

Methods of crop physiology to determine drought tolerance of winter rye (*Secale cereale* L.)

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Rye will probably be greatly affected by drought stress induced yield losses due to climate change, because it is typically grown on sandy soils with low water holding capacity. The aim of this study is to make statements about the drought tolerance mechanisms of rye and their use in plant breeding.

In the year 2011, 16 winter rye genotypes were examined in a drought environment under a foil tunnel without rainfall and irrigation from shooting stage until harvest, and a control environment with optimum irrigation in Braunschweig, Germany. Different phenological, physiological, and agronomic determinations were carried out. Among others, canopy temperature, carbon isotope discrimination, leaf area index, stomatal conductance, chlorophyll

content, yield, and yield components were measured. Under the influence of drought stress, maturity was reached 12 days earlier and the total above-ground biomass yield decreased by 47 %. All investigated traits showed significant differences between environments and in some cases also between the genotypes. Canopy temperature, stomatal conductance, and carbon isotope discrimination were significantly correlated with grain and total above-ground biomass yield under drought stress. Canopy temperature showed the highest correlations (max. $r = 0.76^{***}$; $p < 0.05$) of the investigated traits, but it is very dependent on climate conditions, especially in the temperate climate zone.