Original Research Article

Quality evaluation and economics of gum cluster bean genotypes under Akola conditions

ABSTRACT

A field experiment was carried out in 2020-21 at Instructional Farm, Department of Vegetable Science, Dr. PDKV, Akola with the objective to find out superior genotype of cluster bean for its quality parameters and cost of production i.e., gum content (%), protein content (%), test weight (g) and economics respectively. The experiment was laid out in Randomized Block Design (RBD) with three replications and twelve treatments as genotypes. With respect to quality parameters, genotype IC-329639(T_4) recorded maximum gum content (32.86 %), while maximum protein content (38.33 %) was found in genotype IC-298638(T_8) and maximum (3.98 g) test weight in the genotype IC-421837(T_7). Consequently, with regards to economics, highest gross returns(Rs 174000 ha^{-1}), net returns(Rs 129137.7 ha^{-1}) and B:C ratio (3.87) was recorded in the genotype IC-329639(T_4).

Keywords: *gum cluster bean genotypes, Akola conditions, gum content (%), protein content (%), test weight (g) and economics*

1. INTRODUCTION

The gum cluster bean (*Cyamopsis tetragonoloba)* is an annual legume vegetable belonging to family Fabaceae and it is the source of guar gum. It is also known as chavlikayi, gawar, govar, gorikayi in different parts of India. Cluster bean is drought tolerant and it is hardy, deep-rooted crop mainly grown for its tender fruits and seeds in arid and semi-arid parts of India. Cluster bean grows upright, reach a height of 2-3meters (7-10 ft) with erect branches, stem is angled, and leaves are trifoliate, ovate and serrate. The flowers are pink or white in colour and they are borne on auxiliary raceme. The developing pods are compressed, erect, linear and clustered which contains 5-12 seeds per pod with white or grey in colour. Usually, matured cluster bean seeds are white or grey in colour but with excess moisture they can turn black in colour and lose germination

capacity. The chromosome number of guar is 2n=14. The seeds of cluster bean have a characteristic feature. Its kernel contains protein rich germ (44-46%) and a large endosperm contains galactomannan. This is a polysaccharide containing polymers of mannose and galactose. Cluster bean are rich source of protein, vitamin A and C and possess several medicinal uses in diabetes and control of cholesterol level (Karawya *et al.*, 1994). Guar taproots can access moisture in low soil depths. This crop can also be used as green forage or as green manure crop which enrich the soil by fixing the atmospheric nitrogen (50-60kg/ha) (Lal, 1985). Other than culinary use, cluster bean can produce the industry base byproducts like gum etc. Refined guar gum has many uses in various industries like textile, cosmetics, explosives and oil industry. Guar gum acts as a binder, stabilizer or thickener in many products. The food industry shares 30-40% and textile industry shares about 19-20% of total consumption of guar gum (Kumar, 2005).

Cluster bean are grown in arid zones of West and North-West India, Pakistan, Sudan and parts of U.S.A. India is world-leading in production as it contributes 80-85% shares of its total production and Rajasthan occupies the largest area (82.10%) under guar cultivation in the country (Anitha et al., 2009 and Pathak et al., 2010). In North Indian states like Haryana, Gujarat, Rajasthan andPunjab guar is mainly cultivated for guar gum production and for forage, whereas, in South India mainly for vegetable purpose. Cluster bean mainly cultivated for seed production have been successfully adopted in Yavatmal district of Maharashtra (Kumar and Rodge, 2012).

India is leading exporter of guar gum. The country exports over 1,17,000 tons of guar and its derivatives, comprising of 33,000 tons of refined split guar gum and 84,000 tons of treated and pulverized guar gum. Foreign exchange earnings increased from 142 crores in 1994 to 1120 crores during 2007 in India (Henry and Mathur, 2008).

2. MATERIAL AND METHODS

The field was carried out at Instructional farm, Department of vegetable science, Dr. PDKV, Akola during summer season of 2020-21 with three replications and 12 genotypes as treatments. Treatment details are listed below in the Table1.

Treatments	Genotypes	Source
T_1	IC 421838	

T_2	IC 421834	NBPGR, (New Delhi)
T_3	IC 421830	
T_4	IC 329639	
T_5	IC 421821	
T_6	IC 421832	
T_7	IC 421837	
T_8	IC 298638	
T_9	IC 421825	
T_{10}	IC 248087	
T_{11}	IC 298638-1	
T_{12}	RGC-986(Check)	Central Arid Zone Research Institute, Jodhpur (Rajasthan)

Table1: Treatment details

2.1 Climate and weather conditions: Akola is located at latitude 20.7^{o}N and longitude of 77.07^{o}E.The annual temperature ranges from a high of 47.6^{o}C (117.68^{o}F) to a low of 2.2^{o}C (35.96^{o}F). Akola lies near the Tropic of Cancer and becomes very hot during the summer, especially in May. The mean annual precipitation averages 800 millimeters (31 in). Most of the rainfall is received from the South-West monsoon from June to October, but there is some rainfall in January and February as well. The relative humidity ranges from 22.25% in the summer to 64.1% in the rainy season. Thus, it has a hot, dry summer and a moderately cold winter.

2.2 Experimental layout: Seeds were sown directly in field at a spacing of 45x10cm in a ridges and furrows plot of 2 x 1.5 m size. Drainage channels were also made between plots. The genotypes were planted in Randomize Block Design (RBD).

2.3 Quality analysis methods

2.3.1 **Gum content (%):** Gum content of endosperm of seed was estimated by adopting the methodology suggested by Association of Official Analytical Chemists (Anon., 1958).

2.3.2 **Protein content (%):** By Micro-kjeldhal method (Subbaiah and Asija, 1956). Thereafter crude protein was calculated by multiplying the nitrogen value by 6.25 (Oser, 1965).

2.3.3 **Test weight (g):** After harvesting of dry pods, the weight of 1000 randomly selected seeds were recorded and average was worked out.

2.4.Economics (Benefit: Cost Ratio): The economics were calculated by using following formula

Net return (Rs/ha) = Gross returns (Rs/ha) - Cost of cultivation (Rs/ha)

$$\text{Benefit: Cost ratio} = \frac{\text{Total gross returns (Rs. /hectare)}}{\text{Total cost of cultivation (Rs. /hectare)}}$$

3. RESULT AND DISCUSSION

3.1 Quality parameters

The data regarding the quality parameters are tabulated in Table2and depicted in Figure 1.Significantly maximum (32.86%) gum content was recorded in the genotype IC-329639(T_4), which was at par with the genotypeRGC-986, i.e., check (31.66%) and minimum gum content (13.2%) was observed in the genotype IC-298638(T_8). This variation in gum content may be due to difference in number of seeds plant^{-1}, seed yield plant^{-1}, 100 seed weight and pod yield plant^{-1} to specific genetical traits, which are discussed by Balakumbahan et al. (2020) and Dodla et al. (2017).

Maximumprotein content (38.33%) was found in genotype IC-298638(T_8), which was significantly at par with genotypeIC-421821 (35.58 %) i.e., T_5, and the minimum protein content (25.08 %) was observed in the genotype IC-421838(T_1). Differences in protein content among genotypes might be due to specific genetic traits, which are conformity with findings of Dodla et al. (2017) and Jitendra et al. (2014).

Significantly maximum (3.98 g) test weight was recorded in the genotype IC-421837(T_7), which was statistically at par with the genotypeIC421832 (3.52 g) i.e., T_6 and minimum (3.12 g) test

weight was recorded in the genotypeIC-298638-1(T_{11}). The potential of 1000 seed weight might be due to initial capacity, more nutrients available for germination and seed weight, which were also discussed by Sanghi et al. (1964) and Chaudhary and Singh (1976).

Treatments	Gum content (%)	Protein content (%)	Test weight (g)
T1 - IC-421838	27.46	25.08	3.51
T2 - IC-421834	26.73	28.00	3.41
T3 - IC-421830	28.56	28.58	3.24
T4 - IC-329639	32.86	32.66	3.91
T5 - IC-421821	25.90	35.58	3.35
T6 - IC-421832	23.20	36.75	3.52
T7 - IC-421837	32.33	35.58	3.98
T8 - IC-298638	13.20	38.33	3.39
T9 - IC-421825	25.70	25.66	3.16
T10-IC-248087	22.36	25.61	3.17
T11-IC-298638-1	24.80	30.33	3.12
T12-RGC-986 (Check)	31.66	26.83	3.18
'F' Test	Sig.	Sig.	Sig.
SE (m) ±	1.520	1.465	0.230
CD at 5%	4.459	4.296	0.675

Table2: Quality parameters as influenced by gum cluster bean genotypes

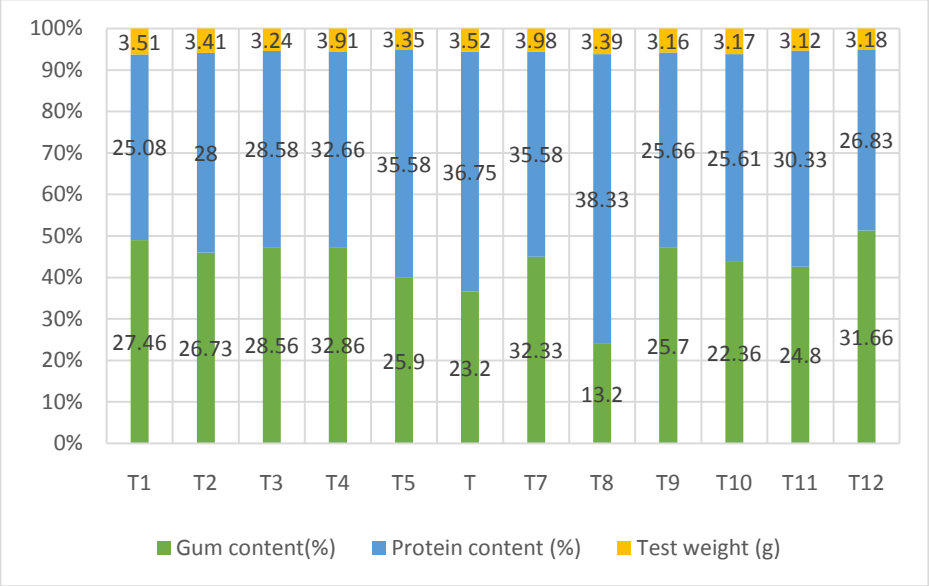

Fig1: Gum content (%), Protein content (%) and test weight (g) as influenced by gum cluster bean genotypes

3.2 Economics

The data regarding the cost of production, B:C ratio, gross returns and net returns under Akola conditions are tabulated in Table3 and depicted in Figure 2. Highest net monetary return (Rs 129137.7) in one hectare area was recorded by genotype IC-329639(T_4), closely followed by the genotype IC-298638(T_8) with (Rs 111337.7) and the lowest net returns (Rs 47337.7) was recorded genotype IC-248087(T_{10}).

Highest gross returns (Rs 174000) were recorded in the genotype IC-329639(T_4) is due to higher yield and higher net returns obtained with comparatively lesser increase in cost of cultivation.

Therefore, highest B:C ratio (3.87) was recorded in the genotype IC-329639(T_4) .and lowest B:C ratio (2.05) was recorded in the genotype IC-248087(T_{10}).

Treatments	Gross	Cost of	Net returns	B:C

	return (Rs/ha)	cultivation (Rs/ha)	(Rs/ha)	Ratio
T1 - IC-421838	132600	44862.2	87737.7	2.95
T2 - IC-421834	121400	44862.2	76537.7	2.70
T3 - IC-421830	149200	44862.2	104337.7	3.32
T4 - IC-329639	174000	44862.2	129137.7	3.87
T5 - IC-421821	112400	44862.2	67537.7	2.50
T6 - IC-421832	106400	44862.2	61537.7	2.37
T7 - IC-421837	154800	44862.2	109937.7	3.45
T8 - IC-298638	156200	44862.2	111337.7	3.48
T9 - IC-421825	93800	44862.2	48937.7	2.09
T10-IC-248087	92200	44862.2	47337.7	2.05
T11-IC-298638-1	102600	44862.2	57737.7	2.28
T12-RGC-986 (Check)	110400	44862.2	65537.7	2.46

Table3: Economics as influenced by gum cluster bean genotypes under Akola conditions

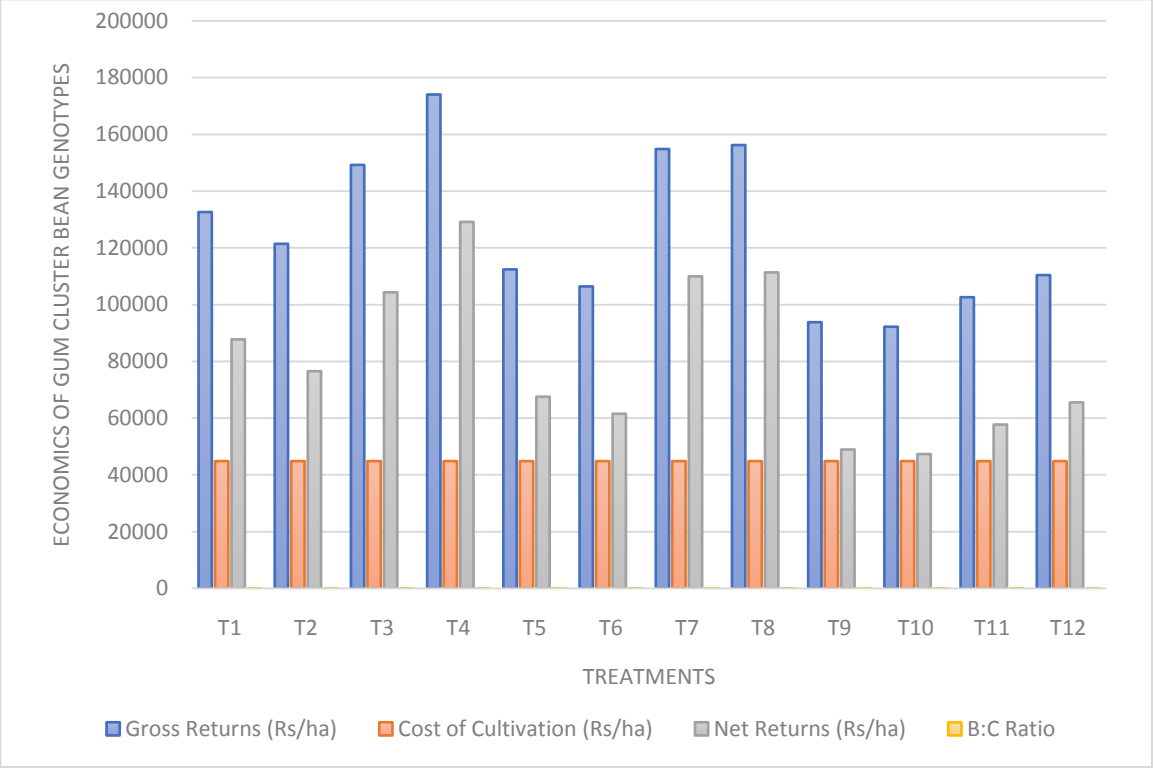

Fig2. Economics as influenced by gum cluster bean genotypes

4. CONCLUSION

Genotype IC-421838(T_1) was superior with respect to gum content (32.86 %), protein content (38.33 %) and test weight (3.98 g) under Akola conditions during a particular season. Hence, it may be concluded that, the genotype IC-329639(T_4) proved economically better as for producing maximum B:C ratio. The results are based on the outcomes of one season trail;therefore, they are suggestive and not definitive. The results of the current investigation need to be confirmed only by repeating the study for at least three seasons.

5. REFERENCE

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