EFFCT OF ORGANIC, INORGANIC AND BIOFERTILIZERS ON GROWTH, YIELD AND QUALITY OF CLUSTER BEAN (*Cyamopsis tetragonaloba* L.)

ABSTRACT

Cluster bean (*Cyamopsis tetragonaloba* L. Taub] popularly known as "Guar" is an important legume crop mainly grown under rainfed condition in arid and semi-regions of Rajasthan during *kharif* season.The experiment was conducted in the horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj (UP) During July 2021- October 2021. The experiment was laid out in RBD with 9 Treatments with 3 replications. The results revealed that T8 (N20P50K50 Vermicompost 5 t ha^{-1} + PSB 5 kg ha^{-1} + Rhizobium 5 kg ha^{-1}) – performed the best in terms in Plant Height (140.22), Number of Branches (21.39), Length of Pods (25.00), Width of Pods (3.70), Weight of Pods (4.10), Number of cluster per plant (21.60), Number of Pods per plant (89.17), Number of seeds per pod (11.80), Number of Pod yields per plant (196.87), Number of pod yield per plot (68.03), TSS (12) B:C Ratio (2.5:1). Therefore, the treatment T8 (N20P50K50 Vermicompost 5 t ha^{-1} + PSB 5 kg ha^{-1} + Rhizobium 5 kg ha^{-1}) is the best when compared to other treatments. As, the highest benefit cost ratio was observed in T8 (N20P50K50 Vermicompost 5 t ha^{-1} + PSB 5 kg ha^{-1} + Rhizobium 5 kg ha^{-1}). i.e., (2.5:1) which states that is economically profitable compared to all other treatments.

Keywords: Cluster Bean, Growth, yield, Quality.

INTRODUCTION

Cluster bean (*Cyamopsis tetragonaloba* L. Taub] popularly known as "Guar" is an important legume crop mainly grown under rainfed condition in arid and semi-regions of Rajasthan during *kharif* season. It is very hardy and drought tolerant crop. Its deep penetratingroots enable the plant to utilize available moisture more efficiently and thus offer better scope for rainfed cropping. The crop also survives even at moderate salinity and alkalinity conditions. There is no other legume crop so hardy and drought tolerant as Cluster bean, which is especiallysuited for soil and climate of Rajasthan. ***(*Kherawat *et al.*,2013*)*.** The pods of Cluster bean are as rich in food value as that of Cluster Bean. **According to** (**Aykroyd2007)** the composition of Cluster bean is 81.0 (g) moisture, 10.8 (9) carbohydrate,3.2 (g) protein, 1.4 (8) of fat, 1.4 (g) of minerals, 0.09 (mg) thiamine, 0.03(mg) riboflavin, 47 I.U. vitamin C, 316 I.U, vitamin A (100 g^{-1}) of edible portion. **Nitrogen** is required for the synthesis of chlorophyll and amino acids, which contribute to the protein building blocks and consequently plant growth. Cluster bean cultivars with nitrogen applied had higher crude protein, crude fibre, ash percentage, carbs, leaf area per plant, dry matter, and green fodder yields **(Ayub*et al.*, 2010). Phosphorus** is the second most critical nutrient to add to the soil in order to maintain plant growth and crop yield **(Singh *et al.*, 2009).** It boosts rhizobium activity and promotes the production of root nodules. As a result, it aids in the

fixation of more nitrogen from the atmosphere in root nodules. **Handbook of Agriculture by ICAR, (2010). Potassium** benefits ascribed to k include resistance of plant againest pest, disease, and stresses caused by drougt, salinity, sodicity in assuring improoving crop quality charecteristics **(Kherawat *et al.*, 2013). Farmyard manure** the organic manure like FYM is the oldest and cheapest source ornutrient being popular from the ancient times. Application of FYM on field enrich thesoil fertility is an old practice unlike chemical fertilizers which contain only one, two or three plant nutrients. FYM seems to act directly for increasing the crop yields either by acceleration of respiratory process with increasing cell permeability and hormonal growth action or by combination of all these processes. FYM provides plants both macro and micronutrients. A well decomposed FYM contains 0.5%N, 0.2%P2O5and 0.5% K20. **Handbook of Agriculture by ICAR, (2010). Vermicompost** are products derived from the accelerated biological degradation of organic wastes by earthworms and microorganisms. Earthworms consume and fragment the organic wastes into finer particles by passing them through a grinding gizzard and derive their nourishment from microorganisms that grow upon them. These materials contained mineral contents (% dry weight) ranging from 2.2–3.0 N, 0.4-2.9 P, 1.7-2.5 K, and 1.2-9.5 Ca compared to those of a commercial plant growth**(Arancon *et al.*, 2005). *Rhizobium*** the use of biofertilizers are more eco-friendly in nature. They can play asignificant role in fixing atmospheric nitrogen; biofertilizer enrich soil fertility and improves soil fertility. Of these biofertilizers, *rhizobium* inoculants specific for different leguminous cropin the most important in India. The largest contribution of biological nitrogen fixation to agriculture is derived from the symbiosis between legumes and *Rhizobium* species.

MATERIALS AND METHODS

The experiment was conducted at Experimental Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (UP) during 2021 during Kharif season in India. The experiment material consist of MDU 1 variety of cluster bean, which is released from Tamil Nadu agricultural university, Tamil Nadu. The soil of the experiment field was alkaline, sandy loam and pH of 7.2. The pit was dug with 30×30×30 cm^3 and applied dose of FYM is 20 tonnes/ha and N, P, K is 20 kg, 50kg and 50kg/ha respectively. The experiment was laid out in randomized block design with three replications consisting of 8 treatment combinations, inorganic fertilizers, two kind of organic manures (FYM and vermicompost) and biofertilizers (Rhizobium abd PSB) alone, some treatments are comprising of organic manures with biofertilizers and different quantity levels of inorganic fertilizers. The plot size was 45cm×30cm spacing rows and plants. Statistical analysis of variance was performed on the data collected throughout the experiment. The observation were recorded for Plant height(cm), Number of Branches per plant, Length of pods, Width of pods, Weight of pods, Number of Cluster per plant, Number of Pods per plant, Number of Seeds per pod, Number of pod yield per plant (g), Number of pod yield per plot (kg), Total soluble solid TSS (˚Brix), economics were analysed statestically. The significance of the treatments was determined using the 'F' test at a level of significance of 5%.

3. RESULTS AND DISCUSSION

Growth Parameters

The data on growth parameters in different treatment combinations was recorded (Table 1). The maximum height (33.50, 48.83 and 140.22 cm) at 30, 60, 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum Plant height recorded in Absolute Control (23.83, 38.00 and 94.30 cm). It might be due to improved soil physical, chemical and biological properties. Higher availability of all plant nutrients resulted in the improved plant characters like plant height. These finding are in conformity with the findings of, **Kumar *et al.* (2004) and Ashwini (2005) in french bean.**

The maximum Number of Branches (15.50, 17.67 and 21.39) at 30, 60, 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum Number of Branches recorded in Absolute Control (6.18, 8.17 and 8.94). Increase in the number of branches per plant due to PSB inoculation may be attributed to the conversion of unavailable phosphorus to available forms particularly during the early crop growth phase which would have helped in the absorption of all major and minor nutrients required for the plant to put forth early vigour in vegetative phase and helps to increase number of branches similar observations were also recorded by **Prasad *et al*., (2013)** in cowpea.

Yield Parameters

The maximum Length of Pods (25.00) at 90 DAT was recordedon 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum Length of Pods recorded in Absolute Control (8.83). Increase in Length of pods is due to better assimilation of photosynthates and better portioning into developing pod cluster have taken place and improving yield attributing characters like pod length and diameter. Similar results are in accordance with the **Ashwini (2005) in French Bean.** Width of Pods (3.70) at 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum Width of Pods recorded in Absolute Control (2.50). At various amounts of NPK, Vermicompost, PSB, and Rhizobium, the mean value of Width of Pods was determined to be significant. Enhanced yield attributing features such pod width have occurred due to improved photosynthate assimilation and better portioning into growing pod clusters. **Nirmala and Vadivel (1978)** made similar observations in cucumber. Weight of Pods (4.10) at 90 DAT was recordedon 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum Weight of Pods recorded in Absolute Control (2.50). At various amounts of NPK, Vermicompost, PSB, and Rhizobium, the mean value of Weight of Pods was determined to be significant. Enhanced yield attributing features such pod width have occurred due to improved photosynthate assimilation and better portioning into growing pod clusters. **Gandhi and Sivakumar (2010)** made similar observations in cucumber.

Number of Cluster per plant (21.60)at 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum Number of Cluster per plant recorded in Absolute Control(14.42). PSB could be the greater availability of nutrients in the soil and resulted better growth and development which might be attributed to better mobilization of phosphorus and increased allocation of photosynthates towards the economic parts and also hormonal balance on the plant system **Ramana *et al.*, (2011).** Number of Pods per plant (89.17) at 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+Rhizobium. While the minimum Number of Pods per plant recorded in Absolute Control (67.40).

The maximum Number of Seeds per pods (11.80) at 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+Rhizobium. While the minimum Number of Seeds per pods recorded in Absolute Control (7.93). The significant improvement in yield attributes of cluster bean was due to fact that rhizobium inoculation increased the root volume through better root development, nodulation, more nutrient availability resulting in vigorous plant growth which in turn results in better flowering, pod formation and increased pod yield. Since, PSB helps in reducing phosphorus fixation by its chelating effect and also solubilized the fixed phosphorus leading to more uptakes of nutrients and reflected in better yields. Similar findings were found by Mishra and Baboo (2002).

The maximum Number of Pod yields per plant(196.87) at 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost+ PSB+ Rhizobium. While the minimum Number of Pod yields per plant recorded in Absolute Control (156.47). PSB could be due to the greater availability of nutrients in the soil and resulted better growth and development which might be attributed to better mobilization of phosphorus and increased allocation of photosynthates towards the economic parts and also hormonal balance on the plant system These finding are in conformity with the findings of, **Ramana *et al.*, (2011)**.The maximum Number of Pod yields per plot (68.03) at 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum Number of Pod yields per plot recorded in Absolute Control (46.47). The Enhancing yield attributing features such pod width have occurred due to improved photosynthate assimilation and better portioning into growing pod clusters. **Gandhi and Sivakumar (2010)** made similar observations in cucumber.

The maximum TSS (Brix) (12) at 90 DAT was recorded on 80% RDF Chemical fertilizers + 20% Vermicompost + PSB+ Rhizobium. While the minimum TSS (Brix) recorded in Absolute Control (8.66). The increased protein content attributed to increase in N content and uptake by the crop due to phosphorus application. Increase of protein content of cluster bean over due to the seed inoculation increased the N content of pods which ultimately reflects TSS content of pods. Similar findings were found by **Tripathi and Edward (2017) in guar.**

Table 1 : Plant characteristics

Plant Height			Number of Branches			Length of pods	Width of pods	Weight of pods	No. of cluster plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	Pod yield plant^{-1}	Pod yield plot^{-1} (kg)	TSS
30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS									
23.83	38	94.3	6.18	8.17	8.94	8.83	2.5	2.5	14.42	67.4	7.93	156.5	46.47	8.66
25.67	41.28	100.7	7.5	10.39	17.99	12.5	2.55	2.55	15.37	71.43	8	169.9	47.27	9.33
27.56	44.33	103.9	8.5	12.39	18.05	12.51	2.59	2.59	16.02	73.22	8.06	176.5	48.43	10.4
26.5	38.07	122.8	7.5	15.06	21	16.75	2.89	3.1	19.39	82.71	9.33	184.6	57.32	10.83
27.5	37.6	122.3	12	15.1	20.13	16	2.8	2.9	18.66	79.13	9.26	180.5	56.64	10.8
28.06	40.63	110.8	7.78	12.22	18.67	14.1	2.6	2.6	16.89	78.42	8.4	178.1	49.47	10.5
26.89	38.39	122.2	6.6	14.94	19.67	15	2.7	2.8	17.15	78.46	8.46	179.1	50.55	10.6
30.83	45.17	130.3	12	15.1	21.39	21	2.9	3.5	19.82	85.34	11.46	192.1	67.33	11
33.5	48.83	140.2	15.5	17.67	21.39	25	3.7	4.1	21.6	89.17	11.8	196.9	68.03	12
S	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
0.71	**2.31**	**8.45**	**0.53**	**0.78**	**1.09**	**1.00**	**0.18**	**0.19**	**1.12**	**4.63**	**0.442**	**8.93**	**0.36**	**0.65**
2.01	**4.40**	**5.03**	**4.58**	**4.76**	**4.60**	**4.96**	**4.91**	**5.07**	**4.91**	**4.78**	**3.79**	**3.92**	**4.51**	**4.91**
0.342	**1.111**	**4.076**	**0.25**	**0.376**	**0.523**	**0.484**	**0.084**	**0.09**	**0.52**	**2.23**	**0.213**	**4.3**	**0.17**	**0.31**

CONCLUSION

The result from the present investigation concluded that the treatment T_8 which received RDF Chemical fertilizers + 20% Vermicompost + PSB + Rhizobium was found superior Plant height, Number of branches, Number of days of first picking, Average fruit width, Fruit yield per plant (kg), Number of seeds per fruit, Average fruit length, Number of clusters plant, Number of pods in a cluster, TSS˚(Brix), net income of 84750.00 Rs./ha and B:C ratio of 2.5.

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