

Canopy temperature as a tool for the selection of drought tolerance in rye

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Introduction

Drought tolerance is an increasingly important trait in plant breeding, especially for crops like rye, known for its high ability to adapt to marginal environments. Large G*E interactions often lead to low heritability of drought stress tolerance in selection on grain yield. Canopy temperature may be a sensitive and specific indicator of drought stress. The aim of this presentation is to show the suitability of canopy temperature for this purpose. The concept shall be tested on data from field experiments in 2011 and 2012 on 3 drought stress prone sites in Germany and Poland.

Methods

- 480 inbred lines and hybrids of rye, irrigated (80% Plant available soil water) and non-irrigated, 2 replications
- 1920 test plots
- Measurement of canopy temperature, environmental conditions and plant development (Fig. 1)
- T_{diff} = canopy temp. - air temp.
- Regression: T_{diff} , grain yield

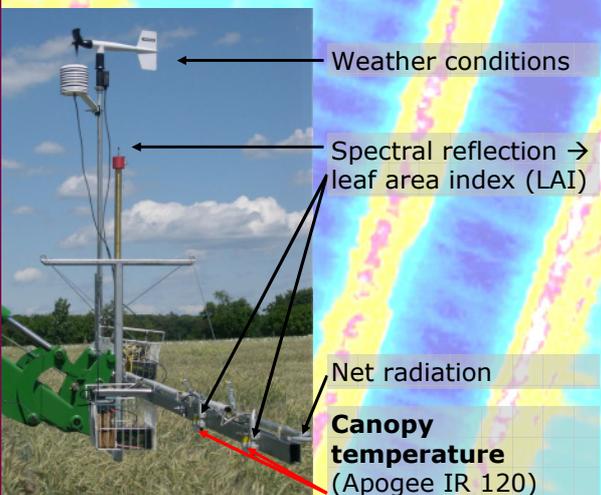


Fig. 1: Georeferenced tractor based measurement system (Background picture: IR-Photography of field experiment)

Results

Correlation between canopy temperature and grain yield depends on:

- Environmental conditions (level and slope of regression in Fig. 2 depends on measurement day and measurement conditions)
- Soil water status (available soil water, soil texture in Fig. 2)

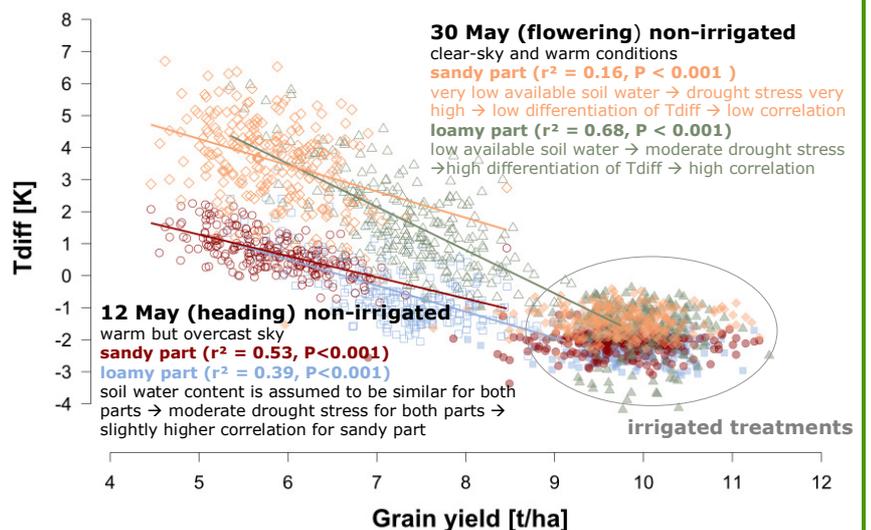


Fig. 2: T_{diff} (canopy temperature minus air temperature) and grain yield for the 1920 test plots in Wohld (Germany) in irrigated (solid symbols) and non-irrigated treatments (open symbols), 12 and 30 May 2012, separately for the sandy and loamy soil plots of the trial. The regression lines are shown for non-irrigated plots only.

Discussion and outlook

Canopy to air temperature was highly dependent on environmental conditions, soil water status, and plant development. Hence, the regressions for both dates differ considerably. For 30 May the correlation was very low on the sandy part, thus drought stress was high for all genotypes with very low genotypic differentiation. On the loamy part the genotypes seem to differ in their ability to use the remaining available soil water content. For 12 May the situation was reverse, with higher correlation on the sandy part. We can conclude that a medium level of drought stress is beneficial for detecting genotypic differentiation in drought tolerance in rye.