i-RAT: An interactive rapid assessment tool to assess economic and environmental impacts of different sugarcane irrigation practices

Brian Collins [a], **Steve Attard [b]**, **Zsuzsa Banhalmi-Zakar [a]** and **Yvette Everingham [a]**

[a] *Agriculture Technology and Adoption Centre, College of Science and Engineering, James Cook University, Townsville, Australia*
[b] *AgriTech Solutions, Ayr, Queensland, Australia*
Email: brian.collins@jcu.edu.au

Abstract: Water pollution and climate change are among the greatest threats to the iconic Great Barrier Reef (GBR). Improving the GBR resilience requires a multi-dimensional approach considering the complex interactions between farm management, farm economics, GHG emission, and green finance systems. There is a need for a tool that conveniently measures improvements in sustainability at the paddock scale and can link improved management to sustainable finance systems.

An interactive rapid assessment and visualisation tool named Irrigation Rapid Assessment Tool (i-RAT; https://i-rat.net) was developed to evaluate the impacts of different irrigation practices on sugarcane farmers and extension staff. The tool combines the power of computer modelling with the knowledge and experience of local cane growers and advisors to enable quick and easy comparison of thousands of combinations of farm management scenarios, which is impossible to do in the field.

i-RAT was developed via a participatory process based on the conceptual framework by Jakku and Thorburn (2010). Four focus groups were consulted through the design and implementation of i-RAT to ensure a wide range of end-users were considered in the design process.

i-RAT allows farmers to compare expected yield and water/energy costs under the 'current' irrigation scenario (i.e., irrigation system (furrow, sprinkler, or subsurface drip), frequency, and rate) with those under a 'new' scenario. Farmers can select (through drop-down menus) the appropriate options for numerous variables, including soil type, climate, tillage, and N fertilisation. Outputs consist of text and graphics summarising the impact of the change in irrigation management on individual paddocks' finance, water and energy consumption, water quality, productivity, and greenhouse gas emission. i-RAT also informs sugarcane farmers about new opportunities provided by, for example, engaging in carbon markets.

The core of i-RAT is the sugarcane module from the Agricultural Production Systems sIMulator (APSIM; Holzworth et al. 2014) modelling platform. A datacube from thousands of simulated scenarios was generated. Multiple weather stations and various soil types and management (planting/harvest schedule, tillage, and N fertilisation) scenarios representing farming practices in the Burdekin and Mackay-Whitsunday regions were used for simulations (1971–2021).

i-RAT makes the power of computer modelling available to a wide range of stakeholders. It allows farmers to see the impacts of saving water (and electricity) on cane yield and profitability under variable environmental conditions. i-RAT can also inform banking and sustainable finance stakeholders about how changes in irrigation practices can bring about positive environmental changes. i-RAT can contribute to transformational change in sustainable irrigation management to deliver economic, environmental, and social benefits.

REFERENCES

Holzworth, D.P., Huth, N., DeVoil, P.G., et al. 2014. APSIM – Evolution towards a new generation of agricultural systems simulation. Environmental Modelling & Software 62, 327–350.

Jakku, E., Thorburn, P.J. 2010. A conceptual framework for guiding the participatory development of agricultural decision support systems. Agric Syst 103, 675–682.

Keywords: *Crop model, farm economy, green finance, N pollution, water quality*