

Fertilizer nitrogen use efficiency in irrigated cotton cropping systems

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Abstract

Irrigated cotton in Australia is mainly grown on heavy textured clay soils which are prone to waterlogging and loss of significant amounts of nitrogen to the atmosphere. This study investigated fertilizer nitrogen use efficiency (fNUE) on commercial cotton farms. Fertilizer NUE was consistently low, with on average 47% of the applied fertiliser lost over the season and only 17% of the N taken up by the crop derived from fertiliser. The results demonstrate that currently nitrogen fertiliser is not used efficiently and that cotton growers could significantly reduce N fertiliser inputs without any negative impact on lint yield.

Keywords: term, term, term

1. Material and methods

Over three years field trials were undertaken at four different commercial farms comparing the growers N practice with up to three potential N best management practices (reduced fertiliser rate, enhanced efficiency fertilisers, irrigation) using a randomized complete block design with four replicates. The recovery of N fertiliser in the soil and plant was assessed by applying ¹⁵N-labelled to micro-plots.

2. Results

The average lint yield across all sites and years was 2,25 t ha⁻¹ with no significant effect of different fertiliser products and reduced rates on lint yield.

Nitrogen fertiliser use efficiency in irrigated cotton systems was consistently low, with 47% of the applied fertiliser lost over the season (Fig. 1).

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.

2. Conclusions

Our results show that N fertiliser is not used efficiently under current on-farm management strategies and demonstrate 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.

Commercial farms have highly elevated levels of available N in the soil, most likely due to excessive N fertiliser applications in previous years, indicating that growers could significantly reduce N fertiliser inputs without any negative impact on lint yield.

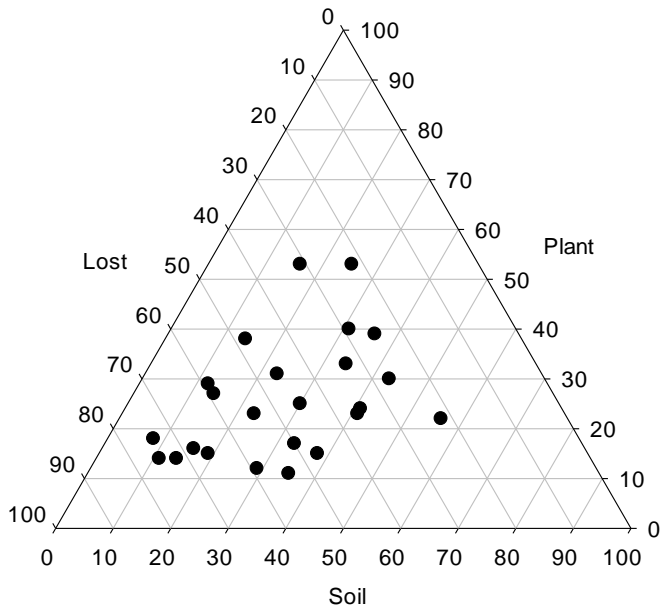


Fig. 1: Fate of ¹⁵N fertiliser applied as urea to 24 cotton production system treatments. Average recoveries of 28% and 25% in soil and plant respectively and 47% lost completely.

