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Effects of soil water deficit and air humidity on reflectance indices and biomass in spring wheat

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Abstract

Wheat productivity is challenged by increasingly frequent periods of soil water deficit. As a consequence of global warming, air humidity is also decreasing, which stimulates further water losses through evapo-transpiration. Identification and physiological characterisation of wheat germplasm resilient to both soil- and air-borne water deficit is crucial to improve yield stability under increasingly adverse growing conditions. Plants of 5 spring wheat genotypes selected from the Best Physiological Traits panel developed by CIMMYT, were cultivated in the greenhouse at the University of Hohenheim during November-December 2022 and February- March 2023 for 6 weeks, under two different air relative humidity (average daily relative humidity 78.6 % and 36 %). Average air temperature was 31.5 OC/ 25.1 OC, (day/night). Photosynthetic photon flux density at the top of the canopy was 600 μmolm^{-2} s^{-1} kept for 14 hours a day. When 5-week-old, watering was withheld for 7 days to half of the plants, after which the flag and third leaf from top were measured for photochemical reflectance index (PRI) which is associated to de-epoxidation of the xanthophyll cycle, and SPAD as a surrogate of chlorophyll concentration. Plants were also harvested to determine dry weight and leaf area per plant. Leaf area and total plant biomass were decreased by both, soil- and air-borne water deficit. Moreover, genotypes responded differently to the stress as the genotype by stress (soil- and air-water deficit) were significant. SPAD values were decreased by air humidity in the flag leaf whereas the third leaf it was only affected by soil water deficit and the interaction between genotype and soil and/or air water deficit was not significant. The PRI of the flag leaf was not affected by either soil water deficit or air humidity, this could be due to the relatively low light intensity achieved in the greenhouse. However, genotypes did showed differences in PRI. We found no association of the spectral reflectance indices and the biomass

Keywords: Air humidity, photochemical reflectance index (PRI), soil moisture, xanthophyll cycle

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