AN AJSS An Asian Journal of Soil Science
Volume 12 | Issue 1 | June, 2017 | 116-120 | e ISSN–0976–7231 ■ Visit us : www.researchjournal.co.in

Research Article

DOI : 10.15740/HAS/AJSS/12.1/116-120

Effect of different modules on yield and yield attributes of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] grown on light textured soil of Kachchh region

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Received : 21.02.2017; **Revised :** 25.04.2017; **Accepted :** 07.05.2017

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Summary

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] which is locally known as "guara" belongs to the family Fabaceae. It is hardy crop and its cultivation is suitable for rainfed, low fertility soil conditions. A field experiment consisting of five different modules was conducted during *Kharif* season from 2009-10 to 2014-15 with five quadrates in each module (2m×2m) under Randomized Block Design at Regional Research Station, SDAU, Bhachau, Kachchh to study the effect of different modules on yield and yield attributes of cluster bean grown on light textured soil of Kachchh. Among the five different modules, three were organic modules, one was chemical module and control. The results of the experiments differed significantly. The significant improvement in yield attributes and yield were recorded with the chemical module T_4. Organic modules T_2 recorded the highest growth improvement and yield as compared to control.

Key words : Yield, Yield attributes, FYM, Vermi compost, VAM

How to cite this article : Sipai, A.H., Sevak, Kuldeep, Khorajiya, K.U., Addangadi, Kotramma and Chaudhary, A.N. (2017). Effect of different modules on yield and yield attributes of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] grown on light textured soil of Kachchh region. *Asian J. Soil Sci.*, **12** (1) : 116-120 : **DOI : 10.15740/HAS/AJSS/12.1/116-120.**

Introduction

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] which is locally known as "guara" belongs to the family Fabaceae (*Leguminaceae*). It is commercially grown for its seeds as a source of natural polysaccharide (galactomannan), commercially known as guar gum. In recent years this crop is emerged as an important industrial crop for its useful 'Guar gum', its root nodules contain nitrogen fixing bacteria and incorporation of crop residues improves soil fertility and productivity. The well developed tap root system makes it a drought hardy crop. Among all the agricultural export commodities, guar has become the highest foreign exchange earner of rupees 212.87 billions (Fathima and Sudha, 2016). Guar contains many important nutrients and phytochemicals such as saponin and flavonoids. In India it is mostly confined to Gujarat, Karnataka, Rajasthan, Maharashtra and Haryana. In Gujarat, Kachchh is the largest district and covers one third part of the Gujarat. Pulses are becoming major crops growing under Kachchh region. Compared

to other parts of Gujarat, Kachchh contains highest amount of degraded lands. Main cause for the degradation of land are the arid and semi-arid climatic condition, salinization, alkalinization, light texture soil with low organic carbon content and poor water holding capacity. The soils of arid and semi-arid regions have very low inherent productivity potential due to physical and nutritional constraints and are highly vulnerable to various degradation processes.

It is hardy crop and its cultivation is suitable for rain fed, low fertility soil conditions as well as under irrigated and high fertile soil conditions. Guar cultivation is, thus, one of the best alternatives to diversify cropping system and address the entire above problems in Kacchchh district agriculture. Addition of chemical fertilizers to grow crops is an established fact in agriculture but increasing cost of these inputs force to evaluate suitable combinations of these inorganic fertilizers with organic source of nutrients at farm level. Application of organic manures like farmyard manure, vermicompost and poultry manure has shown an increased growth in terms of height and yield of the plant, therefore, it could be better alternative to inorganic fertilizers (Tamilselvi and Devi, 2009 and Indirabai and Suja, 2009). Application of vermicompost favorably improves the physical properties of soil. This might be due to higher addition of humus through organic manures. FYM is known to play an important role in improving the fertility and productivity of the soils through its positive effects on soil physical, chemical and biological properties and balanced plant nutrition. It improves the structure and water holding capacity of soil (Kumar *et al.*, 2011). Hence, the present study on effect of different modules on yield and yield attributes of cluster bean grown on light textured soil of Kachchh region was under taken.

Resource and Research Methods

The experiment was conducted at Regional Research Station, SDAU, Bhachau during the *Kharif*

Table A : The details of the module are presented

Treatments	Module details
T_1 (Module1)	**Organic module-I (OFM-I)**
	Soil application of 20 kg N/ha through FYM + *Trichoderma viride* @ 1.5kg/ha
	Soil application of phosphorus through enriched compost through PROM @ 40kg/ha
	Seed treatment with *Rhizobium* @ 30 g/kg seed
	Install 50 bird perches /ha
	Application of bio pesticides as per need
T_2 (Module 2)	**Organic module-II (OFM-II)**
	Soil application of 20 kg N/ha through Vermicompost + *Trichoderma viride* @ 1.5kg/ha
	Soil application of phosphorus through enriched compost through PROM @ 40kg/ha
	Seed treatment with *Rhizobium* @ 30 g/kg seed
	Install 50 bird perches /ha
	Application of bio pesticides as per need
T_3 (Module 3)	**Organic module-III (OFM-III)**
	Soil application of 20 kg N/ha through FYM + *Trichoderma viride* @ 1.5kg/ha
	Soil application of phosphorus through enriched compost through PROM + VAM @ 40kg/ha
	Seed treatment with *Rhizobium* @ 30 g/kg seed
	Install 50 bird perches /ha
	Application of bio pesticides as per need
T_4 (Module 4)	**Chemical module-IV (CM-IV)**
	Seed treatment with Carbendazim + Thiram @ 3 g/kg seed
	Apply 20 kg N and 40 kg P_2O_5/ha in the form of chemical fertilizer
	Apply prophenophos 50% EC @ 0.05% when *Helicoverpa* population exceeds 5 larvae/meter row length
	Spray mancozeb 0.2% if incidence of Aschochyta leaf blight is observed
T_5 (Module 5)	Control

season from 2009-10 to 2014-15. The soil was sandy loam and low in organic matter. The soil pH was 8.03 and having organic carbon (0.27 %), available nitrogen (172.48kg ha^{-1}) and available phosphorus (36.60kg ha^{-1}) and medium in potassium (308.40kg ha^{-1}). The treatments comprised of three organic modules, one chemical module and control, the details of the module are presented in the following Table A.

The experiment was laid out in Randomized Block Design with five quadrates in each module (2m×2m). Manures and fertilizers were applied as per the treatment. Cluster bean variety GG-2 (Gujarat Guar) was sown at the seed rate of 15-20 kg/ha with the spacing of 45cm x 10cm. Gross plot size was 14.5m x 20.5m. Further observations were recorded and statistical analysis was done. The BCR value was computed by dividing net return by total expenditure of each module.

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following headings :

Effect of different modules on yield attributes :

In the Table 1 the pooled data of yield attributes from year 2009-10 to 2014-15 were presented.The results from the Table 1 indicated that there were significant difference among the treatments regarding the yield attributes *viz.*, plant height, number of branches per plant, number of pods per plant, pod length and number of seeds per pod. Module T_4 recorded the maximum plant height (55cm), followed by modules T_2 (52cm) and T_3 (50cm) which were at par with each other and least plant height *i.e.* 39 cm was recorded with the module T_5 (control). Regarding the number of branches per plant, module T_4 recorded the maximum number of branches per plant (6.02), followed by modules T_2 (5.66) and T_3 (5.50cm) which were at par with each other and least number of branches were recorded with the module T_5 (control). Module T_4 (41) recorded the maximum number of pods per plant, followed by module T_2 (38) and least number of pods per plant were recorded with the module T_5 (control). Module T_4 recorded the maximum pod length *i.e.* 5.60 cm followed by module T_2 (5.43cm) and least pod length was recorded with the module T_5 (control). Module T_4 (7.61) and T_2 (7.33) recorded the highest number of seeds per pod and these were at par with each other, least number of seeds per pod were recorded with the module T_5 (control) *i.e.* 4.98. The significant improvement in growth parameters with the moduleT_4 that is application of recommended dose of fertilizers was observed, this might be attributed to quick and easy availability of nutrients through fertilizers. In organic modules T_2 followed by T_3 were found best for good growth of the plant due to adequate supply of photosynthates for development of sink. Balbhim *et al.* (2015) reported that growth and yield attributes of cluster bean were increased by the application of chemical fertilizers followed by application of vermicompost and FYM. Results are also in agreement with that of Gopinathan and Prakash (2015), who reported that vermicompost produced with earthworm digested organic waste are rich in NPK, micronutrients, beneficial soil microbes- nitrogen fixing and phosphate solubilizing bacteria and actinomycets. They are proving as excellent growth promoter and protector. Vermicompost also has a positive effect on vegetative growth, stimulating shoot and root development. The effects include alterations in seedling morphology such as increased leaf area and

Table 1: Effect of different organic modules on growth and yield parameter of cluster bean (Pooled)

Treatments	Plant height (cm)	Branches/plant	Pods/plant	Pod length (cm)	Seeds/pod
Modules-T_1	49	5.39	36	4.84	6.46
Modules-T_2	52	5.66	38	5.43	7.33
Modules-T_3	50	5.50	36	4.97	6.61
Modules-T_4	55	6.02	41	5.60	7.61
Modules-T_5 (Control)	39	4.61	32	4.41	4.98
S.E.±	0.801	0.110	0.536	0.102	0.292
C.D. (P=0.05)	2.22	0.30	1.49	0.28	0.82
CV%	8.11	10.71	7.63	9.83	9.89

root branching (Edwards *et al*., 2004). Hence, the maximum plant growth can be obtained by using vermicompost.

Effect of different modules on yield :

Results from the Table 2 showed that there is significant difference among the different treatments for seed and straw yield in both individual years as well as in pooled data. The maximum seed and straw yield were recorded in module T_4 in both individual years and pooled data as compared to organic module and control. The increase in seed yield might be due to higher number of pods per plant (41), more number of seeds per pod (7.61), maximum pod length that is 5.60 cm. In case of organic modules T_2 followed by T_3 were found best for seed and straw yield, due to improvement of soil physical, chemical and biological properties cumulatively benefited the cluster bean crop. Patel *et al.* (2010) reported that application of organic manures either FYM or vermicompost alone or in conjunction with *Rhizobium* as a seed treatment at low fertility level (75% RDF) or 100% RDF gave significantly higher seed yield than at higher fertility level (150% RDF) or only chemical fertilizers in cluster bean. Sitaram *et al.* (2014) reported that vermicompost improves the physical, chemical and biological properties of the soil including supply of almost all the essential plant nutrients for the growth and development of plant. Humic acid in vermicompost enhances the availability of both native and added micro-nutrients in soil and thus, plant growth, yield attributes and yield increases.

Economical analysis of the treatments (Table 3) showed that significantly higher net returns was obtained with the module T_4 compared to organic modules and control because of less expenditure. Organic modules module T_1 and T_2 recorded the maximum net returns compared to control, module T_2 recorded the maximum gross income compared to chemical and other organic modules. All these observation showed that module T_2 can be effectively used to get higher seed and straw yield for organic farming. It improves the soil fertility and save the environment from the ill effects of chemical

Table 2 : Effect of different organic modules on seed yield and straw yield of cluster bean

	Seed yield kg ha^{-1}						Straw yield kg ha^{-1}					
Treatments	2009-10	2010-11	2011-12	2013-14	2014-15	Pooled	2009-10	2010-11	2011-12	2013-14	2014-15	Pooled
Modules-T_1	457	499	512	569	554	518	933	970	983	1018	1035	988
Modules-T_2	512	580	635	664	611	600	1049	1140	1152	1192	1097	1126
Modules-T_3	507	540	550	585	502	537	972	1095	1102	1130	950	1050
Modules-T_4	540	617	641	665	612	615	1201	1219	1225	1259	1158	1213
Modules-T_5 (Control)	434	451	457	492	443	455	795	817	817	856	778	812
S.E.±	24.61	32.43	35.08	33.87	34.62	14.54	58.82	62.91	57.16	63.80	62.90	25.49
C.D. (P=0.05)	73.79	97.23	105.18	101.56	103.78	40.30	176.35	188.62	171.36	191.30	188.70	70.67
YxT						34.34						60.35
S.E.±						NS						NS
C.D. (P=0.05)												
CV%	11.23	13.50	14.03	12.72	14.23	14.11	13.28	13.42	12.10	13.08	14.03	13.00

NS= Non-significant

Table 3: Effect of different modules on yield and economics of cluster bean (pooled)

Treatments	Seed yield kg ha^{-1}	Straw yield kg ha^{-1}	Gross income Rs.ha^{-1}	Total expenditure Rs.ha^{-1}	Net return Rs. ha^{-1}	BCR
Modules-T_1	518	988	35339	12200	23139	1.90
Modules-T_2	600	1126	40878	18525	22353	1.21
Modules-T_3	537	1050	36713	22275	14438	0.65
Modules-T_4	615	1213	34389	9358	25031	2.68
Modules-T_5 (Control)	455	812	30874	7050	23824	3.38

compound and promising alternative to chemical fertilizers.

Conclusion :

Among all the different modules, module T_4 was found best for growth characters and yield. Among all the organic modules T_2 followed by T_3 recorded the maximum yield and yield attributes. T_2 that is the application of vermicompost can be recommended to the farmers because vermicomposting is a low-technology, environmentally-friendly. This organic fertilizer is considered in agriculture as a promising alternative to inorganic fertilizers.

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