GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

Thesis topic description

Physiological response of sorghum bicolor with changing VPD under soil drying

Background:

The fluctuating atmospheric moisture levels amid global warming present a significant challenge for crop cultivation. Plants subjected to various abiotic stresses tend to modify the physiological behavior and their stomata accordingly. The transpiration response to changing vapor pressure deficit (VPD) in plants, such as maize, has been investigated (Cramer et al., 2008, Yang et al., 2012). In general, plants respond to a rise in VPD by increasing their rate of transpiration. However, once a certain break-point is reached, the rate of water loss via transpiration begins to decline (Gholipoor et al., 2013; Devi and Reddy, 2018). Gaining a deep understanding of water stress or physiological responses in plants due to both soil water level and evaporative demand is crucial.

Problem and working hypotheses:

In recent decades, due to an exponential rise in vapor pressure deficit (VPD) and soil drying, VPD has become an increasingly important factor influencing plant functioning in terrestrial biomes Despite its significance, few studies have specifically examined the physiological response of sorghum (bicolor (L.) Moench) to high VPD, limiting our understanding and ability to predict future impacts on this crop. In this study, we will investigate the combine impact of increasing VPD and soil drying on transpiration rate, stomatal conductance, gas assimilation (photosynthesis) and leaf water potential.

Methods:

Sorghum, will be selected for detailed characterization to VPD and drought stress. Overall, a pot experiment will be conducted to study physiological responses to VPD and soil drying. The studies will be conducted at the controlled environment facility which will enable us to change the range of temperature, RH, and VPD. The plants will be grown in same soil type and the measurements will be recorded with subsequent soil drying. To measure the transpiration, the pots will be kept on weighing balance and the stomatal conductance, gas assimilation (photosynthesis), etc. will be measured for the fully expanded youngest leaf using a portable photosynthesis system (LI-COR6800, LI-COR Biosciences, Lincoln, NE, the USA). The fictional relationships between the measured variables will be established to achieve the proposed objectives.

Requirements for candidates:

The topic requires an interest in conducting an experiment with basic knowledge of data plotting. For the experimental part, careful and precise operations in the laboratory are required to ensure reliable measurements, which can be learned during the thesis.
The technical support, handling of the devices, etc. is guaranteed. Careful experimental work in the laboratory is important. **The starting date is flexible.**

Contact: Dr. Faisal Hayat (faisal.hayat@uni-goettingen.de), Prof. Dr. Martin Maier (martin.maier@uni-goettingen.de), Abt. Bodenphysik, DNPW, Georg-August-Universität Göttingen

References:

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Devi and Reddy, 2018. https://doi.org/10.3389/fpls.2018.01572