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# Study of Comparision of Different Stability Parameters in Sesamum (*Sesamum indicum* L.)

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**ABSTRACT**

The study of different stability parameters in sesamum genotypes over 6 environments indicated that stability parameters like Wricke's (1962) ecovalence, mean variance due to genotype-environment interaction of Plaisted and Peterson (1959) and variance or information of ranks over environments gave similar results to that of the deviation from regression ($S^2d$) of Eberhart and Russell (1966). The genotypes, YLM 106 (number of seeds per capsule and number of capsules per plant), YLM 82 (number of seeds per capsule, oil content and1000 seed weight), YLM 17 (seed yield per plant) and Madhavi (1000 seed weight and oil content) showed stable performance over environments.

**Key words :** Regression model, Sesamum, Stability.

Sesame is a well known edible oil seed grown in India. There is a need to enhance the productivity potential of sesame by evolving high yielding genotypes, which depends on the availability of variability for yield and its component traits in the populations. When genotypes are evaluated over a series of environments the relative ranking usually differ. Genotypes are known to differ genetically for their stability across environments. Knowledge on the genotype-environment interactions is the basic requirement to a plant breeder for successful crop improvement (Shantha Kumar, 2000). The present study was undertaken to evaluate different stability parameters for the stability of yield and its components in ten sesame genotypes.

## MATERIAL AND METHODS

Ten genotypes of sesame namely Gouri, Madhavi, YLM 11, YLM 17, YLM 66, YLM 82, YLM 106, VZM 5, YLM 78 and YLM 80 were sown during *kharif,* 2010 (three sowing dates) and *rabi,* 2010-11 (three sowing dates) thus providing 6 environments at Agricultural College Farm, Bapatla. Material was grown in a Randomized Block Design with three replications with 2m row plots of 3 rows per genotype per replication. An inter and intra row spacing of 30 cm and 10 cm was adopted. The observations on plant height (cm), days to 50% flowering, number of primaries, number of secondaries, number of capsules per plant, number of seeds per capsule, 1000- seed weight (g), oil content (%) and seed yield per plant (g) were recorded. Statistical analysis of phenotypic stability was carried out using regression model (Eberhart and Russell, 1966), stability factor (Lewis, 1954), ecovalence (Wricke, 1962) method, Pair-wise analysis (Plaisted and Peterson 1959), genotypic stability (Hanson, 1970), stability variance (Shukla, 1972), variance or information of each genotype over environments, mean of ranks of each genotype over environments and variance or information of ranks of each genotype over environments. Rank correlation coefficients among different stability parameters were worked out as per Spearman (1904).

The mean values of genotypes over environments were ranked in order of superiority such that the genotype with $10^{th}$ rank was the one with maximum mean and the one with first rank with minimum mean. Similarly another parameter mean of ranks over environments was calculated such that the genotypes with $10^{th}$ and $1^{st}$ rank were the one with greater and least desirability respectively. Mean of ranks over environments may give its consistency over environments. The variance (or) information values of the ranks over environments were ranked such that the genotype with $10^{th}$ rank or least variance or maximum information may prove desirable compared to the one with first rank and with maximum variance or least information. Variance (or) information of genotype over environments may indicate the stability of a particular genotype. A genotype with least variance or maximum information over environments may show less fluctuations to the frequent changes in the environments.

Wricke's ecovalence over environments and variety-environment interaction variance of a genotype proposed by Plaisted and Peterson (1959) also indicate a genotype's contribution to the total interaction variance of genotype and environment. However, these differ from the earlier parameter variance or information of genotype over environments such that these two models take care of the replication and error effects. The high mean ($\overline{X}$), unit regression coefficients (b) and non-significant deviation from regression ($S^2d$) proposed by Eberhart and Russell (1966) define a stable genotype.

According to Shukla's ($s^2_i$) stability variance the genotype with $10^{th}$ rank or least variance and non-significance may prove stable to fluctuations in environments compared to the genotype with first rank or maximum variance and significant. Hanson ($D^2_i$) genotypic stability is a measure which combines the information from equivalence and regression into a simple useful measure of yield stability. In this model the genotypes with least variance over environments were considered to be stable and were ranked as $10^{th}$ and vice versa.

## RESULTS AND DISCUSSION

A comparison of different stability parameters was made based on rank correlation coefficients between pairs of these parameters and by empirically comparing the stable or desirable genotypes under each of these parameters (Table 1 and 2).

The mean and mean of ranks were significantly and positively correlated for all characters considered in the study as they are similar calculations and have same criteria for defining a stable genotype (Table 1). The genotypes classified as more or less stable are the same in both these cases (Table 2).

In the same way variance or information over environments were significantly and positively correlated with Lewis stability factor and Hanson genotypic stability for all characters considered in the study (Table 1) as they have same criteria for defining a stable genotype. The genotypes classified as more or less stable are the same in case of variance or information over environments with Hanson's genotypic stability (Table 2).

Lewis stability factor and Hanson's genotypic stability showed positive significant association for the characters number of capsules per plant, number of seeds per capsule and seed yield per plant.

The variance or information over environments and Lewis stability factor showed close association for characters. This was confirmed by the genotypes ranked as stable under these parameters. For example, for number of capsules per plant genotypes 2 (Madhavi), 5 (YLM 66) and 3 (YLM 11) according to variance and stability factor, respectively, were ranked as stable.

Ecovalence with Hanson genotypic stability also showed positive and significant association for number of seeds per plant and seed yield per plant, with $S^2d$ for number of capsules per plant, number of seeds per capsule and seed yield per plant and with variance of genotype-environment interaction Plaisted and Peterson (1959) for number of capsules per plant and number of seeds per capsule.

Similarly the variance due to genotype and environment interaction of Plaisted and Peterson (1959) showed positive association with $S^2d$ for number of capsules per plant and number of seeds per capsule. For number of capsules per plant, the most stable genotypes were 4 (YLM 17) and 5 (YLM 66) according to $S^2d$ and variance due to genotype and environment interaction of Plaisted and Peterson (1959), respectively.

The stable genotype was YLM 78 and less stable genotype was YLM 11 for seed yield per plant under parameters 'b', ecovalence, variance due to genotype and environment interaction of Plaisted and Peterson (1959) and de*via*tion from regression.

The $S^2d$ showed positive association with Hansan's genotypic stability for number of seeds per capsule and seed yield per plant and with Shukla's stability variance for number of capsules per plant, number of seeds per capsule and seed

Table 1. Rank correlation coefficients between pairs of different stability parameters for three characters in sesamum (*Sesamum indicum* L.).

| | | Vari- ance | Stability factor | Ecova- lence | Mean variance due to g x e | Regression coefficient | Deviation from regression | Mean of ranks | Variance of ranks | Hanson genotypic stability | Shukla's variance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | Number of capsules /plant | 0.248 | 0.46 | -0.57 | -0.66 | 0.6 | -0.6 | 0.97* | 0.054 | 0.006 | -0.57 |
| | Number of seeds /capsule | 0.115 | 0.46 | 0.32 | 0.527 | -0.17 | 0.175 | 0.939* | 0.503 | 0.187 | 0.32 |
| | Seed yield /plant | 0.2 | 0.39 | -0.66 | -0.28 | 0.636* | -0.69 | 0.98* | 0.15 | -0.163 | -0.72* |
| Variance | Number of capsules /plant | | 0.95* | 0.309 | 0.067 | -0.272 | 0.27 | 0.21 | 0.59 | 0.915* | 0.309 |
| | Number of seeds /capsule | | 0.86* | 0.37 | 0.454 | -0.38 | 0.38 | -0.006 | -0.139 | 0.903* | 0.369 |
| | Seed yield /plant | | 0.87* | 0.14 | 0.09 | -0.224 | 0.18 | 0.275 | 0.38 | 0.72* | 0.163 |
| Stability factor | Number of capsules /plant | | | 0.187 | -0.03 | -0.115 | 0.115 | 0.454 | 0.6 | 0.842* | 0.187 |
| | Number of seeds /capsule | | | 0.563 | 0.68 | -0.515 | 0.515 | 0.38 | 0.248 | 0.903* | 0.56 |
| | Seed yield /plant | | | 0.139 | 0.0909 | -0.212 | 0.0606 | 0.4636 | 0.467 | 0.6848* | 0.103 |
| Ecovalence | Number of capsules /plant | | | | 0.903* | -0.818* | 0.818* | -0.55 | 0.612 | 0.6 | 1 |
| | Number of seeds /capsule | | | | 0.951* | -0.878* | 0.878* | 0.296 | 0.6 | 0.696* | 1 |
| | Seed yield / plant | | | | 0.333 | -0.975* | 0.885* | -0.57 | 0.527 | 0.672* | 0.963* |
| Mean variance due to g ´ e | Number of capsules /plant | | | | | -0.709* | 0.709* | -0.624 | 0.2727 | 0.345 | 0.903* |
| | Number of seeds /capsule | | | | | -0.8303* | 0.8303* | 0.490 | 0.5515 | 0.721* | 0.9515*. |
| | Seed yield /plant | | | | | -0.272 | 0.448 | -0.263 | 0.042 | 0.272 | 0.393 |
| Regression coefficient | Number of capsules /plant | | | | | | -1 | 0.55 | -0.539 | -0.478 | -0.818* |
| | Number of seeds /capsule | | | | | | -1 | -0.26 | -0.393 | -0.684* | -0.878* |
| | Seed yield /plant | | | | | | -0.88 | 0.548 | -0.575 | -0.733* | -0.94* |
| Deviation from regression | Number of capsules /plant | | | | | | | -0.551 | 0.539 | 0.478 | 0.818* |
| | Number of seeds /capsule | | | | | | | 0.2606 | 0.393 | 0.684* | 0.878* |
| | Seed yield /plant | | | | | | | -0.639 | 0.375 | 0.703* | 0.945* |
| Mean of ranks | Number of capsules /plant | | | | | | | | 0.115 | 0.006 | -0.551 |
| | Number of seeds /capsule | | | | | | | | 0.503 | 0.090 | 0.296 |
| | Seed yield /plant | | | | | | | | 0.281 | -0.087 | -0.669* |
| Variance of ranks | Number of capsules /plant | | | | | | | | | 0.733* | 0.612 |
| | Number of seeds /capsule | | | | | | | | | 0.175 | 0.6 |
| | Seed yield /plant | | | | | | | | | 0.539 | 0.369 |
| Hanson genotypic stability | Number of capsules /plant | | | | | | | | | | 0.6 |
| | Number of seeds /capsule | | | | | | | | | | 0.696* |
| | Seed yield /plant | | | | | | | | | | 0.696* |

*Significant at 0.05 level

Table 2. More and less stable genotypes according to different stability parameters in sesamum (*Sesamum indicum* L.)

| | Mean | | Variance | | Lewis' stability factor | | Wricke's ecovalence | | Mean variance due to g x e (Plaisted & Peterson) | | Regression coefficient | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | More stable | Less stable | More stable | Less stable | More stable | Less stable | More stable | Less stable | More stable | Less stable | More stable | Less stable |
| Plant height | 2, 4,5 | 10,9,1 | 6,2,5 | 8,7,9 | 6,4,2 | 9,10,7 | 4,6,5 | 9,10,7 | 1,4,3 | 5,10,8 | 4,9,7 | 8,1,2 |
| Days to 50% flowering | 9,10,7 | 3,5,6 | 2,3,7 | 10,6,8 | 2,4,7 | 6,10,5 | 5,8,9 | 10,6,3 | 5,7,8 | 10,6,2 | 3,9,5 | 2,10,4 |
| Number of primaries | 2,1,4 | 9,10,7 | 8,3,5 | 7,9,4 | 8,2,3 | 7,4,10 | 5,8,3 | 1,9,6 | 7,1,8 | 10,3,9 | 5,1,4 | 7,9,2 |
| Number of secondaries | 3,8,6 | 9,10,7 | 9,10,2 | 5,4,3 | 9,2,1 | 5,4,6 | 1,7,9 | 3,5,6 | 2,1,4 | 8,3,5 | 4,1,8 | 3,9,2 |
| Number of capsules/plant | 2,1,3 | 4,8,5 | 2,5,3 | 6,10,8 | 2,5,3 | 6,8,10 | 4,9,5 | 6,3,10 | 9,4,5 | 2,6,3 | 7,4,1 | 2,3,8 |
| Number of seeds /capsule | 3,2,5 | 9,10,8 | 9,2,3 | 4,1,8 | 2,3,9 | 1,4,10 | 3,8,5 | 10,4,1 | 3,5,8 | 10,4,1 | 7,6,5 | 4,9,1 |
| 1000 seed weight | 9,4,2 | 10,5,8 | 9,6,8 | 1,5 | 9,4,6 | 1,5,7 | 8,6,10 | 1,5,3 | 6,8,7 | 9,10,1 | 2,6,8 | 1,9,3 |
| Oil content | 1,5,3 | 8,10,2 | 4,2,8 | 10,7,3 | 4,2,1 | 10,7,6 | 5,2,8 | 1,7,10 | 5,4,3 | 6,8,10 | 5,6,2 | 10,1,7 |
| Seed yield /plant | 2,3,1 | 8,9,10 | 3,2,5 | 1,6,7 | 2,5,3 | 6,7,1 | 8,9,10 | 1,3,6 | 9,6,5 | 1,10,3 | 4,9,7 | 3,1,6 |

Table 2 cont.......

| | Deviation from regres-sion | | Mean of ranks | | Variance of ranks | | Hanson genotypic stability | | Shukla's stability variance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | More stable | Less stable | More stable | Less stable | More stable | Less stable | More stable | Less stable | More stable | Less stable |
| Plant height | 1,6,4 | 9,10,6 | 4,2,5 | 10,9,1 | 4,10,9 | 8,7,2 | 6,4,5 | 9,10,7 | 4,6,5 | 7,5,6 |
| Days to 50% flowering | 5,2,8 | 10,3,6 | 9,10,7 | 3,5,6 | 9,7,3 | 10,2,8 | 2,4,7 | 10,6,8 | 5,8,9 | 10,6,3 |
| Number of primaries | 8,5,3 | 4,7,10 | 2,1,4,8 | 9,5,10 | 3,5,9 | 10,7,1 | 8,3,5 | 9,7,4 | 5,8,3 | 7,5,8 |
| Number of secondaries | 9,4,7 | 3,6,5 | 8,3,5 | 9,7,10 | 9,8,7 | 6,5,3 | 9,2,10 | 5,4,3 | 1,7,9 | 3,5,6 |
| Number of capsules/plant | 8,4,5 | 6,3,10 | 2,4,5 | 6,3,8 | 2,4,5 | 6,3,8 | 5,2,9 | 6,10,8 | 4,9,5 | 5,4,2 |
| Number of seeds /capsule | 8,3,9 | 10,6,1 | 3,2,4 | 9,10,7 | 3,7,8 | 10,9,5 | 9,3,2 | 4,1,10 | 3,8,5 | 10,4,1 |
| 1000 seed weight | 9,10,8 | 5,7,1 | 9,4,2 | 10,5,8 | 9,6,4 | 1,3,5 | 9,10,4 | 1,5,7 | 8,10,9 | 1,5,3 |
| Oil content | 2,10,5 | 7,1,6 | 1,5,3 | 8,10,2 | 8,5,2 | 7,9,3 | 4,2,8 | 10,7,3 | 5,2,8 | 1,7,10 |
| Seed yield /plant | 8,10,9 | 1,3,4 | 2,3,4 | 8,9 | 2,4,8 | 1,7,5 | 2,10,9 | 1,6,7 | 8,9,10 | 1,3,6 |

1. GOURI 2. MADHAVI 3. YLM 11 4. YLM 17 5. YLM 66
6. YLM 82 7.YLM 106 8. VZM 5 9. YLM 78 10. YLM-80

yield per plant. The genotypes 8 (VZM 5), 9 (YLM 78) and 10 (YLM 80) were classified as most stable and the genotype 1 (Gouri) was considered as less stable according to these parameters.

The study indicates similarity of results for spotting stable genotypes according to ecovalence, variance due to genotype-environment interaction of Plaisted and Peterson and b and $S^2d$ of Eberhart and Russell.

Luthra and Singh (1974) observed low rank correlation coefficient between ecovalence and deviation due to regression of Eberhart and Russell (1966). They however, observed that the most stable varieties could be detected by using any of these methods. In the present study the significant rank correlation between ecovalence and deviation due to regression of Eberhart and Russell (1966) was noticed because the genotypes classified as more or less stable were almost same under both these methods whereas in the experiment of Luthra and Singh (1974) though the stable genotypes were same according to both methods, the two methods differed in spotting less stable genotypes resulting in low rank correlation coefficient between the rankings of genotypes.

The other parameters like mean, stability factor, mean of ranks and variance or information over environments also specify the same genotypes as more stable.

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