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“Development on the margin”

Impact of Post-anthesis Water Deficit Stress on Water Use Efficiency and Yield in Mediterranean and mid-European Wheat Cultivars

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Abstract

Cultivation of wheat prevails in the subtropic and temperate climates with water shortage being frequently a severe constraint during the late season particularly in Mediterranean and continental areas. Hence we examined wheat cultivars from Mediterranean (cvs. Golia + Gönen) and temperate climates (cvs. Monsun, Taifun, Naxos and Triso) with respect to their performance of water use and yield under post-anthesis water deficits.

Plants were raised in pots under a rain shelter from April to August 2007, 2009 and 2010 receiving the same optimum treatment throughout the season apart from a 3 week period after heading in which soil moisture was either maintained at field capacity or was lowered and kept at 75 % to 50 % of the available field capacity by deficit irrigation. The 2-factorial experiments (cvs. \times water) had a complete block design with 5 replicates.

Water use efficiency (WUE), and its components, evapotranspiration efficiency (ETE) and harvest index (HI), displayed consistent differences between the cultivars each year resulting in a stable rank order for WUE (Triso \geq Naxos \geq Monsun \sim Taifun $>$ Golia $>$ Gönen) though temperature varied considerably between the 3 years. Post-anthesis water deficits had just slight effects on WUE in 2007 and 2009, but improved it significantly in 2010. ETE as well as HI correlated equally well with the variation in WUE due to cultivars, irrigation regimes, and years.

Deficit irrigation lowered grain yield by only 6 and 9 % in 2007 and 2010 resp., but not in 2009, and did not change ranks among cultivars (Triso \sim Naxos \sim Monsun $>$ Taifun $>$ Golia $>$ Gönen). In 2007, irrigation regimes interacted with cultivars obviously due to a lowering of the yield by deficit irrigation in all cultivars (6–12%), but not in Taifun. In 2010, all cultivars responded similarly to water deficits (8–15 %, no interaction cvs. \times water).

Hence, all tested cultivars seemed to be similarly susceptible to mild post-anthesis water deficits. However, since Mid-European cultivars displayed lower WUEs than Mediterranean ones and since yield of the former ones under stress exceeded that of each of the latter ones without stress, conclusion is reasonable that the 2 Mediterranean cultivars are not better adapted to the future Mid-European climate.

Keywords: Adaption to drought, components of water use efficiency, wheat of different origin, yield