P 7.14 - Plant design features that improve grain yield of sorghum under terminal drought stress

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The crop physiological basis of adaptation to post-anthesis drought stress of stay-green sorghum is not yet fully understood, but restricting pre-anthesis water use has been identified as an important mechanism. Plants with the stay-green trait exhibit greener leaves and stems during post-anthesis water deficit, compared with their senescent counterparts. The aim of this paper is to identify some of the crop physiological processes associated with drought adaptation of four sorghum hybrids that represented the B35 (A35 parent inbred line) and KS19 (RQL12 parent inbred line) sources of stay-green. The hybrids were grown as individual plants in five semi-controlled experiments under well-watered conditions (anthesis harvest) and post-anthesis drought (maturity harvest) and in two irrigated field experiments at two plant densities, all in south-east Queensland, Australia. Observations included leaf area dynamics, transpiration, transpiration efficiency (TE), leaf nitrogen (N), biomass, and grain yield. Under low plant density, both sources of stay-green restricted pre-anthesis plant size. RQL12 hybrids achieved this through early anthesis and a slight reduction in tillering. A35 hybrids had a high leaf appearance rate, which resulted in high early vigour of the main shoot and low tillering. As hybrids did not differ in TE, the smaller plant size reduced pre-anthesis water use. This minimized reductions in grain number under drought, and hence reductions in grain yield. Stay-green hybrids had a high leaf N content per unit leaf area, but this had no impact on leaf senescence under drought stress, which was predominantly driven by water availability. The B35 mechanism of drought adaptation appeared to have little advantage in environments where genotypic differences in tillering were poorly expressed, in particular if this was due to high temperatures early in the season. The drought escape mechanism of RQL12 hybrids through earliness, by contrast, was less dependent on environmental conditions. Plant breeders need to take these contrasting environmental responses into consideration when selecting stay-green QTLs for germplasm that is targeted for specific stress environments.

P 7.15 - Model assisted phenotyping of processes involved in rice response to drought: case study of a tropical japonica population during vegetative phase

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Tropical japonica rice is frequently exposed to drought in upland ecosystems. Its drought tolerance is poor compared to other crops but the group has great genetic, in part unexploited diversity in adaptations. Exploring the japonica's phenotypic and genetic diversity for drought tolerance is thus crucial to breed rice for drought prone environments. Under such conditions, yield depends on drought timing and intensity along plant phenology. During the vegetative phase, drought affects vigour (leaf number and area, tillering, roots) and therefore resource acquisition.

Plant adaptation to drought is a complex mix of physiological tolerance, phenology and morphology, all of which interact with each other and with environment, resulting in phenotypic plasticity. This involves variable regulation of source-sink relationships during morphogenesis (phyllochron, organ expansion, tillering), leaf senescence and transpiration. Studying this system requires dissection into simpler traits involving a smaller number of genes/alleles. However, trait dissection must also account for Genotype*Environment (GxE) interactions and trait plasticity. This is particularly difficult for process based traits that cannot be measured directly.

In this context, modelling is relevant if used to dissect a complex system into elemental processes. Each process can be formalized as a response function, with parameters seen as being analogous to genes.

The objective of this work is to explore the added value of using dynamic whole plant modelling to assist phenotyping plant response to drought, as a basis for a genetic association study. This work focuses on rice plant transpiration and morphogenesis processes evaluated on seedlings of a diverse sample of tropical japonicas.
A greenhouse pot experiment was conducted at Cirad, Montpellier, on 203 japonica accessions with three replications and two treatments (irrigated and drought). Drought was imposed by dry-down from leaf-6 appearance until a targeted stress level was reached, as indicated by Fraction of Transpirable Soil Water (FTSW).
FTSW and plant transpiration rates were monitored gravimetrically.
At the same time a minimum set of morphological plant descriptors and climate were collected, in order to calibrate, for each genotype and in both well watered and stressed conditions, the corresponding modules of *EcoMeristem* plant growth model .
This paper presents first results and discusses the discriminative power and the added value of model assisted phenotyping for the case of rice drought responses.

P 7.16 - Photovoltaic water pumping system–sustainable water irrigation technique under drought prone area

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Photovoltaic Systems based Power Plants have emerged as viable power sources for water pumping and are being increasingly used for meeting electrical energy needs in un-electrified locations. Photovoltaic-based water pumping system is eco-friendly in nature and pollution free technology can be more appropriate to the needs of the developing countries like India than solar/thermal energy conversion.
The present study was conducted in, purposively, selected Hisar, Rohtak and Jhajjar districts of Haryana state. A total number of 282 respondents, i.e., 141 beneficiaries and 141 non-beneficiaries were interviewed in the sample for the study.
The study revealed that due to adoption of PWPS in the Rabi season the maximum decrease in area was observed in wheat crop, whereas, the area under vegetable and horticulture was increased. The same trend was also observed during the Kharif season as the area under traditional crop namely cotton, rice and bajra were decreased, respectively. However, the area under vegetable, horticulture, sugar cane and jawar was increased.
A significant majority of farmers had medium level of technical, general and overall knowledge by the adopted respondents. In case of non-adopted, as high as had low level of technical, general and overall knowledge. Majority of adopted and non-adopted respondents had favorable attitude towards PWPS.
The PWPS adopted respondents reported that ‘This technology only works in less than 8 meters water table’, ‘High cost of PWPS’, ‘Lack of extension literature’ and ‘Lack of attention of mass media’ was found to be the most serious extension constraint by the adopted respondents, moreover the similar results were also obtained in case of non adopted respondents.
Extension functionaries recommended that 16.25, 8.25, 7.58, 5.00, 4.50, 4.16 and 3.66 percent of area should be covered under vegetable, mushroom, horticulture, floriculture, spices, medicinal plants and fisheries, respectively, by PWPS adopted farmers who were having less than 5 acres land holding, while 12.16, 8.00, 5.50, 4.50, 3.16, 2.25 and 1.82 percent area under vegetable, horticulture, mushroom, floriculture, fisheries, spices and medicinal plants, respectively for 5 to 15 acres land holding and horticulture (9.67%),vegetable (8.16%), mushroom (3.17%), floriculture (2.75%), fisheries (2.25%), spices (2.00%) and medicinal plants (1.33%) for more than 15 acres land holding.