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ABSTRACTS

大会摘要集

Hosts: Chinese Academy of Agricultural Sciences
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Organizer: Institute of Crop Sciences, Chinese Academy of Agricultural Sciences

主办单位： 中国农业科学院
中国作物学会
承办单位： 中国农业科学院作物科学研究所

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how to best combine traits for region-specific and management-specific adaptation of new genotypes. The APSIM-Wheat model has been developed and widely-used for diverse applications in scientific research and decision support. However, the model requires further effort to accurately simulate important candidate traits associated with improving water productivity. Wheat experiments were conducted in the field and glasshouse to assess traits related with water productivity, e.g., early vigor, tillering, leaf area development, water soluble carbohydrate (WSC) and transpiration efficiency. Contrasting cultivars were selected to study intrinsic mechanisms affecting these traits. Data were collected through field observation, destructive samplings and high-throughput technologies. In glasshouse experiments, multi-view images were taken to reconstruct 3D point clouds, and to then extract accurate 3D phenotype information for early vigor contrasting cultivars. In field experiments, an unmanned aerial vehicle and hand-held camera was used to monitor development of ground cover and the Normalized Difference Vegetation Index (NDVI). These measurements were complemented by manual measurement of wheat phenology, tiller development, biomass partitioning, and leaf area development during the growing season. An improved wheat model is being developed by using the Plant Model framework in the next generation prototype of APSIM. Experiments described above and previously collected datasets are being used to develop new algorithms to model early vigor, tillering, WSC dynamics and transpiration efficiency. The new model will be used to assess wheat traits related to water productivity across the Australian wheatbelt.

Keywords: Wheat; APSIM; Crop model; Climate change; Climate adaptation; High throughput phenotyping; Water use efficiency

O133. Abscisic acid, root-shoot communication, water use efficiency and drought resistance

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It is almost 50 years since Little and Eidt (1968) reported an almost accidental finding that abscisic acid (ABA) reduced the transpiration of white spruce cuttings. Since then significant progress has been made showing that roots in drying soil produce ABA that is transported to the shoots where the hormone induces stomatal closure by changing the potassium concentration of the guard cells. Thus, endogenous ABA acts as a non-hydraulic root signal in response to soil drying, maintaining the leaf hydration and turgor. The sensitivity of stomata to ABA varies with species and genotypes inducing different responses to soil drying. Application of exogenous ABA increased the ABA concentration in the leaves of wheat, slowed the development of leaf water deficits, but induced stomatal conductance to decrease at lower relative water contents. The closure of stomata at high soil water contents in the vegetative phase or early reproductive phase has been shown to increase the transpiration efficiency and conserve water in the soil, making more water available in the mid-reproductive phase, thereby increasing yields and water use efficiency. However, ABA can also be detrimental, slowing leaf expansion, inducing leaf, flower, and seed abscission. Exogenous ABA increased the transpiration efficiency of wheat at moderate levels of water stress, and increased the desiccation tolerance of leaves (as measured by the lethal water potential of the leaves). This isohydric response may be beneficial in increasing yields in terminal drought environments in which water at depths may be limited, but may not be beneficial in enabling osmotic adjustment and root growth to tap deep water in the profile. Thus, whether ABA biosynthesis and responsiveness improves yields in the field may depend on the drought environment and may explain why increasing ABA does not always increase the drought resistance of crops.

Keywords: Abscisic acid; Drought tolerance; Isohydric response; Non-hydraulic root signal; Transpiration efficiency

O134. Genetic enhancement for flowering period heat tolerance in pearl millet (*Pennisetum glaucum* L. (R.) Br.)

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Pearl millet, basically a rainfed crop worldwide, is increasingly being cultivated in summer season in north-western parts of India where air temperatures during flowering time often exceed 42 °C. Heat tolerant hybrids, few in number that give good seed set, cultivated under irrigated and well-managed conditions, yield about 4–5 tons ha⁻¹ of grain and 8–10 tons ha⁻¹ of dry fodder, more than twice as compared to rainy season crop. With a view to broaden the genetic base of heat tolerant hybrids, ICRISAT, in partnership with private seed companies, screened about 400 breeding lines, including hybrid parents, germplasm accessions and populations at 4–5 sites in this high heat stress ecology in north-western India during summer seasons of 2009–2012. Fifteen breeding lines, and some populations having high seed set (58–71%) under maximum air temperatures of > 42 °C were identified. A Heat Tolerant Composite was developed using these identified heat tolerant lines at ICRISAT. This composite along with some identified heat tolerant populations/OPV's like ICTP 8202 and MC 94 Bulk were planted in high heat stress sites in target ecology during summer seasons of 2013, 2014 and 2015 and selections were made for plants with high seed set under high temperatures. Further evaluation of progenies for heat tolerance and selection within them in the heat-stress ecology, alternating with generation advance during the rainy season at ICRISAT, Patancheru, led to the production of S_4–S_5 progenies that have shown very high seed set (ranging from 67 to 90%) and thus higher levels of heat tolerance across heat stress locations in 2015 when heat susceptible checks had seed set in the range of 7–28%. Utilization of these lines provides the opportunity to broaden the genetic base of heat tolerant hybrids with high yield potential.

Keywords: *Pennisetum glaucum*; Heat tolerance; Flowering period; Seed set; Air temperature

O135. Stress-resilient maize for adaptation to climate change effects

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Climate change is threatening food production systems and therefore the food security and livelihoods of billions of population in Asia who depend on agriculture. Rain-fed systems are more dependent on prevailing weather conditions, and therefore extremely vulnerable to climate change effects. Asia tropics are projected to experience an increasing frequency of extreme weather conditions with high variability beyond the current capacity to cope up with. Several climate modelling studies suggested sharper increases in both day- and night-time temperatures in future, which could adversely impact crop production in the tropical regions. Such impacts are already being felt in a number of real and recognizable ways in the region,