

# More Profit from Nitrogen Program: delivering cross-sector collaboration in NUE research

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## Abstract

The More Profit from Nitrogen Program (MPfN) is a four year partnership between Australia's four most intensive users of nitrogenous fertilisers: cotton, dairy, sugar and horticulture. The Program is conducting research and development to the increase nitrogen use efficiency (NUE) across the four sectors whilst improving profitable and sustainable use. By better understanding the influence of contributing factors on NUE in farming systems, the Program is:

- Generating greater knowledge and understanding of the interplay of factors to optimise N formulation, rate and timing across industries, farming regions and irrigated/ non-irrigated situations;
- Generating greater knowledge and understanding of the contribution (quantifying rate and timing) of mineralisation to crop or pasture N budgets; and
- Generating greater knowledge and understanding of how enhanced efficiency fertiliser (EEF) formulations can better match a crop or pasture specific N requirements.

The Program is supported by \$5.889 million funding from the Australian Government's Rural Research and Development (R&D) for Profit program in addition to cash and in-kind contributions from each of the industry sectors, research organisations and collaborating partners equating to \$9.757 million.

The MPfN Program is at the mid-way point of research activities but is already resulting in a more collaborative research effort to accelerate aligned research methodology, standardising terminology to reduce confusion for industry end users and communicating NUE outcomes using common indicators across the four industry sectors. MPfN is a proactive collaboration formed to expedite NUE across Australia's intensive cropping and grazing industries to reduce environmental impact and increase the long-term sustainability of Australian farming businesses by increasing yield, product quality and overall profitability.

## Key Words

Nitrogen Use Efficiency research, Nitrogen Management, Cross-sector collaboration, industry extension

## Introduction

Application of Nitrogen (N) fertiliser is a vital component of farm system inputs in Australia in order to produce high yielding, quality crops, produce and pastures and is therefore a key profit driver for farmers. Calculating the optimum amount to apply is often difficult as the N cycle is complex and there are regional uncertainties associated with the contribution of mineralised N from the soil in the uptake, cycling and use by key primary industry crops and pastures. N availability is also affected by soil type and condition, climatic and seasonal variability, paddock management history, irrigation management practices and applied fertiliser formulation, timing, rate and placement.

Given the potential risk of reduced yield from insufficient N, coupled with the relatively-low unit cost of N fertiliser, producers can err on the side of over-supply and/or application when plant uptake is not optimal, resulting in poor NUE. Significant research has been undertaken on N input and management requirements across Australian agricultural systems, however, the low NUE of many modern farming systems and impacts upon economic and environmental imperatives means that N research remains relevant and essential. This collaborative national research program of Australia is drawing upon an unprecedented multi-organisational research and extension effort to address improvements in NUE.

The industries involved each share common markets which have growing expectations for product producers to have evidence of sustainable farming practices and good environmental risk management. Through greater collaboration, the MPfN Program is providing these industries with much needed NUE improvement strategies to drive more profitable use of N by farmers and demonstrate improvements in quality food and fibre production with the lowest possible environmental impact. Two and a half years of research is already delivering evidence of increased farm profitability and reduced environmental risk through trial of new technologies and management practices which increase NUE. Moreover, it is developing resources and tools which increase farmer understanding of soil, water and management influences which contribute to NUE.

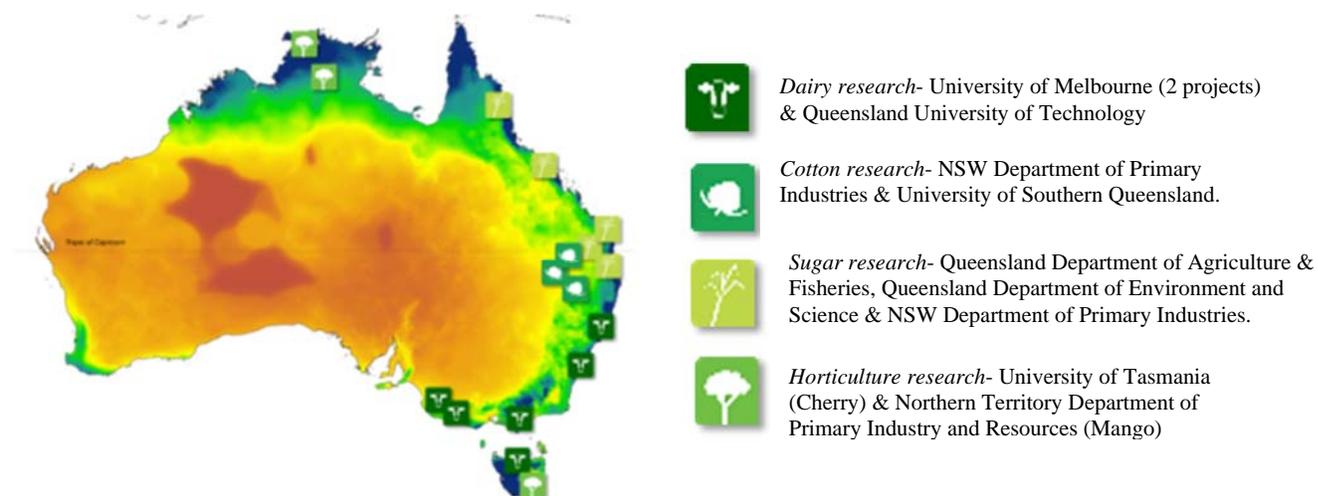
## Methods

### *How the Program is being delivered*

Ten research sub-projects are being delivered by 8 lead research agencies, together with a further 24 collaboration partners, encompassing 72 interacting research, technical and PhD candidate positions. The research is informing new N fertiliser formulations, application and measurement technologies, decision support tools and best management practice guidelines. A total of 40 field based experiments have been established (see Figure 1) and are supported by laboratory experimentation and modelling.

Collaborative work between the sub-projects is coordinated by a dedicated Science Coordinator through the Cotton Research and Development Corporation, in:

- Standardising approach to soil N mineralisation measurement methods;
- Cross-sector agreement on potential NUE indicators and model parameters;
- Establishing an agreed minimum data-set for research into NUE; and
- The use of remote sensing technology in NUE research measurement and future on-farm applications.



**Figure 1: Approximate location of the More Profit from Nitrogen Program's 40 research trials across Australia for the cotton, dairy, sugar and horticulture industries.**

Researchers, together with extension and adoption program leaders from industry, come together via webinars and face to face workshops periodically throughout each year of the Program. There is a strong emphasis on shared learning and progressive outcomes released to industry so that key extension resources can be updated and communicated to on-farm service providers (private, industry, commercial and government agency) and primary producers throughout research duration.

### *The Sub-research Projects*

#### **Increasing nitrogen use efficiency in dairy pastures**

##### **Queensland University of Technology & NSW DPI**

Trials established to investigate interactions between N application (including EEFs), soil mineralised N and irrigation in sub-tropical pasture systems.

#### **Improving dairy farm nitrogen efficiency using advanced technologies**

##### **The University of Melbourne**

Gaining a better understanding of the amount of N supplied through mineralisation to dairy pastures in South West Victoria. An industry nutrient calculator, which accounts for mineralised available N, will be developed for the industry Fert\$mart N BMPs.

#### **Quantifying the whole farm systems impact of nitrogen best practice on dairy farms**

**The University of Melbourne & Tasmanian Institute of Agriculture/ University of Tasmania**

Employing Australian dairy's *DairyMod* to test and validate current industry *Fert\$mart* N BMPs across key dairy farming regions.

#### **Enhancing nitrogen use efficiency & improving phosphorus nutrition in cotton**

**NSW Department of Primary Industries**

Investigating the intricate relationship between N supplied through soil mineralised and fertiliser sources, P supply, fertiliser placement & timing, and irrigation strategy to achieve greater NUE and improved soil P nutrition.

#### **Optimising nitrogen and water interactions in cotton**

**University of Southern Queensland**

Increasing understanding of the influence of rainfall/irrigation wet-dry cycles on mineralising soil organic N into plant available forms and trial of a potentially available organic N rapid soil test.

#### **Optimising nutrient management for improved productivity and fruit quality in mangoes**

**Northern Territory Department of Primary Industry and Resources**

Research is using  $^{15}\text{N}$  to quantify plant N and cycling through the soil-plant-atmosphere system of mango crops and determine soil mineralised N to inform industry NUE BMPs, including EEF options.

#### **Optimising nutrient management for improved productivity and fruit quality in cherries**

**Tasmanian Institute of Agriculture/ University of Tasmania**

Research is using  $^{15}\text{N}$  to quantify plant N and cycling through the soil-plant-atmosphere system of cherry crops and determine soil mineralised N to inform industry NUE BMPs, including biological options.

#### **Smart blending of enhanced efficiency fertilisers to maximise sugarcane profitability**

**Queensland Government Department of Environment and Science**

Investigation into optimal blending ratios of EEFs with conventional urea to better match sugarcane crop N dynamics across five sugarcane regions.

#### **New technologies and managements: transforming nitrogen use efficiency in cane production**

**Queensland Government Department of Agriculture and Fisheries**

Targeted formulation and management technique options investigated to better match N release to cane crop demand by controlling N transformation and solubility and combating N "leakiness" to the environment.

#### **Improved nitrogen use efficiency through accounting for deep soil and mineralisable N supply, and deployment of enhanced efficiency fertilisers (EEF) to better match crop N demand**

**NSW Department of Primary Industries**

Assessment of N stores in soils of sub-tropical sugarcane regions to improve understanding of N supplied from mineralisation and optimal use of EEFs to better match crop N demand. A dose response model for urea and PCU is being developed.

### **Results**

#### *Collaboration- breaking down silos*

- The Program has delivered 74 extension activities within research and industry networks resulting in a total reach so of 8,500 individuals to date.
- There have been 79 communications on research activities, primarily within industry media channels, resulting in a reach of over 200,000 industry stakeholders.
- There have been over 50 collaboration activities between the partners of the MPfN Program and their industry networks, resulting in input and feedback into sub-project research by 1,100 researchers and industry representatives (host farmers, service providers, commercial resellers, private sector advisors).
- There are scheduled future activities to directly deliver research outcomes to prime stakeholder groups that provide a direct conduit to on-farm nitrogen use advice such as the fertiliser industry and agronomy groups.

## **Conclusion**

MPfN is a platform for cross-industry collaboration on N management, and the results are fostering information and knowledge exchange amongst Australia's leading scientists. Since commencing in 2016, the MPfN Program has produced early outputs which are already embedded into industry extension programs, reducing lag time between the research and adoption by cotton, sugar, horticulture and dairy producers. By Program end in 2022, it will deliver technologies and decision support resources that will significantly increase NUE to reduce environmental impact whilst increasing the long-term sustainability and profitability of Australian farming businesses.

It is timely that Australia's leading agronomists will come together at the 2019 Australian Agronomy Conference where the MPfN Program can directly communicate the extensive geographical and scientific investigational efforts on NUE being delivered by the four industries. It will provide a conduit to engage with the agronomy sector on the next vital stage of the Program in extension and adoption of recommended practices emanating from research outcomes.

## **References**

[www.crdc.com.au/more-profit-nitrogen](http://www.crdc.com.au/more-profit-nitrogen)

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