Tropentag, September 14-16, 2022, hybrid conference

"Can agroecological farming feed the world?
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Water uptake does not drive sodium and chlorine uptake in sweet potato genotypes exposed to salt stress

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Abstract

Whereas potassium is taken-up actively to the plant, sodium uptake and distribution often is driven by the transpirational volume flow in the shoots of plants grown under salinity. Thus, reducing transpiration rate is regarded as an adaptation mechanism to reduce tissue salt load. In combination with a high K uptake, plants may be able to maintain growth and are, thus, seen as salt tolerant. Little is known about these mechanisms in sweet potato. Therefore, cuttings of two sweet potato genotypes contrasting in salinity tolerance (CIP 188002.1, tolerant; CIP 189151.8, sensitive) were subjected to 0 and 50 mM NaCl root zone salinity in a hydroponic system and grown under low (40 %) and high (80 %) relative air humidity (rH) to create difference in transpiration. After 18 days of initial hydroponic growth, NaCl was added for another 33 days. Cumulative plant water loss and total ion uptake were determined and related to air humidity and genotypes. Plants subjected to low rH lost twice as much water per unit leaf area compared to high rH but the Na accumulation remained almost the same. In low rH, cumulative water loss per unit leaf area in plants subjected to 50mM salt stress was significantly increased ($p < 0.003$) in the tolerant but decreased ($p < 0.001$) in the sensitive genotype whereas no difference was found under high rH. Independent of genotype, the transpirational history of individual leaves was not correlated with their respective salt load, however, young leaves of the tolerant genotype grown under salt stress in high rH maintained more than twice the amount of K as compared to the sensitive genotype. We conclude that transpirational volume flow is not the main driving force for Na and Cl uptake and distribution within the plant. However, at least at high rH, high levels of K in young leaves may allow a larger accumulation of dry matter. The sodium distributing pattern (Na deposition in older leaves) will be discussed in view of active ion transport linked with ATP trade-offs.

Keywords: Ion uptake and Salt stress, vapour Pressure Deficit (VPD), Water uptake

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