

Project 5.11 Improved Water Quality Outcomes from On-Farm Nitrogen Management

Project Summary

This project is utilising existing farm trials at identified nitrogen (N) loss 'hot spots' to explore two important approaches to N fertiliser management in sugarcane crops. The first is whether finer scale yield records can be used to calculate Productivity Zone Yield Potentials (PZYP) to guide localised fertiliser nitrogen application rates. The second compares enhanced efficiency fertilisers (EEFs) to standard N fertilisers, with a focus on improving crop recovery of applied N and minimising offsite N losses. Water quality benefits that derive from such practice changes are being evaluated. Productivity, economic and environmental indicators will validate these strategies for reducing surplus N and produce recommendations for enhanced Best Management Practices (BMPs).

Problem

Dissolved inorganic nitrogen (DIN) from agriculture is a major contributor to total DIN loads entering the Great Barrier Reef lagoon. Over-use of N fertiliser occurs in response to poor efficiency of use of fertiliser N by the sugarcane crop. Best practice fertiliser application rates are based on regionally-derived target yields (district yield potential, DYP) achieved in only a few percent of fields. Applying N fertiliser to meet a DYP target in consistently lower-yielding fields creates hot-spots for offsite N export. More spatially-specific yield targets, combined with Enhanced Efficiency Fertilisers, may reduce or eliminate N hot-spots and mitigate N losses from sugarcane farms. This project is quantifying the productivity risks and water quality benefits from these strategies.

How Research Addresses Problem

The project is active in four areas: (i) Running seven field experiments from Mackay to Freshwater, using a common design comparing standard fertiliser applications at DYP or PZYP rates to the best available EEF products at the same N rates. Crop productivity and N use efficiency are monitored, while N in runoff water is measured at two sites. (ii) A PhD project is looking at the efficacy of various EEF technologies when fertilisers are applied in bands at high N fertiliser rates. (iii) Technical engagement is occurring with the fertiliser industry around product efficacy and use strategies. (iv) Scientific leadership is provided to the EEF60/Reef Trust Phase 4 project led by CANEGROWERS.



The Silkwood experimental site showing large scale strip plots under different fertiliser N management, with runoff flumes and gauges to sample runoff water quality

There are replicated sites for this project in the Freshwater, Tully, Silkwood, Burdekin and Mackay districts. All experiments were established in 1st or 2nd ratoon crops, and are currently in the 3rd year under the different N management strategies. Each site also contains a reference treatment with no fertiliser N applied, to quantify the background soil N contribution.

The first two seasons showed that the blend of EEF products was a more efficient source of N supply for crop uptake, with similar biomass N accumulation at lower fertiliser application rates. Greater crop recovery with EEFs rarely resulted in yield increases above that achieved with conventional fertiliser at the DYP benchmark rates. However, while rate reductions with conventional N fertilisers increased the risks of productivity loss, this did not occur with EEFs at rates based on PZYP. Results in year 1 of the EEF60 project seem to be consistent with these responses across a wider range of sites and soil types.

The PhD studies have shown that the chemical environment in and around a concentrated band of N fertiliser impacts on the efficacy of technologies designed to slow N release to better match crop N demands. This will influence development of new fertiliser products and the application strategies used with these products. Data suggest that blends of EEF technologies, or different application strategies, may limit these negative impacts. These strategies will be tested in the current project. Strong linkages have been developed with a large number of fertiliser manufacturers and distributors.



Photo: Chelsea Stropplana, UQ

Further information

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