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Effects of water deficit and radiation intensity on leaf pigments in (sub)tropical bread wheat

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Abstract

(Sub)tropical wheat production is threatened by increasing, climate change -induced frequencies and intensities of soil- and airborne water deficits. Leaves, and in particular their pigments, form the basis for assimilate accumulation in plants and, therefore, the source for yield building processes. Under intense solar radiation alone, or in combination with water deficit, leaves may adapt their pigment composition to mitigate negative impacts and maintain the integrity of the photosynthetic apparatus. However, little is known about the genetic variation in pigment composition and its potential for acclimation to stress in wheat.

To test this, 4 contrasting wheat lines from CIMMYT's Best PT panel, funded by IWYP (International Wheat Yield Partnership) and FFAR (Foundation for Food & Agriculture Research), were grown in a glasshouse at the University of Hohenheim, in 1.5 l pots containing a 50/50 (v/v) mixture of soil and commercial compost. Five-week-old plants were exposed to low VPD, targeting values of 0.7 and 0.2 kPa day and night, watering withhold for 10 days and an increased radiation intensity of 1200 μmol m^{-2} s^{-1} for 1 week. Chla fluorescence, photochemical reflectance index (PRI), and SPAD were measured on the youngest fully developed leaf and two older leaves lower on the main tiller at the beginning and at the end of treatments. Concomitantly with these measurements, leaf samples were taken and immediately frozen in liquid N_2 for further pigments analysis by HPLC. Results will be discussed in relation to: 1. Identification of differences in pigment composition among wheat lines with contrasting response to water deficit and radiation intensity; 2. association of changes in the pigment ensemble and leaf reflective properties, elicited by soilborne water deficit and radiation intensity; 3. Discuss the potential of photoprotective pigments as a selection trait for drought resilient wheat.

Keywords: HPLC, leaf pigments, radiation intensity, water deficit, wheat

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