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Multi-scale phenotyping of West-European and South-African maize hybrids with contrasting drought sensitivity

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Abstract

The urgent need of breeding more drought tolerant crops in order to meet the future needs of the growing world population, requires better understanding of the drought adaptation mechanisms. Phenotyping remains one of the main factors limiting breeding advance.

By using a novel non-invasive root and shoot phenotyping system, we were able to link root and shoot phenotype and study their detailed development in time. Kinematic analysis provided the cellular basis of the observed differences in leaf growth.

In this study, a set of commercial hybrid maize lines with contrasting drought sensitivity from West-Europe and South-Africa, together with the reference inbred line B73 were subjected to control and severe drought conditions in a glasshouse experiment in order to perform an extensive phenotyping of shoot and root growth.

We showed that drought tolerance could be directly linked to advanced leaf and root growth dynamics and increased photosynthetic rates. At the cellular level, growth rate differences were mainly correlated with cell division rate. The typical ideotype of a drought tolerant line has fast growing shoot and root, and keeps its photosynthesis rate at a relatively high level even during wilting.

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