

STABILITY ANALYSIS OF GRAIN YIELD IN PEARL MILLET USING STANDARD VARIETY MEAN AS ENVIRONMENTAL INDEX

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ABSTRACT

Stability analysis for 12 varieties and one hybrid of pearl millet was performed using mean values of all varieties and mean values of standard variety WC-C-75 across environments as estimates of environmental values. With the standard variety regression analysis the estimates of b_i were smaller with higher standard errors and remainder mean squares, and lower r^2_i values than the estimates of usual regression analysis. The standard variety regression proved less precise than the usual regression analysis.

Key words: *Pennisetum typhoides*, pearl millet, standard variety regression, stability analysis.

In plant breeding, the yield of new varieties is usually compared with the standard variety over a series of trials in order to find its replacement by using stability analysis where mean yield of individual varieties is regressed on the site means of all varieties [1–4]. In the present investigation the use of dependent environmental indices in regression analysis was compared with the regression on standard variety mean values [5] as independent environmental indices using grain yield (kg/ha) data of 12 composite varieties and one hybrid of pearl millet tested in the All India Coordinated Pearl Millet Improvement Project (AICPMIP) advanced population trials during 1987–88 at 26 sites. The standard variety used in the analysis was WC-C-75.

The comparison of stability parameters over the two methods reveals that there was a change in the magnitude of b_i values but not in their ranks since the rank correlation was 0.96 ($P \leq 0.01$). The b_i values, in general, were lower with regression analysis on WC-C-75 variety but their standard errors were consistently higher showing an increase of 0 to 150 per cent over the estimates from the usual regression analysis. This is also reflected in the higher estimates of the remainder mean squares. The coefficient of determination was 79 to 96% with the usual regression analysis but it was 72–87% with the standard variety regression revealing a better fit of the linear model with the former. The rank correlation

between the remainder mean squares of the two methods was nonsignificant ($r_s = 0.17$, $P > 0.05$). This clearly demonstrates that the regression analysis on standard variety WC-C-75 is less precise than the usual regression analysis (Table 1).

Table 1. Estimates of stability parameters for grain yield of different pearl millet varieties/hybrid using environmental mean values (ej) and standard variety (WC-C-75) mean values as environmental indices

Variety	Mean yield (kg/ha)	On ej values				On WC-C-75			
		bi	SE bi	Rem M.S.	r^2_i	bi	SE bi	Rem M.S.	r^2_i
MP 122	1745	0.91	0.05	47380	0.93	0.81*	0.09	165772**	0.77
MP 131	1826	1.09	0.07	110808**	0.90	0.97	0.12	289154	0.74
MP 143	1847	1.06	0.06	65682**	0.93	0.95	0.10	212886**	0.78
MP 153	1834	1.02	0.06	80608**	0.91	0.97	0.08	139278**	0.85
MP 154	1851	0.92	0.10	178774**	0.79	0.87	0.10	217753**	0.75
MP 155	2007	1.08	0.04	37010	0.96	0.96	0.10	204535**	0.80
MP 156	1865	1.12*	0.05	56905*	0.95	1.01	0.10	218594**	0.80
MP 158	1908	1.11	0.06	81368**	0.93	1.06	0.08	144304**	0.87
MP 159	1817	1.00	0.06	78914**	0.91	0.87	0.11	247439**	0.72
MP 161	1614	0.89	0.08	124145**	0.84	0.81	0.10	212174**	0.73
MP 162	1640	0.84	0.08	119479**	0.83	0.77*	0.10	196719**	0.72
WC-C-75	1764	0.96	0.07	102985**	0.88				
MBH 130	1912	1.00	0.07	95601**	0.90	0.90	0.10	218891**	0.76
LSD (0.05)	102								

** Significant at 5 and 1% levels, respectively, for the remainder; * on bi values indicates significant differences from unity.

The results from the two analyses will be similar to the extent that standard variety performance is close to the average performance of all varieties across environments. A bi value of 0.96 of WC-C-75 indicates that it responds to environments in the same way and to the same degree as the mean of all varieties but the significant remainder mean square of WC-C-75 reflects the instabilities and unpredictability of response. When a combined regression analysis was performed [6] both mean squares due to combined regression and remainder were significant indicating that although a significant portion of variation among environments is accounted for by the regression of WC-C-75 on environmental indices yet a major portion remained unaccounted for. Thus the similarity of performance between WC-C-75 and environmental indices was not complete which is reflected in the less precise analysis using WC-C-75 as the independent variable.

The regression coefficient of a variety performance on WC-C-75 would be unity if the response of the variety is the same in magnitude and direction as that of WC-C-75 and the variety will not show any interaction in relation to the standard variety. However, if $b \neq 1$ the variety would show interaction as in the case of MP 122 and MP 162 where their b_i 's are less than unity. These varieties showed interaction and are less responsive than WC-C-75 to improvement in environments.

It may be concluded that the use of general response of all genotypes as measure of environmental effect needs not to be replaced with the standard variety in the regression analysis of stability unless there is a priori basis to the contrary.

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