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## Studies on growth and yield of elite gum cluster bean genotypes under Akola conditions

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### Abstract

A field experiment entitled, "Performance of elite genotypes of gum cluster bean under Akola conditions" was carried out in 2020-21 during summer season at Instructional Farm, Department of Vegetable Science, Dr. PDKV, Akola. The field experiment was laid out in Randomized Block Design (RBD) with three replications and twelve treatments as genotypes. The results of the experiment showed that, with respect to growth parameters viz., days to germination, genotype IC-298638 (T<sub>8</sub>) was found early. Maximum height of plant and number of leaves plant<sup>-1</sup> was observed in the genotype IC-421837 (T<sub>7</sub>). The maximum number of branches were recorded in genotype IC-421838 (T<sub>1</sub>). Lesser day to first flower initiation was recorded in genotype IC-298638 (T<sub>8</sub>). Consequently, with respect to yield parameters, genotype IC-329639 (T<sub>4</sub>) was found superior with respect to number of pods cluster<sup>-1</sup>, seed yield plant<sup>-1</sup> and yield plot<sup>-1</sup>. Genotype IC-298638 (T<sub>8</sub>) recorded minimum days for seed harvesting. Maximum number of pods plant<sup>-1</sup> and number of seeds pod<sup>-1</sup> was recorded in the genotype IC-421837 (T<sub>7</sub>). Genotype IC-421838 (T<sub>1</sub>) showed maximum pod length. The maximum number of clusters plant<sup>-1</sup> and yield hectare<sup>-1</sup> were estimated in the genotypes IC-421821 (T<sub>5</sub>) and IC-421834 (T<sub>2</sub>) respectively.

**Keywords:** Gum cluster bean, genotypes and Akola conditions

### Introduction

Gum cluster bean (*Cyamopsis tetragonoloba*) is a leguminous vegetable belonging to family Fabaceae and it is the source of guar gum. It is called as chavlikayi, gawar, govar, gorikayi in different states of India. Cluster bean is drought tolerant, hardy crop, deep rooted mainly grown for its tender fruits and seeds in arid and semi-arid parts of India. Cluster bean grows upright, reach a height of 2-3 meters (7-10 ft) with erect branches, stem is angled and leaves are trifoliate, ovate and serrate. The flower is 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 in protein, vitamin A and C and have several medicinal uses i.e., control of cholesterol level (Karawya *et al.*, 1994)<sup>[9]</sup>. Cluster bean taproot can access moisture in low soil depths. This crop can also be used as green forage and as green manure crop which enriches the soil by fixing the atmospheric nitrogen (50-60 kg/ha) (Lal, 1985)<sup>[10]</sup>.

### Materials and Methods

This experiment was conducted in RBD with three replications and 12 genotypes as treatments at Instructional Farm, Department of Horticulture, Dr. PDKV, Akola during 2020-21. Treatment details are listed below in the table

### Result and Discussion

#### Growth parameters

The growth parameters include days to germination, plant height at 30, 60 and 90 days after sowing (DAS), number of leaves plant<sup>-1</sup> at 30, 60 and 90 DAS, number of branches at 30, 60 and 90 DAS, days to first flower initiation are presented in table 2.

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**Table 1:** Treatment details

Sr. No.	Treatments	Genotypes	Source
1.	T1	IC-421838	NBPGR, (New Delhi)
2.	T2	IC-421834	
3.	T3	IC-421830	
4.	T4	IC-329639	
5.	T5	IC-421821	
6.	T6	IC-421832	
7.	T7	IC-421837	
8.	T8	IC-298638	
9.	T9	IC-421825	
10.	T10	IC-248087	
11.	T11	IC-298638-1	
12.	T12	RGC-986 (Check)	CAZRI, Jodhpur (Rajasthan)

The significant differences among the genotypes for days to germination. Significantly minimum number of days (25.13 days) was recorded in T<sub>8</sub> i.e., genotype IC-298638. However, significantly maximum number of days required for germination (33.67 days) was recorded in T<sub>4</sub> i.e., genotype IC-329639. The variation in seed germination period in genotypes may be due to genetic constituent and response of specific genotype to the prevailing environmental conditions, which was also discussed by Arora *et al.* (2011) [1].

Plant height is an important component of vegetative stage and is indirectly influences on the yield components. Plant height were recorded at 30, 60 and 90 DAS. At 30 DAS, significantly maximum plant height (32.07 cm) was found in genotype IC-421838 i.e., T<sub>1</sub>, followed by IC-298638 (30.49 cm). However, minimum plant height (25.55) was observed in genotype IC-421832 i.e., T<sub>6</sub>. While at 60 and 90 DAS, the maximum plant height was recorded in the T<sub>7</sub> i.e., genotype IC-421837 with (95.96 cm and 117.44 cm respectively). However, the minimum plant height was recorded in genotype RGC-986 i.e., (check). This alteration might be due to genotypic make up and increased synthesis and phytohormones which results in plant growth, which were also discussed by Thorat *et al.* (2009) [13] and Dodla *et al.* (2017) [4].

Number of leaves plant<sup>-1</sup> at 30 DAS, maximum (18.35) was observed in the genotype IC-421834 i.e., T<sub>2</sub>. Whereas, the minimum number of leaves (9.4) was estimated in T<sub>8</sub> i.e., genotype IC-298638. Maximum number of leaves (45.87) at 60DAS was found in genotype IC-421830 i.e., T<sub>3</sub>. While, the minimum number of leaves plant<sup>-1</sup> (29.97) were found out in genotype IC-298638-1 i.e., T<sub>11</sub>. At 90 DAS, maximum number of leaves plant<sup>-1</sup> (69.87) was figured out in the genotype IC-421837 i.e., T<sub>7</sub>, and minimum number of leaves plant<sup>-1</sup> (55.87) in IC-421821 (T<sub>5</sub>). This varied leaves production plant<sup>-1</sup> might be due to difference in growth rate and their genetic makeup, as a result, the variation in phenotypic expression has occurred, which was discussed by Kanchan *et al.* (2016) [8].

Highest number of branches plant<sup>-1</sup> (2.85) was shown in T<sub>1</sub> i.e., genotype IC-421838, while minimum (1.18) was recorded in genotype IC-421837 i.e., T<sub>7</sub> at 30 DAS. Same trend was recorded at 60 and 90 DAS, where genotype IC-421838 (T<sub>1</sub>) recorded significantly maximum number of branches<sup>-1</sup> (4.2 and 7.5 respectively). Minimum number of branches<sup>-1</sup> (2.27 and 5.38 respectively) was observed in the genotype IC-421834 (T<sub>2</sub>) and IC-298638 (T<sub>8</sub>) respectively. This differences in the branches of genotypes may be due to

level of synthesis of auxins and proliferation of lateral buds which gives better shape to plant, which were discussed by Dodla *et al.* (2017) [4] and Satyavathi *et al.* (2014) [12].

The genotype IC-298638 (T<sub>8</sub>) took minimum days to first flower initiation (22 days) as compared to other genotypes and genotype IC-298638-1 (T<sub>11</sub>) took maximum days (26.83 days), which are discussed by Dodla *et al.* (2017) [4].

### Yield parameters

The yield parameters include number of pods cluster<sup>-1</sup>, number of pods plant<sup>-1</sup>, number of cluster plant<sup>-1</sup>, number of seeds pod<sup>-1</sup>, pod length (cm), days for seed harvesting, seed yield plant<sup>-1</sup> (g), yield plot<sup>-1</sup> (kg), yield hectare<sup>-1</sup> (q) are presented in table 3.

Highest number of pods cluster<sup>-1</sup> (7.69) was showed in the genotype IC-329639 i.e., T<sub>4</sub>, while the least number of pods cluster<sup>-1</sup> (2.06) was recorded in the genotype IC-421838 i.e., T<sub>1</sub>. This may be due to better assimilation of photosynthates which were discussed by Dodla *et al.* (2017) [4].

Significantly maximum number of pods plant<sup>-1</sup> (203.88) was shown in genotype IC-421837 (T<sub>7</sub>) and minimum number of pods plant<sup>-1</sup> (59.55) was estimated in genotype IC-421838 (T<sub>1</sub>). Difference in number of pods plant<sup>-1</sup> in genotypes might be due to direct inter-relationship between number of cluster plant<sup>-1</sup> and number of pods cluster<sup>-1</sup>, are discussed by Dodla *et al.* (2017) [4].

Maximum number of cluster plant<sup>-1</sup> (55.66) was found out in genotype IC-421821 i.e., T<sub>5</sub> and minimum (14.88) was observed in the genotype IC-298638 i.e., T<sub>8</sub>. Difference in number of cluster plant<sup>-1</sup> may be due to better cell division, amino acid and protein synthesis in the confined environmental conditions, which were discussed by Dwivedi *et al.* (1999) [5] and Kalyani (2006) [7].

With respect to number of seeds pod<sup>-1</sup>, maximum (8.14 seeds pod<sup>-1</sup>) was recorded in genotype IC-421837 (T<sub>7</sub>) and minimum (5.69 seeds pod<sup>-1</sup>) was observed in the genotype IC-298638 (T<sub>8</sub>). This differences in number of seeds pod<sup>-1</sup> may be due to genetic differences of the genotypes which are also discussed by Tikka *et al.* (1974) [14], Chaudhary and Singh (1976) [3] and Jitendra *et al.* (2014) [6].

Maximum pod length (11.83 cm) and minimum pod length (5.61 cm) was recorded in the genotypes IC-421838 (T<sub>1</sub>) and IC-421832 (T<sub>6</sub>) respectively. Pod length differences may be due to environmental interaction between genotypes, which are discussed by Dodla *et al.* (2017) [4].

With respect to days for seed harvesting, genotype IC-298638 (T<sub>8</sub>) recorded minimum (219.00 days) number of days and genotype IC-421830 (T<sub>3</sub>) recorded maximum (268.98 days) number of days. This variation may be due to agro-climatic conditions and where the crop have been cultivated, which are documented by Kanchan *et al.* (2016) [8].

Among the genotypes, genotype IC-329639 (T<sub>4</sub>) recorded superior in seed yield plant<sup>-1</sup> (31.38 g) and genotype IC-298638 (T<sub>8</sub>) recorded lower seed yield plant<sup>-1</sup> (3.37 g). This variation among genotypes might be due to its genetic potential to use the growth resources and translocate of photosynthates from source to sink, which are discussed by Kanchan *et al.* (2016) [8].

With regard to yield plot<sup>-1</sup> genotype IC-329639 (T<sub>4</sub>) recorded maximum (8.72 kg) and genotype IC-248087 (T<sub>10</sub>) recorded minimum (2.45 kg). The difference in yield plot<sup>-1</sup> could be attributed due to positive relationship with increase in germination which resulted in good crop stand, which are

narrated by Balakumbahan *et al.* (2020) [2]. Significantly maximum (120.4 q ha<sup>-1</sup>) yield hectare<sup>-1</sup> was recorded in the genotype IC-421834 (T<sub>2</sub>) and the minimum (46.14 q ha<sup>-1</sup>) yield hectare<sup>-1</sup> was recorded in the genotype IC-

248087 (T<sub>10</sub>). This difference may be due to genetic constituent and the influence of existing environment, which are discussed by Mehrotra (1980) [11].

**Table 2:** Growth parameters as influenced by gum cluster bean genotype

Treatments	Days to Germination	Plant height(cm)			No. of leaves plant <sup>-1</sup>			No. of branches			Days to 1 <sup>st</sup> flower initiation
		30DAS	60DAS	90DAS	30DAS	60DAS	90DAS	30DAS	60DAS	90DAS	
T1	28.42	32.07	85.55	114.23	15.34	40.98	65.45	2.85	4.20	7.50	24.33
T2	30.24	29.13	95.05	117.26	18.35	42.30	69.21	1.93	2.27	5.44	25.16
T3	26.57	26.63	89.95	108.62	13.80	45.87	60.65	1.62	2.50	5.77	26.00
T4	33.67	29.74	84.51	109.12	10.56	38.98	59.71	1.96	3.12	5.88	24.00
T5	29.12	29.15	89.55	116.81	11.98	37.86	55.87	2.35	3.34	6.76	23.83
T6	27.91	25.55	90.85	113.40	15.00	41.76	63.87	2.46	3.23	7.33	25.33
T7	26.31	27.58	95.96	117.44	12.87	39.76	69.87	1.18	2.37	5.44	23.5
T8	25.13	30.49	92.37	108.45	9.40	32.87	59.21	1.56	2.87	5.38	22.00
T9	30.67	27.53	85.95	105.05	13.76	34.78	62.02	2.42	3.27	7.44	22.10
T10	28.76	28.54	83.74	106.68	14.24	39.21	64.77	2.50	3.50	6.60	24.66
T11	29.23	30.36	91.37	108.43	12.09	29.97	56.76	2.14	3.83	6.76	26.83
T12	26.83	27.00	70.73	89.67	10.76	30.65	57.52	2.34	3.15	7.03	24.33
'F' Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	1.222	1.55	1.90	2.27	0.973	2.593	2.028	0.267	0.298	0.501	1.172
CD at 5%	3.585	4.54	5.57	6.68	2.854	7.607	5.950	0.783	0.876	1.471	3.439

**Table 3:** Yield parameters as influenced by gum cluster bean genotypes

Treatments	No. of pods cluster <sup>-1</sup>	No. of pods plant <sup>-1</sup>	No. of cluster plant <sup>-1</sup>	No. of seeds pod <sup>-1</sup>	Pod length (cm)	Days to seed harvesting	Seed yield plant <sup>-1</sup> (g)	Yield plot <sup>1</sup> (kg)	Yield hectare <sup>-1</sup> (q)
T1	2.06	59.55	28.55	6.77	11.83	229.98	5.50	4.93	91.35
T2	2.81	59.77	21.66	7.23	10.63	253.98	25.31	7.55	120.40
T3	3.64	96.88	26.55	6.14	7.96	268.98	16.43	4.03	74.63
T4	7.69	133.66	17.66	7.90	7.90	246.00	31.38	8.72	110.34
T5	3.64	203.11	55.66	6.33	7.57	234.96	18.59	3.10	56.26
T6	2.28	89.26	39.22	6.91	5.61	240.00	16.27	2.97	53.51
T7	5.96	203.88	34.22	8.14	7.24	229.92	26.05	6.76	93.54
T8	5.55	82.11	14.88	5.69	10.40	219.00	3.37	4.13	78.15
T9	4.07	152.33	52.00	7.12	8.83	223.98	22.13	2.48	46.91
T10	2.99	121.88	40.77	7.18	6.69	254.10	15.89	2.45	46.14
T11	3.50	85.18	30.11	7.15	6.67	268.96	23.04	2.72	51.35
T12	4.42	140.88	32	7.08	6.21	249.00	25.51	2.94	55.29
'F' Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.689	1.357	1.216	0.276	0.469	1.336	0.701	0.538	1.240
CD at 5%	2.021	3.981	3.567	0.811	9.459	3.919	2.057	1.579	3.638

## Conclusion

The genotype IC-421837 (T<sub>7</sub>) was superior with respect to plant height, number of leaves plant<sup>-1</sup>. Whereas, the genotype IC-421838 (T<sub>1</sub>) was significantly superior with respect to number of branches, number of pods cluster<sup>-1</sup> (7.69), number of pods plant<sup>-1</sup> (203.88), number of cluster plant<sup>-1</sup> (55.66), number of seeds pod<sup>-1</sup> (8.14), pod length (11.83 cm), seed yield plant<sup>-1</sup> (31.38 gm), yield plot<sup>-1</sup> (8.72 kg), yield hectare<sup>-1</sup> (120.4 q). Genotype IC-298638 (T<sub>8</sub>) was found earlier for germination (25.13 days), days to first flower initiation (22.00 days) and days for seed harvesting (219.00 days).

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