IDT4-014 | Effect of vapour pressure deficit on sugarcane transpiration efficiency in a drying soil

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Plants with higher transpiration efficiency (TE), which can accumulate more biomass per unit amount of transpired water, could be beneficial in future climates with erratic scenarios. In this study, the impact of VPD on whole-plant and leaf-level TE of sugarcane was investigated to determine if there is genotypic variation and to determine if the differences were maintained across wet and dry soil water conditions. Four sugarcane genotypes with contrasting TE were maintained in two controlled growth chambers under high and low VPD (2.75kPa and 1.3kPa) with two soil water treatments. Growth of plants was monitored weekly using PlantScan (a combination of LiDAR and visual imaging), dry weight and water use were recorded, and leaf gas exchange measurements was carried out on several occasions. Genotypes showed significant differences in growth, water use and gas exchange attributes, but there was no interaction effect due to VPD or soil water. Plants in high VPD conditions had significantly higher water use than plants in low VPD conditions. However, there were no significant differences in growth. As a result, TE was significantly higher for plants grown in low VPD conditions than for those in high VPD conditions irrespective of soil water condition (high VPD wet/dry, 4.64/4.02gL-1; low VPD wet/dry, 8.47/7.22gL-1). Because sugarcane plants increase transpiration and water use at high VPD conditions without any significant gain in photosynthesis and growth, gains in TE can be achieved if genotypes that restrict transpiration at high VPD can be identified.

IDT4-015 | Role of pearl millet aquaporin genes in abiotic stress response

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Pearl millet, *Pennisetum glaucum*L.), a crop of semi-arid tropics, has remarkable tolerance to a wide range of abiotic stresses, including high degree of genetic diversity for drought stress tolerance. To investigate the molecular mechanisms that possibly account for differences in drought tolerance, four recombinant inbred lines from a high resolution cross (HRC) were selected for their variability in transpiration rate (Tr) response to vapour pressure deficit (VPD) conditions. The expression of PgAQPs in contrasting genotypes varied during the day, generally decreasing in the afternoon regardless of the VPD conditions. However, under high VPD conditions (4.21kPa), both root and leaf tissues of the VPD-insensitive genotypes had higher transcript abundance than the VPD-sensitive genotypes. Three PIP2 subfamily genes (*PIP2;1*, *PIP2;3* and *PIP2;6*) particularly *PIP2;6* gene, showed an increase in transcript abundance under high VPD conditions. Transgenic tobacco plants constitutively expressing *PgPIP2;6* gene were developed for functional validation studies in homozygous T2 transgenic tobacco plants. The transgenic plants showed better tolerance under drought stress, VPD and salinity compared to wild type plants as seen from biochemical, physiological and molecular studies. The transgenic plants also showed increased soluble sugar, membrane stability, reduced electrolyte leakage and other photosynthetic parameters as compared to the wild type (WT). Taken together, our studies suggest that, *PgPIP2;6*gene can be deployed to engineer stress tolerant transgenic crops for sustained growth and productivity under unfavourable conditions.