

Influence of temperature and soil type on inhibition of urea hydrolysis by the urease inhibitor NBPT in Australian soils

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Introduction

Urease inhibitors such as N-(n-butyl) thiophosphoric triamide (NBPT) have the potential to improve the N-use efficiency of urea by inhibiting ureases which catalyse the hydrolysis of urea. Studies have shown that NBPT can successfully reduce urea hydrolysis, but limited work has been done on Australian soils.

Aims and methodology

To investigate hydrolysis rates of urea +/- NBPT (0.1% w/w urea) in differing Australian agricultural surface (0-10 cm) soils (Table 1) using small-scale (40-200 g soil) controlled temperature incubation studies, and to investigate the factors controlling NBPT efficacy.

Table 1. Selected soil properties

Parameter	Kalkee	Longerenong	Dookie	Pin Gin
Agricultural use	cropping	cropping	pasture	sugarcane
Texture	clay loam	medium clay	fine sandy loam	clay loam
Total C (%)	1.39	0.45	2.06	3.06
Total N (%)	0.14	0.09	0.99	0.19
Ct:Nt ratio	10	13	11	16
pHw	7.8	8.1	5.4	4.6
Urease activity (µg urea-N/g soil.hr)	54	78	186	70 (soil) 154 (trash)

Results

- NBPT reduced hydrolysis of surface applied urea (160 kg N/ha) in 2 wheat cropping soils from western Victoria (Figs. 1a and b) over 5-25°C.
- At lower temperature (5-15°C) NBPT conserved >65% of the urea for 16 days in the wheat cropping soils (Figs. 1a and b)
- In a pasture soil and a sugarcane soil with a sugarcane trash blanket NBPT was less effective in reducing urea hydrolysis (Figs. 1c and d) over 5 to 45°C.
- Differences in inhibition reflect the different urease activities of the systems and subsequent rates of urea hydrolysis.
- Urease activity and treatment had a significant ($P < 0.001$) effect on the percentage of urea hydrolysed. Temperature was also important but to a lesser extent ($P < 0.01$).

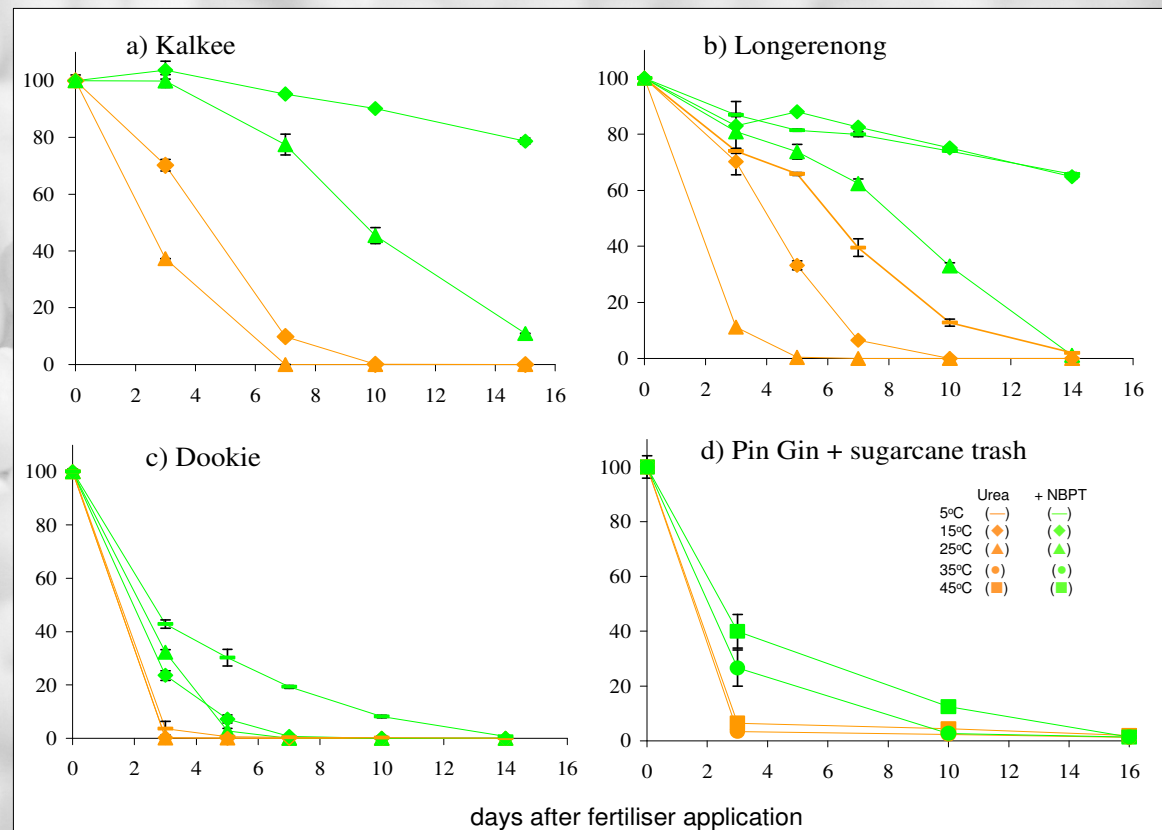


Figure 1. Urea remaining after fertiliser application for +/- NBPT addition in soil (a-c) and soil + trash (d) at different temperatures.

Conclusions

NBPT has the potential to reduce urea hydrolysis in some Australian soils. The reduction in urea hydrolysis due to NBPT was dependent upon

- the substrate to which it was applied (soil type, or plant residue) which influences the urease activity, and
- temperature.