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STABILITY ANALYSIS FOR SEED YIELD IN GREEN GRAM (*VIGNA RADIATA L.* WILCZEK)

J.D. Patel, M.R. Naik*, S.B. Chaudhari, K.O. Vaghela and V.C. Kodappully

Department of Agricultural Botany, N.M. College of Agriculture,
Navsari Agricultural University, Navsari 396450, Gujarat, India

ABSTRACT

Thirty-six green gram genotypes were raised in four different environment (different sowing dates) to study the environment and G x E interaction components. The study revealed significant differences for all the characters, indicating wide differences between environments and differential behaviour of genotypes in different environments. The linear and non-linear G x E components were significant for all the characters, indicating the importance of both predictable and unpredictable components in determining interaction of the genotypes with environments. The genotypes *viz.*, GM-4, KM-5-122, KM-5-122 x KM-5-124, KM-5-122 x GM-3, KM-5-124 x GM-4, KM-5-124 x GM-3, KM-5-167 x KM-5-191, KM-5-167 x GM-3, KM-5-183 x GM-3, GM-4 x GM-3 and GM-4 x K-851 were stable for seed yield per plant in average environmental condition, whereas KM-5-124 considered to be stable for poor environmental condition. Hence these genotypes could be used in further breeding programme.

Key words : Stability analysis, Seed yield, Green gram.

The stability performance of genotypes across the environments is important to plant breeders when recommending the cultivars suitable to different environments. Studies on individual components can lead to simplification in genetic explanation of yield stability. These studies are reliable to plant breeders in the prediction and determination of the effects of the environment. Though the information on genotype x environment interaction has been adequately worked out in cereal crops, the relative basic information on the important pulse crop like green gram is meager. Hence, the present investigation was undertaken to study the stability of the component traits in relation to the seed yield.

A set of 36 genotypes of green gram were evaluated in four different environments created by two different sowing dates in summer-2007 and *kharif*-2007 seasons at College Farm, Navsari Agricultural University, Navsari, Gujarat, India. The experiment at each environment involved 4 m long single row plots, following randomized block design with three replications. The rows were 45 cm apart with distance between plants within rows being 15 cm. Recommended package of practices were adopted for raising the crop. The data were recorded on five randomly selected competitive plants in each replication at the time of harvest for the characters plant height (cm), branches per plant, clusters per plant, pods per plant, pod length (cm), seeds per pod, 100-seed weight (g) and seed yield per plant (g). The data were analysed for stability parameters following Eberhart and Russsell (1966) model. A genotype having unit regression coefficient (bi=1) and non-significant deviation from regression ($s^2di=0$) was considered as stable.

Analysis of variance was carried out environment wise and also for the pooled data over environments (Table 1) which revealed significant differences among the genotypes in each of the four environments and also on the basis of pooled data over environments.

Pooled analysis of variance was carried out to determine differences among genotypes, environments and the genotype x environment

* Main Cotton Research Station, Navsari Agric. Univ., Surat-7.

Table 1. Pooled analysis of variance (mean sum of squares) for stability as per Eberhart and Russel (1966) in respect of eight characters in green gram over four different environments.

Source of variation	d.f.	Plant height (cm)	Branches per plant	Clusters per plant	Pods per plant	Pod length (cm)	Seeds per pod	100-seed weight (g)	Seed yield per plant (g)
Genotype (G)	35	201.60**++	0.965**++	8.067**++	114.24**++	3.114**++	5.400**++	2.610**++	20.280**++
Environment (E)	3	424.48**++	0.360**++	3.646**++	84.624**++	1.809**++	2.843**++	1.649**++	13.782**++
G x E	105	4.228**	0.051**	0.257**	2.902**	0.223**	0.157**	0.085**	0.437**
Environment (linear)	1	1273.45**++	1.076**++	10.937**++	253.87**++	5.426**++	8.528**++	4.947**++	41.347**++
G x E (linear)	35	4.762**	0.065**	0.204**	4.496**++	0.145**	0.207**+	0.108**	0.650**++
Pooled deviation	72	3.851**	0.043**	0.276**	2.046**	0.255**	0.129**	0.071**	0.321**
Pooled error	280	1.197	0.011	0.032	0.504	0.076	0.083	0.036	0.175

*,**, Significant at 5 and 1 per cent levels against pooled error.
+, ++ Significant at 5 and 1 per cent levels against pooled deviation.

Table 2. Mean performance and stability parameters for seed yield per plant in green gram

Parent/cross	Seed Yield per plant (g)		
	Mean	bi	S^2di
KM-5-122	7.00	0.66	-0.16
KM-5-124	7.28	-0.66*	-0.09
KM-5-167	6.10	0.98	-0.07
KM-5-183	5.57	0.08	0.07
KM-5-191	5.40	0.01*	-0.13
GM-4	9.39	1.80	0.04
GM-3	7.64	0.88	0.39*
K-851	6.47	0.49	-0.15
KM-5-122 x KM-5-124	10.32	1.49	0.02
KM-5-122 x KM-5-167	8.35	0.84	0.01
KM-5-122 x KM-5-183	5.26	1.73	0.95**
KM-5-122 x KM-5-191	8.47	1.22	-0.01
KM-5-122 x GM - 4	6.47	0.01	0.25
KM-5-122 x GM - 3	8.90	1.32	0.23
KM-5-122 x K- 851	8.23	1.52	-0.13
KM-5-124 x KM-5-167	7.35	1.33	-0.07
KM-5-124 x KM-5-183	5.76	-0.81	0.34
KM-5-124 x KM-5-191	7.61	-0.10	-0.02
KM-5-124 x GM- 4	13.86	1.59	0.15
KM-5-124 x GM- 3	9.91	1.86	0.26
KM-5-124 x K- 851	9.68	1.17	0.38*
KM-5-167 x KM-5-183	7.72	0.56	0.15
KM-5-167 x KM-5-191	8.97	1.35	0.25
KM-5-167 x GM-4	7.54	1.23	-0.14
KM-5-167 x GM-3	9.22	0.70	0.31
KM-5-167 x K- 851	4.57	0.87	-0.17
KM-5-183 x KM-5-191	4.89	1.82	0.35
KM-5-183 x GM-4	7.20	1.11	0.07
KM-5-183 x GM-3	11.72	0.99	0.01
KM-5-183 x K-851	7.49	1.06	-0.14
KM-5-191 x GM-4	13.30	2.20	0.62*
KM-5-191 x GM- 3	7.20	-0.06	0.07
KM-5-191 x K-851	7.17	1.42	0.00
GM- 4 x GM-3	11.79	2.37	0.23
GM- 4 X K-851	8.82	1.38	0.32
GM- 3 X K-851	11.14	1.60	1.05**
Parental mean	6.86		
Hybrid mean	8.54		
S. E.±	0.32	0.52	

*,** significant at 5% and 1% probability levels, respectively.

interaction. Which showed highly significant differences among genotypes for seed yield/plant (Table 1) indicating the presence of considerable amount of genetic variability. Similar finding was reported by Malik and Singh (1991), Naidu *et al.* (1991) and Jahangirdar *et al.* (1994). Environmental variance was also highly significant which indicated that the environments were diverse (Table 1). Significant variance due to environments was also reported by Imrie and Shanmugsundaram (1987), Naidu *et al.* (1991) and Jahangirdar *et al.* (1994).

Genotypes showed variable performance for seed yield / plant which was indicated by highly significant mean squares due to genotype x environment interaction. similar results were also noticed by Fernandez and Chen (1989), Naidu *et al.* (1991) and Jahangirdar *et al.* (1994).

Analysis of variance has been presented in Table 1. The analysis of variance revealed highly significant differences due to environment (linear) which indicated that the environments influenced the characters differently due to large macro-environmental differences among the four environments. The genotype x environment (linear) interaction was highly significant (Table 1). Naidu et al.(1991) and Jahangirdar et al (1994) also reported significant variance for linear component of genotype x environment interaction. The significant mean squares due to genotype x environment (linear) component indicated the presence of predictable genotype x environment interaction. The significant variance due to genotype x environment (linear) also indicated that the genotypes differed in their regression on the environmental index and the need for stability analysis. Variances due to pooled deviation from regression were also highly significant which indicated that the prediction of the response of genotypes on the basis of regression analysis for this character might not be very reliable. As the variance due to genotype x environment (linear) was significant and higher than the corresponding non-linear component i.e., pooled deviation, the prediction of the response of the genotypes across the environments was possible.

The mean performance (X), the regression co-efficient (bi) and the deviation mean square (s2di) for seed yield per plant are presented in Table 2. Six parents exhibited non-significant s2di along with unit regression coefficient. Out of these parents GM-4, KM-5-124 and KM-5-122 reflected higher mean indicating their stable performance across environments. Parent KM-5-124 exhibited significant regression coefficient below unity and non-significant s2di with higher mean as compared to parental mean which indicated that it had better responsive to unfavorable environments.

Among the hybrids, nine crosses viz., KM-5-122 x KM-5-124, KM-5-122 x GM-3, KM-5-124 x GM-4, KM-5-124 x GM-3, KM-5-167 x KM-5-191, KM-5-167 x GM-3, KM-5-183 x GM-3, GM-4 x GM-3 and GM-4 x K-851 displayed non-significant deviation from regression and more seed yield per plant compared to the mean of hybrids which indicated their average stability for this trait. The non-linear component was significant incase of four hybrids suggesting unpredictability of their performance under environmental changes.

The genotypes exhibiting stability are specially suitable for cultivation in specific growing conditions of high yielding ability. The wider adaptability of the identified genotypes was mainly attributed to their wider adaptability for component traits like pods per plant, seeds per pod, pod length and 100 seed weight. These genotypes are recommended for hybridization programme to develop high yielding varieties with stability in their performance.

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