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GENOTYPE X ENVIRONMENT INTERACTION FOR GRAIN YIELD IN COWPEA*

K. THIYAGARAJAN[1] and S. RAJASEKARAN[2]

Seven parents of cowpea (Co 3, Co 4, V 87, KC 199, C 152, KC 195 and CoVu 4) and their twelve F_1 hybrids were evaluated for stability parameters with respect to grain yield in six environments. Pooled analysis of variance revealed that genotypes and environment were significant for grain yield. Mean square due to pooled deviation was non significant, indicating the absence of non-linear portion of genotype x environment interaction The mean square due to linear component was significant for grain yield. The parent Co 4 and the hybrids Co 4 x C 152, Co 4 x KC 195, V 87 x CoVu 4 and KC 199 x C 152 which were stable for grain yield can be utilised in the development of high yielding stable lines.

Cowpea (*Vigna unguiculata* (L.) walp,) is one of the major pulse crops in India. The most obvious problem in raising the present cowpea production level is increasing its yield potential. However, when the hazards besetting the crop in the lowland tropics are considered, increasing yield level *per se* may be a lower order of priority than stabili zing productivity. Some workers have reported stability for forage yield in cowpea (Sureshkumar, 1980; Kandalkar and Sanghi, 1982) while Mehrotra and Chaudhary (1981) reported stability for seed yield for cowpea under rainfed conditions. In the present study, seven parents and their twelve F_1 hybrids of cowpea were evaluated for their yield stability.

MATERIALS AND METHODS

The experimental material consisted of four female parents (Co 3, Co 4, V 87, KC 199) and three male parents (C 152, KC 195, CoVu 4)and their twelve F_1's of cowpea. Six different environments were created by sowing these materials in two different seasons, namely, *Kharif* and *rabi* during 1984 with three levels of phosphorus in each season. They were (i) '0' kg P_2O_5 and 2 kg N/ha; (ii) 50 kg P_2O_5 and 25 kg N/ ha and (iii) 100 kg P_2O_5 and 25 kg N/ha. The experments were conducted at the National Pulses Research Centre, Pudukkottai, Tamil Nadu, India in a randomized replicated block design in 1.5 m long rows spaced 45 cm apart with a plant to plant distance of 15 cm under each environment. The plot yield was used for statistical analysis and stability paramet ers were worked according to the method suggested by Eberhart and Russell (1966)

RESULTS AND DISCUSSION

The analysis of variance (Table I) revealed significant differences among genotypes for seed yield. The significant genotype x environment interaction indicated that there were changes in the relative rankings of different genotypes over environments. This differential behaviour of genotypes of cowpea to

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1 Assistant Professor, National Pulses Research Centre, Pudukkottai-622 001.

2 Professor & Head, Sugarcane Research Station, Cuddalore,

Table 1. Analysis of Variance for *G x E* Interaction and stability parameters for Grain Yield in Cowpea.

Source	d.f.	Mean square
Genotypes (G)	18	42885.7536**
Evironments (E)	5	769392.2026**
G x E	90	8490,1177**
Pooled error	216	4650,2248
Env. × (G X E)	95	16169.7249
Environment (linear)	1	1282320.3376
Genotype x Env. (linear)	18	6370.1035**
Pooled deviation	76	1745.5482

**Significant at 0.01 level of probability

Table 2 Mean yields and estimates of stability parameters for grain yield of 19 cowpea genotype in Six environments

Genotypes	Mean yield (g/plot)	bi	S²di
Co 3 x C 152	388.80	1.098	— 579.33
Co 3 x KC 195	379.82	1.103	2249.69
Co 3 x CoVu 4	428.55	1.561@	— 269.00
Co 4 x C 152	459.06	0.936	— 274.54
Co 4 x KC 195	412.65	1.000	— 1095.24
Co 4 x CoVu 4	460.01	1.264	268.66
V 87 x C 152	441.54	1.305	2095.65
V 87 x KC 195	375.32	0.826	— 493.46
V 87 x CoVu 4	462.19	1.184	— 116.28
KC 199 x C 152	407.92	1.099	— 792.75
KC 199 x KC 195	345.88	0.879	— 1311.91
KC 199 x CoVu 4	369.65	1.124	— 986 74
Co 3	383.28	1.337	816.83
Co 4	406.83	0.960	2839.02
V 87	305.44	0.817	— 3.58
KC 199	325.34	0.188@	97 61
C 152	371.80	0.731	1790.22
KC 195	299.14	0.571@	— 791.56
CoVu 4	379 85	1.074	273 71
Mean	389.64		
S.E.	18.6844	0 16092	

r(× and b)	0.660**
× and $S^{-2}d$)	0.175 N.S.
(b and $S^{-2}d$)	0.100 N.S.

@ deviation from unity significant

varying environments was also reported earlier (Sureshkumar, 1980; Kandalkar and Sanghi, 1982; Fakorede *et al.*, 1983). The genotype x environment interaction effects were futher partitioned into linear and non-linear components The mean square due to regression (linear component of G X E interaction) was significant for grain yield. This indicated the presence of genetic differences

among genotypes for regression on environmental index (Eberhart and Russell 1966; Desai *et al.*, 1983). The non-linear component was non-significant for grain yield indicating that the genotypes did not differ in their deviation from linearity and their response to environment was therefore to some extent predictable (Shah *et al.*, 1983).

The regression coefficient (bi) values were significant for Co 3 x CoVu 4, KC 199 and KC 195 indicating linear portion of genotype-environment interaction (Table 2). But $S^{-2}di$ values were non significant for all the genotypes. This was in conformity with the overall information obtained from the pooled analysis where linear portion of genotype environment interaction was significant. The parents Co 4 recorded the highest grain yield among the parents with average response and was stable indicating its suitability to all kinds of environments. The hybrid V 87 x CoVu 4 recorded the highest grain yield with average response and was stable The hybrid Co 4 x C 152, Co 4 x KC 195, Co 4 x CoVu 4 and V 87 x C 152 were found to have increased performance average response and were suitable to all kinds of environments.

The correlation coefficients between three stability parameters viz., mean b and $S^{-2}d$ for grain yield suggested that there was a positive association between 'mean' and 'b'. This indicated that the grain yielding abilily and capacity to respond to environmental variations were closely associated. However the correlation coefficients between mean and $S^{-2}d$ and between b and $S^{-2}d$ were low. This suggested that these parameters were governed by independent genetic systems.

The present study suggested that variety Co 4 could effectively be utilised in hybridisation programme: The hybrids Co 4 x C 152, Co 4 x KC 195. Co 4 x CoVu 4, V 87 x C 152 and V 87 x CoVu 4 which had above average performance, average response and stability for grain yield can also be utilized in breeding for stable genotypes

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