, branches, dry matter production, partitioning, number of pods and yield. These finding are in conformity with the findings of, Kumar *et al*. (2004) and Ashwini (2005).

Yield is the index of morphological, physiological and biochemical parameters which comprises the interaction of internal and external factors (Soler *et. al.,* 2008). It largely depends on the production and mobilization of carbohydrates, uptake of water and nutrients from the soil, in addition the environmental factors to which the plant is exposed during growing period. The present study revealed that 75 per cent NPK through inorganic fertilizers + 25 per cent NPK through vermicompost recorded higher yield and yield components. The yield and yield components are high due to better assimilation of photosynthates and better partitioning into developing pod clusters, might have taken place and improved yield attributing characters like pod length and diameter. Similar observations were also recorded by Ashwini (2005) and Jaipaul *et al*. (2011).

The results reveal that sole application of inorganic fertilizers and 75 per cent NPK through inorganic fertilizers + 25 per cent NPK through vermicompost gavebetterresultsascomparetoallothertreatments.Integrationnutrientmanagement have shown better resource utilization and management at farm during the experimentation studyunder semi arid conditions which has shown marginal statistical difference in certain yield attributingcharactersascomparetosoleapplicationofchemicalfertilizers.

5. CONCLUSION

From the above study, In conclusion it is well described that integration of fertilizers with vermicompost providedthebetternutritional environment in the root zone forpropercropgrowthanddevelopment.The results reveal that 75 per cent NPK through fertilizers + 25 per cent NPK through vermicompost and sole application of fertilizers (25 kg N, 50 kg P_2O_5 and 50 kg K_2O ha^{-1}) and gavebetterresultsascomparetoallothertreatments.Integrationnutrientmanagement have shown better resource utilization and management at farm during the experimentation studyunder semi arid conditions which has shown marginal statistical difference in yield attributingcharactersascomparetosoleapplicationofchemicalfertilizers.

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