



Using AMMI Analysis to Select the Most Stable and Productive Varieties in Plant Breeding Programs. Review Article

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ABSTRACT

The genetic stability of genotypes under fluctuating environmental conditions is one of the most important elements in plant breeding programs. These factors enable breeders to make decisions regarding the adaptability of different genotypes to various environments. However, reactions of different genotypes to extreme environmental factors such as water stress, high temperatures, salinity, and other stresses complicate the choice of superior genotypes. So, analysis of genetic stability (in particular, the AMMI model) and estimation of GEI could be one of the most important criteria that plant breeders should take into consideration. In this regard, plant breeders use various statistical tools and methods for the detection of stable and high-yielding genotypes across environments. Of the many tools available, AMMI Biplot is one such important and effective methodology. This method is capable of showing those genotypes which combine genetic stability with productivity in various environments. Such genotypes are considered stable due to their superior genetic makeup and resilience to changeable environmental conditions. The AMMI-Biplot technique has been very efficient in the analysis of GEI and in the identification of superior genotypes. In the plant varieties, genetic stability is thought of as a multivariate character that is a consequence of the interaction of thousands of gene pairs with various environmental factors, therefore causing wide variations in the phenotypic expression of the characters. Genetically stable genotypes possess a high level of adaptability to diverse approved environments. The importance of this interaction in agriculture rests on the fact that testing of varieties in more than one environment is a pre-requisite for its approval, as well as for selecting a suitable environment and the development of genetically stable varieties resistant to environmental fluctuations. For this reason, the relevance of AMMI analysis rests on the possibility of classifying genotypes according to their stability in the environment, identification of optimal environments for each genotype, and realization of the analyses of the genotype-environment interaction through biplots. The final objective of AMMI analysis is thus to study the interaction of genotypes with environmental conditions for assessing productivity stability of varieties.

Keywords: AMMI Analysis, Varieties, Yield Stability, Biplot Analysis, Multi-Environment Trials, Plant Breeding Programs..

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INTRODUCTION

The AMMI-Bi-plot analysis is a modern and highly efficient procedure for genetic stability analysis and variety selection based on high productivity and stability. The AMMI model (Additional Main Effects and Multiplier Interaction) tries to analyze interaction between genetic factors (genes) and various environments for the identification of those genotypes that interact positively with desirable environmental conditions. AMMI analysis helps to reveal the genotypes whose performance in the environment has been stable; this will enable plant breeders to identify the best varieties most adapted under differing conditions [1].

GEI interaction poses a constant challenge for plant breeders, as it weakens the correlation between phenotypic and genotypic values and complicates the selection of genotypes when assessed in multiple environments [2, 3, 4]. In the presence of GEI, breeders often use the analysis of genetic stability to discriminate between most productive and