How to estimate maize sensitivity to water deficit in field? A method consistent with the estimators measured in a phenotyping platform

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Interactive exhibit

How to estimate maize sensitivity to water deficit in field? A method consistent with the estimators measured in a phenotyping platform

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Tolerance to soil water deficit is a priority of many maize breeding programs. Its genetic analysis requires estimators that characterize each genotype in a reproducible way. For that, we have tested and compared the abilities of hybrids to maintain leaf growth in a large range of soil water potentials (i) in a phenotyping platform that measured leaf elongation rate and (ii) in a network of field experiments via an estimator of the sensitivity of grain number to water deficit.

Tolerance to soil water deficit was estimated in a network of 14 field experiments via the regression between yield components and soil water potential measured with tensiometers.
A drought index was obtained by averaging soil water potential, measured with tensiometers, for the phenological phase during which grain number was determined (evaluated for each individual hybrid in each site). It closely correlated with grain number in each of the 19 hybrids that were analyzed over 14 environmental situations in France, Hungary and Chile. The slope of the regression line between drought index and grain number, established for each hybrid, was taken as an estimate of the sensitivity to soil water deficit of that hybrid. Sensitivity estimated in this way varied 2-fold in the set of studied hybrids, and correlated with that of leaf growth to soil water deficit in short-term experiments in the phenotyping platform.

This method is promising for the evaluation of hybrids in the context of a breeding program with a minimum amount of environmental measurements and can be extended to a large number of genotypes compatible with a genetic analysis.

Keywords: Zea mays, Drought tolerance, Model-assisted phenotyping, Grain yield, Growth