Evaluation of wheat drought tolerance under four water regimes based on a dual isotope ($\delta^{13}C$ and $\delta^{18}O$) conceptual model

Karimi Mazraehshah HR, **Van Damme P**

Lab. Tropical and Subtropical Agronomy and Ethnobotany, Dep. Plant Production, Ghent University, Coupure Links 653, B-9000 Ghent, Belgium

Measurement of natural variations in the relative abundances of plant stable carbon isotopes ^{12}C and ^{13}C, by means of a carbon isotope discrimination ($\Delta^{13}C$) technique, has been widely used in C_3 plant species to select and evaluate plant cultivars that can withstand drought. A plant cultivar, which is resistant to water scarcity should display less depletion in ^{13}C compared with a susceptible cultivar. Interpretation of $\Delta^{13}C$ may not be straightforward since variation may occur through a coherent change in stomatal restriction of CO_2 diffusion and down-regulation of photosynthetic capacity, which may result in similar $\Delta^{13}C$ values. Recently, a dual isotope approach based on ($\delta^{13}C$ and $\delta^{18}O$) of bulk leaf tissue has been suggested to differentiate between sources of variation in $\Delta^{13}C$. This model gives insight into the relationship between stomatal conductance (g_s) and photosynthetic capacity (A_{max}) caused by different environmental constraints and plant-internal factors. Reports on using this model in cereal plants are very scarce, especially when water is the main environmental constraint. We used this model to explain relationships between leaf gas exchange parameters and growth and yield responses of six winter wheat (*Triticum aestivum*) cultivars with similar crop phenology. In addition, we assessed the validity of ^{18}O as a useful physiological trait under suboptimal water available conditions in a pot experiment with four different soil water contents under a rain protecting shelter with natural ventilation conditions in the faculty of Bioscience Engineering, Ghent, Belgium. All leaf gas exchange parameters were measured on mature flag leaf blades at post anthesis stage. Isotope analysis ($\delta^{13}C$ and $\delta^{18}O$) were done on bulk flag leaf dry matters collected after gas exchange analysis. We found significant negative correlations between g_s and $\delta^{18}O$ and g_s and $\delta^{13}C$. Our results reveal that this model is capable to predict drought tolerant

wheat cultivars and to interpret post anthesis variations in (g_s) and (A_{max}) of wheat cultivars while drought stress levels are increasing.