Field Evaluation of Deep Water Capture Using Thermal Imaging

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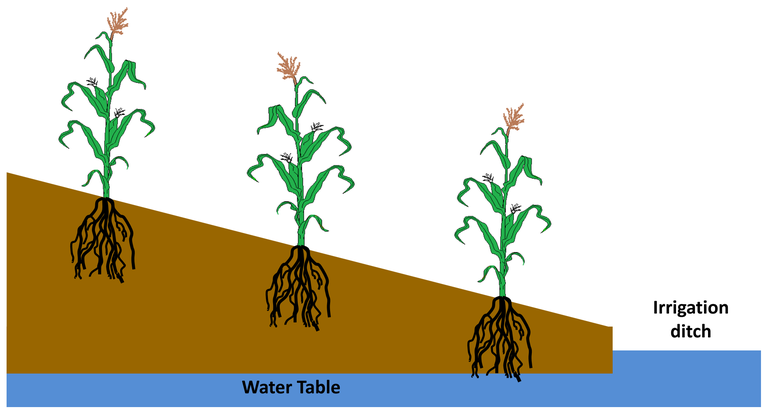
Context

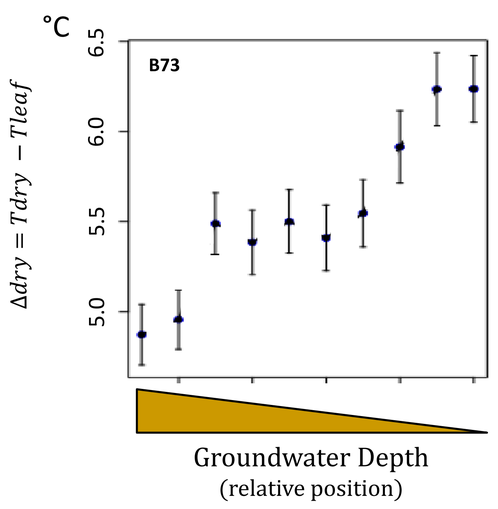
Deep water extraction is an important determinant of drought tolerance, but is difficult to estimate for breeding applications. Our project evaluates the potential of high resolution thermal imaging and accurate measurements of leaf temperature combined with a controlled water table design to estimate the sensitivity of maize (*Zea mays* L.) genotypes to the depth of water table and, presumably, their ability to capture deep water.

Method

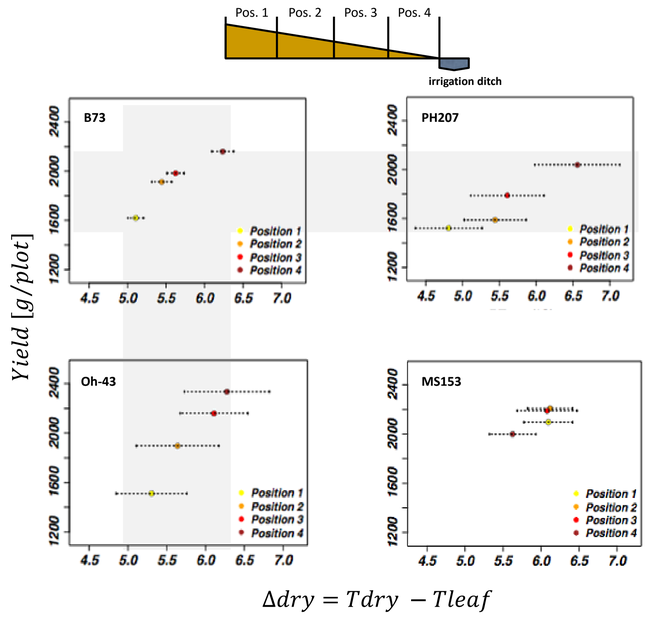
We have replicated complete blocks of a set of genotypes at different positions along a slightly inclined field. An irrigation ditch maintained a stable water depth which, according to the position along the slope, was located 1.0 to 2.5 meters below the soil surface. Leaf temperature, water table depth and soil moisture have been monitored for each genotype during the flowering period, and yield components have been recorded at harvest.



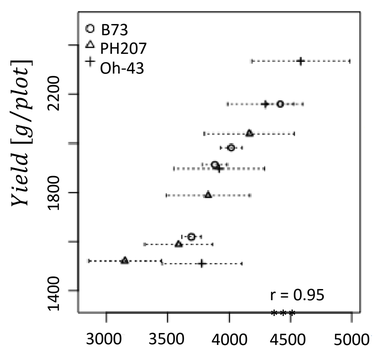
Results & Discussion



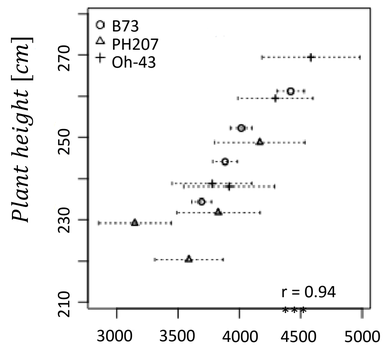
The variation of leaf temperature for the same genotype in different water conditions has been analysed using different indices. Several indices showed a good correlation with the water table depth, indicating the value of leaf temperature as a quantitative indicator of deep water extraction and, presumably, root system depth.



A linear relationship was observed between the number of grains and several indices of leaf temperature. The regression slope and the range of values contrasted between genotypes



Interestingly, when indices were multiplied by predictors of leaf area, a unique regression seemed to apply to several genotypes, which suggests that remotely sensed leaf temperature should be adjusted to leaf area in order to link it with biomass accumulation and transpiration



Conclusion

The use of thermal imaging systems in carefully designed fields appear therefore to be a valuable strategy to evaluate plant water relations in physiological studies and phenotyping applications.

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