EVALUATION OF FOUR SUGARCANE MODELS FOR SIMULATING CLIMATE CHANGE IMPACTS AT SITES IN SEVEN COUNTRIES

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\textbf{Introduction}

- Realistic assessment of future climate change impacts on sugarcane production is essential for strategic planning, and accurate crop simulation models are important tools in this process.
- The AgMIP Sugarcane Model Intercomparison Project seeks to assess the suitability of sugarcane models for simulating sugarcane growth and yield under a wide range of environments across the globe under current and possible future climates.
- This poster reports on project protocols and recent outcomes.

\textbf{Protocols & methods}

- High-quality sugarcane growth analysis datasets were provided by research groups in seven countries:
  - Maun, USA (flood irrigated, plant and ratoon crops, 3 N-levels)
  - Piracicaba, Brazil (10 month cycle; 3 treatments: row and dryland)
  - Komatipoort, South Africa (dryland, 18 month cycle; 8 treatments; harvest date)
  - Chiredzi, Zimbabwe (flood irrigated, 12 month cycle; 2 varieties, 3 crops)
  - Ayr, Australia (flood irrigated, 15/13 month cycle; 6 treatments; 2 crops, 3 N levels)
  - La Mercy, South Africa (dryland: 18 month harvest age, 8 harvest dates)
  - Houma, USA (dryland: 14 month cycle)

- Each dataset is simulated by several modelling groups, with the following models represented: APSIM-Sugar, DSSAT-Canegro, Mosicas and Qcane.
- In some cases, different versions of models were used, and/or the same models were operated by different users (e.g. A1, A2).
- Tasks are arranged into stages within phases according to the diagram below:

\textbf{Results: sample sensitivity analysis}

- Sensitivity analysis was performed with a single model and treatment per site in order to demonstrate the process.
  - The irrigated sites showed minimal response to changes in rainfall and CO\textsubscript{2} (e.g. labelled series in the chart), while the rainfed sites responded to these and temperature (labelled series).
  - Interestingly, all sites except San Carlos appear currently sub-optimal in terms of temperature, with yield increases simulated for all sites in the +2 °C category. Yields decreased with larger temperature increments, however.
  - Model behavior is deemed broadly consistent with current knowledge and theory, but comparison with other models will be more definitive.

\textbf{Insights}

- Model ensembles not as good a predictor as expected.
- Improvement from accessing phenology information not as great as anticipated (e.g. Stalk dry mass root mean squared error (RMSE) decreased 10% from Stage 1 to 2, but sucrose RMSE increased 2%).
- Modellers take very different approaches to calibration (e.g. changing RUE vs. modifying soil parameters).
- Global model testing in diverse environments / production scenarios, rather than local testing, is necessary to avoid model-fitting by unwarranted parameter adjustments.