Institute of Agricultural Sciences in the Tropics (Hans- Ruthenberg-Institute) Water stress Management (490g)

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

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Introduction

- Wheat productivity is being challenged by increasingly frequent periods of soil water deficit.
- Global warming is also causing air humidity to decrease, stimulating further water losses through evapotranspiration.
- Identification and physiological characterization of wheat germplasm resilient to both soil- and air-borne water deficit is crucial to improve yield stability under adverse growing conditions.

Conclusions

- PRI is used for the assessment of plant stress as it is associated to DEPS. In this study it was not affected by either soil water deficit and/or air humidity. This can be attributed to the relatively low light intesity achieved in the greenhouse (around 600 μmolm^{-2} s^{-1}). However values for genotypes varied in different treatments.
- This study did not establish the corretion of spectral reflectance indices and the wheat plant biomass.

Results and Discussion

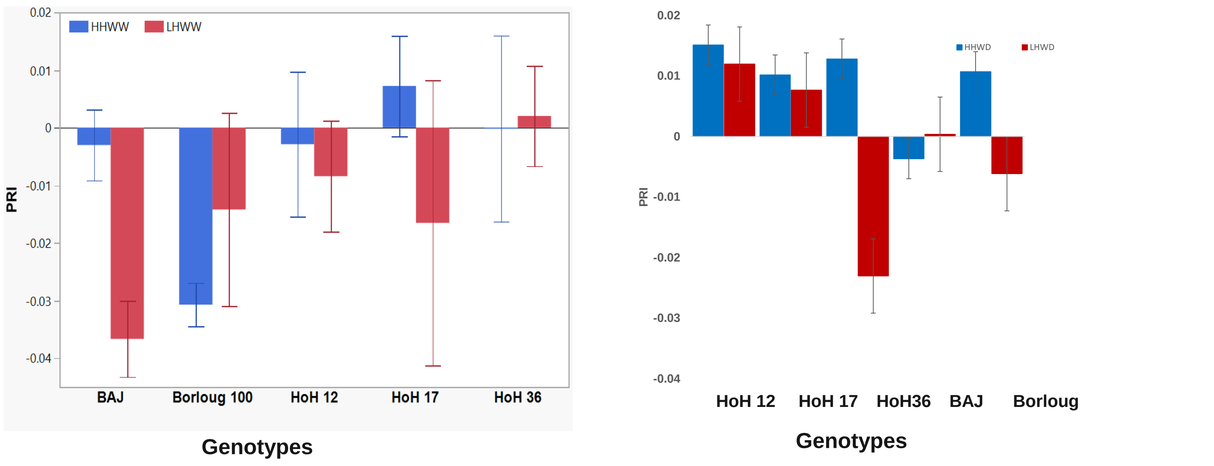

Fig 1: Photochemical reflectance Index (PRI), of five spring wheat varieties under different treatments.

- Results showed relatively high variations in the photochemical reflectance index (-0.04 to 0.02). PRI differences were also observed among treatments.

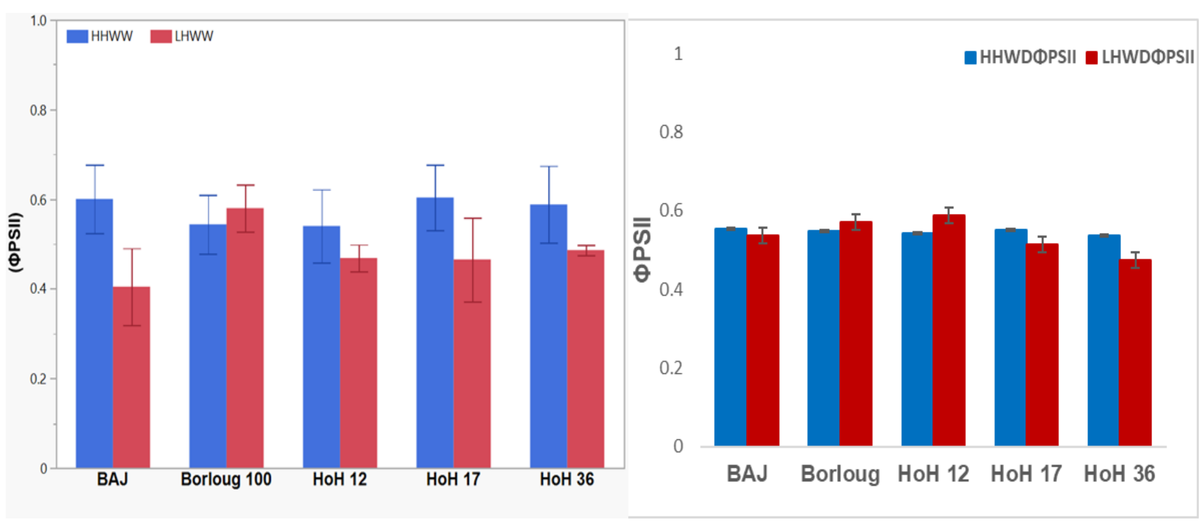

Fig 2: Quantum yield of PSII (ΦPSII) of five spring wheat genotypes under high humidity well watered (HHWW) high humidity water deficit (HHWD), low humidity well watered (LHWW) and low humidity water deficit (LHWD) conditions.

- Variability for ΦPSII was observed in LHWW treatment. BAJ was better adapted in HHWW than in LHWW. While in HHWD and LHWD.

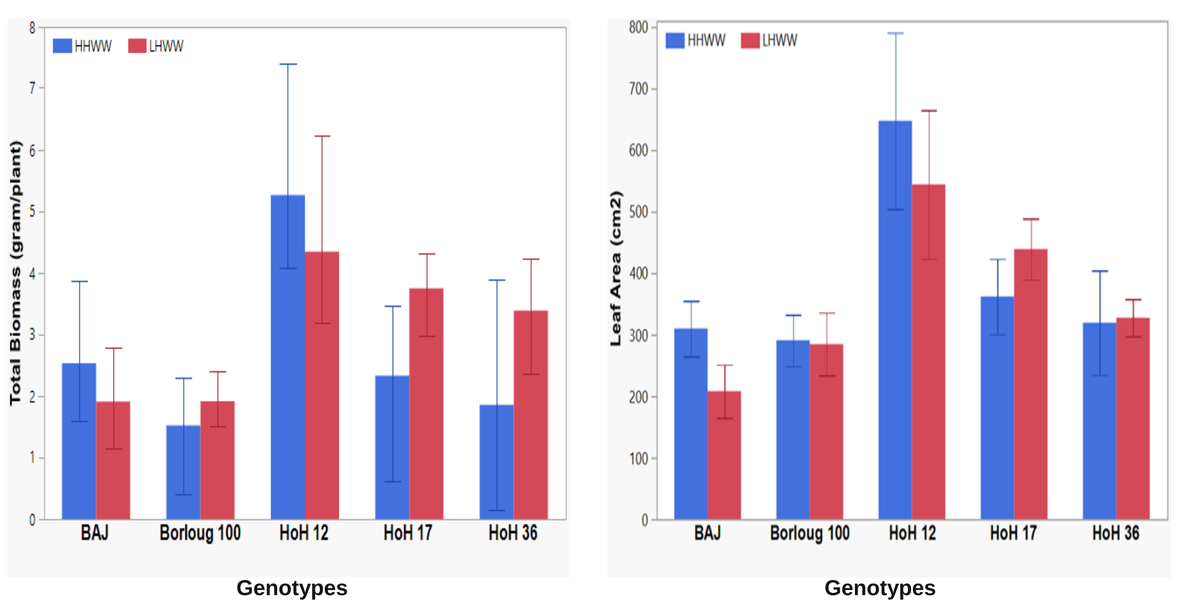

Fig 3: Leaf area (cm^2) under and total biomass accumulation of five spring wheat genotypes under high humidity high humidity well watered (HHWW), and low humidity well watered(LHWW).

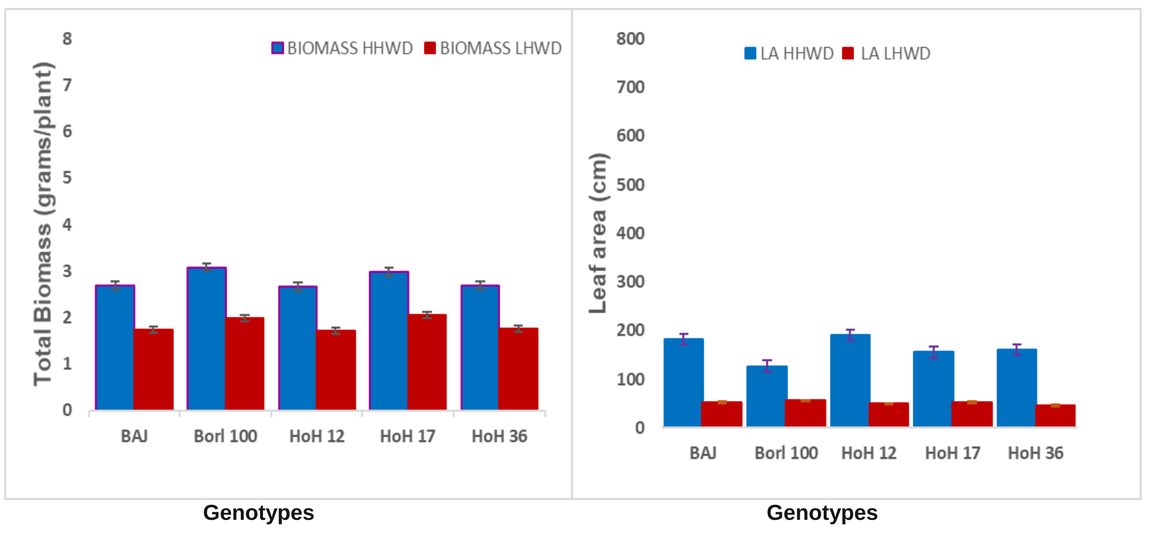

Fig 4: Leaf area (cm^2) under and total biomass accumulation of five spring wheat genotypes under high humidity high humidity well deficit (HHWD), and low humidity well deficit (LHWD).

- Both soil- and air-borne water deficits decreased leaf area and total plant biomass. Genotypes responded differently to the stress as the genotype by stress (soil- and air-water deficit) was significant.

Materials and Methods

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 (78.6 % and 36 %). When 5-week-old, watering was withheld for 7 days for half of the plants from each relative humidity. The average air temperature was 31.5^{o}C/ 25.1^{o}C, (day/night). Photosynthetic photon flux density at the top of the canopy was 600 μmolm^{-2} s^{-1} kept for 14 hours a day.