25th International Congress on Modelling and Simulation, Darwin, NT, Australia, 9 to 14 July 2023
mssanz.org.au/modsim2023

Development of an online weather and irrigation forecast decision support tool using an action learning process

J. Sexton [a,b], B. Philippa [c], B. Melville [a], A. Schepen [d], S. Attard [e], M. Davis [f] and Y. Everingham [a]

[a] College of Science and Engineering, James Cook University, Townsville, Australia
[b] CSIRO, Townsville, Australia
[c] College of Science and Engineering, James Cook University, Cairns, Australia
[d] CSIRO, Brisbane, Australia
[e] AgriTech Solutions, Ayr, Australia
[f] Burdekin Productivity Services, Ayr, Australia
Email: justin.sexton@csiro.au

Abstract: Often one of the most difficult yet most rewarding parts of research is turning research results into practical actions. This is the aim of decision support tools. Providing accurate and timely weather forecasts and advice on irrigation requirements can potentially reduce water use, increase productivity, and improve environmental outcomes. As such several irrigation decision support tools have previously been developed. However, many established tools do not make use of weather forecasts in estimating upcoming conditions. IrrigWeb™ for sugarcane, uses historic monthly averages and assumes no rainfall when estimating the next irrigation date. Furthermore, the scale, and location of available forecasts may not represent local climatological differences. Here we describe the development of Opticane (https://www.opticane.net), a weather and irrigation forecasting tool for the sugarcane industry, developed in partnership with Burdekin Productivity Services.

In consultation with industry partners, the initial front-end conceptual design was to provide a map with weather station data for the study region as a landing page for users. Users would then be able to 'zoom in' to details for their farm and further again for irrigation information for specific irrigation units. This 'zoom in' concept was applied throughout the development process to allow for simple displays as much as possible. The conceptual design of the back end was to have observations of weather conditions since the crop planting, weather forecasts fed into a crop model (IrrigWeb) to produce personalized irrigation advice for a user.

A major advantage of Opticane over other irrigation tools was the production of local, ensemble weather forecasts that could then be used to forecast irrigation needs. Specifically, five local climate zones were identified to provide forecasts for similar areas within the study region following Sexton *et al*. 2017. For each climate zone, seven-day post-processed weather forecasts were produced from deterministic forecasts, based on a Bayesian joint probability model (Schepen et al. 2020). This process provided more locally relevant, ensemble forecasts while restricting the computational burden.

Although originally conceived purely as an irrigation decision support tool, consultation with industry partners led to the inclusion of multiple other tools such as generic advice on crop water requirements and providing advice for other management tasks based on industry best management practices. Developing Opticane with continuous feedback from growers and industry partners was critical to producing outputs that matched the needs of the users in a format they could use. We encourage researchers to explore the co-development of interactive tools with industry partners. This co-development will help to engage partners with research outputs and potentially improve uptake of research outputs.

REFERENCES

Schepen, A., Everingham, Y., Wang, Q., 2020. An improved workflow for calibration and downscaling of GCM climate forecasts for agricultural applications – A case study on prediction of sugarcane yield in Australia. Agricultural and Forest Meteorology 291: 107991 DOI: 10.1016/j.agrformet.2020.107991.

Sexton, J., Everingham, Y., Skocaj, D., Biggs, J., Thorburn, P., Schroeder, B., 2017. Identification of climatological sub-regions within the Tully mill area. Proceedings of the Australian Society of Sugar Cane Technologists, Cairns, Queensland, Australia.

Keywords: *Opticane, irrigation, weather forecast, clustering, post-processing*