STABILITY ANALYSIS IN INDIAN MUSTARD

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ABSTRACT

Forty-two diverse genotypes were evaluated under twelve pertinent environments for stability of seed yield and its components. PR 15 exhibited high mean yield and high stability, while, ten genotypes with high mean yield and average stability. For oil content, RLM 82, RLM 96 and RL 18 showed high mean alongwith high stability. For 1000-seed weight, Varuna ; for seeds per siliqua, RLM 514 ; for siliqua length, RLM 29/25, RLM 185 and RLM 602 and for siliqua on main shoot, RLM 602 and RCU 101, had high mean and high stability. For rest of the characters, none of the genotypes showed high mean associated with high stability. The regression coefficient for seed yield was positively correlated with that for plant height, number of primary branches, siliqua length and 1000-seed weight. The deviation mean square for seed yield had significant positive correlation with that for siliqua length and seeds per siliqua. The characters which did not show significant correlation of stability parameters were considered as homeostatic devices, plasticity of which was important for stability of seed yield. The lines which showed high stability for seed yield had low or average stability for the yield components.

INTRODUCTION

In Indian mustard a lot of variability has been generated by inducing new variants and also by germplasm collection. The newly developed lines have shown wide spectrum of variability for plant traits. The present investigation was conducted over twelve environments to have an idea of relative role of genotype x environmental interaction and the stability of performance of the new promising genotypes.

MATERIAL AND METHODS

Forty two genotypes were selected for the present investigation. These were grown over twelve pertinent environments created by varying dates of sowing and levels of fertilizer. The data were recorded on five competitive random plants for plant height (PH), number of primary branches (PB), number of secondary branches (SB), main shoot length (MSL), Siliquae on main shoot (SM), Siliqua length (SL), seeds per siliqua (SS), 1000-seed weight (SW), plant yield (PY) and oil content (OC). The statistical analysis of the data were done by Eberhart and Russell (1966) method.

RESULTS AND DISCUSSION

The analysis of variance for all the traits is presented in Table 1. The variance due to genotypes, environments and genotype x environmental interactions were highly significant for all the traits. The environment linear component of the variance was significant for all the characters, indicating, that the response to the environment was predictable. The genotype x environmental interaction variances (linear) were also highly significant for all the characters. Mean squares due to pooled deviations were highly significant for all the characters.

The different stability parameters namely mean performance, regression coefficient and mean square deviation from regression coefficient were used for evaluation of the genotypes. For yield per plant, PR 15 exhibited high mean yield and high stability. Eleven lines showed high mean yield with average stability, while fifteen genotypes had average mean yield and average stability. Five genotypes had high mean yield and poor stability. The most stable genotype was K_3 but it was a poor yielder. Apparently, there is a need to breed for high mean yield with high stability which were not collectively possessed by any of the genotypes.

For oil content, RLM 82, RLM 96, and RL 18 had high mean associated with high stability. Another eight genotypes showed high mean performance with average stability, while seven genotypes had high oil content with low stability.

For plant height, Varuna, Pant Rai-I, Pant Rai-1D and Pant Rai-2 ; for siliquae on main shoot, RLM 602 and RCU 101 ; for siliqua length, RLM 29/25, RLM 185 and RLM 602 ; for seeds per siliqua, RLM 514 and for 1000-seed, Varuna, had high mean and high stability. For rest of the characters, none of the genotypes showed high mean along with high stability. So there is a need to breed for the improvement of number of primary branches, number of secondary branches and main shoot length.

The status for mean performance and stability of some of the promising lines is summarised in Table 2. The most important yield components in Raya are plant height, number of primary branches, number of secondary branches, main shoot length and number of siliquae on main shoot. The parental lines which showed high mean and regression coefficient around unity, were RCU 101, P 26/21, RLM 29, RLM 602 and RLM 185. RCU 101 showed high buffering ability for secondary branch number, siliquae on main shoot and siliqua length ; P 26/21 for siliquae on main shoot ; RLM 29 for primary branch number ; siliquae on main shoot and oil content and RLM 602 for secondary branch number, siliquae on main shoot and main shoot length. On the other hand RLM 185 was poor in buffering ability for secondary branch number, siliquae on main shoot and main shoot length. Similar results were reported by Grafius (1956) in oats and Bain and Gupta (1974) in wheat, where yield components shifted in a compensating manner in the variable environments to give consistent performance of the final character namely seed yield.

Bradshaw (1965) observed that stability in morphological traits results from plasticity in certain physiological processes involved in the expression of that trait. These physiological processes act in compensating manner, ultimately exhibiting high buffering ability of the resultant morphological character. In the present investigation, RCU 101 possessed strong system of plasticity for secondary branches ; RLM 29 for primary branches, RLM 602 for secondary branches and main shoot length and RLM 185 for primary branches.

The correlation of stability parameters of seed yield with other characters indicated that stability for seed yield was correlated with the stability for number of primary branches, siliquae on main shoot and 1000-seed weight with respect to linear response ; and with siliqua length in case of non-linear response. It could be inferred that out of seed yield components, secondary branches and main shoot length were the important homeostatic devices chiefly responsible for imparting stability in yielding ability. As was also observed from the patental performance, the variation in these yield components tended to be counter-balanced ensuring uniform yield potentiality in stable genotypes.

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Table 2 : Status for mean performance and stability of the promising lines.

Genotypes	SY		OC		PH		PB		SB		MSL		SM		SL		SS		SW	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
RLM 29/25	A	H	H	L	T	L	A	L	A	A	L	A	A	L	H	H	H	A	A	A
RLM 29	H	A	H	A	T	L	H	A	A	H	A	A	H	A	A	L	A	H	A	A
RLM 45	A	L	H	A	T	L	A	L	H	A	A	A	H	A	A	A	A	H	A	L
RLM 82	H	L	H	H	T	A	H	A	A	A	A	A	A	A	A	A	A	A	A	H
RLM 96	A	H	H	H	T	A	H	A	A	H	A	A	A	A	A	H	A	A	A	A
RLM 185	H	A	H	A	T	L	H	A	A	L	A	L	H	L	H	H	A	A	A	L
RLM 215	A	A	H	L	T	A	H	L	A	L	A	A	H	A	A	H	A	H	L'	A
RLM 234	A	A	H	L	T	A	A	A	H	A	A	A	A	A	A	L	A	H	A	A
RLM 514	A	H	A	L	M	H	H	A	A	H	L	A	A	A	A	A	H	H	L	A
RLM 528	A	A	A	H	T	A	H	A	H	A	A	A	H	A	A	L	A	A	H	A
RLM 602	H	A	A	A	T	L	A	A	H	A	H	A	H	H	H	H	A	L	A	A
P. Rai 15	H	H	A	A	D	A	L	H	A	A	A	A	A	A	H	A	L	H	H	A
RCU 101	H	A	A	L	T	H	H	L	H	A	A	H	H	H	H	A	A	A	L	L
P 26/21	H	A	A	L	T	A	A	A	A	A	A	A	H	A	A	A	L	L	A	A
RL 18	A	A	H	H	T	A	L	H	A	A	A	A	A	A	A	A	A	A	A	A
Varuna	A	A	L	H	D	H	L	H	L	A	A	A	L	H	A	A	A	L	H	H

1 - Mean, 2 - Stability, A - Average, L-Low, H-High, T-Tall, D-Dwarf, M-Medium

Table 1 : Pooled analysis of variance.

Source of variation	d.f.	SY	OC	PH	PB	SB	MSL	SM	SL	SS	SW
Genotypes	41	28.9**	17.4**	10413**	7.8**	33.9**	237**	99**	0.3**	1.7**	2.2**
Environ.	11	663.2**	67.0**	47393**	37.9**	646.5**	4041**	2106**	2.8**	25.7**	3.2**
Variety x Environ.	451	5.6**	1.9**	154**	0.7**	7.2**	30**	14**	0.1**	0.8**	0.1**
Environ. + (Var. x Env.)	462	21.2	2.8	1279	1.6	22.5	135	64	0.1	1.4	0.1
Environ. (linear)	1	7295.2**	731.9**	1274**	416.5**	7110.7**	44441**	28158**	30.7**	282.6**	35.0**
Var. x Env. (linear)	41	5.4**	2.1**	483**	0.8**	7.5**	29**	163**	0.1**	1.4**	0.1**
Pooled deviation	420	5.4**	1.1**	119**	0.6**	7.1**	29**	139**	0.1**	0.7**	0.1**
Pooled error	984	0.15	0.01	75	0.04	0.29	1.07	1.2	0.02	0.01	0.004

** *Significant at P = 0.01*

Table 3 : Correlation coefficient of stability parameters of seed yield with other yield components.

Stability parameters of seed yield	Characters								
	OC	PH	PB	SB	MSL	SM	SL	SS	SY
b-value	0.21	0.53**	0.48**	0.22	0.08	0.10	0.90**	0.18	0.34**
S^2d	–0.18	–0.04	–0.003	0.16	–0.04	0.18	0.98**	0.38**	0.06

** Significant R at P = 0.05 ; ** Significant at P = 0.01*