Session 2.5 Crop Model Improvement and Genetics Applications

40. *Poster Presentation*

Title: **Model improvements for simulating heat stress in irrigated wheat by considering canopy temperature in a semi-arid environment: a multi-model comparison**

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Abstract: To account for the more frequent occurrence of extreme high temperatures expected under climate change, many models have focused on simulation of heat stress effects. However, most attempts to model heat stress have used air temperature (Tair), rather than crop canopy temperature (Tc). Recent improvements in models include the simulation of canopy temperature and range from empirical (EMP) to complex iterative models solving an energy balance correcting for atmospheric stability conditions (EBSC). A greatly simplified variation of the energy balance models assumes neutral stability conditions (EBN), avoiding iteration. The objectives of this study are: (1) to compare these new EMP, EBN, and EBSC approaches to simulate Tc and grain yield, and (2) to assess if simulation of Tc improves the ability of crop models to capture heat stress impacts. Nine crop models (three of each type) simulated crop growth and development for irrigated spring wheat in Arizona for a series of planting dates. The simulations were conducted twice: (1) using Tc on processes sensitive to heat stress and (2) using Tair on processes sensitive to heat stress. The three EBSC models had the lowest RMSE (2.9°C) while the three EBN had the highest (6.7°C). The RMSE of the EMP models was 3.9°C. Despite their relatively poor simulation of Tc, the EBN models simulated grain yields with lower RMSE (1.7 t ha-1) than the others. The use of Tc versus Tair lead to some improvements in simulating grain yield for most models.

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57. *Poster Presentation*

Title: **Daphne: a generic database to integrate multiscale agronomic and phenotypic information for crop modelling**

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Abstract: Studies of genotype x environment x management (GXEXM) interactions commonly use Crop Simulation Models (CSM). The minimum datasets required for a successful model implementation are multi-scale, multi-species and multi-disciplinary. We observed that although they are organized differently, CSM input files and field experiment datasets shared the same measurements (yield, leaf area index, biomass, etc.) and a few similar tables corresponding to the minimum dataset (weather, soil, crop, and management data). Based on this analysis, we have designed the schema of DAPHNE.

We used the relevant technology of metadata. Thus, in DAPHNE, all variable labels are stored in a metadata table including the units and methods of measurements and the observed and experimental units. The main advantage of this technology is that the addition of any variable does not imply to reconsider the structure of the database. Database query performance is also improved. DAPHNE already has a wide application in GXEXM experiments on sorghum and sugarcane. The genericness of the schema of DAPHNE can allow intercomparison of CSM that require the same datasets with no common data structure.