„Expansin expression and apoplastic pH in expanding leaves under NaCl stress“

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Soil salinity poses a major threat to agriculture, because during the osmotic stress phase, salt-sensitive crops such as maize (*Zea mays* L.) exhibit a strong growth reduction. A modified capacity of cell walls to expand irreversibly has been suggested to be the major growth-limiting factor during the salinity-induced osmotic stress phase. Elucidation of the way that salinity affects shoot growth is thus of great importance for a better understanding of processes that contribute to salt resistance. For this purpose, shoot growth and shoot growth-related factors have been compared between a salt-sensitive and a salt-resistant maize hybrid under saline condition.

The 100 mM NaCl treatment of maize plants that differ in their degree of salt-resistance over a period of 8–days has revealed genotype-specific differences regarding the ability of the young shoots to maintain growth. The salt-sensitive hybrid Lector exhibited a strong reduction in growth, as is known to occur in the first phase of salt stress. In contrast, the shoots of the salt-resistant hybrid SR03 were only marginally affected and maintained growth. The up-regulation of the mRNA of wall-loosening factors (*ZmXTH1*, *ZmXET1*, *ZmEXPA1*, *ZmEXPB2*, *ZmEXPB6*, and *ZmEXPB8)* within the expanding shoots of the salt-resistant hybrid might contribute to a mechanism for improving wall extensibility under stress and thus might counteract growth reduction as occurs, for example, in the salt-sensitive hybrid. In favour of this assumption, transcripts of these wall-loosening factors were down-regulated in the size-reduced leaves of the salt-sensitive Lector hybrid. These genotypic differences are indicative of a role for these wall-loosening agents in processes related to salt-resistance.

Genotypic-specific effects were also confirmed to occur on the proteome level: salinity did not affect the abundance of the vegetatively expressed β-expansins in the shoots of the salt-resistant SR03. However, β-expansin proteins were down-regulated in size-reduced shoots of the salt-sensitive cultivar. 2D-Western blotting revealed that one out of four isoform was down-regulated in size-reduced leaves of the salt-sensitive Lector. Growth might be reduced because salinity possibly impairs the synthesis of this growth-mediating enzyme. These genotypic differences are indicative of a role for the β-expansins in maintaining growth and thus of their contribution to salt resistance.

After salt treatment, the apoplastic pH seemed to be differentially regulated between both hybrids. The leaf apoplast of the salt-resistant SR03 was acidified in response to salinity. The findings that (i) acidification of the leaf apoplast is a major requirement for increasing wall extensibility and that (ii) expansins are activated by an acidic pH, are both indicative that the observed acidification represents a mechanism possibly related to the maintenance of growth under saline conditions. In favour of this hypothesis, the leaf apoplast of the salt-sensitive Lector does not acidify but exhibits a strong reduction in its shoot growth.

A comparative study of plants that differ in their degree of salt resistance revealed contrasting physiological features in terms of cell wall-associated agents that mediate growth. Wall-loosening agents were impaired in size-reduced leaves of the salt-sensitive hybrid but not in leaves of the salt-resistant hybrid that maintained growth. This physiological difference is indicative for a role of these wall-loosening agents for salt-resistance and thus may be used for screening for salt-resistant plants.