Tropentag, September 17-19, 2013, Stuttgart-Hohenheim

"Agricultural development within the rural-urban continuum"

Salinity Down-Regulates Transpiration Rate of *Medicago sativa* to Increasing Vapour Pressure Deficit

Hongbin Wei[1], Marcus Giese[1], Yingzhi Gao[2], Qiushi Ning[3], Folkard Asch[1]

[1] *University of Hohenheim, Institute of Plant Production and Agroecology in the Tropics and Subtropics, Germany*

[2] *Northeast Normal University, Inst. of Grassland Science, China*

[3] *Chinese Academy of Sciences, State Key Laboratory of Vegetation and Environmental Change, China*

Abstract

Medicago sativa is perennial forage with high yield and good quality. Plants growing in arid and semi-arid regions are often subjected to soil and atmospheric water deficit as well as high soil salinity during their life cycles. Plant transpiration increases at elevated atmospheric vapour pressure deficit (VPD), C3 species are reported to have a breakpoint (BP), above which stomatal conductance declines and limits transpiration rate to a maximum. Soil salinity is likely to be involved in transpiration response by affecting root hydraulic resistance, leaf water potential and stomatal conductance in salt-treated plants. The objective of this study was to compare the transpiration response of *Medicago sativa* over a range of VPD at various salt concentrations to identify the tolerance mechanisms to confront atmospheric water vapour deficit and salinity. Seeds of *Medicago sativa* were cultivated in a greenhouse till 8 weeks old and subjected to five salt treatments of 0, 40, 80, 120, 160 mM (NaCl :Na2SO_4 = 1:1) for 14 days. Then plants were exposed to increasing VPD (0.5, 1.0, 1.5, 2.5, 3.5 kPa) in a controlled environment chamber.

Leaf area ratio (LAR) and specific leaf area (SLA) significantly decreased at 80 mM and higher salt treatment, meaning *Medicago sativa* developed leaf thickness with increasing salinity at the expense of leaf area per plant. Total biomass was significantly reduced by salt stress but slightly changed when salt concentration exceeded 80 mM. Transpiration rate (TR) in control plants increased linearly with VPD up to 1.0 kPa, above which TR declined markedly. Salt treatment increased BP along the salt concentration gradient to 2.0 kPa at 160 mM, reflecting a compromised sensitivity in stomatal regulation. Increasing salt levels resulted in stomatal closure and consistent decrease of whole-plant transpiration rate. The results suggest that *Medicago sativa* down-regulates transpiration rate to conserve soil water, while reduction of SLA is assumed to compensate for decreased CO_2 diffusion. *Medicago sativa* can effectively counteract negative effects of salinity and varying VPD in a semi-arid environment.

Keywords: *Medicago sativa*, salinity stress, transpiration rate, vapour pressure deficit

Contact Address: Marcus Giese, University of Hohenheim, Institute of Plant Production and Agroecology in the Tropics and Subtropics, Stuttgart, Germany, e-mail: m.giese@uni-hohenheim.de