

Stability analysis for yield and quality of some sugarcane clones

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ABSTRACT

Varietal trial experiments with some advance lines of sugarcane were conducted at 4 different cane growing zones of Bangladesh with a view to screening out the most stable genotypes. Experimental results revealed that the genotypes I-156/66, I-2/66 and I-92/66 showed almost stable cane yield at all the places. For recoverable sucrose content I-112/67, I-170/67 and I-144/66 showed better stable performance at all environments. But in considering both yield and quality I-112/67 was found to show better stability at all the locations.

INTRODUCTION

The expression of a phenotypic character is dependent upon the interaction of genotype and environment. At different environments the expression of a character may be varied. This differential response of a genotype due to environmental variation is a problem for selecting genotypes. In any successful breeding programme it is necessary to screen and identify phenotypically stable genotype which could perform persistent performance under a wide range of environments. The statistical analysis used by Finlay & Wilkinson (1963) and Eberhart & Russell (1966) is useful tool for determining the phenotypic stability of a genotype. Finlay and Wilkinson (1963) used simple linear regression as a quantitative measure of phenotypic stability to describe varietal adaptability in a range of environments. According to them absolute phenotypic stability of a line would be expressed by $b = 0$ and the ideal variety in respect of adaptation would be the one having the maximum yield potential in the most favourable environment. Later on Eberhart and Russell (1966) suggested that in addition to mean and regression, deviation from regression should be considered. According to them an ideally adaptable variety would be the one having mean value, unit regression co-efficient ($b = 1.0$) and a deviation from regression as small as possible ($S^2_{di} \rightarrow 0$).

Genetically sugarcane is highly heterozygous. Environmental influence on the expression of characters of this crop is prominent. Selection of genotypes under a wide range of environment is important for developing stable sugarcane varieties. The present

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investigation was undertaken with a view to screening out sugarcane clones which were phenotypically stable at all the cane growing zones of Bangladesh.

MATERIALS AND METHODS

The study was undertaken during the year 1977-78 simultaneously at the experimental farms of Sugarcane Research Institute, Ishurdi, Carew & Co. Ltd., Darsana, Rajshahi Sugar Mills, Rajshahi and Thakurgaon Sugar Mills, Dinajpur. Experimental materials included at each location were I-2/66, I-149/66, I-156/66, I-170/67, I-134/70, I-92/66, L, Jaba-C, I-112/67 and Co. 1158. The experiment was laid out in randomized block design at each zone. Equal normal cultural practices were followed. For this study observations were made only on yield of cane per acre and percentage of recoverable sucrose content.

The statistical analysis of stability were performed by utilizing the methods of Eberhart and Russell (1966). The model suggested by them to compare genotypes with regard to stability of performance is $Y_{ij} = \bar{M}_i + B_i l_j + d_{ij}$, ($i = 1, 2, \dots, V$, $J = 1, 2, \dots, N$) where Y_{ij} denotes the mean value of the i th variety at the j th environment, $\bar{M}_i$ refers to the mean of the i th variety over all environment, B_i is the regression co-efficient that measures the response of the i th variety to varying environments, l_j is the environmental index obtained as the mean of all varieties at the j th environment minus grand mean and d_{ij} denotes the deviation from regression of the i th variety at the j th environment, V being the total number of varieties and N the number of different environments included in the investigation. In this method a variety simultaneously satisfying the following properties is defined as a stable and desirable variety: (i) its mean ($\bar{Y}_i$) is greater than grand mean (M), (ii) the value of its estimated regression co-efficient (B_i) on varying environments is approximating to unity, and (iii) the estimated value of mean deviation from regression ($S^2 d_i$) for the variety is as small as possible.

RESULTS AND DISCUSSION

The data on yield and quality were analysed separately for partitioning the explainable and non-explainable parts of the genotype environment interaction. The varietal differences were found highly significant in individual location and also when pooled over the four locations (Table 1). Genotype Environment interaction was also found statistically significant indicating the phenotypic unstability of the genotypes under varying environments (Table 1). Similar results were also observed by S. Subba Rao *et al.*, (1978) in studying the genotypic stability of sorghum varieties.

Stability parameters shown in the Table-2 indicated that the clones I-156/66, I-2/66 and I-92/66 showed higher cane yield than the grand mean, almost unit regression values and smaller deviation from regression results. The strains I-149/66 and I-170/67 out yielded the grand mean but showed greater 'b' and smaller deviation from regression values. In case of the strain I-112/67 almost similar cane yield with the grand mean, unit 'b' & smaller deviation from regression values were observed (table 2). For the percentage of recoverable sucrose content I-112/67, I-170/67 and I-149/66

were found to exceed the grand mean. In case of unit regression (b) and smaller deviation from regression ($S^2 di$) value these three strains showed desirable performance indicating their stable adaptability.

Table 1. Pooled analysis of variance.

Source of variation	df	M.S.	
		Yield in TCA	Recoverable sucrose content (%)
Replication within location	12	52.71**	0.018
Location	3	493.87**	0.957**
Location (Lender)	1	37.32	0.071**
Genotype	9	114.35**	0.108**
Location X Genotype	27	68.61**	0.019**
Regression	9	72.74**	0.076
Pooled deviation	20	9.92	0.005
Error	108	14.99	0.010

** = Significant at 1% level.

Table 2. Stability parameters for yield and quality of some sugarcane clones.

Genotypes	Yield in (TCA)			Percentage of Quality (Recoverable sucrose content)		
	$\bar{y}$	b	$S^2 di$	$\bar{y}$	b	$S^2 di$
Co.1158	35.08	1.08	2.48	9.84	1.0879	-0.0087
I-2/66	38.43	1.27	-14.86	9.30	0.8908	-0.0098
I-149/66	37.92	2.61	-12.09	10.69	1.3362	-0.001
I-156/66	41.04	0.52	-10.98	9.80	0.8099	-0.0003
I-170/67	36.98	2.14	10.54	10.58	0.8525	-0.0034
I-134/70	34.67	1.03	-11.64	9.93	1.1787	-0.0064
I-92/66	39.06	1.54	-13.13	9.81	0.7631	-0.0090
L-Jaba-A	34.06	-0.45	26.83	9.95	1.3418	0.0053
L-Jaba-C	33.96	-0.35	2.24	10.04	0.6823	-0.0084
I-112/67	36.67	0.56	-9.03	11.69	1.1333	-0.0065
Grand Mean	36.79			10.10		

In conclusion considering both yield and quality I-112/67 may be considered as stable genotype for all locations and further observations are needed for the strains I-149/66 and I-170/66.

Acknowledgement

The authors are greatly indebted to Mr. Abdul Gafur, Assistant Statistician, Sugarcane Research Institute, Ishurdi, Pabna for his help in statistical analysis.

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