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Evolution of Spring Barley Genotypes in Multi-Environments Trials

by AMMI and GGE Biplot Analysis

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Abstract

The uniformity of genotypes is significant for crop breeding program decisions to selection and improves new varieties. The AMMI (Additive main effects and multiplicative interaction) analysis and Genotype x Environment Interaction (GEI) is make to estimation grain yield and understands GxE interaction patterns by researches as differential ranking of variety yields in multi-environment trials. Therefore, fifteen barley advanced line, six national cultivars and four foreign varieties (registered in abroad) were used in the study. The experiments were performed according to a complete randomized block design with four replications at five environments during two years. The stability and superiority of genotypes for yield and other traits were determined using AMMI and GGE Biplot analysis. Factors (G, GE, and GEI) were found to be highly significant (P < 0.01) for grain yield. AMMI analysis indicated that the major contributions to treatment sum of squares were environments (98.52%), GE (0.45%) and genotypes (1.02%), respectively, suggesting that grain yield of genotypes were affected environmental conditions. The GGE Biplot indicated that PCA 1 axes (Principal component) was significant as P<0.01 and supplied to 49.36% of complete GxE interaction. The AMMI indicated that G8 and G23 desirable and stable genotypes for grain yield in multi-environment. Moreover, E2 and E5 (irrigated environments) were high yielding, while E3 (drought stress) low yielding as forecast. On the other hand, GGE Biplot indicated that three group were occurred among traits, first group (GY: grain yield, CC: crude cellulose, CD: cold damage), second group(PC, HW: hectolitre weight, TGW: thousand grain weight, SH: seed humidity), third group(LOD: lodging, PH: plant height, HT: heading time). Moreover: the study showed that G3, G6, G7, G8, G13 and G21 were the best genotypes both grain yield and other traits. The results of AMMI model and GGE Biplot indicated that G8 is suitable to recommend for release and G23 desirable origin for yield stability and G7 valuable source for quality to use in barley breeding program.

Keywords: Barley; GEI; AMMI; GGE biplot; Grain yield; Stability