RESEARCH

Climate forecasting to improve nitrogen management in the Wet Tropics

Project details

Key Focus Area:

Capability development, attraction and retention

Project name

Climate forecasting to improve sugarcane nitrogen management in the Wet Tropics

Project number

STU073

Principal provider

SRA

Project leader

Danielle Skocaj

SRA researcher Danielle Skocaj's PhD thesis investigated the impact of climatic conditions on Tully sugarcane yields and nitrogen fertiliser requirements. She found that climate forecasting can be used to predict N fertiliser requirements for ratoon crops. ***By Gavin Rodman and Danielle Skocaj, SRA Tully***

The Wet Tropics experiences one of the most variable climates in the world. The El Niño Southern Oscillation (ENSO) is one of the largest sources of year-to-year climate variability in this region.

ENSO has two extreme but closely linked phases, El Niño and La Niña. El Niño refers to the unusual warming of normally cool water in the central and eastern equatorial Pacific Ocean resulting in drier conditions than normal along Australia's sugarcane growing regions.

Conversely, La Niña refers to increased warming of water in the Western Pacific Ocean and extensive cooling of water in the central and eastern Pacific Ocean. Rainfall and storm activity increases over Australia and tropical cyclones tend to be frequent.

The influence of ENSO on Australia's rainfall significantly impacts cane yields. The La Niña event of 2010/2011 was one of the strongest on record and resulted in prolonged periods of wet weather, cyclonic activity, extremely low cane yields and widespread standover cane.

The impact of climate variability on cane yields and nitrogen losses makes the task of applying the right amount of nitrogen fertiliser to optimise profitability and minimise environmental losses extremely challenging.

Danielle found total rainfall over the spring-summer period had a strong influence on Tully cane yields. High spring-summer rainfall favours lower cane yields.

To investigate the impact of spring-summer rainfall on nitrogen fertiliser requirements Danielle used data from field experiments and a crop growth model to simulate nitrogen fertiliser requirements for ratoon crops grown on the Bulgun series soil in dry (low spring-summer rainfall) and wet (high spring-summer rainfall) years. The Bulgun soil is often referred to as a poorly-drained alluvium.

As the majority of nitrogen fertiliser is typically applied to ratoon crops during spring, existing seasonal climate forecasting techniques based on sea surface temperature changes in the Pacific Ocean were investigated to see if fertiliser requirements could be predicted with sufficient lead time (at the start of spring).

The simulation study identified nitrogen fertiliser requirements are, on average, 25 percent lower in wet years for ratoon crops grown on the Bulgun soil. The study also showed that sea surface temperatures can be used to predict fertiliser requirements for ratoon crops grown on the Bulgun soil.

The link between nitrogen inputs and sea surface temperatures exists because the chance of experiencing high spring-summer rainfall and hence lower cane yields increases when sea surface temperatures are in the La Niña phase.

High spring-summer rainfall is associated with lower cane yields at Tully because of increased waterlogging and lower solar radiation. Given high spring-summer rainfall is associated with lower cane yields, reducing nitrogen fertiliser rates in wet years will improve nitrogen use efficiency and grower profitability.

"Based on work to date; Tully growers could consider reducing nitrogen fertiliser application rates to ratoon crops grown on the Bulgun soil when sea surface temperatures are in the La Niña phase," Dr Skocaj said. "This is because the chance of experiencing high spring-summer rainfall and lower cane yields at Tully increases in La Niña years. Growers could also consider using an enhanced efficiency fertiliser product on the Bulgun soil in wet years."

These results are specific to a single poorly-drained alluvial soil (Bulgun series) at Tully. The Bulgun and other poorly-drained alluvial soils are widespread throughout the Wet Tropics. More research is required to extend these findings to other soil types and districts.