

Does combining canopy reflectance and canopy temperature allow identifying drought resistance strategies in potato?

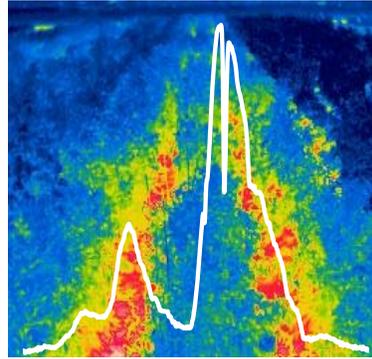
Julia Auber*¹, M. Awais Khan², Evelyn Farfan², Merideth Bonierbale², Folkard Asch¹

¹University of Hohenheim, 70599 Stuttgart, Germany
²International Potato Center, Lima, Peru

* julia.auber@uni-hohenheim.de

Introduction

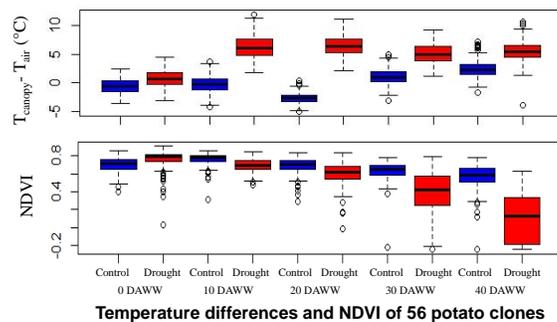
Drought negatively impacts agricultural production. Potato (*Solanum tuberosum* L.) is a drought susceptible crop, mainly due to its shallow root system. Assessment of yield or yield reductions alone does not allow identifying potential resistance strategies. Thermographic evaluation of canopy temperature allows estimating of stomatal control of transpirational water losses. Changes in NDVI derived from canopy hyperspectral reflectance indicate leaf senescence levels. In this study, both parameters were used in combination, in order to evaluate their suitability for identifying drought resistance mechanisms in potato.



Conclusions

- Canopy temperature increased under conditions of mild drought.
- NDVI decreased under conditions of severe drought.
- In combination, canopy temperature and NDVI can be used to differentiate drought resistance mechanisms.
- Minor increases in canopy temperature in concert with maintenance of NDVI indicate root growth promotion under drought.

Results and Discussion



- Leaf temperatures under drought strongly increased after 10 and 20 days after withholding water (DAWW).
- Drought induced stomata closure resulting in higher leaf temperature.
- Higher temperature in both treatments at the end of the growing cycle.
- Drought strongly affected NDVI after 30 days of withholding water.
- NDVI allows identifying „stay-green“ mechanisms.
- Severe drought accelerated leaf senescence.

■ High Tc-Ta / high NDVI

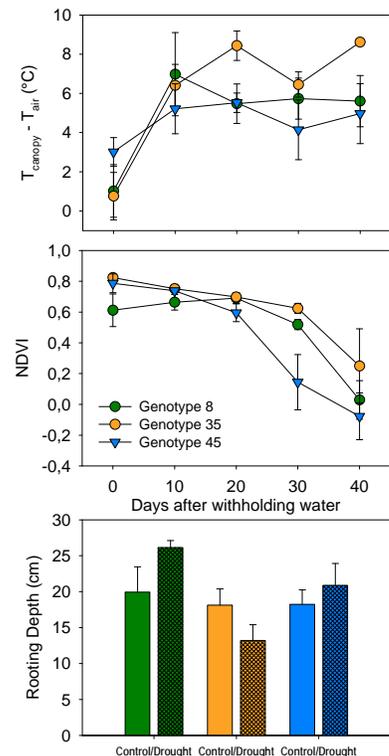
→ Stomatal closure during the whole drought period allows preserving soil moisture and canopy cover could be maintained over a longer period (Genotype 35).

■ Low Tc-Ta / low NDVI

→ Maintenance of transpiration induced early leaf senescence (Genotype 45).

■ Low Tc-Ta / high NDVI

→ Relative maintenance of transpiration and canopy cover of Genotype 8 was related to increased root growth under drought.



Materials and Methods



Field design

A field trial was conducted between October 2013 and February 2014 in the arid coastal site in southern Peru. 56 potato clones were planted in two complete randomized block designs. Two irrigation treatments were applied: fully watered (340mm/4 month) and terminal drought, where irrigation was withheld 67 days after planting. Crop reflectance and canopy temperature were measured in 10 day intervals after drought initiation. Morphological parameters and harvest data were recorded at final harvest after 120 days.

