Short Communication

Indian Journal of Sugarcane Technology **28(02)**: 100-101, December 2013

Genotype x Environment Interaction in Sugarbeet under sub-tropical conditions

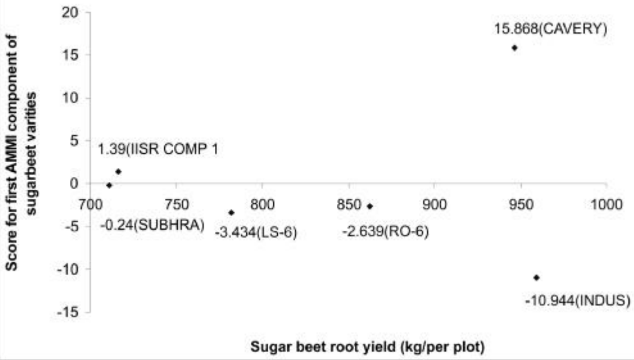
RAJESH KUMAR, A D PATHAK and P K BAJPAI

Indian Institute of Sugarcane Research, Lucknow 226002, India

The AMMI (additive main effects and multiplicative interaction model) was applied to a set of six sugar beet genotypes ('IISR COMP - 1', 'SHUBHRA' (HI 0064), 'LS-6', 'CAUVERY', 'Ramonskaya-06' and 'INDUS' (Pasoda) grown under sub-tropical conditions to test its usefulness and efficiency in comparison to linear regression techniques towards crop maturity and to assess the tolerance of varieties to heat and root rot at four dates of harvesting in the months of May and June. A number of methods have been used to estimate GE interaction in crop plants and the linear regression models have been widely used in this regard (Eberhart and Russell 1966; Perkins and Jinks 1968). However, the presence of non-linear interaction limits their wider applicability. Gauch (1988, 1992) used additive main effects and multiplicative interaction (AMMI) model to overcome some of these weaknesses. The model has been shown to be more accurate as it fits additive main effects for genotypes and environments by an ordinary analysis of variance (ANOVA) procedure and then applies principal component analysis (PCA) to the matrix of residuals of that remains after fitting of the main effects. Zobel *et al.* (1988) demonstrated that the normal analysis of variance procedure fails to detect a significant interaction component. The PCA alone fails to identify and separate the significant genotype and environment main effects and linear regression approach accounts for only a small portion of the interaction sum of squares (SS) when the pattern fits a specific regression model. The AMMI model which is a hybrid model takes care of all these limitations and is able to captures major portion of main effects SS and interactions SS from treatment SS was used for identification of stable genotypes under sub-tropical conditions.

The present investigation was, therefore, carried out (i) to study the genotype x environment interaction in sugar beet under sub-tropical conditions, (ii) to compare the efficiency of AMMI model with linear regression techniques and (iii) to select stable genotypes under such conditions. An experiment was conducted in Randomised Block Design with six sugar beet varieties replicated four times. The crop was harvested at four different dates in the month of May and June and sugar beet root yield was recorded. The study indicated the presence of non-linear interaction in sugar beet. AMMI -1 component accounted 82.83% of total GE interaction SS (Table 2) where as in case of GE regression SS accounted only 6.12 % in case of linear regression model (Table 1). AMMI analysis of data was found to take care of this limitation of presence of non linear interaction effectively and significantly improved the probability of selection of best genotypes as IPCA -1 was able to capture 76.71% more of GE interaction SS than that of linear regression model.

Graph 1- Interaction bi-plot of scores for first AMMI component and sugarbeet yield of different varities



The IPCA-1 scores of the genotypes can be taken as a parameter of stability. The genotypes with IPCA-1 scores near zero ('SUBHRA') and ('IISR COMP-1') were treated as stable in comparison to other genotypes. This information can be effectively displayed in a biplot showing main effect means on the abscissa and IPCA-1 values as the ordinates. The genotypes like 'CAVERY' and 'INDUS' had high yielding ability with high IPCA-1 scores indicating their specific adaptations to the environments concerned. Both of the above genotypes also performed better for sugar beet yield.

AMMI analysis significantly improved the probability of selection of best genotypes as AMMI picked different winners than that by cell mean model (Table 5). This is because noise portion of GE interaction SS was relegated to the residual SS efficiently and IPCA-1 SS accounted for 30.9 % more GE interaction SS than GE regression SS and was therefore rich in pattern. In the present analysis also the overall ranking of genotypes based on the means and by AMMI had great discrepancies and therefore the selection based on the mean estimation will not be precise. The present analysis therefore indicates that it is not only important to estimate the GE interaction but to pattern's it also. Such type of data must be subjected to AMMI analysis to get the desired results.

The genotype 'Indus' was found to be suitable for bad environment and high yielding for root yield to other genotypes as revealed by bi-plot of AMMI component-1 score and root yield for all the genotypes. The other genotype Ramonskaya-06 was also found to be stable but it recorded lower root yield than the 'Indus' and 'Cauvery' genotypes by AMMI analysis. The genotype 'Cauvery' was also found to be high yielding and suitable for good environment. The approach was found to be superior to all mean models to select best genotypes across environments for sugar beet crop. Moreover, the model was also found to provide answer for specific adaptations under sub-tropical condition in case of sugar beet crop.

REFERENCES

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

Gauch H G. 1992. Statistical analysis of regional yield trials: AMMI analysis of factorial designs. Amsterdam: Elsevier.

Gauch H G and Zobel R W. 1988. Predictive and postdictive success of statistical analyses of yield trials. *Theoretical and Applied Genetics,* **76**:1-10.

Perkins J M. and Jinks J L. 1968. Environmental and genotype-environmental components of variability. *Heredity,* **23**:339-356.

Zobel R W, Wright M J and Gauch H J. 1988. Statistical analysis of a yield trial. *Agronomy Journal,* **80**: 388-393.