Evaluation of Pigeonpea Genotypes for Morpho-phenological Traits By Growing on Rice Bunds

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Abstract: *The experiment consisted fifteen pigeonpea (Cajanus cajan (L.). Millsp.) genotypes laid out in randomized block design with three replications. The various morphological characters like plant height, mean number of leaves, number of secondary branches and mean leaf area per plant had the highest magnitude at the harvest in high yielding genotype AKTE-11-1 while low yielding genotype ICPL-87 was recorded lowest magnitude. High yielding genotype AKTE-11-1 required the highest number of days for 50% flowering (140.50) and physiological maturity (179.83) while reverse case was noticed in low yielding genotype ICPL-87.*

Keywords: *Pigeonpea, growth, flowering, maturity*

INTRODUCTION

Pulses occupy a very important place in Indian agriculture and in human diet especially vegetarian diet. Pigeonpea contains high level of protein and important amino acids as methionine, lysine, and tryptophan (Ariraman *et al*, 2014). Besides being a rich source of protein, they maintain soil fertility through biological nitrogen fixation in soil and thus play a vital role in furthering sustainable agriculture (Kannaiyan, 1999). India is largest producer of pigeonpea constituting 75% of world production. In India pigeonpea is grown over an area of about 36.3 lakh hacters. India had produced 27.6 lakh tonnes pulses during Kharif 2010-11. The production of tur in India is approximately 2.76 million tonnes (Anonymous 2010-11). Pigeonpea is an important pulse crop in semi-arid tropics of Andhra Pradesh and Maharashtra States. In Maharashtra pigeonpea is grown over an area of about 1.17 million hacters (Anonymous, 2011). It is a versatile crop and ideally suited for drought-prone areas. In *konkan* region of Maharashtra pigeon pea is grown mainly on rice bunds. This crop is sown during *kharif* in month of June-July after transplanting of rice. This crop matures in the month of November-December. Also this crop is grown in rice fallows after harvest of rice on residual moisture during the month of October and matures in the month of February-March. Its deep root system allows extraction of moisture from deep layers of the soil and thus makes it a crop that produces biomass including protein-rich grain while utilizing residual moisture (Nene and Sheila 1990). In *konkan* region of Maharashtra rice is grown on about 4.2 lakh hectare area. The rice bunds have more residual moisture than the field, the growing of pigeonpea on rice bund increase the total cropped area and this crop grows very well and produces a good yield. Among the several constraints ascribed for low yield in pulses vegetative biomass uncertain with growth habit with low partitioning ability is considered as one of the major physiological constraint in improving yield in pulses. The farmers are using the seed material of any pigeon pea variety and therefore yield is less. It is necessary to identify the pigeon pea variety for growing on rice bunds.

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Therefore present study was carried out to investigate morpho-phenological development in pigeon pea genotypes by growing on rice bunds.

MATERIAL AND METHODS

The experiment was conducted at the experimental field of Department of Agricultural Botany and Agronomy, College of Agriculture, Dapoli, Dist: Ratnagiri (M.S.) Dapoli during *Kharif* 2013. The selection of the site was considered on the basis of availability of the bunds for cultivation of pigeon pea. The experimental material consisted of fifteen different promising genotypes of pigeonpea V1 (AKTE-11-1), V2 (BSMR-853), V3 (VIPULA-1), V4 (T-VISHAKHA), V5 (BDN-711), V6 (PHULE RAJESHWARI), V7 (PKV-TARA), V8 (ICPL-87119), V9 (AKT-8811), V10 (UPAS-120), V11 (TAT-10), V12 (BDN-708), V13 (BSMR-736), V14 (KONKAN TUR-1), V15 (ICPL-87) with three replications. Sowing of seeds was done in June, 2013 in plastic bags. About 2 seeds were dibbled at each bag. To retain only one healthy seedling per hill, thinning was done ten days after sowing. Fourteen day's old seedlings were transplanted on bund of rice field at 30cm distance. Total 33 plants of each genotype were planted on 10m bund length. After transplanting on bunds two weeding's were done at 20 days interval. At the time of transplanting FYM was incorporated in soil and fertilizer dose of 25:50:00 N:P:K (kg/ha) was given as per recommendations. The recommended practices followed as and when required.

The observations were recorded of five randomly selected plants from each variety in each replication. The mean value of five plants for each characters was calculated and recorded and was considered for statistical analysis. The periodical observations are taken at 30, 60, 90, 120, 150 DAS and at harvest. Growth observations as plant height, number of leaves, number of branches were calculated and recorded periodically. Plant spread of randomly selected plants was measured in centimetre from east to west and north to south and recorded. Phenological observations as days to flower initiation, days to 50% flowering, days to appear first pod maturity and days to full maturity calculated as number of days required from sowing of the variety and recorded.

Statistical analysis of the data obtained during the course of investigation was carried out by using statistical analysis methods of analysis of variance as described by Panse and Sukhatme (1985). The standard error of mean (S.E) was worked out and the critical difference at 5 per cent level of significance was calculated wherever the results were found significant.

RESULTS AND DISCUSSION

Various morphological characters play an important role in yield determining process. Screening of genotypes based on the efficiency of morpho-physiological characters is a common practice and has been used by several workers.

In the present investigation, amongst the various pigeonpea genotypes studied for their various morpho-phenological characters, the genotype V1 (AKTE-11-1) was found superior over all other genotypes, whereas the genotype V15 (ICPL-87) revealed the poorest performance. Hence, the results of this study discussed in light of the physiological analysis of these genotypes to reveal the ideal attributes responsible for higher productivity and also for crop improvement in this important pulse crop. The observations on different morphological and phenological characters were recorded periodically and the results are presented in the following sub headings.

Plant height is basically a genetically controlled character; it is being influenced by environmental condition and genotypes. The present study revealed significant differences in plant height among the genotypes at different growth stages. The data on mean plant height indicated that the mean plant height increased with age of the crop. The differences in the plant height of 15 genotypes were significant at all the growth stages except at 30 DAS. The genotype V1 (AKTE-11-1) recorded highest (263.20 cm) and V15 (ICPL-87) recorded lowest (227.83 cm) plant height at harvest. These results were in conformity with those reported by Kataria and Mishra (1993), Singh and Prasad (1987), Singh *et al*. (1995).

The data on mean number of leaves per plant revealed that, there was gradual increase in mean

Table 1
Growth performance of different pigeonpea genotypes at harvest

Genotypes	*Plant height (cm)*	*Number of leaves per plant*	*Number of branches per plant*		*Plant spread (cm)*	
			Primary branches	*Secondary branches*	*North-south*	*East-west*
V1 (AKTE-11-1)	263.20	1119.00	15.22	26.06	67.23	65.33
V2 (BSMR-853)	247.33	999.33	15.72	25.28	65.10	63.97
V3 (VIPULA-1)	251.20	936.67	16.33	24.33	66.47	64.93
V4 (T-VISHAKHA)	235.33	893.00	14.17	23.22	53.87	54.93
V5(BDN-711)	232.77	859.67	14.83	23.33	54.77	55.83
V6(P.RAJESHWARI)	259.03	1064.00	16.61	24.28	67.10	65.17
V7(PKV-TARA)	242.00	1021.33	16.72	25.06	57.83	56.77
V8 (ICPL-87119)	249.67	1070.00	17.06	25.72	67.43	65.63
V9 (AKT-8811)	253.17	1037.33	16.44	23.72	68.17	66.17
V10 (UPAS-120)	229.57	806.33	16.17	23.50	55.20	57.80
V11 (TAT-10)	243.53	792.33	15.28	22.56	54.10	56.50
V12 (BDN-708)	250.67	992.33	16.61	25.67	61.17	59.50
V13(BSMR-736)	241.10	1024.67	16.94	25.44	63.57	64.10
V14 (KONKAN TUR)	261.13	1065.00	17.17	25.83	64.43	63.77
V15 (ICPL-87)	227.83	775.00	15.17	22.22	52.70	56.00
MEAN	245.84	963.73	16.03	24.42	61.28	61.09
SE ±	3.80	48.97	0.27	0.41	0.46	0.43
CD at 5%	**11.02**	**141.85**	**0.80**	**1.19**	**1.32**	**1.26**

Table 2
Mean days to flowering and physiological maturity of different pigeonpea genotypes

Genotypes	*Days after sowing (DAS)*			
	Days to appearance of 1st flower bud	*Days to 50% flowering*	*Days to 1st pod maturity*	*Days to full maturity*
V1 (AKTE-11-1)	129.61	140.50	146.72	179.83
V2 (BSMR-853)	124.36	131.02	137.33	169.00
V3 (VIPULA-1)	127.93	137.61	142.50	145.16
V4 (T-VISHAKHA)	93.57	99.37	105.50	134.67
V5(BDN-711)	96.06	102.24	108.33	136.83
V6(P.RAJESHWARI)	129.13	138.12	143.00	173.44
V7(PKV-TARA)	129.50	136.90	142.83	175.77
V8 (ICPL-87119)	129.07	138.93	144.83	179.73
V9 (AKT-8811)	120.06	131.94	137.17	170.53
V10 (UPAS-120)	85.66	100.67	104.33	130.02
V11 (TAT-10)	90.37	98.10	102.67	129.47
V12 (BDN-708)	124.85	132.70	137.33	176.55
V13(BSMR-736)	125.23	139.67	143.67	178.50
V14 (KONKAN TUR)	127.83	130.00	135.17	164.69
V15 (ICPL-87)	85.17	94.83	99.50	128.84
MEAN	114.56	123.51	128.73	158.20
SE ±	0.94	1.18	1.09	1.88
CD at 5%	2.73	3.42	3.17	5.45

number of leaves upto 150 DAS and decreased thereafter. There were significant differences in the mean number of leaves per plant between the genotypes at all the growth stages. The genotype V1 (AKTE-11-1) recorded significantly highest mean number of leaves (1119.00), while the genotype V15 (ICPL-87) recorded lowest mean number of leaves (775.00) at harvest. These results were in conformity with the findings of Tayo (1982) who revealed in pigeonpea that, higher leaves affected positively in relation to yield. Similar results were also reported by Ganguly and Srivastava (1971) and Sahane *et al*. (1995).

The data on mean number of primary and secondary branches per plant revealed that there was continuous increase in mean number of primary and secondary branches per plant up to harvest. There were significant differences among the genotypes for mean number of primary and secondary branches. These results were in agreement with the findings of Kataria and Mishra (1993) who reported that pigeonpea cultivars differed significantly for mean number of branches per plant. The genotypes V14 (Konkan Tur-1) and V1 (AKTE-11-1) had the highest mean number of primary (17.17) and secondary branches (26.06) while the genotypes V4 (T-Vishakha) and V15 (ICPL-87) had comparatively lowest mean number of primary branches (14.17) and secondary branches (22.22) at harvest respectively. Similar results were reported by Wakankar and Yadav (1975), Upadhyaya and Saharia (1980), Reddy and Rao (1980), Asawa *et al*. (1981), Dumbre and Deshmukh (1983), Patel *et al*. (1988), More (1989) and Lal and Rajni Raina (2002).

The data on mean plant spread revealed that there was continuous increase in mean plant spread per plant up to harvest. There were significant differences among the genotypes for mean plant spread. The genotype V9 (AKTE-8811) had the highest mean plant spread N-S (68.17cm) and E-W (66.17cm) while the genotype V15 (ICPL-87) and V4 (T-Vishakha) recorded comparatively lowest plant spread N-S (52.70cm) and E-W (54.93cm) respectively at harvest. These results are in agreement with the findings of Gondalia *et al*. (1988) and Ghosh and Mathur (2000) who showed that bushy, tall and late maturing pigeonpea performed better than erect, short and early maturing types.

In the present investigation the different genotypes showed significant variation in respect of days to appearance of first flower bud, days to 50 per cent flowering, days to 1st pod maturity and full maturity. The genotype V1 (AKTE-11-1) showed the late maturity period while genotype V15 (ICPL-87) showed earliness. It was interesting to note that the high yielding genotype V1 (AKTE-11-1) required highest days for 50 per cent flowering (140.50 days) and for full maturity (179.83 days). This indicated that the high yielding genotype V1 (AKTE-11-1) had longer vegetative phase as well as reproductive phase. Longer period of vegetative phase would help in more production and accumulation of photosynthates and their efficient translocation for the development of sink during reproductive phase resulting in ultimate increase in the seed yield. The reverse was true in case of low yielding genotypes where shorter period of vegetative and reproductive phases were observed. Similar results were reported by Sindhu *et al*. (1982), Singh *et al*. (1995), Rehman *et al*. (1999) and Torker *et al*. (2004).

The above findings derive support from Balakrishnan and Natarajaratnam (1987) who revealed in pigeonpea that the longer crop duration resulted in bigger canopy size and thus higher light interception and seed yield was positively associated with crop duration and light interception.

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