



Tropentag, September 19-21, 2012, Göttingen -
Kassel/Witzenhausen

“Resilience of agricultural systems against crises”

Genetic Variation of Stem Characters in Wheat (*Triticum aestivum* L.) and their Relation to Yield Components under Drought and Heat Stress

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Abstract

Drought and heat stresses, singly or in combination, are major constraints to wheat during grain filling in Mediterranean environments. After anthesis, the stored carbohydrates in stems play an important role in grain filling in wheat. The aim of this study was to find out the relationship between stem characters such as diameter, weight, and density and yield components including 1000-kernel weight (1000-KW) and grain yield per spike (GYPS). In addition, the genetic control of these characters was investigated. In season 2006/2007, a 7-parents F_1 diallel cross was grown under favourable, drought and combined drought and heat stresses environments. Polygenes with mainly additive effects were involved in the control of stem characters. Results showed that only stem diameter showed highly positive correlation with 1000-KW and GYPS under the three different environments. Stem density was positively correlated with 1000-KW under favourable environment and with GYPS under drought environment. On the other hand, stem weight did not show any correlation with the respective characters. The narrow-sense heritability (h^2) of stem diameter was of comparable magnitude under favourable (0.73), drought (0.62) and combined drought and heat stress (0.76). Stem diameter was negatively and significantly correlated with heat susceptibility index of 1000-KW (-0.37) but it was not significantly correlated with GPYS. The relationship between significant stem characters and 1000-KW and GYPS in 12 F_2 populations forming a 3×4 North Carolina Design was also investigated under heat stress in season 2007/2008. Stem diameter ($h^2 = 0.62$) displayed positive correlation with 1000-KW under heat stress which was uniformly significant in the 12 F_2 populations analysed and with GYPS in only 9 of the 12 populations. However, under heat stress stem density ($h^2 = 0.52$) was positively correlated with 1000-KW in only 5 F_2 populations and with GYPS in only 6 of the 12 F_2 populations. Based on strong correlation among stem diameter and yield components characters under stresses, we concluded that this character plays an important role in grain filling under such circumstances. This is possibly due to a greater stem capacity to store assimilates. Subsequently, after anthesis, these assimilates are being remobilised to grains.

Keywords: Heat susceptibility index, stem diameter, yield attributes