



FINAL REPORT 2018

For Public Release

Part 1 - Summary Details

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CRDC Project Number: AOTG1601

Project Title: Increasing Profitability Through Improved Nitrogen Use Efficiency and Reducing Losses of Nitrogen

Project Commencement Date: July 2015

Project Completion Date: June 2018

CRDC Research Program: 1 Farmers

Final Report Executive Summary

Fertiliser nitrogen use efficiency in irrigated cotton was assessed on the Darling Downs over 3 years. A total of 47 treatments were examined from 2015/16-2017/18 from 12 locations combining N application rate (farmer's practice vs 30% reduction), product (urea v DMPP) and irrigation method (furrow vs overhead).

The average yield across all sites and years for the three main fertiliser treatments (DMPP, Urea and Farmer's Practice) was 9.9 bales ha⁻¹ with the farmer's average N application rate of 161 kg N ha⁻¹. There was no significant effect of different fertiliser products and reduced rates on lint yield. On average 81 kg N ha⁻¹ was removed in the lint and seed and 138 kg N ha⁻¹ was lost from the system (maximum 260 kg N ha⁻¹) in the form of soil and fertiliser N over the cropping season.

Nitrogen fertiliser use efficiency in irrigated cotton systems was consistently low, with 47% of the applied fertiliser lost over the season. The average rate of N application was only 137 kg N ha⁻¹, well below the industry average of 275 kg N ha⁻¹. We estimate that non-fertiliser derived N losses were 24% of mineralised N.

On average, only 17% of the N taken up by the crop was derived from fertiliser i.e. 83% was soil derived N. Nitrogen fertiliser losses were lower in the overhead irrigated sites (35%) compared to the furrow irrigated sites (51%). At harvest, on average 28% of the applied N was recovered in the soil, with 11% removed in lint and seed and 14% remaining on the field as residual plant material.

The use of the nitrification inhibitor DMPP increased the recovery of N fertiliser in the soil (at harvest) by 21% and reduced overall losses of N fertiliser by 16%, indicating that DMPP could potentially increase fNUE in irrigated cotton systems. More long-term trials on the effect of

DMPP in irrigated cotton systems are required to better assess the potential of this product. Ideally, these are done with reduced N rates over multiple years and in N limited systems.

In addition to the N fertiliser, on average 264 kg N ha⁻¹ was supplied from soil mineralisation (169 kg N ha⁻¹) and mineral N in the soil profile at planting (144 kg N ha⁻¹) compared to an average fertiliser application of only 137 kg N ha⁻¹.

Commercial farms have highly elevated levels of available N in the soil, most likely due to excessive N fertiliser applications in previous years. Total crop N uptake averaged 218 kg N ha⁻¹ in the N fertilised treatments, while an average of 194 kg N ha⁻¹ taken up by the crop in the 0N plots. Our results confirm that growers could significantly reduce N fertiliser inputs without any negative impact on lint yield.

Nitrogen fertiliser is not used efficiently under current on-farm management strategies and demonstrates that mineralisation of soil organic N and recycling of N from previous fertilisation events or returned with crop residues is a key source of N in irrigated cotton production systems.

The intercomparison of calculators highlighted the great variability in the N recommendations on offer to the cotton industry. These differences can be attributed to the different methods used to estimate soil N mineralisation, crop residue decomposition and N losses.

The project has shown that remote sensing can provide accurate prediction of yield variability with RDVI being most suitable vegetation index for identification of in-field variability and in field management zones.

For the delineation of management zones it is crucial to have a certain degree of in-field variability and to use multiple years of data to understand whether variable yields are either stable or unstable.

Remotely sensed Vegetation indices could potentially be used in early January to assist in-season N management, but it is essential to evaluate the causes of variability in order to develop N management decisions.