

Gene action for physiological parameters and use of relative water content (RWC) for selection of tolerant and high yield genotypes in F₂ population of wheat

ABSTRACT

In order to identify parents suitable for use in a breeding program for the development of high quality and high yield varieties of bread wheat with drought tolerant genotypes, the combining ability and gene action for certain physiological traits were investigated in half-diallel crossings among eight parental lines. The cultivars investigated (Irena/Babax//Pastor, S-78-11, Tajan, Chamran, Moghan3, Hamoon, Veery/Nacozari and Hirmand) possess different tolerance levels to drought stress. Eight parental genotypes, and their resulting 28 F₂ generations, were grown in a triplicate randomised complete block design. Drought stress and non-stress conditions were achieved through irrigation at 75% and 25% soil moisture depletion. Data were subjected to analysis of variance, combining abilities factor analysis and correlation analysis between drought tolerance indices and factor scores (according to Griffing's method 2, model 1). General combining ability and specific combining ability effects were significant for traits; however, non-additive gene effects were dominant over additive effects. The cultivar Chamran transmitted high relative water content (RWC) to its progeny, based on general combining ability. Broad-sense heritability was high and strict-sense heritability was low for the traits, confirming the importance of non-additive gene effects. The results of factor analysis revealed that three factors explained approximately 70% of total variation; these factors were strongly influenced by chlorophyll a and b, proline content, cell membrane stability, RWC and plant yield. Based on drought stress indices (STI and GMP), the cross Irena×Chamran was the most tolerant genotype. Correlation coefficients between two drought stress indices and the third factor from the factor analysis, which influenced RWC and plant yield, were positive and significant. Thus, RWC may be a good criterion for selection of tolerant genotypes with higher yields in breeding programmes.

Keyword: Combining ability; Drought stress; Factor analysis; Gene action; Physiological parameters