The magnetic magic of manganese in maize

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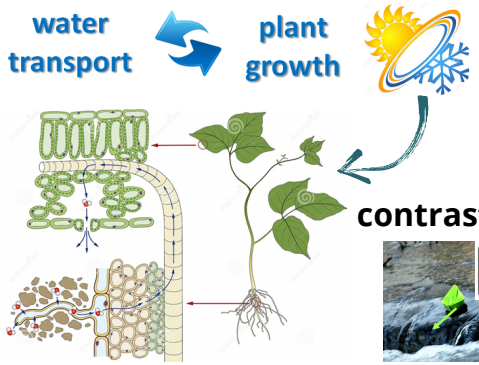
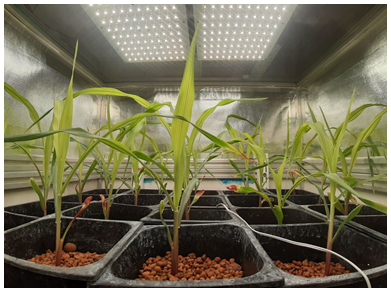
Monbvation. Plant hydraulics depends on environmental factors and the structure of the vascular system and affects the functioning and growth of cells. Moreover, plants grown in different climatic conditions differ in size, morphology, and physiological parameters.

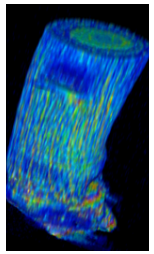
Methods. Plant phenotype was recorded daily during exposure to stress factors, and at the end of the experiment, data on transport processes in the leaf growth zone were obtained by magnetic resonance imaging with contrast. Manganese ions were used as a contrast agent. Thus, a general model will link the development of a plant, primarily the processes of cell and tissue growth determined mainly by water transport, and the functioning of the transport system of the xylem vessels, which itself is also formed during growth and morphogenesis.

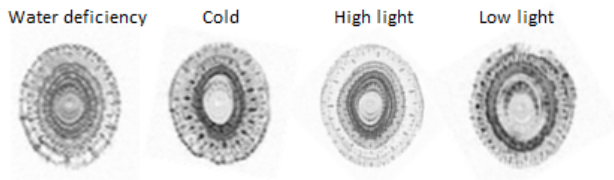


The project aims to study the interaction of transport and growth processes in plants under stressful environmental factors. We analyzed the data obtained within the experiment in which maize plants were grown under cold, drought, high and low light, and soil salinity conditions.

contrast MRI + **Multi-view imaging**

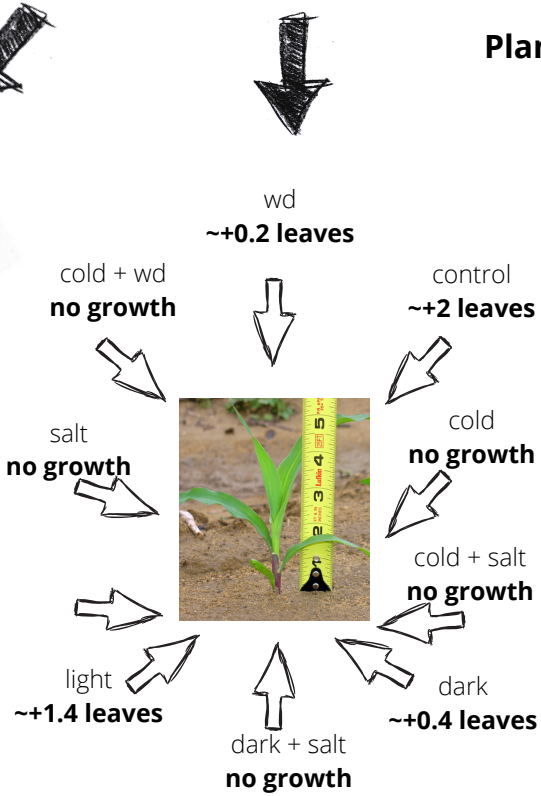


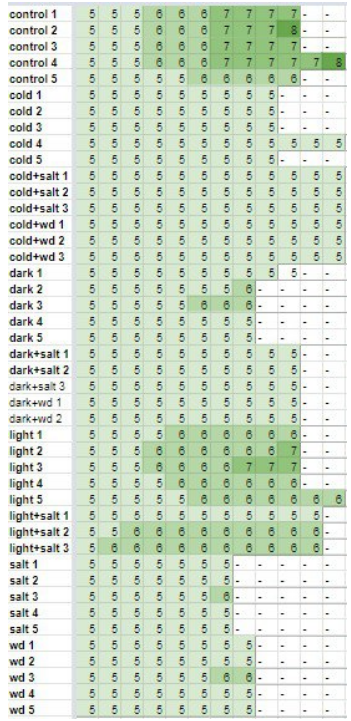




Distribution of signal intensity over virtual sections of plants after Mn contrast injection

Plant structure dynamics





Results. Analysis of multi-view imaging showed significant variation in plant growth rate for different experimental groups. For the same plants, we used the high-resolution contrast-enhanced MRI method of an ultra-high-field tomograph 1.7 T BioSpec 117/16 USR from Bruker to understand water distribution over the shoot structures of maize under standard and stress conditions. Image analysis revealed that environmental stresses caused a rearrangement of the signal distribution pattern in the growing leaf tissue. The total conductivity of the leaf and stem changed significantly in response to stress factors. For example, plants grown under high light showed a signal decrease, while plants grown under a lack of light conditions showed the opposite trend.