[O32] Drought Physiology

Chair: Junichi Kashiwagi (Hokkaido University, Japan)
Thu. Sep 9, 2021 2:30 PM - 4:30 PM Room 3 (Oral) (Abiotic Stress for Crop Production)

2:50 PM - 3:10 PM

[O32-02]Physiological Traits to Breed for Drought Adaptation

(Invited Speaker)

○Matthew Reynolds, Margaret Krause, Francisco Pinto, Sivakumar Sukumaran (International Maize and Wheat Improvement Center, Mexico)

Yield under water deficit can be boosted either by increasing water uptake or by making efficient use of water (EUW); these are not mutually exclusive. If water is available in subsoil then selecting for deeper roots is an obvious strategy, assuming annual water replenishment. Direct phenotyping of roots is not feasible at breeding scale, but proxies can be used such as canopy temperature and water index which respond directly to transpiration rate as a function of vascular capacity. We demonstrate how the combination of remote sensing indices can estimate root:shoot under field conditions. Several traits contribute to EUW. Conservative use of water in photosynthesis, i.e. transpiration efficiency (TE), can help budget water uptake, permitting crops to complete their life cycle before soil water runs out. It can be measured using carbon isotope discrimination of leaves grown without water stress. Spike photosynthesis occurs with relatively high TE due to recycling of respiratory CO_2, however, not easy to measure. Another trait related to budgeting is storage of soluble carbohydrates mainly in stems when growing conditions are favorable, that are remobilized to grains as stress intensifies. Use of physiological traits in breeding can be considered for progeny and/or parental selection. The latter involves characterizing fewer materials so more difficult-to-phenotype traits can also be considered. As an example, strategic crossing of parents with complementary source and sink traits produced considerable transgressive segregation among progeny for canopy temperature and increased stem reserves after anthesis under drought, which was found to be predictive of grain yield.