



2018 ASA and CSSA Meeting • November 04 - 07 • Baltimore, MD
With the Canadian Society of Agronomy

ABSTRACT



34-4: Unconscious Selection and Plant Hydraulics: Did Breeders Select Against Water-Saving Traits in Well-Watered Minnesota and for Them in Drought-Prone Australia?.

Monday, November 5, 2018

09:30 AM - 09:45 AM

Baltimore Convention Center - Room 313

In crops, reduced transpiration rate (TR) under high vapor pressure deficit (VPD) has been associated with drought tolerance under Mediterranean-type environments by saving water for grain-filling. However, because studies are systematically undertaken on a limited number of lines from heterogeneous or unknown genetic backgrounds, it is unclear whether such trait is associated with breeding for drought tolerance and if such trait would translate into yield penalties under well-watered environments. Furthermore, very few of these studies examined TR responses to “true” VPD, i.e., independent from confounding variation in temperature (T). To address those bottlenecks, we phenotyped TR response curves to VPD across 77 randomly selected wheat lines structured in 3 groups from Australia (23), Minnesota (29), and a control group consisting of parents (25) assembled from 23 countries over 5 continents. To this end, we used a high-throughput phenotyping system that allowed for characterizing TR response curves to VPD at a constant T of 30°C in the 1-3.2 kPa range.

With no exception, all the Australian cultivars exhibited a decrease in TR above a VPD threshold ranging from 1.8 to 2.4 kPa, reflecting the water-saving response. In sharp contrast, with one exception, all 27 of the Minnesota genotypes linearly increased TR as VPD increased. The responses of the diversity panel were intermediary, with 60% and 40% of the genotypes exhibiting a linear and segmented TR responses to VPD, respectively. Using crop simulation modelling, we confirmed yield benefits/penalties resulting from the segmented and linear TR responses in wheat grown in North Africa. Those results provide a first evidence i) of genotypic variability in TR response to “true” VPD, ii) that consistently with Darwin’s “unconscious selection” paradigm, the water-saving trait may have been bred out in Minnesota but favored in Australia and iii) that these decisions are consistent with expected yield benefits/penalties.

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