https://doi.org/10.29321/MAJ.10.A02523

Madras Agric J. 71 (9) 603-605 September 1984

GENOTYPE x ENVIRONMENT INTERACTION FOR SEED YIELD IN SINGLE STEMMED VARIETIES OF CLUSTERBEAN

A. HENRY[1] and H. S. DAULAY[2]

Genotype-environment interaction for yield in clusterbean (*Cyamopsis tetragonoloba* (L.) Taub) was studied by growing 10 unbranched genotypes for 3 years during monsoon seasons of 1979-1981. There was a significant variation in respect of genotype x environmental interactions for seed yield. A large portion of these interactions was accounted for by the linear regression on the environmetal means ; although the non-linear component was also significant. The genotype FS 277 was found to be comparatively stable with high mean yield and average response to the changes in invironmental conditions. The genotype HFG-134 had the highest mean yield, and was found especially suitable for unfavourable growing seasons. Thus, the exploitation of these varieties in a breeding programme will help in improving the productivity of the crop.

A study of genotype-environment interactions can lead to successful evaluation of stable genotypes which would be used in future breeding programmes. Methods have been developed to estimate the magnitude of both linear and non-linear components of genotype-environment interactions (Finlay and Wilkinson, 1968, Eberhart and Russell 1966, Perkins and Jinks, 1968). However, information on these aspects is very limited in case of clusterbean (*Cyamopsis tetragonoloba* (L.) Taub). Therefore this investigation was taken up to identify more stable and superior genotypes of clusterbean.

MATERIALS AND METHODS

Under rainfed conditions, performance of 10 single stemmed varieties collected from major clusterbean growing areas of India was studied in a randomized block design with 3 replications for 3 years (1970-1981) in monsoon seasons. The plot size was 10 m^2 and row to row distance was kept at 30 cm in all the seasons. Seed rate used was 20 kg/ha. The crop received a basal dose of 20 kg N and 40 kg P/ha in all the seasons. The stability parameters of different varieties were computed on the basis of mean performance (q/ha) over years. using statistical model suggested by Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Analysis of variance for grain yield revealed that the mean squares due to genotypes, environment (linear) and genotype-environment were highly significant when tested against experimental pooled error (Table 2). The linear component of genotype-environment interaction was significant for grain yield. Therefore, prediction of grain yield for most of the genotypes appeared to be possible. It further revealed that the genotypes reacted considerably with the environmental

[1]S-1 Scientist (Plant Breeding), [2]S-3 Scientist (Agronomy)
Central Arid Zone Research Institute, Jodhpur-342 003.

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

Genotypes	1979 ≠ (681.5mm)	1980 (239.0mm)	1981 (238.0mm)	Mean	b	$\bar{s}d^2$
PLG 119	6.4	3.5	7.5	5.80	0.82	6.213**
HFG 314	6.1	6.4	7.5	6.67	0.59	-1.886
FS 277	4.6	4.6	7.3	5.50	1.19	0.749
PLG 174	4.1	5.2	8.5	5.93	1.82	-0.188
NC 4/P2-1	3.9	6.9	3 6	4.80	-0.48	5 741**
PLG 85	3.8	4.5	7.1	5.13	1.38	-0.165
PLG 80	3.6	5.3	7.4	5.43	1.49	0.070
NCK-Sel	3.4	4.4	5.7	4.50	0.90	-0.112
HFG 399	3.3	4.8	8 0	5.37	1.91	-0.164
AG 111	3.0	3.3	3.9	3.40	0.48	-0.499
Mean	4.2	4.9	6.7	5.25		
SEm±	0.40	0.44	0.49			
CD 5%	1.17	1.30	1.45			
CV %	16.26	15.44	12.76			

** 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.

Table 2. Analysis of variance for genotype x environment for grain yield of clusterbean

Source	dF	Mean square
Genotype	9	2.362**
Env. + (Genotype X Env.)	20	2.977**
Env. (linear)	1	31.505** + +
Genotype X Env. (linear)	9	1.692**
pooled deviation	10	1.282**
Pooled error	60	0.196

**P = 0.01 against pooled error.

+ + P = 0.1 against pooled deviation.

condition that existed in different years of testing. A major portion of these interactions was accounted for by the presence of linear component although non-liner component was also significant. The significance of the later appeared to be due to the presence of genetic variability among the material tested (Perkins and Jinks, 1968, Paroda and Hayes, 1971; Paroda *et al*., 1973).

Mean grain yield and the 2 stability parameters viz., regression coefficient and deviation from regression ($\bar{s}^2d$), for the 10 genotypes studied from 1979 to 1981 are given in Table 1. In general, genotypes performed well in the monsoon season of 1981 owing to good distribution of rainfall while the yield levels were low in 1979 and 1980 both being drought years. Variety FS 277 had average responses to changes in environmental condition, as it has regression value approaching unity and also less deviation from regression. However, this variety was not the highest yielder but had higher mean yield (5.50 q/ha) as against the population mean yield (5.25 q/ha). The variety HFG 314 had the heighest mean yield (6.67 q/ha), and found to perform better in adverse environmental condition as reflected by low regression value and less deviation from regression and hence stable yielder under such situations. The varieties PLG 174 and PLG 80 were found to perform better especially under favourable growing season as reflected by regression value ($b > 1$) and less deviation from regression. These varieties had higher mean yield in the range of 5.4 - 5.9 q/ha against the pupulation mean yield. The varieties like PLG 119 had high mean yield, NC 4/P2-1 with low mean yield, had large deviation form regression and hence were the unstable varieties. The variety AG 111 gave the lowest mean yield among all the varieties tested and in conformity with the results obtained by Paroda *et al.* (1980).

The present studies revealed that genotype FS 277 was found to be stable with high mean yield and average responses to the changes in environmental conditions. The genotype HFG 314 had the highest mean seed yield among material tested, and was found especially suited for unfavourable growing season. Thus, the exploitation of these varieties will help in improving the productivity of the crop. Genotypes like HFG 399 PLG 174 and PLG 80 performed well especially under favourable seasons.

The authors are grateful to the Director, Shri S. P. Malhotra, Central Arid Zone Research Institute, Jodhpur, for providing necessary facilities.

REFERENCES

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

FINLAY, R. W. and G. N. WILKINSON 1963. The analysis of adaptation in a plant breeding programme. Aust. *J. agric. Res.*, 14 : 742-754.

PARODA, R. S. and J. D. HAYES 1971. An investigation of genotype-environment interaction for rate of ear emergence in spring barley. Heredity, 26 : 157-175.

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

PARODA, R. S., K. R. SOLANKI and B. S. CHAUDHARY 1973. Phenotypic stability in oats. Indian *J Gent.*, 33 : 92-95.

PERKINS, J. M. and J. L. JINKS 1968. Environmental and genotype environment components of variability. III. multiple lines ancrosses. Heredity, 23 : 339-356.