

The Application of GGE Biplot Analysis for Evaluating Test Locations and Mega-Environment Investigation of Cotton Regional Trials

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Abstract

In the process to the marketing of cultivars, identification of superior test locations within multi-environment variety trial schemes is of critical relevance. It is relevant to breeding organizations as well as to governmental organizations in charge of cultivar registration. Where competition among breeding companies exists, effective and fair multi-environment variety trials are of utmost importance to motivate investment in breeding. The objective of this study was to use genotype main effect plus genotype by environment interaction (GGE) biplot analysis to evaluate test locations in terms of discrimination ability, representativeness, and desirability, and to investigate the presence of multiple mega-environments in cotton production in the Yangtze River Valley, China. Four traits (cotton lint yield, fiber length, lint breaking tenacity, micronaire) and two composite selection indices were considered. It was found that the assumption of a single mega-environment in the Yangtze River valley for cotton production does not hold. The YaRV consists of three cotton mega-environments: a main one represented by 11 locations and two minor ones represented by two test locations each. This demands that the strategy of cotton variety registration or recommendation must be adjusted. GGE biplot analysis has also led to the identification of test location superior for cotton variety evaluation. Although test location desirable for selecting different traits varied greatly, Jinzhou was found to be desirable for selecting for all traits considered while Janyang was found to be desirable for none.

English abstract

In the process to the marketing of cultivars, identification of superior test locations within multi-environment variety trial schemes is of critical relevance. It is relevant to breeding organizations as well as to governmental organizations in charge of cultivar registration. Where competition among breeding companies exists, effective and fair multi-environment variety trials are of utmost importance to motivate investment in breeding. The objective of this study was to use genotype main effect plus genotype by environment interaction (GGE) biplot analysis to evaluate test locations in terms of discrimination ability, representativeness, and desirability, and to investigate the presence of multiple mega-environments in cotton production in the Yangtze River Valley, China. Four traits (cotton lint yield, fiber length, lint breaking tenacity, micronaire) and two composite selection indices were considered. It was found that the assumption of a single mega-environment in the Yangtze River valley for cotton production does not hold. The YaRV consists of three cotton mega-environments: a main one represented by 11 locations and two minor ones represented by two test locations each. This demands that the strategy of cotton variety registration or recommendation must be adjusted. GGE biplot analysis has also led to the identification of test location superior for cotton variety evaluation. Although test location desirable for selecting different traits varied greatly, Jinzhou was found to be desirable for selecting for all traits considered while Janyang was found to be desirable for none.