Assessing and developing targeted climate forecasts for the sugar industry

February 2005 – February 2006

Location: Townsville and Toowoomba, Queensland

Principal investigator

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The need

Owing to the significant impacts that climate has on industry success, the new millennium has brought an increasing focus within the Australian sugar industry to how seasonal climate forecasting technologies can aid industry decision making. While advances have been made in this area, much remains to be explored. For example, we lack knowledge of how low frequency signals on decadal through to multi-decadal timescales could potentially complement decision-making activities. The five-phase SOI system has been the benchmark climate forecasting system used to assist industry's forward planning activities. But investigation of how this system compares with other methods has not been undertaken for key sugar growing regions. Research that details the integration of seasonal climate forecasting with sugar-related decision support tools is also sparse.

How this project fits with MCV objectives

This project contributes to the MCV objectives of improving seasonal forecasting and providing farmers with tools and services for managing climate risk.

Project objectives

The objective of this project was to perform more research in the three areas mentioned above and feed this knowledge into ongoing, sugar-related projects to equip Australian sugar industry representatives and researchers with the skills and knowledge to capitalise on benefits associated with climate forecasting capabilities.

Methods

1. Investigations using low frequency signals

Investigations using low frequency signals for sugar industry regions, pitched within an industry decision-making framework, have been scarce. We performed two investigations to help fill this void. The first was an exploratory analysis to assess if long term variations in sea surface temperature (SST) and mean sea level pressure were related to decadal rainfall. The second sought to identify if, for crucial sugarcane harvesting periods, rainfall was likely to be enhanced or suppressed when ENSO signals were in phase with decadal to multi-decadal signals.

2. Benchmarking the five-phase SOI system

The five-phase SOI system has been extensively used by the Australian sugar industry. There exist alternative climate forecasting systems for consideration but a formal investigation to identify how these methods compare for key sugarcane growing regions has not been undertaken.

3. Linking climate forecasts with decision support tools

We undertook an investigation to identify the effectiveness of linking phase-based climate forecasting systems to improve irrigation scheduling.

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Desired outcomes

- Heightened industry competitiveness and profitability at a global scale stemming from modernised management and improved forward planning activities
- Improved agronomic management through more effective linkages between crop models and climate forecasting systems
- Increased awareness and understanding about the potential benefits of improving understanding of climate variability at decadal to multi-decadal timescales
- Increased awareness about different types of forecasting systems
- Better understanding of the performance of different climate forecasting systems for sugar industry decisions
- Better understanding of how to fairly compare different forecasting systems

Achievements to date

Investigations using Low Frequency Signals

Our research suggests that further enhancement or suppression of rainfall during the harvest window of June to November was not a concern when the low frequency signals were in phase with ENSO, but an exploratory investigation revealed a relationship between the IPO (negative values) and decadal rainfall for the central (Plane Creek) and southern (Harwood) sugar-growing locations.

Owing to the lack of independent data points and filtering procedures applied to the data, caution should be heeded when interpreting acquired data. The results, however, support further research on better understanding potential decadal mechanisms in the climate system.

Benchmarking the five-phase SOI system

We implemented a modified version of the traditional field significance method to compare the five forecasting systems on an overall scale, both spatially (7 regions) and temporally (12 rolling three monthly periods). We computed the overall measure of global significance for a three-phase SOI system, a three-phase SST system, a five-phase SOI system, a nine-phase SST system and the BoM's discriminant forecasting method.

The key learning revealed was that, collectively, the forecasting systems that we considered all performed well.

Linking Climate Forecasts with Decision Support Tools.

We developed a procedure that uses APSIM (Agricultural Production Systems Simulator) to optimally schedule the use of limited irrigation water in order to produce maximum crop yield. The simulator runs through multiple scenarios to determine the optimal timing of irrigation events and, hence, maximum crop yield, given predefined conditions such as the threshold level of crop stress needed to trigger an irrigation, the amount of irrigation water used at each event, and irrigation efficiency. The practical significance to growers from linking a forecasting system with APSIM is that soil type, location and the forecast will play an important role in guiding optimum use of limited irrigation water.

What is left to do?

- Finalise publications
- Present findings to industry case study groups

MCV is a collaborative program between the Grains, Rural Industries and Sugar Research and Development Corporations; the Australian Government Natural Heritage Trust and Department of Agriculture, Fisheries and Forestry; Dairy Australia; Meat & Livestock Australia; and Land & Water Australia. The National Farmers Federation and Australian Wool Innovation Limited are associate partners.

For more information on MCV, visit http://www.managingclimate.gov.au
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