

Cotton Research and Development Corporation

Project Title: Improved Nitrogen Management for Cotton

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Research Organisation: CSIRO

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ABSTRACT

Nitrification inhibitors were successfully used to improve the recovery of fertilizer N in the irrigated cotton-growing system. By slowing the rate of nitrification of applied ammonium-N, it was shown that the loss of N through denitrification was limited by the reduced concentration of nitrate in the soil. The effectiveness of recognised and experimental nitrification inhibitors to inhibit nitrification and reduce N loss through denitrification were compared in field and laboratory experiments. The more effective inhibitors (2-ethynylpyridine (2-EP), Terrazole and N-Serve) were able to retard nitrification for more than 8 weeks. They also improved N fertilizer recovery (from 35 to 50% in one situation) and enabled the cotton crops to better utilise fertilizer N where denitrification loss was severe. In some instances, lint yields were increased significantly (up to 18%) to where the profitability of cotton-growing was substantially improved.

One inhibitor, Terrazole proved cost effective in field experiments and will soon be commercially available. Significant and economic yield improvements were obtained in 3 of the 8 experiments where Terrazole was included; the lack of response to Terrazole was believed due to the use of low fertilizer rates (3/8), water stress (1/8) and hail damage requiring resowing of crops (2/8) and combinations of these factors.

The compounds 2-EP, N-Serve and an experimental compound (XDE-474) also proved effective nitrification inhibitors and improved fertilizer recovery in some instances. Calcium carbide (either wax-coated or not) proved relatively ineffective as a nitrification inhibitor in several experiments and conserved little fertilizer N. Both phenylacetylene and ethynylcyclohexanol were also ineffective, despite their chemical similarity to 2-EP.

The removal of cotton stubble, as compared with retaining it, reduced the efficiency of N use. Although soil mineral N concentrations and crop N uptake were not generally affected during the 3-year experiment, lint yields and fertilizer recovery were decreased where stubble was removed.

The more effective nitrification inhibitors were identified in terms of providing improved N fertilizer recovery, reduced N loss through denitrification and in some instances, significantly increased lint yield and profitability of cotton-growing. Poor fertilizer recovery was closely associated with inferior soil structure.