Legume Res., **32** (4) : 235-239, 2009

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com / indianjournals.com

PHENOTYPIC STABILITY OF YIELD AND RELATED TRAITS IN PIGEONPEA

P.T. Patel[1], R.M. Chauhan[2], L.D. Parmar[3] and S.B.S. Tikka[4]

Main Pulses Research Station, Gujarat Agricultured University,
Sardar Krushinagar-385 506, India.

ABSTRACT

Eleven early maturing pigeonpea genotypes were evaluated along with a national check (ICPL-87) for their yield performance during four years (1997-2000). The experiment was laid out in randomized block design with four replications. Significant genotypic differences for yield and majority of the component characters were observed. Highly significant genotype-environment interaction indicated differential response of the genotypes to the environmental changes. The stability analysis was carried out ,which showed significance of linear component of variation for important traits including grain yield. The genotype SKNP-9264 showed highest yield (1874 kg/ha) with high stability (bi=1.09, S^2di=0.27) followed by SKNP-9256, SKNP-9203-1, SKNP-9217 and SKNP-9226. The genotypes SKNP-9264 and SKNP-9256 were also found stable for pods/plant, primary branches/plant, 100-seed weight, plant height and days to maturity. Similar trend for component traits was also observed for SKNP-9203-1, SKNP-9217 and SKNP-9226. SKNP-9260-2 was found unstable over environments for yield (b_i=0.64, S^2_{di}=1.45). The result revealed that SKNP-9264 and SKNP-9256 can be exploited for stabilizing yield of pigeonpea in fluctuating environments of Gujarat state.

Key words : Pigeonpea, Stability, Yield components.

INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is one of the major pulse crops of Gujarat state covering 14.5 per cent of area and 17 per cent of pulse production. The yield levels have been low and stagnant for decades excepting few favourable trends observed in the recent years. Limited reports are available on yield stability of existing genotypes of pigeonpea Gautam *et al.* (1989) and Khapre *et al.* (1996). Performance of the varieties over environments is of significance because the environmental conditions vary from year to year. Wide adaptation and consistent performance of recommended varieties are very important for their successful cultivation. The range of maximum, minimum temperature and rain fall (mm) during the life span of crop were 25.9 to 32.6, 9.2 to 24.5 and 456.3, 25.4 to 34.3, 8.3 to 25.8 and 616.1, 27.9 to 35.7, 8.7 to 26.7 and 161.3 , 27.0 to 38.7, 10.0 to 25.2 and 399.6 for four different years *viz.* 1997-98, 1998-99, 1999-2000, 2000-01 respectively (Table-3). Year 1998 was favourable, where as year 1999 received less rainfall (161.3 mm). and year 1997 and 2000 were moderately favourable.The present study was aimed to evaluate and screen the newly developed early genotypes/varieties over environments to select the varieties/genotypes on the basis of the stability of performance for yield and its component characters.

MATERIAL AND METHODS

The material of the present investigation comprised of twelve early genotypes of pigeonpea including ten genotypes *viz.*, SKNP-9203-1, SKNP-9204-1, SKNP-9217, SKNP-9226, SKNP-9256, SKNP-9260-1, SKNP-9260-2 and SKNP-9264, GAUT-90-1 and GAUT-90-2 developed through pedigree breeding procedure at Main Pulses Research Station, Gujarat Agricultural University,

[1-4] Department of Genetics and Plant Breeding,C.P.College of Agriculture, and O/O Directorate of Research, Sardarkrushingar-Dantiwada Agricultural University, Sardarkrushinagar-385 506, Gujarat, India.

Sardar Krushinagar, one variety received from BARC, Trombay (BT-54) and one national check (ICPL-87). The experiments were laid out in randomized block design with four replications in all four environments created by sowing same set of material sown during *kharif* 1997 to 2000 at Sardar Krushinagar (26^0 9' N 72^0 19' E, altitude 154.42 m msl) as reported by Singh *et al.* (1983). Each plot had 8 rows of 4m length with row to row and plant to plant spacing 60 cm and 20 cm respectively. Recommended cultural practices were followed to raise the crop. The data of seed yield (kg/ha) and days to maturity were recorded on plot basis, whereas 10 randomly plants in each plot were taken to record observations on 100-seed weight (g), plant height (cm), primary branches/plant, pods/plant and seeds/pod. Stability analysis was carried out as per Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Pooled analysis of variance (Table-1) indicated significant differences among the genotypes and the environments for all the traits suggesting the presence of variability both among the genotypes and the environments. The mean squares for genotype x environment interaction effects were significant for all the traits indicating differential response of genotypes to different environments. The results are in accordance with the earlier findings of Jahargirdar and Makne (1992), Sohram *et al.* (1981), Mehra and Pahuja (1980). High and significant mean squares due to environment (linear) indicated considerable differences among environments and their predominant effect on most of the traits under study. The G x E (linear) mean squares were found significant for grain yield, 100-seed weight, pods/plant, plant height and days to maturity indicating the presence of predictable components whereas significance of pooled deviation for days to maturity, primary branches/plant, 100-seed weight and grain yield showed the presence of non-predictable components.

The non-significant effects of genotypes x environments interaction (linear) against pooled deviation indicated that the reliable predictions of G x E interaction cannot be made for plant height, days to mature, branches/plant, seeds/pod, 100-seed weight and seed yield indicated non linear regression was the major component responsible for differences in stability for different genotypes However, for unpredictable traits, prediction can be made considering stability parameters of individual genotypes Singh *et al.* (1987), Tyagi and Agarwal (1995) and Venkateshwaralu (1998).

Estimation of stability parameters (Table-2) revealed that the number of genotypes found stable i.e. having above average mean performance (x),

Table 1. Pooled analysis of stability for seven quantitative traits in pigeonpea

Source	DF	Plant height (cm)	Days to mature	Primary branches/plant	Pods/plant	Seeds/pod	100-seed weight	Grain yield
Genotype	11	1257.153**	37.568**	1.917**	724.699**	0.084**	0.715**	0.866**
Environments	3	7052.528**	850.833**	85.163**	25213.291**	0.440**	7.908**	7.546**
Genotypes x Environments	33	105.746**	27.269**	0.613*	327.383*	0.040*	0.229**	0.233**
Environments + Genotype x Env.	36	684.644**	95.900**	7.659**	2401.208**	0.073**	0.869**	0.842**
Environment (Linear)	1	21157.584+	2552.500+	255.488+	75639.875+	1.319+	23.724+	22.639+
Genotype x Environment (Linear)	11	131.673*	131.673*	0.356	569.768*+	0.044	0.173**	0.143**
Pooled deviation	24	85.044	85.044*	0.680*	189.003	0.034	0.235**	0.255**
Pooled error	132	37.014	37.014	0.339	195.244	0.021	0.032	0.035

*, ** Significant against pooled error at 5 and 1% respectively.

+, ++ significant against pooled deviation at 5 and 1% respectively.

Table 2. Mean values and stability parameters for grain yield and its components.

Genotypes	Grain yield			Primary branches/plant			Pods/plant			Seeds/pod		
	Mean+	bi	$S^{-2}di$	Mean+	bi	$S^{-2}di$	Mean+	bi	$S^{-2}di$	Mean+	Bi	$S^{-2}di$
ICPL-87 (C)	983.85	0.50	0.16	7.10	0.92	1.76	99.85	0.38*	208.95	3.96	0.17	0.12
BT-54	1279.69	1.06	-0.02	7.91	0.94	0.63	121.39	1.01	-154.96	3.68	0.84	-0.01
GAUT-90-1	1438.02	1.18	0.01	8.60	0.98	0.10	130.38	1.09	-26.49	3.61	0.55	-0.01
GAUT-90-2	1391.15	1.41	-0.01	8.33	1.09	-0.07	138.16	1.26	237.52	3.74	0.62	0.01
SKNP-9203-1	1648.44	1.14	0.40	9.65	1.24	0.30	140.15	1.02	-44.30	3.81	1.71	0.04
SKNP-9204-1	1358.33	0.67	0.26	8.69	1.03	-0.29	120.21	0.70	-10.21	3.91	1.46	0.02
SKNP-9217	1643.23	1.10	0.02	8.44	1.08	0.26	140.98	1.40	34.08	3.93	1.15	-0.01
SKNP-9226	1535.94	1.06	0.02	8.83	0.95	-0.23	144.09	1.40**	-108.26	3.70	0.41**	-0.02
SKNP-9256	1764.58	1.28	0.04	9.24	0.92	0.48	127.36	1.11	-103.56	3.79	0.22*	-0.01
SKNP-9260-1	1530.73	0.87	0.02	8.99	1.11	-0.13	148.61	1.10	-120.71	4.10	1.88	0.01
SKNP-9260-2	1284.90	0.64	1.45*	9.44	0.72	0.95	122.00	0.76**	-171.60	3.78	1.05	0.02
SKNP-9264	1873.96	1.09	0.27	8.91	1.04	0.35	127.19	0.77	184.60	3.99	1.95	0.00
Mean	1477.60	1.00	–	8.68	1.00	–	130.03	1.00	–	3.83	1.00	–
S.Em. ±	0.29	0.37	–	0.48	0.18	–	7.94	0.17	–	0.11	0.56	–

*, ** Significant at 5 and 1% respectively.

+ Average of 4 years (1997, 1998, 1999, 2000).

Contd.....

Table 2. Mean values and stability parameters for grain yield and its components.

Genotypes	100-seed weight (g)			Plant height (cm)			Days to maturity		
	Mean+	bi	$S^{-2}di$	Mean+	bi	$S^{-2}di$	Mean+	bi	$S^{-2}di$
ICPL-87 (C)	8.81	1.48	0.77*	99.50	0.57	80.67	135.63	0.47	38.65*
BT-54	9.57	1.06	0.03	134.95	0.88	-60.88	144.25	0.98	2.23
GAUT-90-1	9.70	1.21	0.04	132.96	0.80	-39.43	146.19	0.76	26.85
GAUT-90-2	10.46	1.08	0.10	137.61	1.16	-4.05	142.38	1.40	10.90
SKNP-9203-1	9.90	1.20	0.10	158.18	1.33	7.07	142.25	0.63**	0.56
SKNP-9204-1	9.56	0.92	0.09	139.30	0.80	-39.76	141.75	1.15*	-1.17
SKNP-9217	9.94	0.91	0.02	147.49	1.05	-30.99	142.06	1.29	5.13
SKNP-9226	9.67	1.08	-0.02	153.78	0.76	-43.91	140.63	1.03	36.99*
SKNP-9256	9.50	1.02	0.09	159.57	1.23	213.12	141.44	0.94	8.05
SKNP-9260-1	9.67	0.81	0.12	156.71	1.18	-36.98	141.38	1.18	0.53
SKNP-9260-2	10.35	0.25	1.15*	165.59	1.45	99.85	147.25	1.84	79.67*
SKNP-9264	9.67	0.98	0.05	150.04	0.79	-0.35	145.69	0.34*	14.47
Mean	9.73	1.00	–	144.64	1.00	–	142.37	1.00	–
S.Em. ±	0.28	0.35	–	5.32	0.22	–	2.61	0.31	–

*, ** Significant at 5 and 1% respectively.

+ Average of 4 years (1997, 1998, 1999, 2000).

unit regression coefficient (b=1) and least deviation from regression coefficient (S^2di) for grain yield, primary branches / plant , pods / plant, seeds / pods, 100- seed weight (g), plant height (cm) and days to maturity were SKNP 9264, SKNP-9260-2, SKNP-9203-1, SKNP-9264, GAUT-90-2, SKNP-9264 and SKNP 9256 , respectively. Besides these, five genotypes for seed yield (SKNP-9256, SKNP-9203-1, SKNP-9217, SKNP-9226 and SKNP-9260-1), five for primary branches/plant, (SKNP-9256, SKNP-9260-1, SKNP-9264, SKNP-9226 and SKNP-9204-1), three for pods/plant (SKNP-9260-1,GAUT-90-2 and SKNP-9256), four for seeds/pod (SKNP-9260-1, , ICPL-87, SKNP-9204-1 and SKNP-9203-1), two

Table 3. Weather data during crop period (Year: 1997-2000).

Year	Month	Temperature (Celsius)		Rainfall (mm)
1997-98	July	33.1	24.4	209.6
	August	32.2	24.5	84.8
	September	32.2	24.2	125.1
	October	32.6	20.1	36.8
	November	30.8	16.3	–
	December	25.9	10.2	–
	January'98	26.7	9.2	–
	February'98	28.9	11.1	
Total				256.3
1998-99	July	33.4	25.8	132.7
	August	33.3	24.9	90.8
	September	33.7	23.8	192.2
	October	34.3	20.9	200.4
	November	31.5	12.9	–
	December	30.2	9.4	–
	January'99	25.4	8.3	–
	February'99	31.4	14.2	–
Total				616.1
1999-2k	July	35.1	26.7	60.9
	August	32.2	25.3	49.6
	September	35.7	25.3	10.6
	October	35.3	20.4	40.2
	November	34.2	13.5	–
	December	30.1	8.7	–
	January'2k	27.9	10.5	–
	February'2k	29.2	10.5	–
Total				161.3
2000-01	July	33.4	25.2	261.2
	August	32.8	24.9	136.9
	September	35.2	22.8	1.5
	October	38.7	18.7	–
	November	33.3	13.7	–
	December	33.0	10.0	–
	January'01	27.0	10.8	–
	February'01	28.3	11.2	–
Total				399.6

for 100-seed weight (SKNP-9203-1 and SKNP-9256), five for plant height (SKNP-9260-2, SKNP-9256, SKNP-9203-1, SKNP-9260-1 and SKNP-9226) and two for days to maturity (SKNP 9260-1 and SKNP 9217) had above average mean value, average regression value (bi=1) and least deviation from regression ($S^2di=0$).

For pods/plant genotypes SKNP-9226 and SKNP-9217 (bi=1.40) were not found stable but suitable to favourable environments, whereas genotype SKNP-9260-2 (bi=0.76) was found suitable for poor environment. For seeds/pod genotypes SKNP-9256 and SKNP-9226 were found unstable but suited to poor environment. For 100-seed weight (bi=1.48, $S^2di=0.77$) and days to maturity (bi=0.47, $S^2di=38.65$) variety ICPL-87 was found unstable. For days to mature three genotypes (SKNP-9260-1, SKNP-9256 and SKNP-9217) were found early with average regression coefficient and least deviation from regression coefficient, thus observed to stable genotypes for these traits. SKNP-9260-2 was found unstable for seed yield, and was also unstable for 100-seed weight and days to mature.

The results signify the importance of stability parameters for selection of suitable genotypes for yield and its attributing characters as reported in late maturing pigeonpea genotypes over four years at Sabour campus, RAU, Bhagalpur by Singh *et al.* (1983). It is suggested that the genotypes SKNP-9264 and SKNP-9256 which had high mean, non significant unit regression and least deviation from regression ($S^2 di = 0$) for grain yield and most of the component traits viz. primary branches / plant, Pods / plant, 100- Seed weight (g) and Plant height (cm) can be exploited for stabilizing yield of early pigeonpea in fluctuating environments of Gujarat.

REFERENCES

Eberhart, S.A. and Russell, W.A. (1966) *Crop Sci.* **6:**36-40.

Gautam S.L. *et al.* (1989). *Indian J. Pulses Res.* **2:**81-84.

Jahargirdar, J.E. and Makne, U.G. (1992). *Indian J. Pulses Res.* **5:**125-127.

Khapre, P.R. *et al.* (1996). *Indian J. Pulses Res.* **9:**64-65.
Mehra, R.B. and Pahuja, A.N. (1980). *Trop Grain Legume Bull.* **17/18:**18-21.
Singh N.B. *et al.* (1983) *Indian J. Genet.* **43:**478-480.
Singh, V.P. *et al.* (1987). *Agric.Sci. Digest.* **7:**203-207.
Sohram, J. *et al.* (1981). *Crop Improv.* **8:**33-36.
Tyagi, P.C. and Agarwal, M.C. (1995). *Indian J. Genet.* **55:**148-150.
Venkateshwarlu, O. (1998). *Inter. Chickpea Pigeonpea Newsl.* pp. 41-42.