

**Research Article****Genotype x environment interaction for biometrical traits in pigeonpea (*Cajanus cajan* L. Millsp.) under varying spacings**

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**Abstract**

Twenty eight genotypes of pigeonpea, which includes promising lines as well as randomly selected varieties were studied for their G X E interaction. The genotypes were sown in a three different environments were made available by three spacings at 60, 90 and 120 cm. Pigeonpea genotypes BDN 2001-6, Phule T 11-39, JJ 65, GT 1, BSMR 736 and LRG 41 are considered to be more desirable ones, as they satisfied the criteria suggested by Eberhart and Russell (1966) for stability over three different spacings.

**Key words**Genotype x environment interaction, stability, *Cajanus cajan***Introduction**

Genotype and its interaction with prevailing environment is the basic factor, which determine the final yield. The maximum yield potential from a particular crop variety can only be released if suitable environment is provided. It is, therefore, necessary to determine the environment that may allow full expression of genes controlling the quantitative traits. The degree of genotype-environment interaction involved in the expression of given characters not only helps the plant breeder in planning the future breeding program, but also in determining the environment and number of tests to be conducted for evaluation of the prepotency of the breeding material developed. Stability of performance across varied regions and high productivity are most desirable attributes of a crop variety. In order to identify superior genotypes that can give reproducible performance, the breeder evaluates them over a number of locations or seasons or any other environments created artificially. In Gujarat and especially in Saurashtra, farmers grow pigeonpea with wide distances (120 cm or even more) in case of sole crop or relay crop after groundnut. While the recommended spacing between rows is either 60 or 90 cm. Growth habit of varieties is either determinate or indeterminate. In this context it is interesting to evaluate the genotypes under varying spacings (60, 90 and 120 cm) to find out the stable genotypes.

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**Materials and methods**

The present study on genotype x environment interaction for biometrical traits in pigeonpea under varying spacings were under taken at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *kharif* 2005. The experimental material comprised of 28 different genotypes of pigeonpea, which includes promising lines as well as randomly selected varieties. The genotypes were sown in a three different environments were made available by three spacings at 60, 90 and 120 cm. Each genotype was grown in single row plot of 3.0 m length. The plant to plant distant was kept 15 cm in all the above environments. The recommended cultural practices including plant protection measures were followed uniformly to raise a good crop of pigeonpea.

**Results and discussions**

Phenotypically stable varieties are usually sought for commercial production of crop plants. In any breeding program it is necessary to screen and identify Phenotypically stable genotypes, which could perform more or less uniformly under different environmental conditions. Considering this fact in mind, the present investigation was carried out to collect information on newly developed genotypes and some released varieties of pigeonpea which may be of great use in launching a dynamic and efficient breeding program. The pooled analysis of variance showed that mean sum of squares due to genotypes were significant for all the characters. While mean sum of squares due to environments were significant for all the characters except pod length and number

of seeds per pod. This indicating the presence of variability among the genotypes and environments. These results are in agreement with those reported by Wanjari *et al.* (1988), Desai *et al.* (1991) and Dahiya *et al.* (1993). On partitioning the genotype x environment interaction into linear and non-linear components, it was found that both the components, i.e. linear as well as non-linear were significant for number of pods per plant and 100-seed weight. In case of number of pods per plant, magnitude of non-linear components was slightly higher than linear component. While linear component was quite higher than non-linear one in 100-seed weight (Table 1). Similar finding were reported by Shoran *et al.* (1981) and Vanniarajan *et al.* (1998). In case of seed yield per plant, days to flowering, number of branches per plant, number of seeds per plant and harvest index only mean squares due to non-linear components were found significant indicating that this part of the variation in the performance of the genotype is unpredictable and both linear regression and deviation from linearity were the major components for difference in stability for the characters. Similar results were reported by Shoran *et al.* (1981), Dahiya *et al.* (1993), Jagtap and Holkar (2000) and Mahto *et al.* (2005). Existence of genotype x environment interactions necessitated the study of different stability parameters, which is important for the development of potential genotypes with consistent higher productivity over a range of environments. The joint regression analysis revealed that genotype x environment interactions were highly significant for seed yield per plant, number of pods per plant and 100-seed weight, which showed differential response of the genotypes to varying environments. Hence evaluation of genotypes in different environmental conditions appeared at least essential for seed yield and its two yield components. Twelve genotypes had high mean yield per plant. Among them, six genotypes namely, BDN 2001-6, Phule T 11-39, JJ 65, GT 1, BSMR 736 and LRG 41 had high mean coupled with non-significant unit regression and the least deviation from regression indicating that they were responsive and stable in all the three spacings. Two genotypes ICP 8863 and PT 02-5 were suitable for favourable environment as they had above average mean,  $B_i$  value more than unity and  $S^2d_i$  value equal to zero. Therefore, they were specifically adapted to high yielding environment. Stability of seed yield in the higher yielding genotypes was accompanied by higher values of yield contributing characters like number of pods per plant and 100-seed weight as well as due to stability in performance of these yield components under varying spacings. From the present investigation it can be inferred that genotypes BDN 2001-6, Phule T 11-39, JJ 65, GT 1, BSMR 736 and LRG 41 are considered to be more

desirable ones, as they satisfied the criteria suggested by Eberhart and Russell (1966) for stability over three different spacings.

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**Table 1 Mean over the environments ( $\bar{x}$ ), regression coefficient ( $b_i$ ) and deviation from regression ( $S^2d_i$ ) for seed yield per plant (g)**

Characters	Seed yield per plant (g)					Number of pods per plant					100 seed weight (g)				
	$\bar{x}$	$b_i$	$\pm$	S.E.	$S^2d_i$	$\bar{x}$	$b_i$	$\pm$	S.E.	$S^2d_i$	$\bar{x}$	$b_i$	$\pm$	S.E.	$S^2d_i$
VRG 54	31.14	1.31	$\pm$	0.479	1.90	149.38	0.66	$\pm$	0.759	404.88	7.08	-0.08*	$\pm$	0.476	-0.01
GPS 2003	40.12	1.11	$\pm$	0.503	3.04	134.31	0.22	$\pm$	0.663	290.01	9.77	0.53	$\pm$	0.952	0.05
WRG 31	33.58	1.17	$\pm$	1.098	48.78	146.04	0.44	$\pm$	0.831	501.28	8.36	1.96**	$\pm$	1.010	0.06
Phule T 8208-1	46.23	2.59	$\pm$	1.684	127.16*	184.09	2.49	$\pm$	0.829	498.21	9.23	0.07	$\pm$	0.673	0.01
ICP 8863	49.02	3.15**	$\pm$	0.368	-2.60	189.18	2.94**	$\pm$	0.563	186.03	8.72	3.30**	$\pm$	0.891	0.04
PT 02-5	45.92	1.80**	$\pm$	0.243	-6.28	178.80	1.89**	$\pm$	0.034	-79.48	9.47	1.82	$\pm$	0.753	0.02
Phule T 1037	35.76	-0.03**	$\pm$	0.052	-8.99	141.98	0.65**	$\pm$	0.091	-73.46	8.76	2.50	$\pm$	1.346	0.13
TT 403	29.33	0.28**	$\pm$	0.265	-5.74	130.42	1.00	$\pm$	0.517	144.80	7.76	-0.11	$\pm$	0.673	0.01
JKM 7	52.08	0.63	$\pm$	2.496	290.26**	215.00	-0.41	$\pm$	2.678	5960.71**	8.77	1.39	$\pm$	0.753	0.02
JKM 198	43.96	1.58	$\pm$	2.109	204.67**	196.91	2.01	$\pm$	0.975	720.70	7.66	0.82	$\pm$	0.825	0.03
BDN 2	33.22	2.32	$\pm$	1.138	53.09	153.73	1.82	$\pm$	1.459	1711.43**	9.16	1.15	$\pm$	0.952	0.05
MRG 1004	37.69	0.21	$\pm$	1.366	80.60	149.27	1.28	$\pm$	0.516	143.74	9.54	3.66**	$\pm$	0.337	-0.02
GT 100	28.65	-0.47**	$\pm$	0.210	-6.99	130.13	-0.33**	$\pm$	0.473	108.31	10.44	1.50	$\pm$	0.673	0.01
ICPL 96033	29.53	-0.56	$\pm$	1.577	110.40*	133.69	1.34	$\pm$	1.320	1387.72*	9.64	5.98++	$\pm$	0.000	-0.03
BRG 2	29.17	0.76	$\pm$	0.202	-7.14	101.27	0.85	$\pm$	0.088	-74.01	10.41	-2.65	$\pm$	2.102	0.36*
BDN 2001-6	54.33	2.15	$\pm$	1.265	67.74	194.38	1.97	$\pm$	1.080	902.12	9.98	0.11	$\pm$	0.476	-0.01



Table 1 continue...

Characters	Seed yield per plant (g)					Number of pods per plant					100 seed weight (g)				
	$\bar{x}$	$b_i$	$\pm$	S.E.	$S^2d_i$	$\bar{x}$	$b_i$	$\pm$	S.E.	$S^2d_i$	$\bar{x}$	$b_i$	$\pm$	S.E.	$S^2d_i$
BDN 702	40.50	2.51	$\pm$	1.690	128.15*	162.73	2.51*	$\pm$	0.646	270.51	8.32	-2.60**	$\pm$	1.064	0.07
BDN 2003-1	32.27	0.07	$\pm$	0.000	-9.11	125.00	1.09	$\pm$	0.440	82.29	8.93	2.58++	$\pm$	0.000	-0.03
Phule T 11-39	54.33	0.01	$\pm$	0.605	8.48	213.60	0.21*	$\pm$	0.343	18.43	8.86	2.07*	$\pm$	0.476	-0.01
AKT 8811	40.28	-0.11	$\pm$	1.396	84.58	175.87	0.25	$\pm$	1.344	1440.58*	8.24	1.77	$\pm$	0.583	0.00
BDN 708	37.72	-0.29	$\pm$	1.804	147.21*	128.09	0.25	$\pm$	0.906	611.52	10.11	3.01++	$\pm$	0.000	-0.03
JKM 189	33.56	1.22	$\pm$	1.704	130.37*	135.16	1.37	$\pm$	0.676	304.32	9.05	-1.94	$\pm$	2.404	0.48*
JJ 65	50.07	1.46	$\pm$	0.853	25.82	194.38	1.18**	$\pm$	0.033	-79.58	9.52	-0.36	$\pm$	0.952	0.05
GT 1	42.14	1.86	$\pm$	0.646	10.96	134.40	1.00	$\pm$	0.699	331.38	9.94	1.77	$\pm$	0.825	0.03
BSMR 736	62.35	1.51	$\pm$	1.035	42.40	212.47	0.78	$\pm$	0.892	589.89	9.76	0.86	$\pm$	0.337	-0.02
BSMR 853	35.82	0.95	$\pm$	1.029	41.77	127.09	0.52	$\pm$	0.991	746.64	9.31	1.84	$\pm$	5.386	2.53*
GT 101	36.46	0.87**	$\pm$	0.029	-9.07	143.33	0.67	$\pm$	0.291	-9.30	8.90	-0.75	$\pm$	1.259	0.11
LRG 41	47.97	-0.05	$\pm$	1.058	44.71	171.69	0.66**	$\pm$	0.537	162.00	9.39	1.68*	$\pm$	0.337	-0.02
Mean	40.47			-		159.01			-		9.11			-	
S.Em. $\pm$	5.75			1.173		18.64			0.908		0.29			1.383	

\*, \*\* Significant at 5 and 1 per cent levels, respectively