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Stability Analysis of Yield in Sesame (*Sesamum Indicum* L.)

K Venkateswara Rao, A Appala Swamy, K Madhu Kumar and Ch Mukunda Rao
Department of Genetic and Plant Breeding, Agricultural College, Naira 532 185

ABSTRACT

Thirty genotypes of sesame were raised in three environments (dates of sowing) during late *Rabi*, 2012-13 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 behavior of genotypes in different environments. The linear and non-linear GxE components were non-significant for all the characters. The genotypes S-0430, NIC-8164 and B-203 were found to be stable for favourable environmental conditions for number of capsules per plant, number of seeds per capsule and oil content, whereas KMR-17 was stable for poor environmental conditions for all the characters under study. The genotypes KMR-17, IS-112-B, IC-607-1-84 and YLM-17 were considered to be stable for seed yield per plant in poor environmental conditions. Hence these genotypes could be used in further breeding programme. IS-112-B and YLM-17 were widely adapted genotypes for seed yield per plant.

Key words : Sesame, Stability.

Sesame (*Sesamum indicum* L.) known as Beniseed, Gingelly, Til or Nuvvulu, is a most important ancient oilseed crop. It posses an oil content of 40-54 per cent and protein 25 per cent. Sesame oil is noted for its stability and quality. As it is a short day plant and sensitive to photoperiod, temperature and prolonged moisture stress, the yield of sesame is not stable and varies widely (Velu and Shunmugavalli, 2005). The variability in environment namely location effect, seasonal fluctuations and their interaction highly influence the performance of genotypes in relation to yield potential. 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 environments. The present investigation was undertaken to study the stability of the component traits in relation to the seed yield.

MATERIAL AND METHODS

The experimental material, comprising of thirty genotypes of sesame, were grown in three environments (different dates of sowing) during late *Rabi,* 2012-13 i.e Environment 1 (E_1) = 10-01-2013; Environment 2 (E_2) = 25-01-2013; Environment 3 (E_3) = 10-02-2013 at the Agricultural college Farm, Naira, Andhra Pradesh, India. The design adopted was RBD with three replications. Each plot consisted of three rows of 3 meters long with a spacing of 30 x 15 cm. Observations were recorded on number of capsules per plant, number of seeds per capsule, oil content (%) and seed yield per plant (g). The data were analyzed for stability parameters following Eberhart and Russell (1966) model. A genotype having unit regression coefficient (b_i=1) and non-significant deviation from regression (s^2d_i = 0) was considered as stable.

RESULTS AND DISCUSSION

Mean squares due to genotypes were significant for number of capsules per plant and oil content, indicating sufficient variability among genotypes (Table 1). The environment interaction components exhibited significance for all the characters, indicating wide differences between environments. Significance of environment (linear) component for all the characters confirms to the observations of widely differing environments, in the analysis of variance. The genotype x environment (linear) interaction component were non-significant for all the characters. Pooled deviation component was highly significant for number of seeds per capsule and oil content indicating the importance of non-linear component in the genotype-environment interaction.

The mean performance (X), the regression coefficient (b) and the deviation mean square (s^2d_i)

Table: 1. Pooled analysis of variance (mean sum of squares) for stability performance (Eberhart & Russell (1966) model) of four characters in sesame (*Sesamum indicum* L.).

Source of variation	d.f.	No. of capsules / plant	No. of seeds / capsule	Oil content	Seed yield / plant
Genotypes	29	140.642**	28.764	18.967**	1.163
Environments	2	1756.400**	119.023*	22.352*	18.064**
Genotype x Environment	58	36.380	22.717	5.164	0.644
Environment + (Genotype x Environment)	60	93.714**	25.927	5.737	1.224*
Environment (linear)	1	3512.801**	238.047**	44.704*	36.129**
Genotype x Environment (linear)	29	43.604	21.028	3.567	0.679
Pooled deviation	30	28.183	23.592**	6.535**	0.588
Pooled error	174	24.381	0.972	0.085	0.177

*Significant at 5% level **Significant at 1% level

for number of capsules per plant, number of seeds per capsule, oil content (%) and seed yield per plant (g) are presented in Table 2 and Table 3.

The genotypes YLM-11 and YLM-110 for number of capsules per plant could perform well under average environmental conditions as they exhibited high mean performance with near to unity regression and least deviation from regression.

The genotypes S-0430, ES-150-1, YLM-66, YLM-109 and YLM-111 for number of capsules per plant; NIC-8164, IS-308-A, YLM-110 and YLM-111 for number of seeds per capsule ; B-203 and YLM-11 for oil content and S-0430, ES-150-1, YLM-66,YLM-110 and YLM-111 for seed yield per plant, were considered to be stable for, favourable environmental condition as they exhibited high means with greater than unity regression.

The genotypes KMR-17, IC-96128 and IC-14160-1 for number of capsules per plant; KMR-17, IC-607-1-84 and YLM-66 for number of seeds per capsule; KRR-1 and KMR-17 for oil content and KMR-17, IS-112-B, IC-607-1-84 and YLM-17 for seed yield per plant, which showed high means with less than unity regression could perform well even under poor environmental conditions.

Successful evaluation of stable genotypes is possible through genotype x environment interaction studies. Earlier, Finlay and Wilkinson (1963) considered the linear regression (b_i) as a measure of stability, but later, Eberhart and Russell (1966) emphasized the need of both b_i and s^2d_i in judging the stability of a genotype. Breese (1969) and Paroda and Hayes (1971) advocated that the b_i could simply be regarded as a measure of responsiveness and s^2d_i as a measure of stability. A genotype having unit regression coefficient (b_i=1) and non-significant deviation from regression (s^2d_i = 0) was considered as stable. However, if a genotype possessed high mean with less than unity regression, the genotype should be suitable for poor environmental conditions.

Twenty genotypes were found to be stable for seed yield as b_i and s^2d_i values were non-significant. The genotypes IS-112-B and YLM-17 showed average response (non-significant b_i) with high mean performance i.e., greater the population mean (4.5g), thus they possessed wide/general adaptability to be suited equally to all kinds of environments.

Stability of yield of a genotype is determined, to a considerable extent by the relative stability of different component characters (Luthra *et al.,* 1974) (Table 4). In the present study, the genotypes IS-112-B and YLM-17 possessed wide/general adaptability and could be recommended for wide cultivation.

Table 2. Mean performance and stability parameters for number of capsules per plant and number of seeds per capsule in sesame (*Sesamum indicum* L.).

S.No.	Genotypes	Number of capsules per plant			Number of seeds per capsule		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
1.	NIC-8164	43.667	0.167	11.742	31.556	1.735	1.851
2.	S-0337	44.889	1.567	2.335	27.778	0.181	11.706**
3.	EC-110-C	45.289	1.488	22.072	26.667	1.315	2.164
4.	SI-1004-B	44.156	2.226**	-25.501	24.111	1.003	6.647**
5.	IC-131943	40.622	0.334	27.505	30.667	1.697	5.704*
6.	EC-334976	34.867	0.737	-0.774	31.000	2.791	59.203**
7.	EC-335004	49.867	0.387*	-25.311	26.000	0.768	5.215*
8.	IS-319-B	41.622	1.526	-13.434	28.667	1.916	8.761**
9.	S-0271	40.444	1.165	-20.791	26.444	-0.421	12.336**
10.	KRR-1	43.089	2.044*	-25.221	30.333	0.494	11.065**
11.	KMR-17	50.311	0.510	-4.169	28.000	0.329	0.144
12.	IS-308-A	45.089	0.660	16.412	30.889	1.241	2.191
13.	SI-2174-1	65.422	0.000	150.183**	23.333	-0.767	0.554
14.	S-0430	50.911	1.268	-25.238	30.778	1.442	5.700*
15.	IC-96128	54.600	0.346	-21.513	31.444	1.444	12.314**
16.	B-203	45.333	0.633	23.714	27.778	0.456	3.207*
17.	IS-112-B	48.578	0.466	-9.279	27.778	0.456	3.207*
18.	IC-14160-1	47.511	0.711	-23.959	34.667	2.798	118.893**
19.	SI-2116	46.644	0.473	-20.885	28.111	-0.144	27.580**
20.	NIC-16236	45.067	0.539	-24.427	30.111	0.294	17.282**
21.	S-0434	50.711	1.038	7.914	25.222	0.750	21.276**
22.	MT-67-25	41.267	0.536*	-25.422	30.333	2.140	100.217**
23.	IC-607-1-84	44.667	0.868	-24.887	32.111	0.402	-0.868
24.	ES-150-1	58.778	1.126	9.705	26.667	2.191	1.596
25.	YLM-11	52.178	0.969	21.626	35.889	-3.692	81.376**
26.	YLM-17	60.822	1.597	102.055*	29.778	-1.349	25.744**
27.	YLM-66	54.244	1.758	-21.915	29.889	0.640	2.497
28.	YLM-109	55.022	2.048*	-25.428	36.222	6.113	131.493**
29.	YLM-110	51.178	1.016	34.855	31.222	2.392	-0.990
30.	YLM-111	58.822	1.794	-11.995	30.778	1.387	-0.195
	μ	48.52			29.47		
	S.E (μ)	3.75			3.43		
	S.E(bi)	0.49			1.72		

*Significant at 5% level
**Significant at 1% level
μ = population mean
S.E (μ) = standard error (mean)

Table 3. Mean performance and stability parameters for oil content and seed yield per plant in sesame (*Sesamum indicum* L.).

S.No.	Genotypes	Oil content (%)			Seed yield per plant (g)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
1.	NIC-8164	41.177	-0.716	12.855**	4.709	0.184	-0.171
2.	S-0337	45.150	-0.367	3.515**	4.127	1.100	0.237
3.	EC-110-C	39.473	-1.738*	-0.061	3.934	1.379	0.224
4.	SI-1004-B	41.597	0.571	4.029**	3.709	1.656	1.161**
5.	IC-131943	42.257	1.236	8.069**	3.993	0.800	-0.128
6.	EC-334976	40.480	2.433	3.529**	3.690	1.659	0.329
7.	EC-335004	42.200	3.711*	-0.076	4.197	0.651	0.338
8.	IS-319-B	40.860	3.645	0.095	4.080	2.052	-0.092
9.	S-0271	41.987	2.546	0.547**	3.637	1.193	0.559*
10.	KRR-1	45.417	-0.936	0.186	4.226	2.038	0.915*
11.	KMR-17	42.203	0.255	0.020	4.524	0.242	-0.088
12.	IS-308-A	42.973	0.183	0.435*	4.412	1.558	0.039
13.	SI-2174-1	44.010	2.525	0.688**	5.517	0.171	1.019*
14.	S-0430	39.477	0.980	4.700**	5.097	1.490	0.006
15.	IC-96128	41.143	-1.157	15.097**	5.787	0.087	1.301**
16.	B-203	43.593	2.708	-0.009	4.391	1.274	0.190
17.	IS-112-B	41.557	1.072	0.289*	4.616	0.619	-0.163
18.	IC-14160-1	34.930	-1.259	21.295**	5.061	0.683	1.025*
19.	SI-2116	37.820	0.080	15.751**	4.234	-0.052	0.568*
20.	NIC-16236	41.057	3.545	1.700**	4.389	0.380	0.078
21.	S-0434	39.363	0.191	4.417**	4.179	0.136	0.338
22.	MT-67-25	38.343	1.458	4.488**	3.673	0.462	1.206**
23.	IC-607-1-84	37.173	-1.065	25.207**	4.510	0.698	-0.149
24.	ES-150-1	43.577	1.741	8.446**	5.007	1.704	-0.122
25.	YLM-11	44.407	1.934	0.196	5.490	-0.330	2.855**
26.	YLM-17	40.143	2.151	18.541**	4.809	0.363	-0.112
27.	YLM-66	45.467	2.153	17.942**	5.129	1.668	-0.174
28.	YLM-109	42.770	0.885	1.100**	5.301	2.454	0.601*
29.	YLM-110	43.910	-0.180	7.447**	5.127	1.672	0.300
30.	YLM-111	43.067	1.415	12.849**	5.614	2.007	0.201
	μ	41.58			4.57		
	S.E (μ)	1.80			0.54		
	S.E(bi)	2.09			0.69		

*Significant at 5% level
**Significant at 1% level
μ = population mean
S.E (μ) = standard error (mean)

Table 4. Genotypes classified into different groups in relation to environmental conditions.

Characters	Stable for average environmental conditions	Stable for favourable environmental conditions	Stable for poor environmental conditions
Number of capsules per plant	YLM-11, YLM-110	S-0430, ES-150-1, YLM-66, YLM-109 and YLM-111	KMR-17, IC-96128 and IC -14160-1
Number of seeds per capsule	-	NIC-8164, IS-308-A, YLM-110 and YLM-111	KMR-17,IC-607-1-84 and YLM-66
Oil content (%)	-	B-203 and YLM-11	KRR-1 and KMR-17
Seed yield per plant (g)	-	S-0430, ES-150-1, YLM-66, YLM-110 and YLM-111	KMR-17, IS-112-B, IC-607-1-84 and YLM-17

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