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GENOTYPE X ENVIRONMENT INTERACTIONS FOR SEED YIELD IN CLUSTERBEAN

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Genotype x environment interaction was investigated for grain yield in 12 branched genotypes of clusterbean (*Cyamopsis tetragonoloba* (L.) Taub), under rainfed conditions, during monsoon seasons (1979-1981). There was a significant variation for genotypes and genotype X environment interaction for grain yield. The linear as well non linear components were significant and between the two, linear component was higher in magnitude. The genotype 'Durgapura Saffed' was the most stable genotype under fluctuating environmental conditions. Genotypes 'HFG 556' and HFG 189' were best for favourable growing seasons while 'DSE1J' and 'DSE16J' were suitable for unfavourable growing seasons.

Clusterbean *Cyamopsis tetragonoloba* (L.) Taub) is a drought resistant leguminous crop mostly grown under dryland conditions. Genotype x environment interactions are of great importance in plant breeding since genotypes are known to exhibit differential reaction varying environmental conditions. Therefore, promising breeding lines of clusterbean need to be evaluated in multienvironmental tests so as to identify most stable and widely adapted genotype. Genotype environment interactions pose a serious problem for evolving as table genotype in case of clusterbean. Information on these aspects is scanty in case of clusterbean.

In the present article, some branched genotypes of clusterbean have been evaluated for genotype-environment interactions for identifying stable genotypes for breeding programme.

MATERIALS AND METHODS

The performance of 12 branched genotypes of clusterbean, received from its major growing area of the country, were evaluated during the monsoon season of 1979-81. The experiment was laid out in a randomized block design with 3 replications. The plot size was 10 m². Row to row distance was kept at 45 cm during all the seasons. The crop received a basal dressing of 20 kg N/ha and 40 kg P/ha in all seasons. The stability parameters of different genotypes were computed on the basis of mean performance (q/ha) over years, using statistical model suggested by Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Mean grain yield (g/ha), regression coefficient (b) and mean deviation from regression ($\bar{s}^2d$) for 12 genotypes are given in Table-1.

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Analysis of variance for grain yield revealed significant differences among the genotypes and the environments. In general, genotypes performed well in monsoon season of 1981, whereas the poorest in 1979, as acute drought conditions were prevailed throughout its growing period. The significant genotype x environment interactions revealed that the genotypes showed differential reaction in different years. A major portion of these interactions was accounted for by the presence of linear component although the non-linear component (deviation) was also significant (Table 2). Similar results were reported by Saini *et. al.* (1977). Paroda *et al.* (1980) and Paroda and Rao (1981). The significance of the latter appeared to be due to the presence of genetic variability among the material tested (Perkins and Jinks, 1968; Paroda and Hayes, 1971) An ideally adaptable variety would be the one having high mean value, unit regression coefficient (b=1.0) and deviation from regression as small as possible ($\bar{s}^2d=0$) (Eberhart and Russell, 1966).

The perusal of data In Table 1 revealed that genotype 'Durgapura Saffed' and 'Suvidha' were the most stable with responses to changes in the environmental condition nearing unity and less deviation from regression. Out of these 'Durgapura Saffed' had high mean yield over all environment (5.35 q/ha) as against population mean yield (5.17 q/ha). However this was not the highest yielder. The stable yield of this genotype was also reported by Paroda *et al.* (1980) and Paroda and Rao (1981).

The genotype 'HFG 556' and 'HFG 189' had high mean yield (6.10, 6.68 q/ha respectively) and were more responsive to favourable growing environments as reflected by high 'b' values ($b > 1$). These genotypes were also stable as these had less deviation value. Genotypes 'DSE2J' and 'DSE16J' with mean yield (5.35-5.53 q/ha) were specially suited for unfavourable season as reflected by low 'b' values ($b < 1$) and low deviation value. The genotype 'HFG 53' had high yield (5.2 q/ha) but also had high deviation value and hence was unstable. The rest of the genotypes tried had low mean seed yield as against the population mean yield and, therefore, were not suitable.

The studies of this kind help a breeder in selecting the most stable genotypes along with the desired response which would largely depend on the euvironmental condition with which they are confronted. In the present material, genotype like 'Durgapura Saffed' was the most stable genotype under fluctuating environmental conditions. Genotypes like 'HFG 556' and 'HFG 189' appeared to be best for favourable growing season while 'DSE2J' and 'DSE16J' were suitable for unfavourable growing seasons. The exploitation of these genotypes in a breeding programme will help in improving the productivity and stability of the crop.

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Table 1. Mean yield (q/ha) and parameters of stability of 12 genotypes of clusterbean

Genotype	1979@ (621 5 mm)	1980 (239.0 mm)	1981 (238.0 mm)	Mean	b	$\bar{s}^2d$.
'HFG 556'	3.59	6.22	10.24	6.68	2.18	0.25
'HFG 189'	3.33	5.78	9.20	6.10	1.91	0 29
'HFG 53'	4.27	2.64	8.72	5.21	1.79	4.80**
'HFG 400'	3.63	4.82	4.79	4.41	0.31	0.29
'HFG 258'	3.48	4.58	5.52	4 53	0.64	0 69
'DSE1J'	3.42	3.56	7.53	4.64	1.49	0.41
'DSE2J'	4.47	5.24	6.33	5.55	0.61	- 0.16
'DSE16J'	5.40	5.17	6.02	5.53	0 25	- 0 09
'Suvidha'	3.11	5.22	6.67	5.00	1.10	0.63
'Durgapura saffed'	4.29	4.82	6.93	5.35	0.92	—0.19
HFG 587'	3.21	5 12	7.16	5.16	1.26	0.26
'RGC 916'	4.92	3.52	3.32	3.93	—0.46	0 40
MEAN	3.93	4.72	6.87	5.17	1.00	
SEm±	0.23	0 42	0.58			
CD 5%	0.68	1.24	1.69			
CV%	8.49	18.63	14.59			

**P = 0.01

Note : Figures in parentheses indicate amount of rainfall received during cropping seasons.
@ A drought year, since bulk of rainfall (438 mm) was received in 29th meteorological week and monsoon receded early in the season, i. e. 33rd meteorological week.

Tabel 2: Analysis of variance for genotype-environment interaction for grain yield of clusterbean

Source	dF	M. S.
Genotype	11	1.644**
Env. + (genotype X env.)	36	2.648** +
Env. (linear)	1	55.532** + +
Genotype X env. (linear)	11	2.785** +
Pooled deviation	12	0.822**
Pooled error	72	0.189
Pnear : non linear ratio		3.39 :1

**P = 0.01 against pooled error,

++P = 0,01 against pooled deviation,

P = 0.05 against pooled deviation.