https://doi.org/10.29321/MAJ.10.A01981

Madras Agric. J.77, (9-12): 417-421 (1990)

PHENOTYPIC STABILITY IN CLUSTERBEAN

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ABSTRACT

There was a significant variation for genotypes and genotype x environment interaction for seed yield in cluster beans. The linear as well as non linear components were significant. Genotypes guar 46-P7 and guar 44-P15-2 were stable under fluctuating environmental conditions. Genotypes guar 46-P24-1, 4210(26), guar 46-P16-2, guar 44-P10 appeared to be the best for favourable growing seasons, while guar 46-P3-1, guar 46-P17-1 and guar 46-P27- 1 were suitable for unfavourable growing conditions. The exploitation of these genotypes in a breeding programme will help in improving the productivity of the crop in its growing areas.

KEY WORDS : Cluster beans, Stability, G x E interaction.

Genotype x environment interactions have an important bearing on the breeding of improved varieties. The larger the interaction the lesser is the chance of progress under selection in a breeding programme. Therefore, need for identification of stable varieties is obvious. In recent past, two analytical approaches, one statistical (Finlay and Wilkinson, 1963, Eberhart and Russell, 1966) and the other genetical (Perkins and Jinks, 1969) have become well known. These models are helpful in understanding the nature and magnitude of genotype x environment interactions. However, information on these aspects is very limited in case of clusterbean (*Cyamopsis tetragonoloba* (L.) Taub), an important grain legume mostly grown on dryland of Rajasthan.

In the present study, a large number of clusterbean genotypes have been evaluated for genotype x environment interaction for identifying stable genotypes for use in breeding programme.

MATERIALS AND METHODS

The performance of 88 genotypes of clusterbean, collected from clusterbean growing areas of the Country, were evaluated during monsoon season of 1977, 1978 and 1980. The experiment was laid out in a randomized block design with two replications. The plot size was one row of 3 m long of each genotype. The inter and intra row distances were kept at 45 cm and 15 cm, respectively during all the seasons. The crop received a basal dressing of 20 kg N + 40 kg P/ha in all the seasons. Data on seed yield per plant was recorded on five randomly selected plants of each of the genotypes.

The stability parameters of different genotypes were computed on the basis of mean performance over years, using statistical model suggested by Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Pooled analysis of variance revealed the existence of significant genetic differences among the genotypes with respect to seed yield. (Table 1). The environments also appeared to be significantly different from one another as the mean square component due to environment was highly significant. Further, the genotype x environment interaction component showed that the genotypes

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Table 1. Pooled analysis of variance for seed yield in clusterbean

Source	df	Mean sum of square
Genotypes	87	1.642**
Environments	2	54.863**++
Genotype + (Genotype + Env.)	176	2.129**++
Env. (linear)	1	109.726**++
Genotype x Env. (linear)	87	1.654**
Pooled deviation	88	1.376**
Pooled error	261	0.035

** P = 0.01 against pooled error
++ P = 0.01 against pooled deviation

reacted considerably with the environmental conditions and was significant. Similar results in clusterbean were also reported by Saini *et al.* (1977), Paroda *et al.* (1980), Paroda and Rao (1981) and Henry and Daulay (1983, 1984). Both linear and non-linear componental (deviation) were significant. The similar results in clusterbean were reported by Henry and Daulay (1983 and 1984). The significance of the latter appeared to be due to the presence of genetic variability (Perkins and Jinks, 1968; Paroda and Hayes, 1971). According to Eberhart and Russell (1966), an ideally adapted variety would be the one having high mean value, unit regression coefficient (b = 1.0) and a deviation from regression as small as possible.

Mean grain yield (g/plant), regression coefficient (b) and deviation from regression ($s^{2}d$) for 78 genotypes are given in Table 2. Genotypes guar 46-P7 and guar 44-P15-2 (5.05 and 4.59 respectively) have regression value nearing to unity and had high mean yield against population mean yield. These genotypes were stable as they had less deviation from the regression. In general, the genotypes guar 44-P10-2, guar 33-P2, guar 44-P1-1, guar 46-P25, guar 44-P2-2, guar 44-P15, guar 44-P1-1 and 1260/12 (3.6-4.53 g) which had almost unit responses to the changes in the environmental conditions and less deviation from regression were low yielders against population mean yield 4.5[illegible] g/plant). On the other hand, the genotypes with unit responses, *viz.* guar 46-P12-1, guar 44-P15, guar 46-P6-1, guar 46-P22-1, guar 46-P3-2 and guar 46 P11-2 (4.68-5.9[illegible] g/plant) were high yielders but were unstable in performance as they had high deviation value.

Genotypes guar 46-P24-1, 4210(26), guar 46-P16-2, and guar 44-P10 (5.07-6.0[illegible] g/plant) had high mean yield over the environments and were responsive to favourable growing seasons as reflected by high 'b' values. These genotypes were also stable as they had less deviation from regression. The genotypes guar 44-P16-2, guar 44-P16-3, guar 44-P12, guar 46-P16-[illegible], guar 46-P2-2, 2470/12, guar 44- P2-[illegible], D.saffed, guar 46-P19-1 also had high mean yield (5.05-7.07 g/plant) but were unstable as they had large deviation values from regression.

The genotypes guar 46-P3-1, guar 46-P17-1 and guar 44-P7-1 (4.86- 5.1[illegible] g/plant) were more responsive to less favourable growing conditions as reflected by low 'b' values. These were stable as they had low deviation from regression. Genotypes guar 44-P9, guar 46-P1-1, guar 46-P3, S.S.MK-1 sel, guar 46-p10-1, Bhaleri, guar 46-P3-3, Nagapur 1 were also responsive to the less favourable growing conditions but had large deviation from regression and hence were unstable.

In the present material, genotypes guar 46-P7 and guar 44-P15-2 were stable under fluctuating environmental conditions. Genotypes guar 46-P24-1, 4210 (26), guar 46-P16-2, guar 44-P10 appeared to be best for favourable growing seasons, while guar 46-P3-1, guar 46- P17-1 and guar 46-P27-1 were suitable for unfavourable growing conditions. The exploitation of these

Table 2. Mean grain yield (g/plant) and two parameters of stability of the 88 genotypes of clusterbean

	Genotype	1977	1978	1980	Mean	b	$s^{2}d$
1	Guar 46-P11-2	4.7	7.1	6.18	5.99	0.89	1.92**
2	Guar 46-P10-1	4.4	4.5	5.75	4.88	-0.65	0.59**
3	Guar 44-P-4-3	3.2	5.9	5.22	4.77	0.82	3.09**
4	UDRAR	4.1	2.9	5.20	4.07	-1.4	0.10
5	Guar 46-P17-1	4.8	4.9	5.15	4.95	-0.12	0.03
6	Guar 46-P3	4.6	5.1	5.55	5.08	-0.15	0.40**
7.	Guar 46-P3-1	5.0	5.3	5.03	5.11	0.19	-0.01
8.	Guar 46-P1-2	4.0	5.9	5.00	4.97	0.80	0.99**
9.	Guar 46-P3-3	4.0	5.4	4.88	4.76	0.61	0.66**
10.	KOLYA	2.2	3.5	4.87	3.52	-0.51	3.23**
11.	Guar 46-P11-6	3.4	4.8	4.81	4.34	0.23	1.23**
12.	Guar 44-P11-3	5.8	7.1	4.69	5.86	1.50	0.08
13.	Guar 46-P-16-2	3.1	9.6	4.66	5.79	3.72	5.72**
14.	Guar 46-P7	4.6	5.9	4.66	5.05	0.88	0.10
15.	Guar 46-P2-2	3.8	7.6	4.62	5.34	2.22	1.80**
16.	Guar 46-P12-1	3.8	5.7	4.54	4.68	0.94	0.72**
17.	Guar 46-P16-2	5.6	9.6	4.58	6.59	3.34	0.12
18.	ABSAR	2.6	3.7	4.57	3.62	-0.28	1.84**
19.	Butchawas	2.5	3.9	4.54	3.65	-0.10	2.15**
20.	Guar 44-P12	4.6	8.3	4.50	5.80	2.64	0.64**
21.	Guar 46-P18	4.6	4.5	4.99	4.53	-0.01	-0.01
22.	Guar 46-P5-2	3.8	4.3	4.49	4.20	-0.02	0.24**
23.	Guar 47-P9-1	2.5	3.5	4.40	3.47	-0.31	1.67**
24.	Guar 46-P6-1	4.1	6.0	4.39	4.83	1.18	0.35**
25.	Guar 44-P16-3	2.7	11.8	4.39	6.30	5.48	9.44**
26.	Guar 44-P10	5.7	8.1	4.29	6.03	2.43	0.04
27.	Guar 46-P27-1	5.0	5.3	4.29	4.86	0.59	0.09
28.	Guar 44-P7-1	4.6	4.8	4.28	4.56	0.31	-0.00
29.	Guar 44-P8-1	3.3	6.8	4.09	4.73	2.03	1.57**
30.	Guar 44-P10-2	3.0	3.9	4.26	3.72	-0.04	0.82**
31.	Guar 44-P9	7.3	4.9	4.26	5.49	-0.07	5.11**
32.	Guar 46-P5	4.6	4.5	4.21	4.44	0.14	0.04
33.	NENASAR	2.3	5.7	4.20	4.07	1.37	3.44**
34.	Nagaur 1	5.4	4.5	4.18	4.69	0.02	0.78**
35.	Guar 46-P19-1	3.7	7.3	4.16	5.05	2.28	1.19**
36.	Guar 46-P1-1	6.2	5.4	4.08	5.23	0.57	1.87**
37.	Bhaleri	6.8	3.4	4.07	4.76	-0.93	5.39**
38.	Guar 48	4.7	4.7	4.07	4.49	0.34	0.11
39.	Guar 46-P24-1	4.4	6.8	4.02	5.07	1.88	0.10
40.	Guar 44-P9-3	3.2	4.9	4.00	4.03	0.77	0.60**
41.	Guar 44-P15-2	4.5	5.3	3.98	4.59	0.84	-0.07
42.	Guar 44-P16-2	5.5	11.8	3.90	7.07	5.26	0.32**

Genotype	1977	1978	1980	Mean	b	s^2d
43. Guar 46-P9-1	4.2	4.9	3.90	4.33	0.65	-0.02
44. Guar culture-1	2.9	7.4	3.85	4.72	2.65	2.49**
45. Guar 40-P17	3.4	7.2	3.78	4.79	2.46	1.20**
46. Guar 44-P7-3	3.7	4.8	3.78	4.09	0.73	0.07
47. Guar 44-P2-2	4.3	5.1	3.78	4.39	0.84	-0.01
48. Guar 44-P9	3.1	5.9	3.77	4.26	1.61	1.04
49. Guar 44-P12-1	4.8	4.7	3.65	4.38	0.54	0.43**
50. MALUSAR	1.7	2.9	3.65	2.75	-0.20	1.87**
51. Guar 46-P15	4.2	3.0	3.60	3.60	-0.52	3.63**
52. Guar 44-P15	4.5	5.3	3.54	4.45	1.07	0.11
53. Guar 46-P17-3	4.3	4.4	3.54	4.08	0.47	0.15
54. Guar 44-P6-2	4.7	4.7	3.54	4.31	0.62	0.41**
55. Guar 46-P6-2	4.1	5.5	3.54	4.38	1.28	-0.02
56. Guar 45	5.0	4.6	3.53	4.38	0.50	0.82**
57. S.S.MK2	3.8	3.4	3.53	3.58	-0.14	0.04
58. Guar 46-P3-2	6.5	5.5	3.50	5.17	0.90	3.65**
59. Guar 46	5.5	3.6	3.47	4.19	-0.25	2.49**
60. Guar 46-P11-2	4.3	6.0	3.46	4.59	1.64	-0.01
61. Guar - P4-1	4.6	4.0	3.36	3.99	0.24	0.68**
62. Guar 44-P8-2	3.1	5.7	3.32	4.04	1.70	0.52**
63. Guar 46-P19-2	5.3	5.0	3.31	4.54	0.85	1.39**
64. Guar 46-P26	3.7	4.9	3.30	3.97	1.05	-0.02
65. Guar Sona	5.0	4.2	3.30	4.17	0.34	1.28**
66. Guar 46-P30-1	1.9	5.7	3.28	3.63	1.93	2.75**
67. Guar 44-P1-1	3.6	4.7	3.26	3.85	0.95	-0.01
68. Guar 44-P9	3.8	5.7	3.18	4.23	1.66	-0.01
69. Guar 46-P11	4.6	4.8	3.04	4.15	0.97	0.67**
70. Guar 46-P22-1	6.4	5.1	3.04	4.85	0.88	4.77**
71. Guar 46-P22-2	3.9	5.1	3.03	4.01	1.30	0.03
72. S.S. MK-1 sel	7.8	4.0	3.05	4.95	-0.14	2.59**
73. Guar 46-P21-2	4.3	5.3	2.99	4.20	1.40	0.23**
74. Guar 46-P3-3	3.7	6.0	2.95	4.22	2.01	-0.04
75. Guar 46-P23	5.0	5.7	2.95	4.55	1.58	0.95**
76. Guar 33-P2	3.3	4.6	2.95	3.62	1.10	-0.006
77. Guar 44-P2-1	5.3	7.4	2.89	5.20	2.75	0.72**
78. Chayanpura	3.5	5.1	2.80	3.80	1.49	-0.02
79. Guar 44-P10-2	3.5	4.5	2.79	3.60	1.06	0.01
80. Guar 44-P15	6.2	5.3	2.79	4.76	1.18	4.48**
81. Guar 46-P7-1	3.7	4.8	2.74	3.75	1.28	0.06
82. Guar 46-P7-2	4.8	3.8	2.74	3.78	0.40	1.91**
83. Guar 46-P8-1	6.6	5.3	2.37	4.76	1.34	7.14**
84. Durgapura saffed	5.8	6.0	3.77	5.19	1.22	1.17**
85. FS 277	5.6	5.0	2.80	4.47	1.06	2.91**

Genotype	1977	1978	1980	Mean	b	s^2d
86. 2470/12	6.0	6.2	3.68	5.29	1.37	1.55**
87. 4210 (26)	5.0	6.4	4.21	5.20	1.40	-0.004
88. 1260/12	4.5	5.5	3.59	4.53	1.18	0.06
Mean	4.36	5.45	3.91	4.58	1.00	
SEm±	0.11	0.19	0.08	0.83	1.05	
CD 5%	0.30	0.52	0.21			

genotypes in a breeding programme will help in improving the productivity of the crop in its growing areas.

ACKNOWLEDGEMENT

The authors are grateful to the Director, Central Arid Zone Research Institute, Jodhpur (Raj.) for providing necessary facilities.

REFERENCES

EBERHART, S.A. and RUSSELL, W.A. 1966. Stability parameters for comparing varieties. **Crop Sci., 6**: 36-40.

FINLAY, K.W. and WILKINSON, G.N. 1963. The analysis of adaptation in a plant breeding programme. **Aust. J. Agric. Res., 14**: 742-52.

HENRY, A. and DAULAY, H.S. 1983. Genotype x environment interactions for seed yield in clusterbean. **Indian J. agric. Sci., 53**: 467-468.

HENRY, A. and DAULAY, H.S. 1984. Genotype x environment interactions for seed yield in clusterbean. **Madras Agric. J., 71**: 217-226.

PARODA, R.S. and HAYES, J.D. 1971. An investigation of genotypic-environmental interactions for rate of ear emergence in spring barley. **Heredity., 26**: 157-175.

PARODA, R.S. SAINI, M.L. and SINGH, J.V. 1980. Variety x environment interactions in clusterbean. **Forage Res., 6**, 71-74.

PARODA, R.S. and RAO, G.V.S. 1981. Genotype x environment interactions for seed yield in clusterbean. **Forage Res., 7**: 169-172.

PERKINS, J.N. and JINKS, J.L. 1968. Environmental and genotype-environmental components of variability III. Multiple lines and crosses. **Heredity, 23**: 339-56.

SAINI, M.L. JHORAR, B.S. and SOLANKI, K.R. 1977. Genotype x environment interactions for seed yield in clusterbean. **Indian J. agric. Sci., 47**: 345-347.

Madras Agric. J.77, (9-12): 421-78 (1990)

HETEROSIS IN SORGHUM UNDER DIFFERENT ENVIRONMENTS*

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ABSTRACT

Six parents in sorghum viz, Co18, 148, Co 23, Co 22, CSV. 3 and As. 3880 were crossed in all possible combinations and the hybrids along with the parents were studied for three economic traits under four different environments consisting two seasons and two manurial levels. For panicle length, number of grains/panicle and grain yield/panicle, heterosis was observed in most of the crosses. Among the parents Co 23 showed high mean expression for number of grains and grain yield. Further the hybrids involving Co 23 as one of the parents revealed high per se performance and heterosis for grain yield.

KEY WORDS : Sorghum, Heterosis, Environments.

* Forms part of Ph.D. Thesis submitted to the Tamil Nadu Agricultural University, Coimbatore 641 003

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