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Multi-environment Trial Analysis for Yield-related Traits of Early Maturing Korean Rice Cultivars

Seung Young Lee^{1,2}, Hyun-Sook Lee¹, Chang-Min Lee¹, Su-Kyung Ha¹, Youngjun Mo^{2*}, Ji-Ung Jeung^{1*}

¹National Institute of Crop Science, Rural Development Administration, Wanju 55365

²Department of Crop Science and Biotechnology, Jeonbuk National University, Jeonju 54896

[Abstract]

Genotype-by-environment interaction (GEI) refers to the comparative response of genotypes to different environments conditions. Thus, understanding GEI is a fundamental component for selecting superior genotypes for breeding programs. The significance of utilizing early maturing cultivars not only provides flexibility in planting dates, but also serves as an effective strategy to reduce methane emission from the paddy fields. In this study, we conducted multi-environment trials (METs) to evaluate yield-related traits such as culm length, panicle length, panicle number, spikelet per plant, and thousand grain weight. A total of eighty-one Korean commercial rice cultivars categorized as early maturing cultivars, were cultivated in three regions, two planting seasons for two years. The genotype main effect plus genotype-by-environment interaction (GGE) biplot analysis of yield-related traits and grain yield explained 70.02–91.24% of genotype plus GEI variation, and exhibited various patterns of mega-environment delineation, discriminating ability, representativeness, and genotype rankings across the planting seasons and environments. Moreover, simultaneous selection using weighted average of absolute scores from the singular value decomposition (WAASB) and multi-trait stability index (MTSI) revealed six highly recommended genotypes with high stability and crop productivity. The winning genotypes under specific environment can be utilized as useful genetic materials to develop regional specialty cultivars, and recommended genotypes can be used as elite climate-resilient parents to improve yield-potential and reduce methane emission as part to accomplish carbon-neutrality.

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*Corresponding author: E-mail, jrnj@korea.kr Tel, +82-63-238-5231