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# STABILITY ANALYSIS FOR YIELD AND SOME QUALITY TRAITS IN WHEAT (*TRITICUM AESTIVUM* L.)

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## ABSTRACT

**Stability analysis of 54 advanced generation lines along with six checks of wheat was made for six characters including three quality traits. The G x E interaction, environment (linear) and environment (nonlinear) components were highly significant for all the traits. Twenty nine genotypes showed stable response for tryptophan content and 12 for seed hardness. Many genotypes also showed stability for protein content. Grain yield was positively correlated with 1000-grain weight and harvest index but negatively associated with protein, tryptophan content, and seed hardness. Protein content showed positive association with tryptophan content and seed hardness.**

**Key words:** Stability, biochemical traits, breadwheat, *T. aestivum*.

A stable variety is needed for commercial cultivation over a wide range of agroclimatic conditions. Preliminary evaluation can be made to identify stable genotypes in a short period. Therefore, the data on grain yield and related biochemical traits obtained from 54 advanced generation lines in wheat were subjected to stability analysis.

## MATERIALS AND METHODS

The experiment with 54 advanced generation selections in wheat with six checks was carried out at Kanpur, Saraimira (Farrukhabad) and Mainpuri in Uttar Pradesh. The experiment was laid out with three replications in randomized complete block design. The plot size was 5 x 1.08 m, comprising six rows, each 5 m long. The recommended agronomic practices were followed during the crop period. The data were recorded on grain yield per plant, 1000-grain weight, seed hardness, and protein (Biuret method) and tryptophan contents (calorimetric method). The data were analysed for stability parameters based on the two stability models of Eberhart and Russell [1] and Perkins and Jinks [2].

## RESULTS AND DISCUSSION

Six checks and 54 advanced generation selections were used for computing stability parameters based on two models. Both the models used in the analysis are associated with each other, so that mean and squared deviation from regression ($S^2_{di}$) are similar and the regression coefficient of the Perkins-Jinks model is equivalent to $b^E$-1. $b^E$ is the regression coefficient of the Eberhart-Russell model. Consequently, the ranking pattern of the genotypes under the Perkins-Jinks model will be similar to the pattern obtained with the Eberhart-Russell model.

The experimental results showed that the genotype x environment interaction was significant for all the characters, which revealed that the average performance of the genotypes with regard to grain yield and other attributes varied significantly. Similar results were reported by Nanda et al. [3].

The environment (linear) interaction component was also significant for all the traits (Table 1). However, high magnitude of environment (linear) to genotype-environment

**Table 1. ANOVA (M.S.S.) for stability for grain yield and quality traits in wheat**

| Source | d.f. | Yield per plant | Harvest index | 1000-grain weight | Protein content | Tryptophan content | Seed hardness |
|---|---|---|---|---|---|---|---|
| | | | **Eberhart and Russell model [1]** | | | | |
| Genotypes (G) | 59 | 1.69** | 6.27** | 7.15* | 0.87** | 1.68* | 1.59* |
| Environments (E) | 2 | 42.65** | 234.41** | 15.57 | 13.07** | 0.21** | 15.60** |
| G x E | 118 | 2.23** | 4.17** | 6.20** | 0.95** | 1.97** | 1.20* |
| E + (G x E) | 120 | 2.90 | 8.01 | 6.36 | 16.16 | 2.30 | 1.40 |
| E (linear) | 1 | 85.26** | 468.71** | 31.00** | 2.60** | 0.43** | 31.16** |
| (G x E) linear | 59 | 2.75 | 6.94 | 6.42 | 1.30 | 1.97 | 0.82 |
| Pooled deviation | 60 | 1.67** | 1.38** | 5.90** | 0.60** | 1.94** | 1.56** |
| Pooled error | 345 | 0.11 | 0.12 | 0.10 | 1.31 | 491.24 | 0.63 |
| | | | **Perkins and Jinks model [2]** | | | | |
| Genotypes (G) | 59 | 1.69** | 6.27* | 7.15* | 0.87** | 1.68* | 1.59* |
| E/Joint | 2 | 42.63 | 234.35 | 15.50 | 13.01** | 0.21** | 15.58** |
| G x E | 118 | 2.23** | 4.17** | 6.20** | 0.95** | 1.91** | 1.20** |
| Heterogeniety between regression | 59 | 2.75 | 8.94 | 6.42 | 1.30 | 1.97 | 0.82 |
| Remainder | 59 | 1.70** | 1.41** | 6.00** | 0.61** | 1.95** | 1.59** |
| $r_{ph}$ with grain yield | — | — | 0.350** | 0.167 | –0.122 | –0.159 | –0.035 |
| $r_g$ with grain yield | — | — | 0.352** | 0.172 | –0.141 | –0.169 | –0.036 |

*, **Significant at 5% and 1% levels, respectively.

**Table 2. Estimates of stability parameters based on**

| Genotype | Grain yield/plant (g) | | | | Harvest index (%) | | | | 1000-grain weight (g) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\bar{X}$ | $b^E$ | $b_i$ | $s^2_{di}$ | $\bar{X}$ | $b^E$ | $b_i$ | $s^2_{di}$ | $\bar{X}$ | $b^E$ | $b_i$ | $s^2_{di}$ |
| B 346 | 9.3 | –0.16 | –1.46 | 0.64 | 39.6 | 1.03* | 0.03 | 3.61 | 32.4 | –2.60 | –3.63 | 7.36 |
| B 386-863 | 9.6 | –0.38 | –1.38 | 0.05 | 38.4 | 0.74 | –0.27 | 1.04 | 33.8 | 5.42 | 3.43 | 6.98 |
| Z 86 | 9.5 | –0.34 | –1.34 | –0.03 | 41.3 | 0.54 | –0.46 | 0.88 | 34.8 | 0.53 | –0.46 | 1.29 |
| B 1153 | 9.2 | –0.94 | –1.94 | 3.01 | 40.4 | 0.72 | –0.28 | 0.48 | 32.2 | 0.88 | –0.12 | 6.67 |
| B 650 | 9.6 | 0.14 | –0.85 | 0.74 | 38.7 | 0.83 | –0.17 | 1.04 | 32.6 | 2.47 | 1.48 | 1.67 |
| IBWSN 025 | 9.8 | –0.25 | –1.25 | –0.02 | 40.2 | –0.19 | –1.19 | 1.96 | 32.5 | 0.89 | –0.11 | 20.19** |
| B 746 | 9.4 | 0.49 | –0.51 | 0.25 | 37.7 | 1.94** | 0.94 | 4.94 | 35.1 | 1.41 | 0.42 | 0.23 |
| B 442-503-4 | 9.2 | –0.08 | –1.08 | 3.36 | 37.3 | 0.46 | –0.54 | 0.80 | 35.6 | 1.45 | 0.45 | 3.57 |
| B 861-3 | 9.6 | 1.38 | 0.39 | –0.03 | 35.5 | 1.15 | 0.15 | 0.74 | 35.5 | –0.99 | –1.99 | 7.88 |
| Z 43 | 9.4 | 1.52 | 0.55 | 0.21 | 37.3 | 0.74 | –0.26 | –0.01 | 32.7 | 0.69 | –0.31 | 3.85 |
| DSN 94-1 | 9.6 | 1.21 | 0.22 | 0.04 | 39.2 | 1.96** | 0.96 | –0.05 | 36.8 | 0.93 | –0.06 | 0.02 |
| K 8020 | 9.3 | 0.61 | –0.39 | 2.37 | 40.3 | 0.67 | –0.34 | –0.02 | 35.0 | 2.51 | 1.52 | 0.13 |
| S.E. | 0.9 | 1.08 | | | 0.8 | 0.42 | | | 1.7 | 3.37 | | |

*,**Significant at 5% an 1% levels, respectively.

(linear) interaction for all the characters was observed, which might be responsible for high adaptation in relation to quality and yield contributing traits in wheat. The linearity predominated for grain yield and seed hardness. Similar results were obtained by Kerkhi et al. [4].

The variances due to pooled deviation (nonlinear) were also significant for all the traits, reflecting considerable genetic diversity in the material which supported the observations of Perkins and Jinks [2]. Such nonlinear deviation may be of practical value to construct and test the utility of multiple regression models to know critically the complex mechanism of adaptation.

A variety is likely to be stable over different environments if it shows high mean value (above average performance), unit or less than unit regression coefficient ($b_i$) with lowest deviation (nonsignificant) from the linear regression ($b_i$). The genotypes B 346, B 389-863, Z 86, B 1153, B 650, IBWSN 025,B 746, B 442-503-4, B 861-3, Z 43 and DSN 94-1 had nonsignificant deviation from regression, with the regression coefficient approaching unity for grain yield. Out of these genotypes, B 1153, B 746 and B 650 gave stable response for protein, tryptophan content and seed hardness, respectively.

**three environments for five traits in wheat**

| Protein contents (%) | | | | Tryptophan content (%) | | | | Seed hardness (kg) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $\bar{X}$ | $b^E$ | $b_i$ | $s^2_{di}$ | $\bar{X}$ | $b^E$ | $b_i$ | $s^2_{di}$ | $\bar{X}$ | $b^E$ | $b_i$ | $s^2_{di}$ |
| 12.1 | 1.00 | 0.01 | –0.01 | 1.5 | 1.45 | 0.45 | 0.04 | 9.9 | 0.15 | –0.85 | 1.81 |
| 11.1 | 0.84 | –0.15 | –0.40 | 1.4 | 2.15 | 1.15 | 0.45 | 8.6 | 1.31 | 0.32 | 0.40 |
| 12.3 | 1.10 | 0.11 | 0.05 | 1.5 | 1.66 | 0.67 | 0.07 | 10.1 | –0.21 | –1.21 | –0.17 |
| 11.4 | 2.30 | 1.31 | 0.21 | 1.6 | 0.42 | –0.58 | 0.06 | 8.7 | 0.08 | –0.92 | 0.12 |
| 11.8 | 2.61 | 1.61 | 0.47 | 1.4 | 3.42* | 2.43 | 0.049 | 9.9 | 2.21 | 1.22 | 3.14 |
| 11.5 | 2.24 | 1.25 | 0.08 | 1.5 | 1.94 | 0.94 | 0.03 | 9.0 | 1.26 | 0.25 | –0.17 |
| 11.3 | 2.91* | 1.91 | 0.05 | 1.4 | –0.49 | –1.49 | 0.01 | 9.1 | 2.00 | 1.00 | 0.03 |
| 11.7 | 3.76* | 2.77 | 0.76 | 1.6 | 0.52 | –0.48 | 0.02 | 8.3 | 0.41 | –0.58 | –0.13 |
| 11.6 | 1.85 | 0.86 | 0.69 | 1.4 | 2.87 | 1.87 | 0.01 | 9.8 | –0.16 | –1.16 | 0.53 |
| 11.1 | 1.02 | 0.03 | 0.11 | 1.5 | 1.11 | 0.12 | 0.01 | 10.1 | 0.43 | –0.56 | 0.75 |
| 10.7 | 2.15 | 1.15 | 2.12 | 1.5 | 0.66 | –0.34 | 0.03 | 10.7 | 0.74 | –0.25 | –0.20 |
| 11.8 | 1.20 | 0.20 | 0.05 | 1.5 | 2.55 | 1.55 | 0.03 | 9.9 | 0.55 | –0.44 | 1.51 |
| 0.5 | 1.18 | | | 0.98 | 1.64 | | | 0.9 | 1.73 | | |

The genotypes B 346, Z 86, B 650 and B 442-503-4 showed stable response for protein content in addition to other quality traits (Table 2).

Protein and tryptophan content showed negative correlation with grain yield which is in agreement with the results reported by Kerkhi et al. [4]. A positive and significant correlation was observed between protein content and seed hardness ($r_p = 0.28^*$, $r_g = 0.30^*$) which suggests that seed hardness is an indicator of protein level in the grain, and the former can be easily and quickly detected under laboratory conditions.

## REFERENCES

1. S. A. Eberhart and W. A. Russell. 1966. Stability parameters for comparing varieties. Crop Sci., 6: 36–40.

2. J. N. Perkins and J. C. Jinks. 1968. Environmental and genotype x environmental components of variability. IV. Non-linear interaction for multiple inbred lines. Heredity, 23: 525–535.

3. G. S. Nanda, K. S. Gill and D. S. Virk. 1983. Stability for plant height, ear length, peduncle length and spikelets per spike in bread wheat. Indian J. Genet., **43** (2): 221–225.

4. S. A. Kerkhi, Z. Ahmad and A. N. Khanna. 1983. Genetic architecture of quality traits over locations in bread wheat. Abstr. XV Intern. Genet. Congr., 12–21 December, 1983. Oxford & IBH Publishing Co., New Delhi, Pt. II: 557.