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PHENOTYPIC STABILITY FOR TUBER YIELD IN POTATO (*SOLANUM TUBEROSUM* L.)

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ABSTRACT

Forty genotypes of potato were grown in twelve environments and analysed for stability of tuber yield per plant. Thirty two genotypes were responsive towards environmental variations. Twenty three genotypes were found to be stable. Fourteen of these twenty three genotypes (Kufri Chandramukhi, Kufri Alankar, Kufri Chamatkar, Kufri Sheatman, Kufri Lauvkar, Kufri Muthu, Kufri Dewa, Kufri Safed, Craigs Defiance, Fabricia, Goya, JF-246, JF-303 and Saco) had high mean performance. Four other genotypes were suitable for rich environmental conditions, since they had high mean and their regression coefficients exceeded unity.

Key words: Potato, *Solanum tuberosum*, phenotypic stability.

Yield in any crop is a variable character, which is influenced by agroclimatic conditions of the place and by the genotypes of a variety. The adaptation of a variety over a wide range of environments has considerable significance in crop improvement, particularly in potato, which is often cultivated under diverse climatic, edaphic and management conditions and for which the seed production areas have agroclimatic conditions quite different from those in the region of crop production.

The stability parameters have been studied in many crops for measuring phenotypic stability, but very little information is available on stability of potato varieties [1]. Accordingly, in the present study, an effect has been made to identify stable genotypes among 40 different potato genotypes.

MATERIALS AND METHODS

Forty potato genotypes received from Central Potato Research Institute, Shimla, were planted in each of the three replications at each of the twelve environments in randomized block design (1979–80 and 1980–81) involving two years. The environments also involved three locations: Daurala (Meerut), Pantnagar (Nainital), and Kufri (Shimla) and two fertility levels of 120:80:100 and 60:40:50 kg/ha NPK. The data were recorded in five individual competitive plants in each of the three replications. Stability parameters for yield were computed using the methods proposed by [2, 3].

RESULTS AND DISCUSSION

The joint regression analysis of the data recorded on 40 genotypes grown over 12 environments is presented in Table 1. The analysis revealed that, 1) the genotypes

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Table 1. Joint regression analyses of variances for tuber yield, using 40 genotypes of potato in 12 environments

Source	d.f.	Mean squares for tuber yield
Lines (genotypes)	39	69834.98××++
Environments (joint regression)	11	534380.47××++
Line × environment	429	4086.36××
Heterogeneity between regression	39	16330.31××**
Remainder	390	2863.35××
Error	936	1965.21

××Significant at 1% level against error mean squares. ++Significant at 1% level against line environment mean squares. **Significant at 1% level against remainder mean squares.

differ significantly, 2) significant variation was present among the environments, and 3) genotypes exhibited significant interactions with environmental variations. The G×E interaction component was further partitioned into linear (heterogeneity between regression) and nonlinear (remainder) components. Mean squares for both these components were tested against error mean squares and, if found significant, the mean squares for linear components were also tested against remainder mean squares. Both linear and nonlinear components were significant, indicating that both predictable and unpredictable components shared G×E interaction.

Regression coefficients were significant for 32 genotypes, indicating the responsiveness of these genotypes to environmental variations (Table 2). However, for 38 genotypes, regression coefficients did not deviate significantly from unity. This indicates average response of these genotypes towards environmental variations. Eight genotypes had significant deviation from regression (S^2d), indicating that unpredictable component also shared G×E interaction. Out of these 8 genotypes, regression coefficients for 7 were also significant against their own remainder mean squares, indicating predominance of predictable component. Hence some reliable predictions can be made about the phenotypic performance of these genotypes in a given environment. However, for VB 8 total G×E interaction was due to unpredictable component. Figure 1 shows the performance and responsiveness of all the 40 genotypes.

According to the Eberhart–Russell model [2], 23 genotypes were found stable ($b=1$ and $S^2d=0$) for tuber yield. Of these, only 14 genotypes (Kufri Chandramukhi, Kufri Alankar, Kufri Chamatkar, Kufri Sheatman, Kufri Lauvkar, Kufri Muthu, Kufri Dewa, Kufri Safed, Craigs Defiance, JF–246 Fabricia, Goya, JF-303 and Saco) also gave above average yield. Therefore, only these 14 genotypes may be considered superior over the remaining genotypes under varying environments. Out of these 14 genotypes, 12 genotypes are cultivars and can be recommended for cultivation in the environments studied. However, two genotypes, i.e. JF-246 and

Table 2. Estimates of means ($\bar{X}$) and stability parameters (regression coefficient, b, and deviation from regression, S^2d) for yield of 40 potato genotypes

Genotype	Parameters of tuber yield			
	X	b	SEb	S^2d
Kufri Chandramukhi	381.5	$0.88^{××}$	0.108	−1163.2
Kufri Sindhuri	442.6	$1.70^{××++}$	0.405	$3331.0^{××}$
Kufri Alankar	412.0	$1.02^{××}$	0.206	778.4
Kufri Chamatkar	405.4	$1.17^{××}$	0.209	1.44.3
Kufri Sheatman	407.7	$1.15^{××}$	0.301	1265.7
Kufri Jyoti	440.0	$0.84^{××++}$	0.235	$2147.5^{×}$
Kufri Lauvkar	450.0	$1.02^{×}$	0.339	77.8
Kufri Muthu	480.9	$0.88^{××}$	0.194	−295.4
Kufri Dewa	457.2	$1.16^{××}$	0.159	974.9
Kufri Kuber	371.7	0.49	0.281	−38.2
Kufri Naveen	322.1	0.68	0.330	−1540.3
Kufri Safed	445.5	$1.03^{××}$	0.179	1030.7
Kufri Red	357.2	$1.27^{××*}$	0.112	134.7
Katahdin	349.2	$1.11^{××}$	0.164	−772.1
Kufri Lalima	519.0	$1.44^{××××++}$	0.217	$3332.5^{××}$
Craigs Defiance	433.7	$1.00^{××}$	0.399	744.7
Darjeeling Red Round (Blue)	337.9	$0.96^{××}$	0.187	1306.3
Darjeeling Red Round (Red)	332.9	$1.20^{×}$	0.401	−736.8
Kufri Bahar	443.9	1.12	0.521	333.6
Froma	356.4	1.05	0.822	354.5
Fabricia	402.0	$0.93^{××}$	0.203	404.3
Great Scot	317.0	0.44	0.357	133.8
Gulabia	294.4	$1.04^{××++}$	0.283	$3280.3^{××}$
Goya	410.6	$0.94^{××}$	0.141	−569.2
Gineke	246.5	0.39	0.323	−731.9
JF-246	471.5	$1.10^{××}$	0.182	−72.8
JF-303	419.1	$1.12^{××}$	0.167	−181.3
JF-4841	447.6	$1.59^{××++}$	0.350	$3092.1^{××}$
Kufri Badshah	472.3	$1.44^{××++}$	0.406	$1997.6^{×}$
Magestic	267.7	$0.63^{×}$	0.244	−1115.3
D.No. 1645	356.5	$1.09^{××}$	0.341	−264.1
P.S. 655	374.7	$1.24^{××}$	0.373	903.0
PH/A-182	372.5	$1.49^{××}$	0.262	127.3
PH/A-202	309.5	$1.30^{××++}$	0.203	$13806.6^{××}$
Phulwa	101.0	0.21	0.497	−1140.2
Saco	397.3	$1.05^{××}$	0.224	333.3
Up-to-date	376.0	$0.53^{××*}$	0.134	−357.6
VB-8	340.6	0.42	0.252	$2598.8^{×}$
Lalmatti	318.4	$0.89^{×}$	0.354	−764.8
SLB/Z-405(a)	352.4	$0.81^{××}$	0.188	846.8
Average	379.8			

×,××Significant against standard error of regression coefficient (SEb) at 5% and 1% levels, respectively. +,++Significant against remainder M.S. at 5% and 1% levels, respectively. *,**Significantly deviating from unity at 5% and 1% levels against SEb, respectively.

JF-303, which are not released varieties, can be utilized in future breeding programme to incorporate stability, because these genotypes carry genes for stability. There

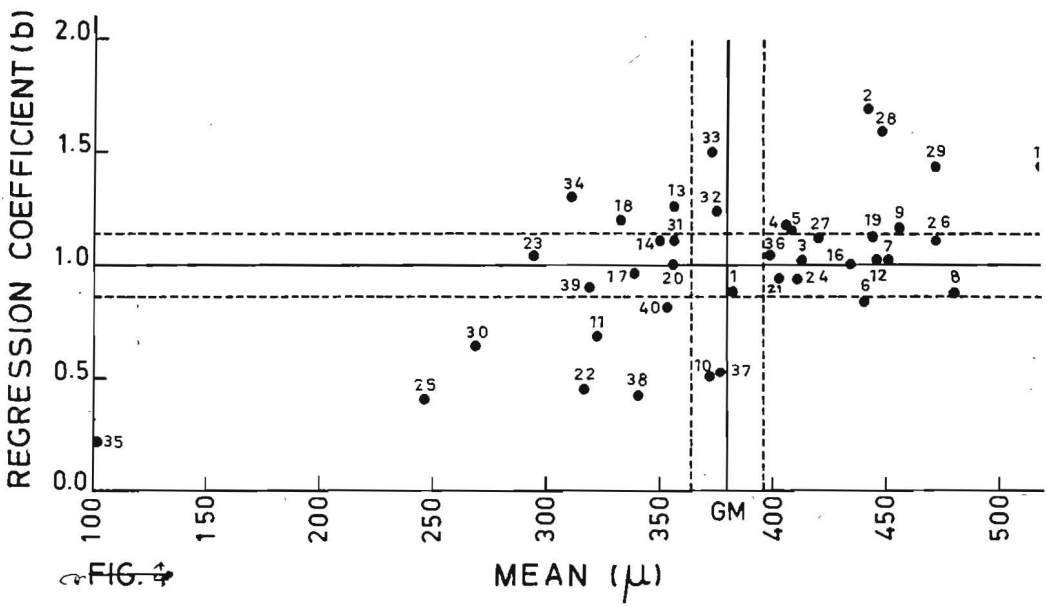

Fig. 1. Mean tuber yield (g/plant) and regression coefficients in potato genotypes.

were other four genotypes which showed above average yield and response. These genotypes, although unstable according to the model of Eberhart and Russsel, (b>1, Fig. 1), are of economic interest due to their specific suitability for rich environments. These four genotypes (Kufri Sindhuri, Kufri Lalima, JF-4841 and Kufri Badshah), which had significant values of S^2d, also had significant estimates of regression mean squares against their own remainder, indicating the presence of predominant predictable component. Thus, these four genotypes can be considered suitable for rich environments. Of these four genotypes, JF-4841 is not identified for release as a cultivar, but can be utilized in future breeding programme. Among the stable genotypes, varieties Kufri Muthu, Kufri Dewa, Kufri Lauvkar, Kufri Safed, Craigs Defiance and Kufri Alankar gave much higher yield than the remaining stable genotypes. Therefore, these varieties may be recommended for cultivation under environments similar to those included in this study.

REFERENCES

1. M. L. Pandita and A. S. Sindhu. 1979. Stability parameters and genotype–environment interaction in potato (*Solanum tuberosum* L.). J. Indian Potato Assoc., **6:** 52–60.

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

3. J. N. Perkins and J. L. Jinks. 1968. Environmental and genotype–environmental components of variability. III. Multiple lines and crosses. Heredity, **23:** 339–356.