Vol XV (1-2), 1978

RELATIVE STABILITY IN YIELD PERFORMANCE OF DIFFERENT WHEAT CULTIVARS

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Ten varieties/strains of bread wheat were tested at 15 locations for their yield performance in the Punjab. The stability in yield performance was tested through regression analysis by partitioning the genotype-environment interaction of each variety into two parts (i) variation due to regression and (ii) the unexplainable deviations from the regression. Significant genotypic differences occurred among various varieties included in the test. LU-26 turned out to be most widely adapted variety followed by Sandal and V. 4489 whereas Yecora and Jupatico appeared to perform better under favourable environments.

INTRODUCTION

In recent years development of semi-dwarf, photo-insensitive, high yielding, and fertilizer responsive varieties of wheat has made significant contribution to wheat production efforts in various countries of the world. In Pakistan vulnerability of the new varieties to diseases and temperature fluctuations may be considered a major constraint in attaining self-sufficiency in wheat. The yielding ability of a variety is the result of interaction between its genotype and environment. Soil character, fertilizer, irrgation, sowing time, rainfall and temperature are the major components of the environment which may influence the exploiting of the yield potential of a genotype (Allard and Bradshaw, 1964).

Varietal differences for stability in yield over varying environments may be used for evolving more stable lines of wheat. For the evaluation of stability parameters, variability in the performance over a range of environments, may be used as a criterion for the comparison of phenotypic stability (Lerner, 1954) while mean performance over all the environments and regression of performance in different environments over the respective environment mean

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has been used for ascertaining the phenotypic stability (Finlay and Wilkinson 1963). The technique was further improved by Eberhart and Russell (1966) by partitioning the genotype-environment interaction of each variety into two parts (i) variation due to regression and (ii) unexplainable deviations from the regression. Using various techniques for determining the stability parameters, some of the wheat breeders found that crosses between genotypes showing high degree of stability produced consistent genotypes (Gupta *et al.* 1977). The present study aimed at determining the stability parameters of some of the commercially grown varieties and new strains over a range of environments.

MATERIALS AND METHODS

Ten varieties/strains of bread wheat were sown at 15 different locations during the first fortnight of December, 1975-76. The trials were laid out in a randomized block design with four replications, with a plot size of 18.39 sq. meters. The fertilizer at the rate of 146-55 NP Kg/ha was applied at the time of sowing. The plantings at the various locations received the normal cultural treatments and the experiment was a part of coordinated yield trial programme organized in cooperation with the Cereal Botanist, Punjab Agricultural Research Institute, Faisalabad. The yield data from these trials were analysed on the Eberhart and Russell (1966) model to estimate the stability parameters.

RESULTS AND DISCUSSION

The mean yield of all the varieties/strains was used as an estimate of site mean yield (Table 1). The mean yield of various varieties/strains at sites in Jhang, Gujranwala, Bahawalpur districts was low, indicating the low yielding environments, while the mean yields of the Sahiwal and Faisalabad sites were high, indicating the high yielding environments. Factors like soil structure and texture, fertility, temperature and rainfall might have contributed towards the variation among high and low yielding environments. Testing of genotypes over different locations, differing in unpredictable environmental variation, such as of rainfall, temperature, etc. is a pertinent measure for selecting stable genotypes (Eberhart and Russell, 1966; Arian and Siddiqui, 1977).

Analysis of variance for stability parameters was carried out and mean squares given in Table 2. The mean squares for the varieties/strains were highly significant showing sufficient genetic variability among the genotypes. The sum of squares due to environment and variety X environments were partitioned into environment (linear), varieties X environments (linear) and

Table 1. *Site mean yield (environment means) obtained from the varietal yield trials laid out at 15 locations during 1975-76.*

Site	Mean yield (tonne/acre)	Site	Mean yield (tonne/acre)
Sahiwal	2.141	Multan (Cotton Research Inst.)	1.738
Faisalabad (Chak No. 200/ R.B.)	1.950	Multan (Govt. Agri Farm)	1.637
Faisalabad. (PARI)	1.867	Khanewal	1.547
Sheikhupura	1.788	Faisalabad (Chak No. 73/J.B.)	1.529
D. I. Khan	1.784	Bahawalpur	1.483
Faisalabad (Chiraghabad)	1.758	Gujranwala	1.452
Sheikhupura (Khan-Kah-Dogran)	1.703	Jhang	1.380
Haroonabad	1.678		

Table 2. *Analysis of variance for stability parameters*

Source	D.F.	M.S.	F.
Varieties/strains	9	0.118	6.11**
Environments (linear)	1	5.7456	313.97**
Varieties X Environment (linear)	9	0.0640	3.50**
Pooled deviations	130	0.0183	
Total :	149		

**Significant $P < 0.01$

deviations from the regression model. The mean squares attributed to the environments (linear) and variety X environments (linear) were highly significant which indicated that regression coefficients of varieties/strains differed significantly among themselves.

Finlay (1963), while studying adaptation regarding its measurement and significance in barley breeding, concluded that varieties with average stability would have a regression coefficient of 1.0; those with values above 1.0 would be less stable but have high yield potential while those with values approaching 1.0 would be very stable over a range of environments. Eberhart and Russell (1966) suggested that a variety with a high mean yield, unit regression coefficient ($bi = 1.0$) and the deviations from regression as small as possible ($s^2_{di} = 0$) is the most stable variety.

The stability parameters of different wheat varieties/strains over 15 environments for yield are presented is Table 3.

Table 3. *Estimates of stability parameters of different varieties/strains for yield over 15 environments.*

Varieties/strains	Mean yield (tonne/acre)	b	s^2d
LU26	1.785	0.8465	0.0115
Jupatico	1.776	1.3890	0.0125
Yecora	1.763	1.4960	0.0073
Sandal	1.762	0.9976	0.0287
V-4489	1.721	0.9469	0.0062
SA-75	1.688	0.3337	0.0306
V-1298	1.634	0.9713	0.0067
Nuri	1.630	1.2768	0.0268
LU–75	1-594	0.9793	0.0041
SA-42	1.538	0.7575	0.0022
L.S.D. $P < 0.05$	0.0969	—	—
L.S.D. $P < 0.01$	0.1281	—	—

The linear regression coefficient (b) and deviations from the regression (s^2_d) values for different genotypes revealed a wide variation in performance across environments. The yields of LU 26, Jupatico, Yecora, Sandal and V-4489, did not differ significantly among themselves but differed significantly from the rest of the varieties. The varieties, LU 26, Sandal and V–4489 with high mean yields had $b = 1.0$. These varieties gave above average yields over

a wide environmental array, thus indicating that these were widely adapted as compared to other entries. However, the value of b greater than 1.0 for varieties Jupatico and Yecora with high mean yields and the b value less than 1.0 for SA 42, with a below-average yield indicated that Jupatico and Yecora were suited to high yielding environments while SA 42 appeared good for low yielding environments. The relationship of the mean yield and the stability of yield (b) is illustrated in Fig. 1.

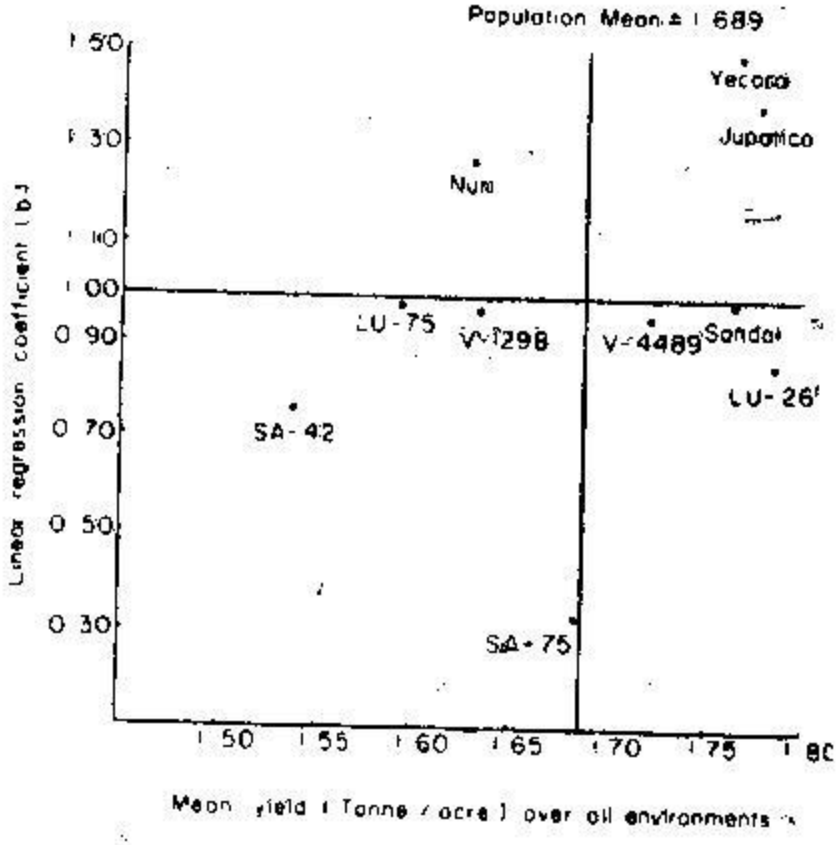

Fig 1 THE RELATIONSHIP OF MEAN YIELD OVER 15 ENVIRONMENTS AND STABILITY OF YIELD (LINEAR REGRESSION COEFFICIENT) OF WHEAT VARIETIES / STRAINS TESTED DURING 1975-76

When examined by s^2_{di}, the values for LU 26, Sandal and V-4489 were 0.0115, 0.0287 and 0.0062, respectively which were close to zero.

Considering the stability parameters discussed above, LU 26 (mean = 1.785, b=0.8465 and s^2_{di} = 3.0115) is the most acceptable variety. This variety can safely be recommended for growing in wide-ranging environments to obtain stable yields.

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