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Seasonal variation on growth and yield parameter of certain cluster bean cultivars (*Cyamopsis tetragonoloba* (L.) TAUB.)

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Abstract

Two field experiments were carried out at Adhiparasakthi Agriculture College, Kalavai during winter and summer season to study the effect of seasonal variations on growth parameters, physiology attributes and yield parameters of different cluster bean cultivars. The genotypes viz., Ankur Rani, super11, Krishna 41, Mansi, Kallakurchi, Thiyagadurgam, Cheyyar, Cuddalore, Lakshmi, Needamangalam, Poigai and Pusa Navbahar were taken up for the study. The result revealed that among the two seasons, summer sowing recorded the higher plant height (95.98 cm), root length (12.43), number of branches per plant (11.59 nos), leaf area index (1.37), total dry mater (26.11g/plant), net assimilate rate (0.254), crop growth rate (0.040) in the genotype Pusa Navbahar followed by Ankur Rani. The green pod yield is (756 q/ha.) and benefit cost ratio (3.83) was also recorded high in genotype Pusa Navbahar.

Keywords: Cluster bean cultivars, growth parameters, yield, physiology attributes, BCR

Introduction

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) Commonly known as Guar, is a drought and highly tolerant deep rooted summer annual legume of high social and economic significance. The qualities of the crop like high adaptation towards erratic rainfall, multiple industrial uses and its importance in cropping system besides other factors such as soil enrichment properties, low input requirement, etc., have made the guar one of the most significant crops for farmers in arid area of India. Guar is a native to the Indian sub-continent. The crop is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat and Punjab and to limited extent in Uttar Pradesh, Madhya Pradesh and Tamil Nadu. The crop is also grown in other parts of the world like, Australia, Brazil and South Africa [4].

In India it has been cultivated mainly on poor soils of rainfed region. India leads the world in guar production with about 80 percent of global production [2]. In India, Guar crop is cultivated mainly during Kharif season (February - May), with an annual production of around 2 million metric tons. Guar crop has experienced a remarkable journey from traditional crop grown on marginal lands mainly for food, animal feed and fodder to a crop with various industrial usages. Guar gum is an important ingredient in producing food emulsifier, food additive, food thickener and other guar gum products. The unique binding, thickening and emulsifying quality of guar gum powder obtained from guar seed has made it a much sought important product in international market [1]. Hence, the present study was undertaken to find out a suitable genotype and optimum sowing time or season under climatic region of Vellore.

Material and methods

The field experiment was conducted at the Adhiparasakthi Agricultural College farm, Kalavai, Vellore District, Tamil Nadu during winter and summer 2014 to study the growth parameters, physiology attributes and yield parameters of cluster bean genotypes. The experiment was laid out in a randomized block design with three replication. A total of twelve genotypes (Cultivars), viz., Ankur Rani, Super 11, Krishna 41, Mansi, Kallakurchi, Thiyagadurgam, Cheyyar, Cuddalore, Lakshmi, Needamangalam, Poigai and Pusa Navbahar were used as treatments. Observations on growth parameters such as plant height, root length, number of branches, total dry mater content, physiological attributes like leaf area index, net assimilation rate, crop growth rate, relative growth rate were recorded at three different phenological stages viz., vegetative (30, 60 and 90 DAS) and yield benefit cost ratio were also studied.

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Result and Discussion

With regard to the winter season crop, the plant height showed significant different between the different genotypes. The genotype Cuddalore recorded the lowest plant height in T8 (73.55cm). The plant height recorded was of the highest (T₁₂) (95.98 cm). In Pusa Navbahar (T₁₂) followed by 87.43 cm in Ankur Rani (T₁). In the summer season crop, the plant height recorded statically differed under different genotypes. Similar to winter season crop, the plant height recorded at harvesting stage registered a significant increase and was of the highest in Pusa Navbahar T₁₂ (95.98 cm) followed by Ankur Rani T₁ (90.88cm) (Table 1). The better root growth may also be attributed to the season that there is an increase in radial growth of the cortical cell due to induced mitosis and meristematic cytokinesis and also due to the increased auxin levels in the roots [10] all of these above mentioned factors have been confirmed in the present study. The production of root length showed that more root length was recorded summer (13.43cm), followed by winter (8.29 cm). The root length would have been increased with the influence of growth promoting hormone like cytokinin synthesized in the roots [11].

The number of branches recorded was of the highest (11.02) in Pusa Navbahar (T₁₂) followed by 10.25 in Pogai (T₁₁). In summer season crop, the number branch was recorded highest in Pusa Navbahar T₁₂ (11.59) followed by Lakshmi (T₉)

(10.22) and Krishna - 41 (T₃) (10.33). The mean number of branches showed that more number of branches was recorded in summer (9.36 cm), than winter (9.04). Similar results were reported by [12] and [11] that significantly superior performance of growth parameters in different growth stages in early sowing mainly due to longer growth period in French bean. The mean data of total dry matter production in showed that more TDMP was recorded in summer (25.34g), than in winter (24.34g). Similar results were also reported earlier by [9] and [3].

Among the two season, the production of Leaf Area Index, Net Assimilation Rate, Crop Growth Rate, Relative Growth Rate were recorded highest in Pusa Navbahar (T₁₂) during summer (1.37,0.254,0.040,0.021) followed by winter (1.34, 0.250, 0.039, 0.019) followed by Ankur Rani (T₁) (Table 2). Similar results were observed by [5], [6] in Soyabean. The genotype T₁₂ Pusa Navbahar was significantly higher green pod yield (756 q/ha.) followed by T₁ Ankur Rani (615 q/ha.), T₁₀ Needamangalam (596q/ha.). The lowest green pod yield was also recorded in T₃ Krishna (310q/ha.). The genotype T₁₂ Pusa Navbahar recorded the highest gross return (Rs.75558/ha.), Net return (Rs.55878 /ha.) and benefit cost ration (3.83) compared to other genotypes (Table 3). The findings from the present work are also in line with the report of [8] in Mungbean.

Table 1: Seasonal influence on growth parameters in different cluster bean cultivars

Treatment (Genotypes)	Plant height (cm)		Root length (cm)		Number of branches/plant		Total dry matter production (g/plant)	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
T ₁ -Ankur Rani	87.43	90.88	6.70	14.13	8.55	8.84	25.98	26.73
T ₂ -Super 11	83.81	85.34	6.93	13.90	8.65	9.25	22.79	23.21
T ₃ -Krishna 41	79.2	77.89	10.90	13.20	10.02	10.20	24.95	25.65
T ₄ - Mansi	75.36	85.12	8.96	12.37	8.45	8.65	23.64	24.27
T ₅ -Kallakurchi,	83.04	81.45	7.53	16.17	7.47	8.15	22.70	23.07
T ₆ -Thiyagadurgam	79.45	78.23	6.36	13.00	8.60	8.77	24.86	25.19
T ₇ - Cheyyar	75.88	76.39	6.80	10.70	8.46	9.12	25.56	26.27
T ₈ - Cuddalore	73.55	82.22	7.63	14.17	9.34	9.80	25.72	26.31
T ₉ - Lakshmi	80.6	78.90	8.30	10.13	10.10	10.22	22.01	22.27
T ₁₀ - Needamangalam	76.89	87.42	12.80	13.37	7.57	8.24	24.35	24.69
T ₁₁ - Poigai	85.69	92.38	7.93	13.43	10.25	9.56	24.10	24.27
T ₁₂ - Pusa Navbahar	92.38	95.98	8.66	12.40	11.02	11.59	25.45	26.11
Mean	92.38	83.53	8.29	13.08	9.04	9.36	24.34	24.83
SE.D	2.51	2.41	3.32	2.20	0.43	0.37	0.99	0.65
CD (0.05)	5.21	4.98	6.88	4.56	0.89	0.76	2.05	1.31

Table 2: Seasonal influence on physiology attributes in different cluster bean cultivars

Treatment (Genotypes)	Leaf area index (LAI)		Net Assimilation Rate (NAR)		Crop Growth Rate (CGR)		Relative Growth Rate (RGR)	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
T ₁ -Ankur Rani	1.23	1.29	0.209	0.212	0.043	0.045	0.016	0.019
T ₂ -Super 11	1.08	1.10	0.169	0.172	0.036	0.038	0.015	0.017
T ₃ -Krishna 41	1.19	1.21	0.178	0.181	0.041	0.043	0.016	0.018
T ₄ - Mansi	1.11	1.13	0.192	0.195	0.037	0.039	0.013	0.015
T ₅ -Kallakurchi,	1.22	1.24	0.198	0.101	0.036	0.038	0.010	0.012
T ₆ -Thiyagadurgam	1.15	1.18	0.187	0.191	0.039	0.041	0.013	0.015
T ₇ - Cheyyar	1.20	1.23	0.130	0.133	0.043	0.045	0.011	0.013
T ₈ - Cuddalore	1.22	1.25	0.167	0.170	0.031	0.033	0.014	0.016
T ₉ - Lakshmi	1.02	1.06	0.181	0.185	0.032	0.034	0.012	0.014
T ₁₀ - Needamangalam	1.09	1.11	0.142	0.145	0.034	0.036	0.014	0.016
T ₁₁ - Poigai	1.20	1.23	0.165	0.168	0.041	0.043	0.010	0.011
T ₁₂ - Pusa Navbahar	1.34	1.37	0.250	0.254	0.039	0.040	0.019	0.021
Mean	1.17	1.20	0.180	0.180	0.037	0.040	0.013	0.020
SE.D	0.03	0.03	0.0191	0.0044	0.0018	0.0015	0.0015	0.0011
CD (0.05)	0.07	0.06	0.0394	0.0091	0.0036	0.0031	0.0032	0.0024

Table 3: Seasonal influence of cost of cultivation of different genotype of cluster bean cultivars

Treatment (Genotypes)	Yield (g/ha.)	Gross Return (Rs./ha.)	Cost of cultivation (Rs./ha.)	Net profit (Rs./ha.)	Benefit cost ratio
T ₁ -Ankur Rani	615	61506	19680	41826	3.12
T ₂ -Super 11	413	41309	19680	21629	2.05
T ₃ -Krishna 41	310	31029	19680	11345	1.57
T ₄ - Mansi	518	51795	19680	32115	2.63
T ₅ -Kallakurchi,	436	43507	19680	23827	2.21
T ₆ -Thiyagadurgam	588	58791	19680	39111	2.98
T ₇ - Cheyyar	584	58371	19680	38691	2.96
T ₈ - Cuddalore	496	49643	19680	29963	2.52
T ₉ - Lakshmi	421	42062	19680	22382	2.13
T ₁₀ - Needamangalam	596	59567	19680	39887	3.02
T ₁₁ - Poigai	411	41148	19680	21468	2.09
T ₁₂ - Pusa Navbahar	756	75558	19680	55878	3.83

Conclusion

Among the two seasons, summer sowing was recorded the higher plant height, root length, number of branches, leaf area index, total dry weight, net assimilation rate, crop growth rate in the genotype Pusa Navbahar followed by Ankur Rani and poigai than winter season. Among the 12 genotypes the Pusa Navbahar has recorded better growth and yield attributing parameters which will ultimately result increasing the productivity of the crop followed by Ankur Rani and Cheyyar.

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