The role of nitrification inhibitors and polymer coated urea in N management in the sub-tropics

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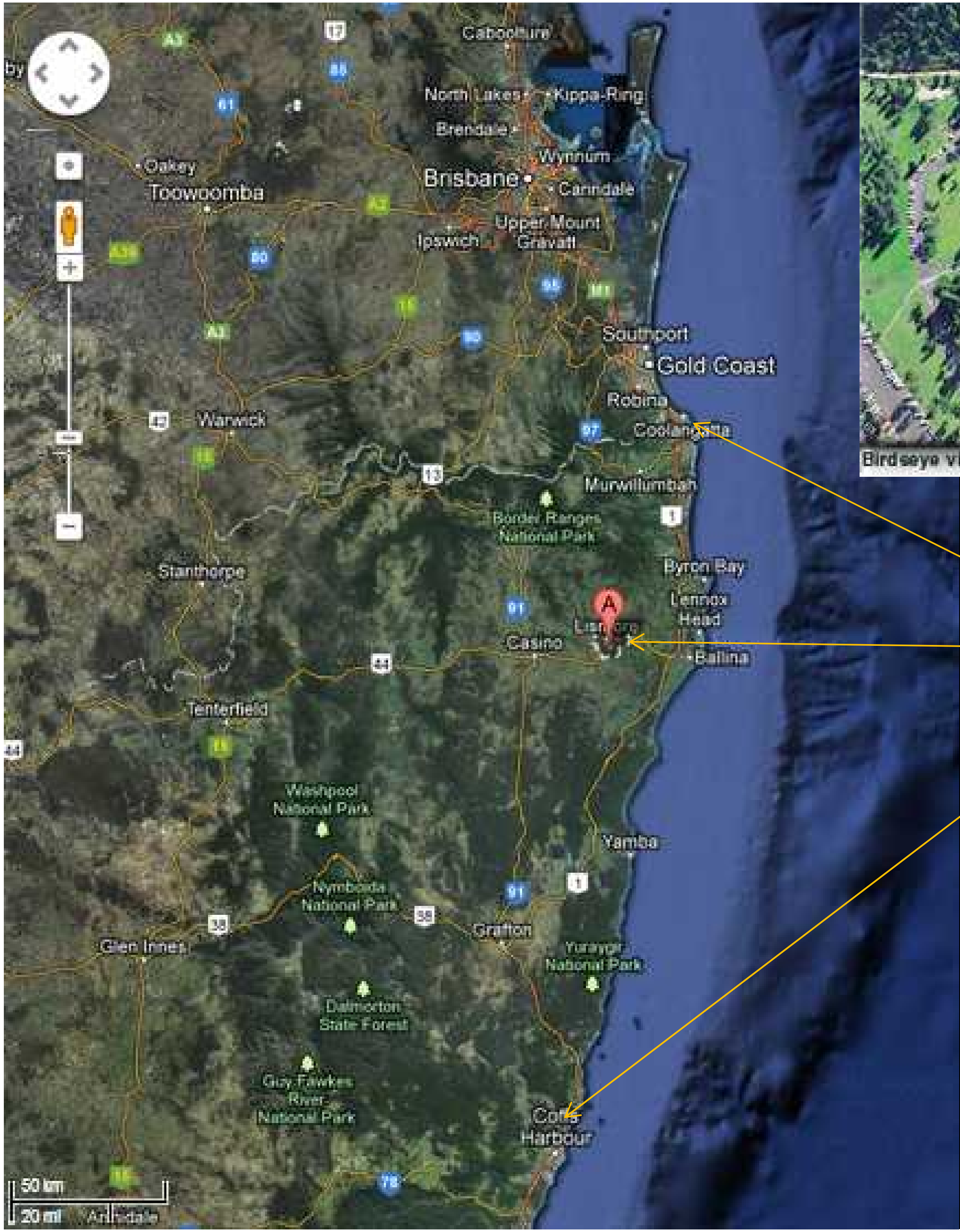

Birdseye view of Lismore Campus.

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Key aims of research

1. **Resolve whether N fertiliser products containing nitrification inhibitors or polymer coating can reduce seasonal nitrous oxide emissions in the subtropics – not much data from tropics and subtropics**

2. **Determine if these products are economically viable options for farmers**

3. **Understand mechanisms driving success or failure of these products in the subtropics**

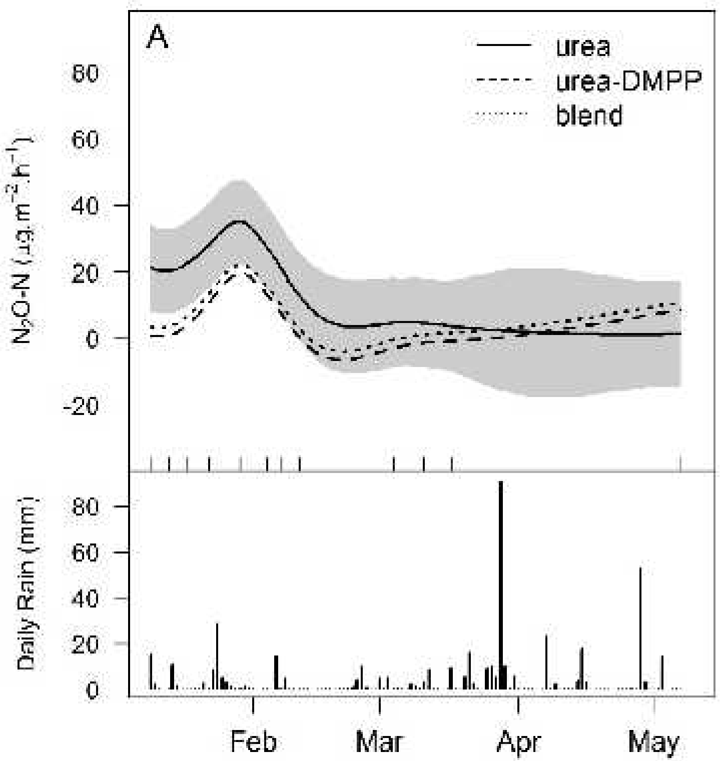


Nitrous oxide emissions in 2013-14 rice trial

Rice cv. Tachiminori sown 7th January 2014 on a redoxic hydrosol (harvest 10th May 2014)

80 kg/ha N applied post sowing (8th January) prior to rain event

Previous crop was sugarcane, removed in autumn 2013 followed by 7 month fallow



GHG emissions were measured using static chamber methodology and data anaylsed as per Morris et al. 2013.

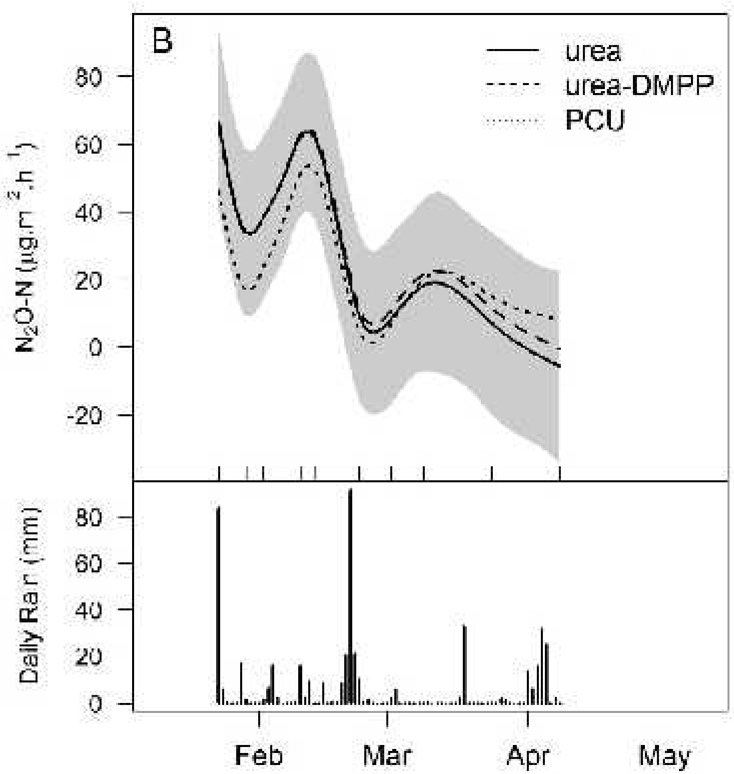
N treatment	N_2O-N (kg ha^{-1})
Urea	0.42
Urea-DMPP	0.30
Blend	0.34
mean	0.35
SE	0.09
lsd	0.34
P	0.68

Nitrous oxide emissions in 2014-15 rice trial

Rice cv. Tachiminori sown 7th December 2014 on a redoxic hydrosol (harvest 21st April2014)

80 kg/ha N broadcast 21st January prior to rain event

Previous crop was sugarcane, removed in autumn 2014 followed by 6 month fallow



GHG emissions were measured using static chamber methodology and data anaylsed as per Morris et al. 2013.

N treatment	N_2O-N (kg ha^{-1})
Urea	0.41
Urea-DMPP	0.45
PCU	0.38
mean	0.41
SE	0.16
lsd	0.21
P	0.73

Results from other trials in the region

Two rice trials with DMPP and PCU on peat soils (2012/13 and 2015/16and one further rice trial on a clay soil (2015/16) that showed no difference in nitrous oxide emissions during peak events or cumulative emissions.

Conclusion: no consistent effect of either product on nitrous oxide emissions

Why the variability in efficacy of DMPP in the subtropics?

Temperature and breakdown of the inhibitor?

Physical separation of DMP from phosphate?

How does temperature effect efficacy?

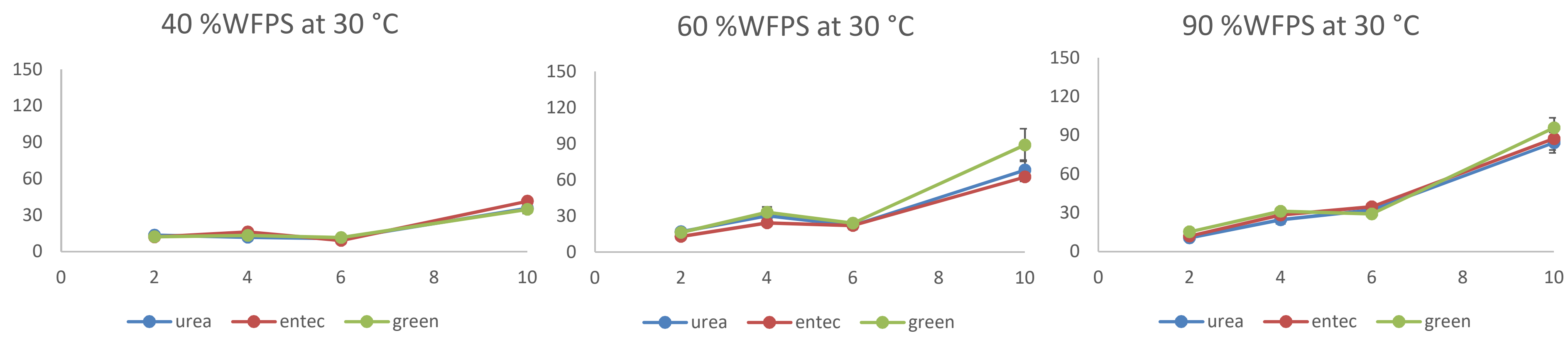
Incubation experiment with urea, green urea and entec

Clay loam soil pH 5.6, 2.3% C, 0.18% N and a CEC of 27 $cmol^+ kg^{-1}$

15 g soil in falcon tubes + 400 kg/ha N (assuming top 100 mm of profile)

Incubated at 3 soil moisture contents (%WFPS) at 30°C

Nitrate concentration (mg/L) in KCl extract



Impact of DMPP and PCU on grain yields

No effect of DMPP or PCU on grain yields in any trials at 80 kg N/ha

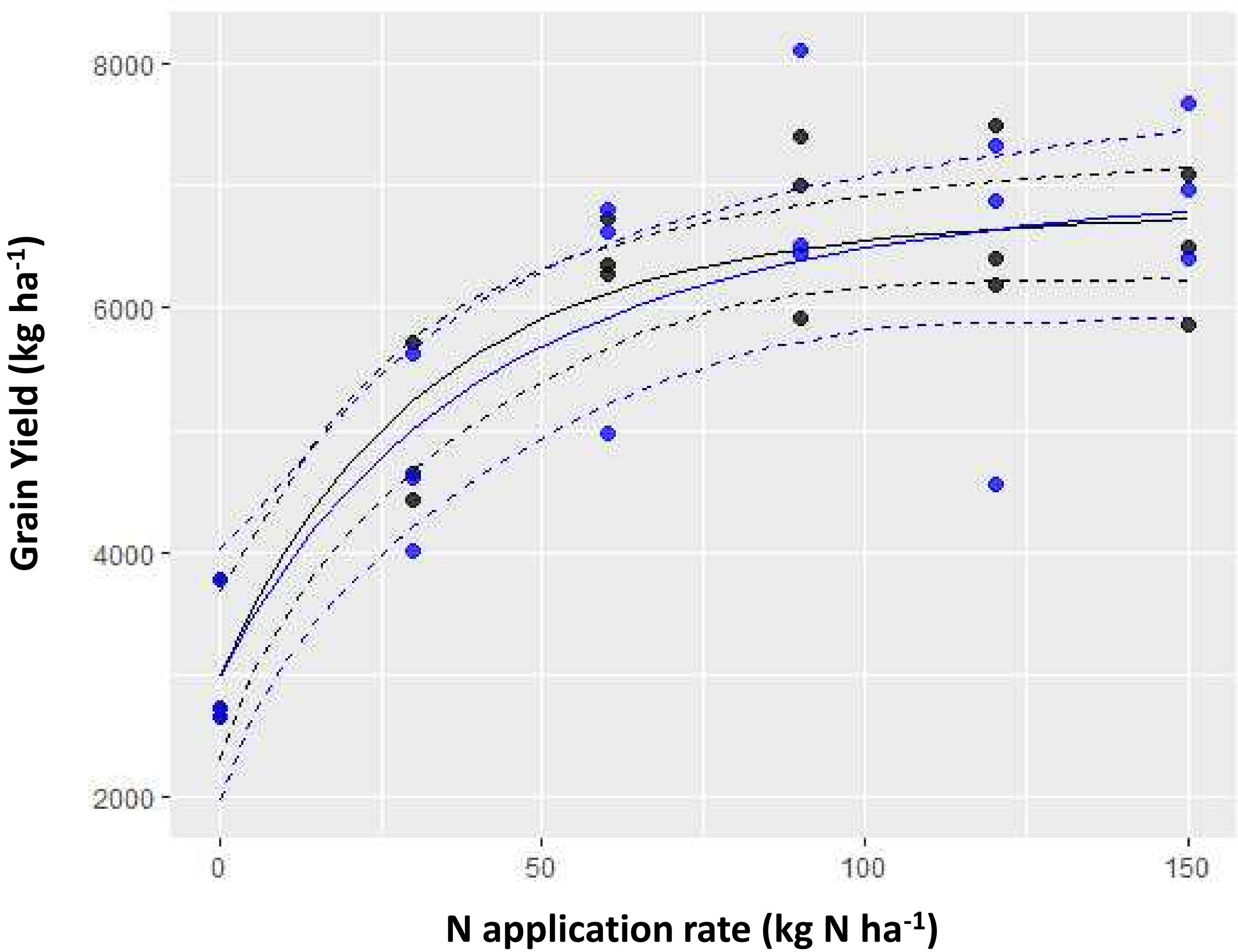
Given that 80 kg/ha is around the optimum N rate in these systems after a 6 month fallow after cane, can we expect a yield response?

How reliable are conclusions from recent meta-analyses?

Abalos et al. (Agriculture, Ecosystems and Environment 189 (2014) 136–144) analysed data from 27 published studies and found 7.5 % yield increase with DCD, DMPP or the urease inhibitor NBPT.

While N rates < 150 kg N/ha were classified as 'low', only 4 studies used a known sub-optimal N rate in addition to the recommended N rate.

Yield response curve: Urea-DMPP (Entec) vs urea (2015-16)



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Summary and conclusions

1. No significant lowering of cumulative nitrous oxide emissions from DMPP or PCU across the 6 month rice growing season in 5 trials

2. Both DMPP and PCU showed evidence of lower nitrous oxide emissions in peak emission events during one season each

3. We need to better understand the impact of temperature and moisture regimes on DMPP

4. Given the extra cost of enhanced efficiency fertiliser (EEF) products, we need more agronomic trials with multiple N rates to produce response curves that can be used to inform farmers of the economics of EEF use

5. Not good enough to say these products are ineffective: we need to work with companies to find alternatives that do work given the proximity of our arming systems to waterways

Acknowledgements

Funding:

Southern Cross University
NSW Department of Primary Industries
Australian Government – Carbon Farming Futures program

Technical assistance:

Lee Kearney (SCU)
Josh Rust (NSW DPI)
Scott Petty (NSW DPI)