Genotype × Environment interaction and stability analyses of yield and yield components of established and mutant rice genotypes tested in multiple locations in Malaysia

ABSTRACT

Genotypes evaluation for stability and high yielding in rice is an important factor for sustainable rice production and food security. These evaluations are essential especially when the objective of the breeding program is to select lines with high adaptability and stability. This study was conducted to investigate G × E interaction over ten environments across the peninsular Malaysia for yield stability in fifteen rice genotypes comprising twelve mutant lines and three established varieties. The experiment was laid out in a randomized complete block design with three replications across the environments. Yield component traits were evaluated over multiple harvests and measured as number of tillers per hill, filled grains per panicle, grain weight per hill and yield per hectare. Data analyses were through analyses of variance and stability analyses were conducted for univariate and multivariate stability parameters. The pooled analysis of variance showed highly significant differences among genotypes, locations, seasons, and genotypes by environment (G × E interaction) for all the traits. Based on univariate (bi, , σi2, Wi2, YSi) and multivariate (AMMI and GGE biplot) stability parameters, rice genotypes were classified into three main groups. The first group are genotypes having high stability along with high yield. These genotypes are widely adapted to diverse environmental conditions. The second group is a genotype that exhibited high yield but low stability, this genotype is suitable for specific environments. The last group is genotypes with low yield and high stability. Genotypes in this class are more suitable for breeding specific traits or yield component compensation such as the capacity to recover rapidly from stresses. Significant rank correlations were measured for regression slope (bi), deviation from regression (), Shukla stability variance (), Wricke's ecovalence (), and Kang stability statistic (YSi) for all the traits.

Keyword: Rice; Stability; GGE biplot; AMMI; Genotype × environment interaction; Multi-environment