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# 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 EC 358039, Madhavi and Tanuku Brown for days to 50% flowering; Nellore Brown Local, EC 358022 and Madhavi for number of seeds per capsule and seed yield per plant and seed yield per plot were stable.

**Key words :** Sesamum, Stability

Sesame (*Sesamum indicum* L.) is an important ancient oil seed crop cultivated extensively in India, after groundnut, mustard and rape seed. Varieties are known to differ generally 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 homogeneity among different stability parameters for the production of some stable genotypes.

## MATERIAL AND METHODS

Ten genotypes were grown during *kharif* 2006 (3 dates of sowing) and *rabi* 2006 (3 dates of sowing) thus providing 6 environments for study in Agricultural College Farm, Bapatla. The experimental material grown in randomized block design with 3 replications of 2 m long plots of 3 rows was used with 30 X 10 cm spacing. Data were recorded on the 12 characters *viz.,* number of primaries, number of secondaries, plant height, days to 50% flowering, number of capsules per plant, days to maturity, number of seeds per capsule, 1000 seed weight, harvest index, oil content, seed yield per plant and seed yield per plot. Statistical analysis of 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),Hanson's (1970) genotypic stability, Shukla's (1972) variance of each genotype over environments, mean of ranks of each genotype over environments and variance of ranks of each genotype over environments. Rank correlation coefficients among different stability parameters were worked out as per Spearman (1904).

## RESULTS AND DISCUSSION

A comparison of different stability parameters was made based on rank correlation coefficients between pairs of these parameters (Table1) and by emperically comparing the stable (or) desirable genotypes under each of these parameter (Table 2).

In the present study the mean and mean of ranks were significantly and positively correlated for all characters considered in the study as they have similar calculations and have same criteria for defining a stable genotype. The genotypes classified as more or less stable are the same in both these cases (Table 2). In the same way variance over environments and Hanson's genotypic stability, ecovalence, regression coefficient and deviation from regression with Shukla's variance were significantly and positively correlated for 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 and is the same in case of variance over environments with Hanson's genotypic stability (genotypes EC 358039, Madhavi and Tanuku Brown for days to 50% flowering) and ecovalence with Shukla's stability variance (genotypes Nellore Brown Local, EC 358022 and Madhavi for seed yield per plant) (Table 2).

Lewis stability factor and Hanson's genotypic stability showed positive significant association for all the characters under study except for seed yield per plant and seed yield per plot. Ecovalence with Hanson's genotypic stability showed significant association for number of seeds per capsule. Variance over environments showed positive association with Shukla's variance for all characters except for number of seeds per capsule.

Table 1 : Rank correlation coefficient between pairs of different stability parameters in Sesamum

| | | Variance | Stability factor | Ecovalence | 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 | No. of capsules plant$^{-1}$ | -0.018 | 0.516 | -0.624 | -0.648 | -0.321 | -0.272 | 0.988** | 0.104 | -0.078 | -0.624 |
| | No. of seeds capsule$^{-1}$ | -0.430 | 0.128 | -0.018 | -0.018 | 0.137 | -0.054 | 0.952** | 0.440 | -0.163 | -0.018 |
| | Seed yield plant$^{-1}$ | -0.284 | 0.479 | -0.115 | -0.006 | -0.381 | -0.187 | 0.988** | 0.431 | -0.139 | -0.115 |
| | Seed yield plot$^{-1}$ | -0.345 | 0.613 | -0.224 | -0.054 | -0.369 | -0.127 | 1.000** | 0.407 | -0.393 | -0.224 |
| Variance | No. of capsules plant$^{-1}$ | | 0.685* | -0.127 | -0.103 | 0.031 | -0.42 | -0.42 | 0.067 | 0.988** | -0.127 |
| | No. of seeds capsule$^{-1}$ | | 0.564 | 0.528 | 0.528 | -0.100 | 0.60 | -0.478 | 0.446 | 0.769** | 0.527 |
| | Seed yield plant$^{-1}$ | | 0.528 | 0.091 | 0.019 | 0.055 | 0.031 | -0.381 | -0.151 | 0.806** | 0.091 |
| | Seed yield plot$^{-1}$ | | -0.054 | 0.091 | -0.006 | 0.067 | -0.042 | -0.345 | -0.175 | 0.769** | 0.090 |
| Stability factor | No. of capsules plant$^{-1}$ | | | -0.612 | -0.600 | -0.060 | -0.381 | 0.431 | -0.127 | 0.673* | -0.612 |
| | No. of seeds capsule$^{-1}$ | | | 0.782** | 0.782** | -0.100 | 0.794** | 0.079 | 0.900** | 0.830** | 0.781** |
| | Seed yield plant$^{-1}$ | | | -0.018 | 0.128 | -0.067 | -0.090 | 0.504 | 0.382 | 0.454 | -0.018 |
| | Seed yield plot$^{-1}$ | | | -0.236 | -0.090 | -0.042 | -0.321 | 0.613 | 0.104 | -0.381 | -0.236 |
| Ecovalence | No. of capsules plant$^{-1}$ | | | | 0.976** | 0.322 | 0.734* | -0.587 | 0.443 | -0.078 | 0.000 |
| | No. of seeds capsule$^{-1}$ | | | | 0.000 | 0.264 | 0.988** | -0.042 | 0.816** | 0.915** | 0.000 |
| | Seed yield plant$^{-1}$ | | | | 0.940** | 0.758* | 0.964** | 0.163 | 0.613 | 0.587 | 0.000 |
| | Seed yield plot$^{-1}$ | | | | 0.952** | 0.734* | 0.904** | -0.224 | 0.600 | 0.527 | 0.000 |
| Mean variance due to g x e | No. of capsules plant$^{-1}$ | | | | | 0.431 | 0.661* | -0.624 | 0.407 | -0.067 | 0.976** |
| | No. of seeds capsule$^{-1}$ | | | | | 0.264 | 0.988** | -0.042 | 0.816** | 0.915** | 0.000 |
| | Seed yield plant$^{-1}$ | | | | | 0.722* | 0.928** | -0.054 | 0.734* | 0.527 | 0.939** |
| | Seed yield plot$^{-1}$ | | | | | 0.722* | 0.855** | -0.054 | 0.734* | 0.515 | 0.951** |
| Regression coefficient | No. of capsules plant$^{-1}$ | | | | | | -0.333 | -0.381 | -0.187 | -0.018 | 0.322 |
| | No. of seeds capsule$^{-1}$ | | | | | | 0.167 | 0.222 | 0.110 | 0.130 | 0.263 |
| | Seed yield plant$^{-1}$ | | | | | | 0.673* | -0.369 | 0.310 | 0.333 | 0.539 |
| | Seed yield plot$^{-1}$ | | | | | | 0.540 | -0.369 | 0.310 | 0.369 | 0.733* |
| Deviation from regression | No. of capsules plant$^{-1}$ | | | | | | | -0.200 | 0.491 | 0.030 | 0.734* |
| | No. of seeds capsule$^{-1}$ | | | | | | | -0.103 | 0.816** | 0.927** | 0.987** |
| | Seed yield plant$^{-1}$ | | | | | | | -0.236 | 0.661* | 0.527 | 0.963** |
| | Seed yield plot$^{-1}$ | | | | | | | -0.127 | 0.734* | 0.490 | 0.903** |
| Mean of ranks | No. of capsules plant$^{-1}$ | | | | | | | | 0.091 | 0.139 | -0.587 |
| | No. of seeds capsule$^{-1}$ | | | | | | | | 0.379 | -0.236 | -0.042 |
| | Seed yield plant$^{-1}$ | | | | | | | | 0.407 | -0.200 | -0.163 |
| | Seed yield plot$^{-1}$ | | | | | | | | 0.407 | -0.393 | -0.224 |
| Variance of ranks | No. of capsules plant$^{-1}$ | | | | | | | | | 0.103 | -0.048 |
| | No. of seeds capsule$^{-1}$ | | | | | | | | | 0.778** | 0.815** |
| | Seed yield plant$^{-1}$ | | | | | | | | | 0.284 | 0.612 |
| | Seed yield plot$^{-1}$ | | | | | | | | | 0.018 | 0.600 |
| Hanson genotypic stability | No. of capsules plant$^{-1}$ | | | | | | | | | | -0.078 |
| | No. of seeds capsule$^{-1}$ | | | | | | | | | | 0.915** |
| | Seed yield plant$^{-1}$ | | | | | | | | | | 0.587 |
| | Seed yield plot$^{-1}$ | | | | | | | | | | 0.624 |

* = Significant at 0.05 level

** = Significant at 0.01 level

Table 2. More and less stable genotypes according to different stability parameters in Sesamum

| | 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 |
| Days to 50% flowering | 1, 2, 9 | 7, 4, 10 | 9, 6, 2 | 4, 8,10 | 9, 6, 2 | 4, 8, 5 | 3, 2, 1 | 9, 6, 4 | 1, 2, 3 | 9, 6, 4 | 5, 1, 7 | 9, 4, 6 |
| Number of capsules per plant | 6,10, 8 | 4, 3, 8 | 6, 1, 4 | 5, 8,10 | 6, 1, 7 | 8, 3, 9 | 3, 4, 10 | 5, 6, 2 | 4, 3,10 | 5, 6, 2 | 4, 9, 2 | 6, 8, 1 |
| Number of seeds per capsule | 10, 6, 7 | 1, 8, 2 | 1, 4, 8 | 9, 5, 7 | 1, 10, 6 | 9, 2, 7 | 8, 10, 1 | 2, 9, 7 | 8, 10, 1 | 2, 9, 7 | 8, 9, 3 | 2, 5, 1 |
| 1000-seed weight | 10, 6, 1 | 7, 2, 9 | 3, 2, 1 | 5, 6, 10 | 3, 1, 2 | 5, 6, 9 | 8, 10, 7 | 5, 6, 9 | 10, 2, 8 | 5, 6, 9 | 8, 10, 4 | 5, 6, 3 |
| Harvest index | 10, 6, 5 | 8, 4, 2 | 1, 7, 9 | 5, 10, 8 | 1, 9, 7 | 8, 5, 10 | 6, 9, 3 | 5, 2, 7 | 6, 4, 9 | 8, 5, 2 | 4, 3, 6 | 10, 5, 1 |
| Oil content | 10, 7, 5 | 8, 9, 3 | 4, 7, 6 | 9, I8, 1 | 4, 7, 3 | 8, 9, 1 | 3, 6, 4 | 9, 1, 8 | 4, 3, 6 | 8, 2, 10 | 10, 9, 6 | 4, 8, 5 |
| Seed yield per plant | 10, 6, 5 | 8, 7, 4 | 1, 9, 4 | 5, 10, 8 | 6, 1, 9 | 8, 5, 3 | 3, 8, 6 | 5, 7, 2 | 6, 8, 3 | 5, 7, 2 | 3, 6, 8 | 5, 10, 1 |
| Seed yield per plot | 10, 6, 5 | 8, 4, 7 | 1, 9, 4 | 5, 10, 8 | 6, 1, 10 | 9, 8, 4 | 8, 3, 6 | 5, 7, 2 | 6, 8, 3 | 5, 7, 2 | 3, 6, 8 | 5, 10, 1 |

| | Deviation from regression | | Mean of ranks | | Variance of ranks | | Hanson's genotypic stability | | Shukla's stability varian ce | |
|---|---|---|---|---|---|---|---|---|---|---|
| | More stable | Less stable | More stable | Less stable | More stable | Less stable | More stable | Less stable | More stable | Less stable |
| Days to 50% flowering | 3, 2, 1 | 6, 8, 5 | 1, 2, 5 | 7, 4,10 | 3, 2, 7 | 6, 9, 8 | 9, 6, 2 | 4, 8, 10 | 3, 2, 1 | 9, 6, 4 |
| Number of capsules per plant | 3, 8, 10 | 5, 2, 7 | 6,10, 5 | 4, 3, 7 | 3, 6, 10 | 2, 5, 1 | 6, 1, 4 | 5, 8, 10 | 3,4, 10 | 5, 6, 2 |
| Number of seeds per capsule | 8, 10, 1 | 9, 2, 7 | 10, 6, 9 | 1, 8, 2 | 10, 6, 4 | 2, 9, 5 | 1, 8, 4 | 9, 2, 5 | 8,10, 1 | 2, 9, 7 |
| 1000-seed weight | 2, 3, 8 | 9, 5, 6 | 10, 6, 1 | 7, 9, 2 | 8, 2, 4 | 5, 9, 1 | 3, 2, 1 | 5, 6, 7 | 8, 10, 7 | 5, 9, 6 |
| Harvest index | 9,10, 6 | 2, 5, 7 | 10, 5, 1 | 8, 4, 7 | 10, 6, 9 | 2, 5, 7 | 9, 1, 6 | 5, 8, 10 | 6, 9, 3 | 5, 2, 7 |
| Oil content | 4, 3, 6 | 9, 1, 10 | 10, 7, 5 | 8, 9, 6 | 7, 8, 6 | 9, 2, 1 | 4, 7, 6 | 9, 8, 1 | 3, 7, 4 | 9, 1, 8 |
| Seed yield per plant | 8, 3, 2 | 5, 7, 2 | 10, 6, 5 | 8, 4, 7 | 10, 6, 9 | 2, 5, 7 | 9, 1, 4 | 5, 10, 7 | 3, 8, 6 | 5, 7, 2 |
| Seed yield per plot | 8, 3, 9 | 5, 7, 2 | 10, 6, 5 | 8, 4, 7 | 10, 6, 9 | 2, 5, 7 | 9, 4, 1 | 5, 10, 7 | 8, 3, 6 | 5, 7, 2 |

1 BPT Local 2 Tanuku Brown 3 Nellore Brown Local 4 NRD 1110 5 Gowri
6 Madhavi 7 Vinayak 8 EC 358022 9 EC 358039 10 YLM-11

The variance over environments and stability factor showed close association for characters. This was confirmed by the genotypes ranked as stable under these parameters. For example, for days to 50% flowering genotypes EC 358039, Madhavi and Tanuku Brown according to both variance and stability factor were ranked as stable. Similarly, the genotypes marked as less stable for seed yield NRD 1110 and EC 358022 according to both variance and stability factor.

The ecovalence indicated positive association with variance of genotype-environment interaction according to Plaisted and Peterson (1959), variance of ranks, regression coefficient and deviation from regression (Table 1). Similarly the variance due to genotype and environment of Plaisted and Peterson (1959) showed positive association with 'b' for seed yield per plant and seed yield per plot and $S^2$d for number of capsules per plant, number of seeds per capsule, seed yield per plant and seed yield per plot. For seed yield per plant the most stable genotypes were Nellore Brown Local, EC 358022 and Madhavi, and EC 358022 and Nellore Brown Local according to ecovalence and variance due to genotype and environment of Plaisted and Peterson (1959) respectively. The more stable genotype according to 'b' were Nellore Brown Local , Madhavi and EC 358022 for seed yield per plant. The stable genotypes with less deviation from regression for seed yield per plant were EC 358022, Nellore Brown Local and Tanuku Brown where as the least stable genotypes for seed yield per plant were Gouri, Vinayak and Tanuku Brown under parameters ecovalence, variance due to genotype and environment of Plaisted and Peterson (1959), deviation from regression and also variance of ranks.

The $S^2$d showed positive association with variance of ranks for number of seeds per capsule, seed yield per plant and seed yield per plot. The genotypes EC 358022, Nellore Brown Local and Tanuku Brown and YLM-11, Madhavi and EC 358039 were classified as most stable according to $S^2$d and variance of ranks respectively. Whereas the genotypes Gouri, Vinayak and Tanuku Brown were considered as less stable according to both parameters.

No relationship existed between mean and regression coefficient, mean and $S^2$d, variance and variance of ranks, variance and 'b', variance and $S^2$d and stability factor and 'b' indicating that these are independent estimates.

The study indicates similarity of results for spotting stable genotypes according to ecovalence, variance due to genotype-environment interaction of Plaisted and Peterson, b and $S^2$d of Eberhart and Russell and variance of ranks. The study also indicated as far as the spotting of stable genotypes simple methods like ecovalence, variance due to genotype environment interaction of Plaisted and Peterson and variance of ranks shall give similar results like $S^2$d whose calculation is cumbersome. The above simpler techniques may be applied as per suitability of experiment and convenience of the experimenter.

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 and less stable are 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.

## LITERATURE CITED

**Eberhart, S A and Russell W A 1966.** Stability parameters for comparing crop varieties. Crop Science, 6 : 36- 40.

**Hanson W D 1970.** Genotypic stability. Theoritical and Applied genetics, 40: 226-231.

**Lewis D 1954.** Genotype-environment interaction. A relationship between dominance, heterosis, phenotypic stability and variability. Heredity, 8 : 333 – 356.

**Luthra O P and Singh R K 1974**. Comparision of different stability models in wheat. Theoretical and Applied Genetics, 45 : 143 – 149.

**Plaisted R L and Peterson L C 1959.** A technique of evaluating the ability of selections to yield consistentcy in different seasons or locations. American Potato Journal, 36 : 381 – 385.

**Shanthakumar G 2000**. Stability analysis for yield and yield influencing traits in finger millet (*Eluesine coracana*). Indian Journal of Agricultural Sciences, 70 (7): 472-474.

**Shukla 1972.** Some statistical aspect of partitioning GE components of variability. Heridity, 29: 237-245.

**Spearman C 1904.** Rank correlations. In Statistical methods by Snedecor G W (1946). Iowa state college press, Ames. Iowa, U.S.A

**Wricke O 1962** Uber eine Method Zur Erffassung derkologi schen strenb reite in Feldversuchen. Z pflan zen zuchtung 47 : 92 – 96.

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