

## R against World Hunger: An Application in Agriculture

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### Abstract

In a future challenged by global warming, water shortages, expanding deserts and an ever-growing human population, the frontiers of research are urged to understand agriculture in a new context. At the laboratory of dryland and oasis cropping at IRA, Medenine, we analyze the genotypic variability of plant responses to water deficit. We apply R in this agricultural context to develop tools that help researchers to prepare, analyze and visualize data and advance R into a platform for communicating ideas and results between researchers, operators and managers.

This poster presents results from an initial investigation of a dry land experiment of two local barley (*Hordeum vulgare* L.) strains cv. Ardhaoui. The barley was sourced from Tlalit and Switir in southern Tunisia, were grown in a glasshouse under well-watered conditions up to one month and were then either subjected to water deficit (withholding irrigation) or were continually well-watered. Variation in relative water content, leaf area, leaf appearance rate and leaf gas exchange in response to water deficit was investigated. We found that high relative water content (RWC) of leaves was maintained in Tlalit by stomatal closure and a reduction of the leaf area. The reduction in leaf area was due to a decline in leaf gas exchange during water deficit. The low LA plants of Tlalit were found to be drought tolerant and able to maintain higher RWC under drought conditions. Water deficit treatment reduced gas by 43 % at anthesis. High Net CO<sub>2</sub> assimilation rate under water deficit was associated with high RWC ( $r=0.998$ ;  $P<0.01$ ). Decline in Net CO<sub>2</sub> assimilation rate was due mainly to stomatal closure. Significant differences between the strains in leaf gas exchange parameters were found, which can give some indications of the degree of their tolerance to drought. Thus the ability of the low LA plants to maintain higher RWC may form the basis for the differences in drought tolerance vis a vis water use efficiency (WUE) in barley strains differing in LA. Results showed that Tlalit distinguished itself as more efficient and more productive than Switir.

We applied R to generate a set of analysis for comparing means, analysing variance, estimating correlations, and predicting linear and non linear regression that can serve as models for a better understanding of plant growth in conditions of low water supply. We further present comparative visualizations of the data facilitated with various R graphics packages. This can serve as a working example for other researchers in the agricultural field to adopt R, show the potentials of various visualization packages for agricultural application and highlight the statistical abilities in this specific application context.