Andhra Pradesh J Agril. Sci : 2(3): 218-223, 2016

IDENTIFICATION OF SUITABLE CLUSTERBEAN VARIETY FOR RAINFED REDSOILS OF SCARCE RAINFALL ZONE

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Date of Receipt: 17-07-2016 Date of Acceptance: 29-08-2016

ABSTRACT

A field experiment was conducted to study the suitability of clusterbean varieties for alfisols of scarce rainfall zone under rainfed conditions for two years during *kharif*, 2014-15 and 2015-16 at Agricultural Research Station, Ananthapuram of Andhra Pradesh. Results revealed that different clusterbean varieties did not exhibit significant influence on plant height, number of pods per plant, number of seeds per pod, test weight, seed and haulm yield. The correlation studies between yield attributes and yield based on two years investigation revealed that number of seeds per plant was significantly and positively influenced by plant height and number of pods per plant. The test weight has significant positive correlation with plant height, number of pods and number of seeds per plant. Seed yield was positively and significantly correlated with number of pods per plant, number of seeds per plant and test weight. The haulm yield expressed significant positive correlation with number of seeds per plant and seed yield.

KEYWORDS: Clusterbean, varieties, Alfisols

INTRODUCTION

Clusterbean, popularly known as guar is *kharif* legume crop, very drought tolerant, sun-loving but susceptible to frost that requires only 300-400 mm annual rainfall recently classified in arid legume group and is grown for vegetable, green fodder, green manure and for grain. Its deep penetrating root system enables the plant to utilize available moisture more efficiently and thus offers better scope for rainfed cropping. The crop survives best even under moderate salinity and alkalinity. Clusterbean tolerates high temperatures and dry conditions and is adapted to arid and semi-arid climates (Undersander *et al*., 1991). It is a principal source of galactomannan (28 -33 % guar gum) and has numerous food and industrial uses *viz.,* textiles, paper, petroleum, pharmaceuticals, food processing, cosmetics, mining explosives, oil drilling etc. India is leading producer of the crop in the world contributing to around 75-82% of the total production. The consumption pattern of its seed is largely influenced by the demand from the petroleum industries in USA and oil fields in the Middle East. The trend of consumption has also increased in rest of the world that has led to its introduction in many countries.

India is a leading exporter of guar gum with 80% of world production, followed by Pakistan. Rajasthan is the largest clusterbean producing states in the world as it dominates the Indian production scenario contributing to 70% of the total production in India followed by Haryana (12%) and Gujarat (11%). Clusterbean basically grown under arid rainfed conditions and there was year to year huge yield fluctuations due to erratic rainfall (Pathak *et al*., 2009 and Singh *et al*., 2003 and 2005).

After seeing great revenues with the crop during previous years by Rajasthan farmers, farmers in Ananthapuram, Guntur, Kurnool, Karimnagar, Nellore, Prakasam and Ranga Reddy districts of Andhra Pradesh have also started the cultivation of this crop for seeds in more than 1000 ha (NRAA, 2014). Ananthapuram district is the second most drought affected district of India. It receives around 500 mm rainfall annually. The agriculture is predominantly dependent on rainfall which is very erratic and uncertain. Being located in the scarce rainfall zone of Andhra Pradesh does not get the full benefit of either the southwest or northeast monsoon. Rainfed agriculture in Anantapuram district is greatly influenced by water shortage caused by low, highly variable and erratic rainfall.

With growing international demand for the guar gum, identification of suitable varieties for different agroclimatic conditions is the pressing need of the hour

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as most of the clusterbean varieties currently being grown were developed under arid conditions and research need to be focused on their suitability for different environments and identifying the management strategies to enhance both seed yield and recovery of quality gum which are crucial to expand the cultivation of this commercially important crop to new areas. To address these issues, eight cluster bean varieties were evaluated for their yield potential during *kharif* season in nontraditional areas like Ananthapuramu district of Andhra Pradesh.

MATERIAL AND METHODS

A field experiment was conducted to study the suitability of clusterbean varieties in alfisols of scarce rainfall zone under rainfed conditions for two years during *kharif*, 2014-15 and 2015-16 at Agricultural Research Station, Ananthapuram of Andhra Pradesh. The soil of the experimental site was red sandy loam with shallow depth, low in organic carbon (0.38%) and low in available nitrogen (138 kg ha^{-1}), medium in available phosphorous (28 kg ha^{-1}) and potassium (215 kg ha^{-1}). The experiment was laid out in randomized block design with three replications. The treatments consisted of eight varieties viz., T_1: JJ-1, T_2: JG- 2, T_3: HG 365, T_4: RGC 936, T_5: RGC 963, T_6: RGC 1002, T_7: RGC 1025 and T_8: RGC 1066.The experimental field was prepared by working with a tractor drawn disc plough and then tractor drawn cultivator was drawn along the field. Healthy seeds of clusterbean varieties with good germination percent (95%) were used for sowing purpose. Sowing was taken up as per the treatments. The seeds were sown by dibbling in furrows at a depth of 5 cm. The furrows were covered immediately after sowing and compacted sufficiently for better germination. Thinning was done at 15 DAS retaining one healthy seedling $hill^{-1}$. The recommended dose of N, P_2O_5 and K_2O kg ha^{-1} was applied at the time of sowing through urea, single super phosphate and muriate of potash respectively. Thinning and gap filling was done whenever necessary, weeding and hoeing were taken up depending on the intensity of weeds at critical stages of crop weed competition. One to two hand weedings were done with the help of star weeder in interrows and with hand hoes in the intrarows and all other cultural practices were kept normal and uniform in all treatments. At harvest five plants were randomly selected from each treatment for recording growth parameters such as plant height, number of pods per plant, number of seeds per pod, test weight. At harvest in each treatment grain and haulm yield from the net plot (5 m x 5 m) was recorded and expressed in kg ha^{-1}.

RESULTS AND DISCUSSION

Rainfall Distribution during the crop growth period

The data on sowing and harvest dates, rainfall distribution during the two years of investigation and crop growth period (Table 1) shows that in the year 2014-15, annual rainfall received was 65.8 per cent (375.2 mm in 26 rainy days) of normal annual rainfall (570 mm). In 2014-15, crop sown on 16-7-2014 and harvested on 10-10-2014 with 86 days crop duration. During this period 160.6 mm rain received in 10 rainy days. In 2015-16, annual rainfall received was 108 per cent (641 mm in 44 rainy days) of 590.6 mm normal annual rainfall. In 2015-16, crop sown on 19-6-2015 and harvested on 11-9-2015 with crop duration of 84 days. During this period 212.6 mm rainfall received in 14 rainy days.

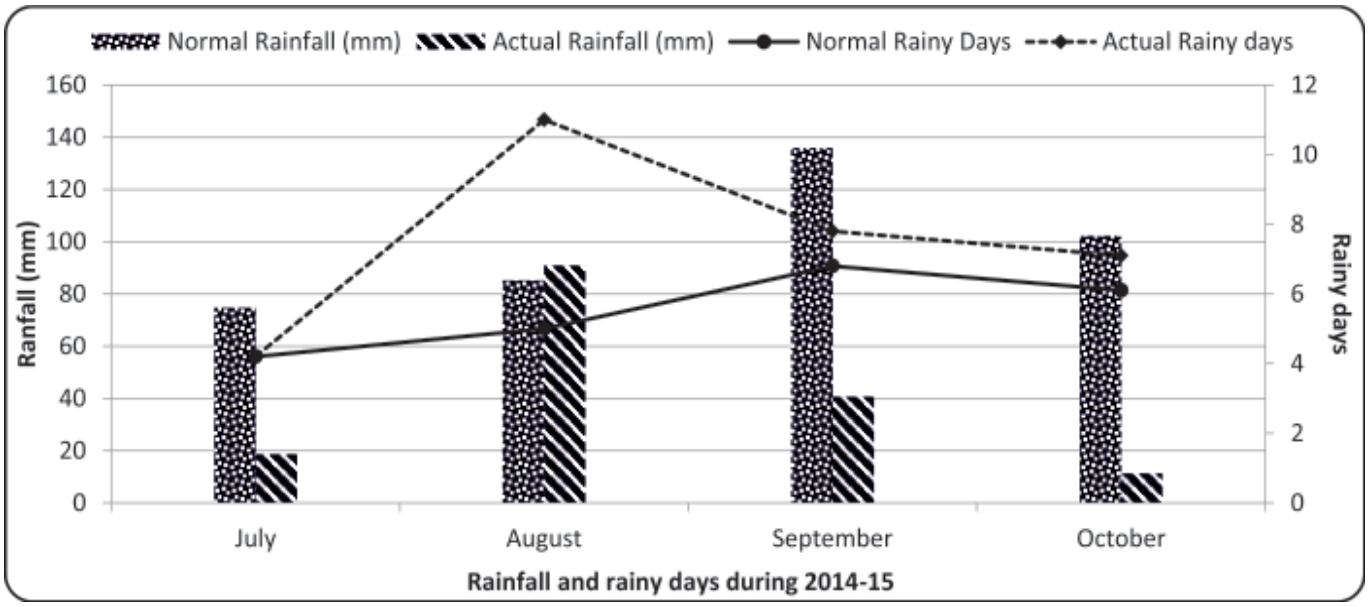
Data pertaining to plant height, yield attributes and seed yield are presented in Table 2. Plant height was not influenced significantly by the clusterbean varieties however highest plant height was recorded with JJ-1 followed by JG-2. This might be due to genetic disparity of cultivars. Different clusterbean varieties did not exert significant influence on number of pods per plant. However, the highest number of pods per plant obtained with JG-2 followed by HG-365, where as RGC-1066 produced least number of pods per plant owing to its erect growing habit with less number of branches and majority of the pod formation on the main stem. Different clusterbean varieties did not execute significant influence on number of seeds per pod. However JJ-1, RGC-936, RGC-1025 produced higher number of seeds per pod and least number of seeds per pod obtained with JG-2 and RGC-1066.

Test weight was not significantly influenced by various varieties. However higher test weight was observed with JJ-1 followed by RGC-1066, RGC-963 and RGC-1002 where as JG-2 and RGC-1025 produced lesser test weight. This result is in agreement with Satyavathi *et al.* (2014) who reported that RGC1025 showed lowest test weight than the other genotypes in *kharif*.

With regard to seed yield different clusterbean varieties did not exhibit significant influence on the seed yield. However, JJ-1 followed by RGC-1002 produced

Table 1. Rainfall and rainy days during crop growth period

Parameter	2014-15	2015-16
Date of sowing	16-07-2014	19-06-2015
Date of harvesting	10-10-2014	11-09-2015
Crop duration (days)	86	84
Normal annual rainfall (mm)	570	590.6
Actual annual rainfall (mm)	375.2	641
Rainfall during crop period (mm)	160.6	212.6
Number of rainy days during the year	26	44
Number of rainy days during crop period	10	14



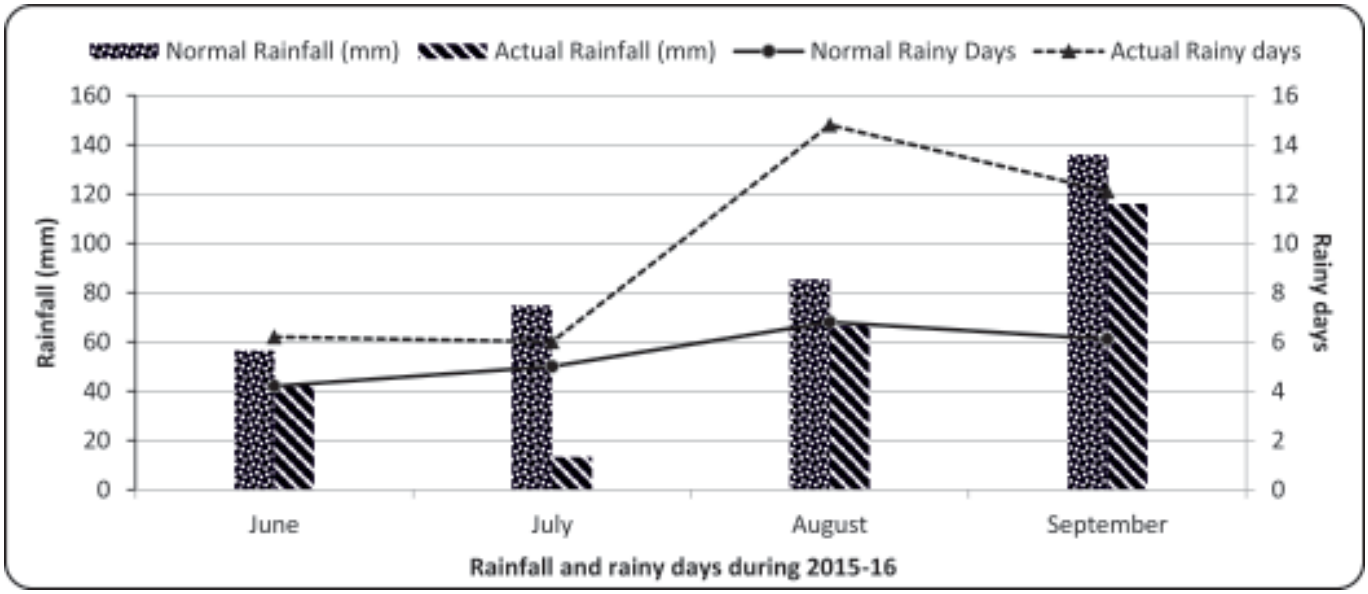


Table 2. Growth and yield attributes of different clusterbean varieties in rainfed alfisols (Mean of 2 years data)

Treatments	Plant height (cm)	Number of pods per plant	Number of seeds per pod	Test weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest Index
T_1: JJ-1	31.7	17.2	6.4	34.1	797	1589	0.33
T_2: JG- 2	29.1	21.0	5.9	32.7	659	1045	0.39
T_3: HG 365	27.4	20.6	6.2	33.6	709	1111	0.39
T_4: RGC 936	26.7	17.3	6.4	33.2	652	1137	0.36
T_5: RGC 963	27.7	19.6	6.0	34.1	630	1169	0.35
T_6: RGC 1002	23.4	18.5	6.1	33.9	736	1320	0.36
T_7: RGC 1025	26.0	18.8	6.4	32.8	685	1157	0.37
T_8: RGC 1066	28.0	16.7	5.9	34.1	655	1253	0.34
S.Em +	5.36	3.49	0.98	5.71	133.5	201	-
CD at 5%	NS	NS	NS	NS	NS	NS	-

Table 3. Correlation coefficient between yield attributes and yield of different clusterbean varieties in rainfed alfisols during 2014-15

Parameter	Plant height (cm)	No. pods per plant	No. seeds per pod	Test weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
Plant height (cm)	1					
No. pods per plant	0.928**	1				
No. seeds per pod	0.961**	0.947**	1			
Test weight (g)	0.934**	0.963**	0.983**	1		
Seed yield (kg/ha)	0.980**	0.909**	0.981**	0.946**	1	
Haulm yield (kg/ha)	0.960**	0.893**	0.983**	0.949**	0.978**	1

**: Significant at 1% level

Table 4. Correlation coefficient between yield attributes and yield of different clusterbean varieties in rainfed alfisols during 2015-16

Parameter	Plant height (cm)	No. pods per plant	No. seeds per pod	Test weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
Plant height (cm)	1					
No. pods per plant	-0.460	1				
No. seeds per pod	-0.421	-0.152	1			
Test weight (g)	0.412	-0.572	-0.371	1		
Seed yield (kg ha^{-1})	-0.404	-0.182	0.093	-0.012	1	
Haulm yield (kg ha^{-1})	0.108	-0.602	-0.028	0.419	0.515	1

Table 5. Correlation coefficient between yield attributes and yield of different clusterbean varieties in rainfed alfisols (Mean of 2 years data)

Parameter	Plant height (cm)	No. pods per plant	No. seeds per pod	Test weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
Plant height (cm)	1					
No. pods per plant	0.732	1				
No. seeds per pod	0.763*	0.866**	1			
Test weight (g)	0.799*	0.870**	0.968**	1		
Seed yield (kg ha^{-1})	0.723	0.776*	0.928**	0.892**	1	
Haulm yield (kg ha^{-1})	0.357	0.477	0.749*	0.711	0.782*	1

*: Significant at 5% level; **: Significant at 1 % level

maximum seed yield where as seed yield was reduced with RGC-963. The superiority of JJ-1 and RGC-1002 over other varieties with respect to yield may be due to its genetic potentiality to utilize the growth resources and translocate photosynthates from source to sink. These results were contradictory to Satyavathi *et al.* (2014) who reported that selected clusterbean genotypes recorded significant difference for biomass and seed yield at harvest. The genotype HG-365 produced highest biomass as well as registered lowest reduction in seed yield during *kharif*. The genotype RGC-936 was prominent in its plant growth habit with profuse branching from base of the stem with smaller lamina and the seed yield was also high. The genotype RGC-986 registered higher reduction in total biomass, vegetative & fodder biomass, pod & seed weight and HI during kharif. The biomass and seed yield of RGC-1025 was found to be best in both the seasons though moderate reduction was observed in humid *kharif* season. The genotype RGC-1017 maintained similar biomass and pod weight in both the seasons, however seed filling was affected in kharif season resulting a 40% reduction in seed yield. The guar genotypes were considered as short day plants and sensitive to photo period. This phenomenon influence their fodder and seed yield in different reasons with varying photoperiod (Paroda *et al*., 1977).

Haulm yield was not significantly influenced by different varieties however higher haulm yield was obtained with JJ-1 and JG-2 registered lowest haulm yield. These results were contradictory to Singh *et al.* (2005) who observed that twenty five clusterbean genotypes tested were significantly different for all the characters like plant height, pods per plant, seeds per pod, seed yield and haulm yield. Higher harvest index obtained with JG-2 followed by HG -365 and RGC -1025 where as JJ -1 registered lowest harvest index. These results were in conformity with Satyavathi *et al.* (2014) who observed that RGC-1025 recorded highest HI (25%) and RGC-986 (13%) recorded lowest HI in Kharif.

Correlation between yield attributes and yield

In 2014-15, number of pods per plant was positively and significantly correlated with plant height (Table 3). Number of seeds per pod was positively and significantly correlated with plant height and number of pods per plant. Test weight was positively and significantly correlated with plant height, number of pods per plant and number of seeds per pod. Seed yield was positively and significantly correlated with plant height, number of pods per plant, number of seeds per pod and test weight. Haulm yield was positively and significantly correlated with plant height, number of pods per plant, number of seeds per pod and test weight

The correlation studies between yield attributes and yield based on two years investigation (Table 5) revealed that number of seeds per plant was significantly and positively influenced by plant height and number of pods per plant. The test weight has significant positive correlation with plant height, number of pods and number of seed per plant. Seed yield was positively and significantly correlated with number of pods per plant, number of seeds per plant and test weight. The haulm yield expressed significant positive correlation with number of seeds per plant and seed yield.

From the study it can be concluded that JJ- 1 and RGC-1002 performed well in this domain. Although growth and yield of these varieties was lower compared to other crops it did not show severe symptoms of drought stress during extreme dry spell periods. Therefore, clusterbean is a promising crop for this dry environment. However, its acceptability and marketing are to be determined.

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