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Evaluation of seed guar (*Cyamopsis tetragonoloba* (L.) Taub.) cultivars for growth and growth attributing characters

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Abstract

The experiment was conducted at the "Student Research Farm", College of Horticulture, Dr. Y.S.R. Horticultural University, Mojerla, Mahabubnagar, Telangna state during *kharif*, 2014 in a Completely Randomized Block Design with three replications and fifteen cultivars of seed guar. The results revealed that the analysis of variance indicated highly significant differences for all the growth characters among all cultivars. Among the cultivars studied RGC 936, RGC 963, JG-2 recorded maximum percentage of germination. RGC 936, RGC963, HG 884 recorded maximum number of primary branches. RGC 936 recorded maximum number of leaves per plant while RGC 1002, RGC 1066, HG 365 were found to be early in terms of days to first flowering and RGC 936, RGC 1066 were early in the terms of days to 50% flowering. RGC 963 produced the maximum number of clusters per plant, number of pods per plant. The cultivar RGC 197 produced the maximum plant height at harvest, number of pods per cluster. Among the cultivars JG-2 recorded maximum pod length and HG 365 recorded maximum pod girth. Hence these cultivars may be further tested in different locations for their stable performance and thereafter may be selected as parental source for future breeding programmes.

Keywords: Seed guar, pods, growth characters, performance and cultivars

Introduction

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub. 2n=14), which is popularly known as *guar* (plate.1), is self pollinated crop belongs to the family Fabaceae. Guar originated in India and Pakistan and is characterized as a short day erect or bushy annual plant (Purseglove, 1981) ^[7]. It enhances soil productiveness by fixing atmospheric nitrogen for its own necessities and also for the succeeding crop (Bewal *et al.*, 2009) ^[2]. It can tolerate saline and moderately alkaline soils with pH ranging between 7.5 and 8.0 (Venkataratnam, 1973) ^[10]. Guar is a mainly grown for its tender fruits for use as vegetable. It is also used as a nutritious fodder for livestock. Mucilaginous seed flour is used for making guar gum (galactomannan) utilized in textile, paper, cosmetic and oil industries throughout the world and is a useful absorbent for explosives (Smith, 1976) ^[9]. In agriculture, guar gum is used as water retainer, soil aggregating and anticrusting agent (Singh *et al.*, 1985) ^[8]. It is predominantly grown in India and Pakistan as a vegetable, fodder and grain crop. Cultivars grown in South India are vegetable types while those in North-West India are grown for seeds.

Guar has assumed great industrial importance in recent years, mainly due to the presence of gum in its endosperm, which constitutes 35-40 per cent of the whole seed. Guar meal, a byproduct of guar gum industry is also of considerable value as it contains more than 42 per cent protein. Now-a-days, guar has emerged as a new industrial crop and is commercially grown in India, Pakistan and U.S.A and to some extent in Australia, South Africa and Brazil. This vegetable gum finds a ready international market for its ever increasing demand in various industries. India is the major guar producer accounting for 80% of the world's production. In India, guar is being grown mainly in arid and semiarid regions of North Western states of Rajasthan, Gujarat, Haryana, Punjab, parts of Uttar Pradesh, Madhya Pradesh and Tamil Nadu covering about 3.34 million hectares with a production of 0.4 million tonnes of guar seed. Rajasthan occupies the largest area under guar cultivation (82.1%),

followed by (8.6%) Haryana (Ahlawat *et al.*, 2013) ^[1]. Although several studies were conducted in *Cyamopsis tetragonoloba* (L.) Taub. for vegetable purpose, studies on cluster bean for Guar Gum purpose is limited in southern parts of India. Production of this crop in India mainly confined to the North-West part of India, however certain areas of Andhra Pradesh and Telangana state are highly suitable for cultivation of this crop as suggested by ICAR-high level expert committee report as an alternate crop for sustainability in scarce rainfall zones (CRIDA, 2012) ^[3].

Material and Methods

Soil samples were drawn at random (from 0-30 cm depth) from the experimental field and the composite sample was analysed for physico-chemical properties. Fifteen cultivars of seed guar seeds were inoculated with Rhizobium bacteria and sown in the Student Research Farm, College of Horticulture, Dr. Y.S.R. Horticultural University, Mojerla, Mahabubnagar, Telangana state during kharif, 2014. The experiment was laid out in a Completely Randomized Block Design. Seeds of each cultivar were sown with a spacing of 30 x 30 cm in 3 x 2 m plots in three replications.

Mojerla falls under semi-arid tropical climate, situated at an altitude of 346 m above the Mean Sea Level. Geographically, it lies at latitude of 16.26° N and longitude of 77.56° E. The monthly mean meteorological data recorded during the crop growth period (August, 2014 to December, 2014) at Meteorological observatory, Krishi Vigyan Kendra, Madanapuram. At all the stages of the crop growth, the weather was congenial for growth and development of seed guar.

All the package of practices to raise the crop was followed as recommended for seed guar under exploited vegetable crop. The need based plant protection measures were taken to raise the healthy crop. Data recorded on eleven different characters on five randomly selected competitive plants in each of the accession at various phenophases of the crop except percentage of germination, days to first flowering and days to 50% flowering. The mean values of five competitive plants were averaged and expressed as mean of the respective character. However, the traits *viz.*, percentage of germination, days to first flowering and days to 50% flowering were recorded on plot basis. The recorded data were subjected to analysis of variance as per the procedure given by Panse and Sukhatme (1985) ^[6].

Result and Discussion

The results of plant growth and growth attributing character analysis of variance for 15 cultivars in seed guar are furnished in Table 1. Highly significant differences among the cultivars were observed for all the characters indicating the presence of sufficient amount of variability for all the characters studied thus offering greater scope for selecting desirable cultivars. On the basis of mean performance of the fifteen cultivars are presented in the Table 2. Significantly maximum Percentage of germination ranged from 79.67 to 100% with a total mean of 94.53%. Maximum percentage of germination was recorded in RGC 936 (100%), RGC 963 (100%) and JG-2 (100%) and minimum for HG 884 (79.67%). Nine cultivars have exceeded the general mean value. Plant height ranged

from 62.33 to 113.00 cm with a total mean of 78.42 cm. Maximum plant height was recorded in RGC 197 (113.00 cm) and minimum for HG 365 (62.33 cm). Seven cultivars have exceeded the general mean value. These results are in conformity with Lenkala *et al.* (2015) ^[5] in Jack bean.

The mean values for number of primary branches per plant in seed guar cultivars ranged from 4.0 to 9.0 with a grand mean of 7. Among the cultivars maximum number of primary branches per plant was recorded in RGC 936 (9.0), RGC 963 (9.0) and HG 884 (9.0), while the minimum number of primary branches was recorded in RGC 1002 (4.0) and RGC 1066 (4.0). Out of 15 cultivars, 7 cultivars have exceeded the general mean value. These findings are in similar to results of Kulaz and Ciftci (2012) ^[4] French bean. The mean values for number of leaves per plant at the stage of maturity in seed guar cultivars ranged from 66 to 118 with a grand mean of 89. Among the cultivars maximum number was recorded in RGC 936 (117.67), while the minimum number of leaves was recorded in RGC 1066 (66.00). Out of 15 cultivars, 7 cultivars have exceeded the general mean value. Days to first flowering exhibited a range of 23.00 to 24.67 days with a total mean of 23.84 days. Among the cultivars maximum days to first flowering was recorded in RGC 197 (24.67) and HG 884 (24.67), while RGC 1002 and RGC 1066 showed minimum days to first flowering (23.00).

The character days to 50 per cent flowering exhibited a range of 26.00 to 28.67 days with a grand mean of 27.20 days. Among the cultivars maximum days to 50 per cent flowering was recorded in RGC 197 (28.67 days), while RGC 936 and HG 365 showed minimum days to 50 per cent flowering (26.00). Similar results were reported by Pan *et al.* (2004) ^[6] in French bean. The mean value of total number of clusters per plant ranged from 15.33 to 40.67 with a grand mean of (26.24). The cultivar RGC 963 recorded the maximum number of clusters per plant (40.67) and the minimum was recorded in RGC 1031 (15.33). Nine cultivars have exceeded the general mean value. Number of pods per cluster ranged from 3.67 to 7.00 with a grand mean value of 4.91. The maximum number of pods per cluster was recorded in RGC 197 (7.00), while the minimum number of pods per cluster was recorded in RGC 1002 (3.67). Nine cultivars have exceeded the general mean value.

The number of pods per plant ranged from 69.67 to 204.00 with a general mean of 127.38. The cultivar RGC 963 recorded the maximum number of pods per plant (204.00) and the minimum was recorded in HG 365 (69.97). Six cultivars have exceeded the general mean value. Length of the pod ranged from 4.73 to 6.37 cm with a total mean of 5.83 cm. The maximum length of pod was recorded in JG-2 (6.37 cm), while the minimum length of pod was recorded in HG 365 (4.73 cm). Nine cultivars have exceeded the general mean value. The girth of the pod ranged from 19.53 to 23.33 mm with a total mean of 21.93 mm. The cultivar HG 365 recorded as a maximum pod girth (23.33 mm) and the minimum girth of pod was recorded in RGC 1025 (19.53 mm). The genotypic and phenotypic coefficient of variations were high for morphological characters such as number of primary branches per plant, number of clusters per plant and number of pods per plant.

Table 1: Analysis of variance for growth components in fifteen cultivars of seed guar (*Cyamopsis tetragonoloba* (L) Taub.)

S. No.	Character	Mean sum of squares		
		Replications (d.f=2)	Treatments (d.f=14)	Error (d.f=28)
1.	Percentage of germination	0.87	123.09**	0.295
2.	Plant height (cm)	3.89	571.69**	6.341
3.	Number of primary branches per plant	1.62	9.76**	0.74
4.	Number of leaves per plant	11.40	604.99**	4.59
5.	Days to first flowering	1.09	1.47*	0.61
6.	Days to 50% flowering	0.47	1.94**	0.54
7.	Number of clusters per plant	0.56	212.02**	2.96
8.	Number of pods per Cluster	0.62	1.98**	0.59
9.	Number of pods per plant	510.49	5192.80**	573.58
10.	Pod length (cm)	0.08	0.56**	0.03
11.	Pod girth (mm)	0.58	3.16**	0.22

Table 2: Mean performance of fifteen cultivars of seed guar (*Cyamopsis tetragonoloba* (L.) Taub.) for plant growth and growth component characters

Cultivars	Percentage of germination	Plant height (cm)	No. of 1 st branches per plant	No. of leaves per plant	Days to first flowering	Days to 50% flowering	No. of clusters per plant	No. of pods per cluster	No. of pods per plant	Pod length (cm)	Pod girth (mm)
RGC 197	89.67	113.00	5.00	74.00	24.67	28.67	17.00	7.00	119.67	6.13	21.53
RGC 936	100.00	88.67	9.00	118.00	23.33	26.00	29.00	4.33	126.00	6.23	23.27
RGC 963	100.00	95.33	9.00	103.00	23.33	26.33	40.67	5.00	204.00	6.16	21.93
RGC 986	95.33	84.00	8.00	99.00	24.33	28.00	38.00	5.00	189.33	5.60	22.00
RGC 1002	99.00	68.67	4.00	79.00	23.00	27.33	21.00	3.67	76.67	5.53	23.27
RGC 1025	99.33	76.67	6.00	76.00	24.33	27.67	28.33	4.33	122.67	5.87	19.53
RGC 1031	99.00	77.67	6.00	82.00	24.67	26.67	15.33	5.33	81.67	5.63	21.93
RGC 1033	87.33	64.67	8.00	103.00	23.67	27.67	29.00	4.67	134.67	5.30	22.00
RGC 1038	88.67	66.33	7.00	102.00	23.67	27.00	31.67	5.00	158.33	5.67	21.73
RGC 1066	93.33	87.33	4.00	66.00	23.00	26.67	14.00	6.00	84.33	6.10	22.13
HG 365	99.33	62.33	5.00	73.00	23.00	26.00	17.33	4.00	69.67	4.73	23.33
HG 884	79.67	66.33	9.00	93.00	24.67	27.67	28.00	4.33	121.33	5.83	21.53
HG 2-20	88.00	79.00	6.00	92.00	23.67	27.00	36.33	5.00	182.00	6.00	22.07
JJ-1	99.33	79.33	5.00	84.00	25.00	28.33	21.00	5.00	105.00	6.23	20.27
JG-2	100.00	67.00	8.00	88.00	23.33	27.00	27.00	5.00	135.33	6.36	22.47
Mean	94.53	78.42	7.00	89.00	23.84	27.20	26.24	4.91	127.38	5.83	21.93
Range lowest	79.67	62.33	4.00	66.00	23.00	26.00	15.33	3.67	69.67	4.73	19.53
Range highest	100.00	113.00	9.00	117.67	24.67	28.67	40.67	7.00	204.00	6.36	23.33
C.V. (%)	0.57	3.21	13.001	2.41	3.28	2.69	6.56	15.75	18.80	2.92	2.12
S.E. $\pm$	0.31	1.45	0.497	1.24	0.45	0.42	0.99	0.44	13.82	0.09	0.26
C.D. at 5%	0.91	4.21	1.44	3.58	1.31	1.22	2.88	1.29	40.06	0.28	0.78
C.D. at 1%	1.23	5.68	1.94	4.83	1.77	1.65	3.88	1.75	54.04	0.38	1.05

Plate 1: Guar plant in experimental plot

Conclusion

All the characters among 15 cultivars of seed guar showed highly significance difference in analysis of variance. Among the cultivars studied RGC 936 and RGC 963 recorded

maximum percentage of germination. Maximum number of primary branches (RGC 936, HG 884), maximum number of leaves per plant (RGC 936) and days to first flowering (RGC 1002, RGC 1066, HG 365) were recorded. The cultivar RGC

197 produced the maximum plant height at harvest, number of pods per cluster. Among the cultivars JG-2 recorded maximum pod length and HG 365 recorded maximum pod girth. As majority of the area in Telangana state is occupied with saline alkali soils with poor organic matter, the adoption of this crop in this region may be recommended to bring the poor and marginal lands under cultivation. Hence these superior cultivars may be further tested in different locations for their stable performance and thereafter may be selected as parental source for future breeding programmes and also may be recommended for commercial cultivation.

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