

Green Urea NV®

# Green Urea

## Trial Report 2026



# Introduction

**Urea is the most used nitrogen (N) fertiliser. When applied to soil, urea is hydrolysed in the presence of moisture to ammonium, facilitated by the action of urease enzyme present in the soil. The hydrolysis process is completed within a few days (1-4 days).**

**Under alkaline or high pH conditions, the ammonium ( $\text{NH}_4^+$ ) can be converted to ammonia gas ( $\text{NH}_3$ ) which can be lost through volatilisation from the soil especially when urea is surface applied. Other loss pathways for applied urea include leaching of nitrate ( $\text{NO}_3^-$ ) and denitrification of  $\text{NO}_3^-$  to nitrous oxide ( $\text{N}_2\text{O}$ ) and dinitrogen ( $\text{N}_2$ ) under very high soil moisture content.**

The scope of this trial focused on the measurement of  $\text{NH}_3$  volatilisation from surface-applied urea and the performance of Green Urea NV<sup>®1</sup> in mitigating the volatilisation losses.

Incitec Pivot Fertilisers (IPF) Green Urea NV, an enhanced efficiency fertiliser (EEF), contains urease inhibitor which slows the conversion of urea to  $\text{NH}_4^+$  which is subject to loss as  $\text{NH}_3$ . The Green Urea NV minimises N losses leading to more retention in the system for a crop and pasture production. Extensive research trials by IPF with the help of co-operators (see appendix) in 2025 measured  $\text{NH}_3$  volatilisation from Green Urea NV compared to Urea across Australia at 7 winter cropping sites across south eastern Australia with varying soil types over multiple topdress applications.

## SUMMARY OF FINDINGS

Up to 22% (10 kg N/ha out of the 46 kg N/ha) of N applied as Urea was lost through  $\text{NH}_3$  volatilisation over two weeks. The Green Urea NV consistently reduced N loss across all sites and application timings by an average of 79%. Results show a higher percentage of losses occurred in the seven days post-treatment applications compared to the second week.

## BUILDING ON 2024 FINDINGS

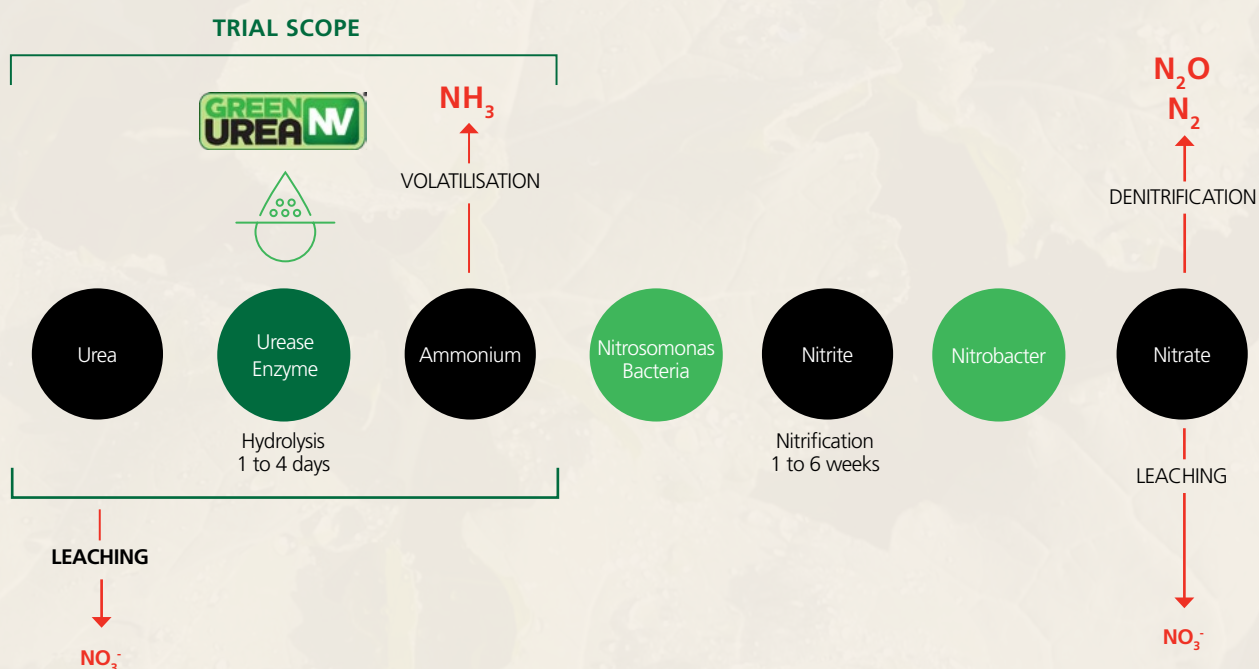
Across 11 winter cropping sites in south-eastern Australia, Green Urea NV consistently reduced ammonia volatilisation losses compared with conventional urea. While losses from standard urea reached up to 26% of applied nitrogen, Green Urea NV reduced volatilisation by an average of 77–82% across June, July and August applications, helping retain more nitrogen in the production system and supporting improved fertiliser efficiency.

To explore the complete 2024 trial results, visit our website at [incitecpivotfertilisers.com.au](https://www.incitecpivotfertilisers.com.au)

<sup>1</sup> Green Urea NV is a registered trademark of Incitec Fertilisers Operations Pty Ltd



**Figure 1: Nitrogen transformation and loss pathways for applied urea.** The urease inhibitor in Green Urea NV slows the urease enzyme responsible for the rapid hydrolysis of urea to ammonium which can be lost as  $\text{NH}_3$  under certain soil and climatic conditions.



## METHOD

The setup for  $\text{NH}_3$  measurement consists of 150 x 300 mm PVC chamber with a cap and an acid treated foam. The chamber which was driven into the soil over the topdressed area provides an enclosure and holds the foam above the soil surface whilst the cap excludes moisture over the course of measurement. The foam was replaced at weekly intervals for two weeks for continuous trapping of  $\text{NH}_3$  from either the Urea or Green Urea NV. The  $\text{NH}_3$  in the foam was subsequently extracted for analysis at the Nutrient Advantage Laboratory. All applications were made at a rate of 46 kg N/ha.

In 2025, additional experiments investigated the daily loss profile, with foams changed every day from day 2 until day 7 and then weekly on day 14 and day 21. Additionally the trial included the effect of a simulated 3mm rainfall event on either day 1 or day 7.

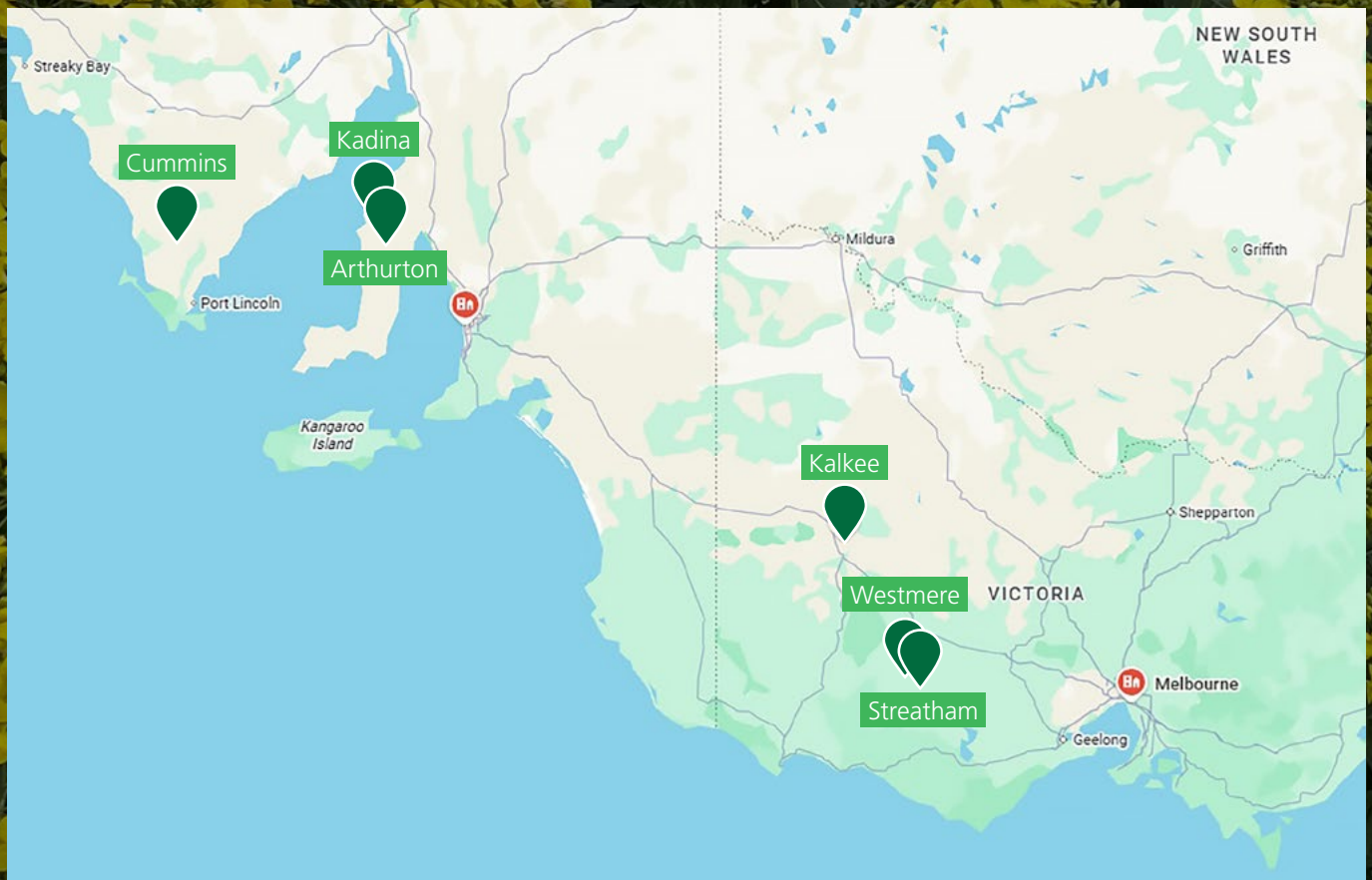
**Figure 2: Setup for ammonia measurement in the field.**



**Table 1. Trial sites showing a range of soil properties and crop types.**

Site	Texture	pH (CaCl <sub>2</sub> )	CEC (cmol (+)/kg)	Organic Carbon (%)	Crop
Cummins, SA (Site 1)	Sandy Clay Loam	6.0	8.4	0.95	Wheat
Cummins, SA (Site 2)	Clay	7.8	30.7	1.6	Wheat
Kadina, SA	Clay Loam	7.7	38.5	2.4	Wheat
Arthurton, SA	Clay Loam	6.8	23.8	2.4	Wheat
Kalkee, VIC	Clay	6.6	28.0	1.4	Wheat
Streatham, VIC	Loam	5.0	7.0	2	Wheat
Westmere, VIC	Silty Loam	5.2	7.2	2.8	Wheat

**Figure 3. IPF's volatilisation trial sites across a range of soil types and geographical areas.**





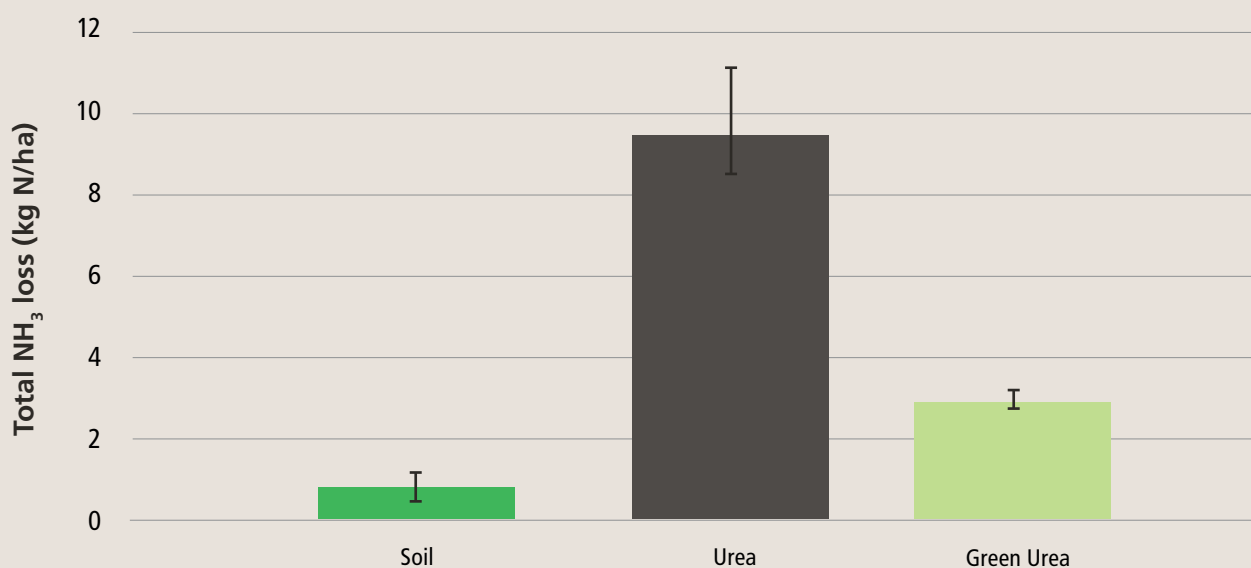
## RESULTS

Results are being presented as how many kilograms of N has been lost as  $\text{NH}_3$  for each topdress at each trial site. At each site, the percentage reduction in  $\text{NH}_3$  loss from Green Urea NV application relative to Urea is shown in the graph. Results from the Westmere site has been presented as an example. Results for the remainder of the trial sites are summarised in the appendix. The  $\text{NH}_3$  volatilisation data, factors driving  $\text{NH}_3$  loss and the economics of N loss are discussed.

At the Westmere site, approximately 10 kg N/ha out of the 46 kg N/ha (22%) applied was lost through  $\text{NH}_3$  volatilisation with 74% of the total N lost occurring in the first week of urea application. Green Urea NV reduced  $\text{NH}_3$  loss by 78%.

**Figure 4: Total ammonia lost (kg N/ha) across multiple topdress applications at the Westmere trial site.** Bars represent standard error of means (n = 4).

Site: Westmere



**Table 2. Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Westmere trial site.**

	Urea	Green Urea
Nitrogen lost (% of application)	19.2	4.3

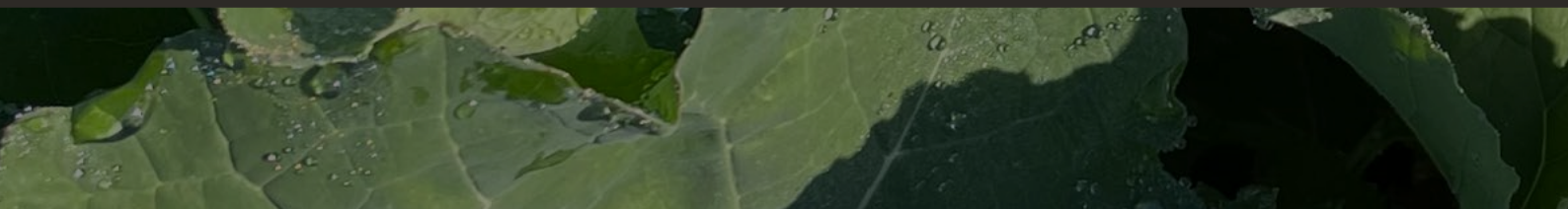
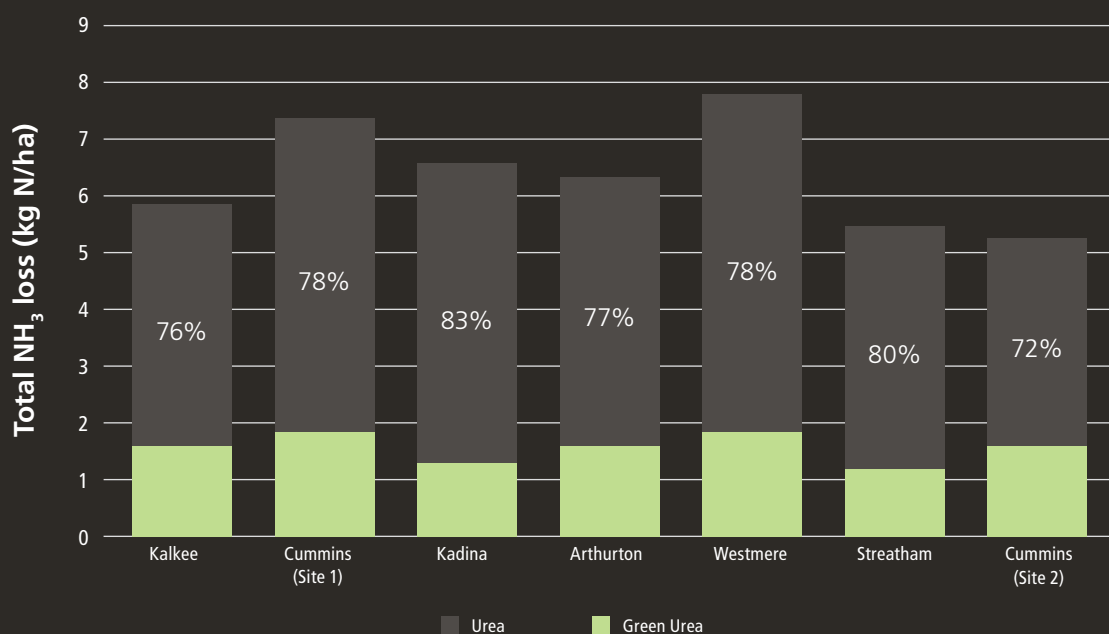


# Green Urea NV reduced volatilisation losses

## Average across topdress applications per site

Overall, Green Urea NV reduced  $\text{NH}_3$  volatilisation, compared to Urea, by between 72 and 83%. The Green Urea NV consistently mitigated  $\text{NH}_3$  volatilisation across a range of soil types and geographical areas over multiple topdress applications.

**Figure 5: Total  $\text{NH}_3$  loss (kg N/ha) from Urea and Green Urea NV treated plots.** Values in bars are the percentage reduction, relative to Urea, in volatilisation losses when Green Urea NV was applied.





## Losses in week 1 vs week 2 – average across all topdress

Most of the  $\text{NH}_3$  volatilisation occurred in the first week (up to 88% of the total  $\text{NH}_3$  loss) following topdress applications compared to the second week. The onset of urea hydrolysis (within the first 4 day of urea application) is characterised by high soil pH around the urea granules creating a favourable environment for  $\text{NH}_3$  volatilisation.

The Green Urea NV slows the hydrolysis of urea – activity of a specific biological process involved in the conversion of urea to  $\text{NH}_4^+$ .

Figure 6: Average percent loss (values in bars) of  $\text{NH}_3$  loss in week 1 vs week 2 applied as Urea across all topdress.

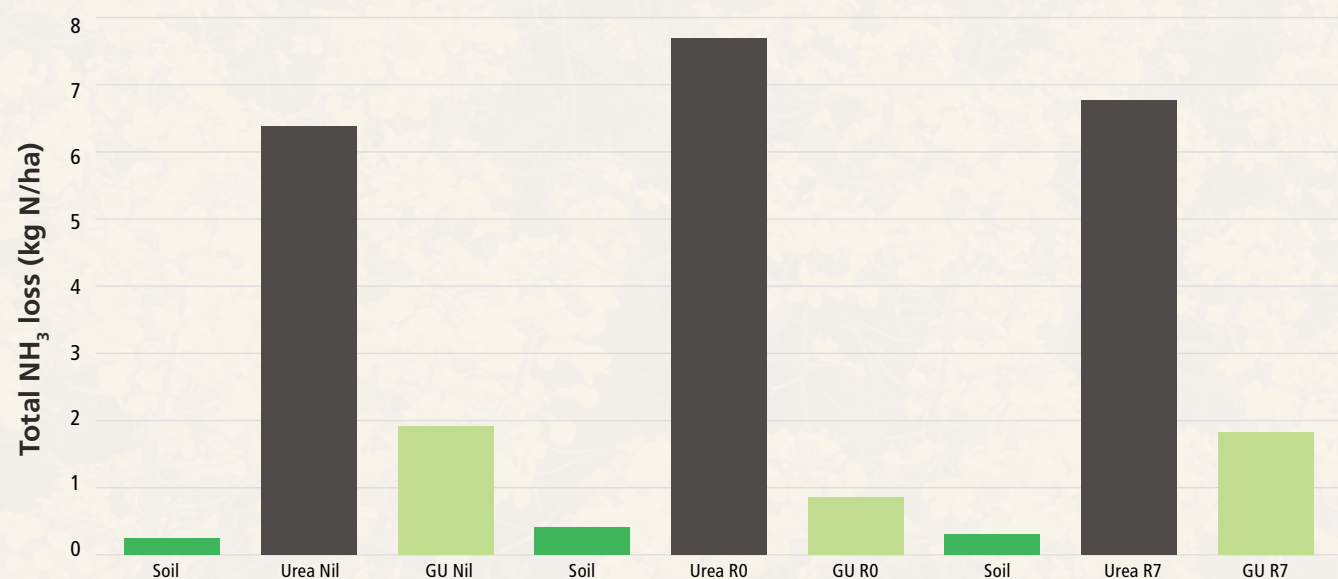




## Simulated rain event

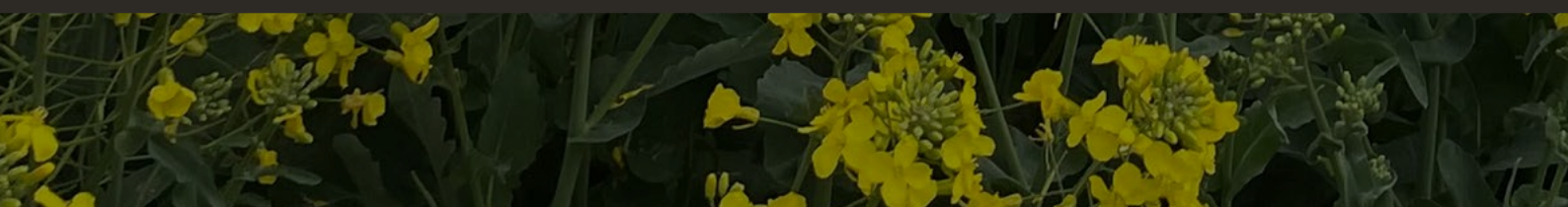
Figure 7 shows the results from applying a simulated rain event on either day 0 or day 7 post treatment applications.  $\text{NH}_3$  losses increased by 3% where 3mm of rainfall occurred on the day of application and 0.8% when rainfall was simulated on day 7. This data highlights the issue of small ineffective rainfall events increasing losses, particularly in the first week post topdress application.

**Figure 7: Total ammonia lost (kg N/ha) at the Cummins trial site.** R0 = 3mm rain day 0, R7 = 3mm rain day 7. Bars represent standard error of means (n = 4).



**Table 3: Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Cummins trial site.**

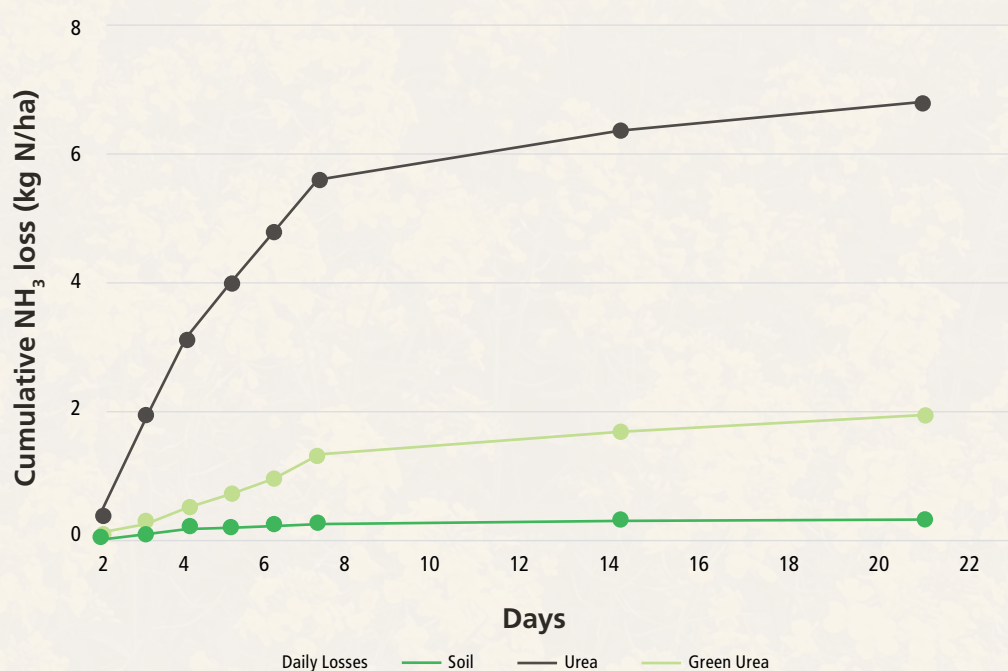
	Urea	Green Urea	Urea R0	Green Urea R0	Urea R7	Green Urea R7
<b>Nitrogen lost (% of application)</b>	13.8	4.1	16.8	2	14.6	4



## Measurements of daily losses

Figure 8 demonstrates the daily loss of  $\text{NH}_3$  where measurements were taken on day 2 following treatment application and then every day until day 7. Measurements were then taken on day 14 and 21. This data highlights the need for effective rainfall within several days post urea topdress applications.

**Figure 8: Cumulative daily ammonia lost (kg N/ha) at the Cummins trial site.**



**Table 4: Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Cummins trial site.**

Nitrogen lost (% of application)								
	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 14	Day 21
<b>Urea</b>	0.9	4.1	6.7	8.7	10.4	12.2	13.7	14.8
<b>Green Urea</b>	0.2	0.7	1.1	1.5	2.2	2.8	3.7	4.1

# Factors impacting ammonia volatilisation

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**Soil pH:** High soil pH drives  $\text{NH}_3$  volatilisation. At high pH, the ammonia-ammonium equilibrium is shifted towards ammonia leading to high volatilisation losses. Regardless of soil type, the soil pH under the urea granule will increase, converting ammonia to ammonia gas and leading to nitrogen loss. Green Urea NV slows this pH rise, reducing volatilisation losses.

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**Cation exchange capacity (CEC) of soil:** Soils with high CEC can retain  $\text{NH}_4^+$  on its exchange (negatively charged surfaces) leading to a reduction in the  $\text{NH}_4^+$  available for conversion to  $\text{NH}_3$ . This results in lower volatilisation losses in soil with high CEC, such as soils high in clay and organic matter contents. Sandy soils have a CEC, meaning they don't hold nutrients well. Green Urea NV reduces nitrogen loss, keeping more available for crop uptake.

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**Organic material (Pasture thatch, Crop residues, stubble, trash):** Organic material can trap urea granules above the soil surface, exposing them to volatilisation. Green Urea NV slows urea breakdown, helping retain nitrogen until it is incorporated.

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**Low rainfall or dew conditions:** When urea granules dissolve but are not incorporated deep enough, volatilisation risk increases. The amount of rainfall needed to reduce losses varies by soil type: sandy soils require  $>10\text{mm}$ , loam soils  $>16\text{mm}$ , and clay soils  $>25\text{mm}$ .

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# The economics

When assessing the cost of nitrogen volatilisation losses, there is the direct cost of loss from the cropping system plus the opportunity miss of lost grain yield (and/or protein). Table 2 shows the calculation of lost value for both Urea and Green Urea from the topdress application at the Westmere site. The total economic loss of Urea was \$59.85/ha compared to \$20.21/ha from the Green Urea, showing a net positive return from Green Urea of \$39.64/ha. From the total net positive return, \$5.15/ha was attributed to direct ammonia loss and \$36.05/ha from potential lost grain production.

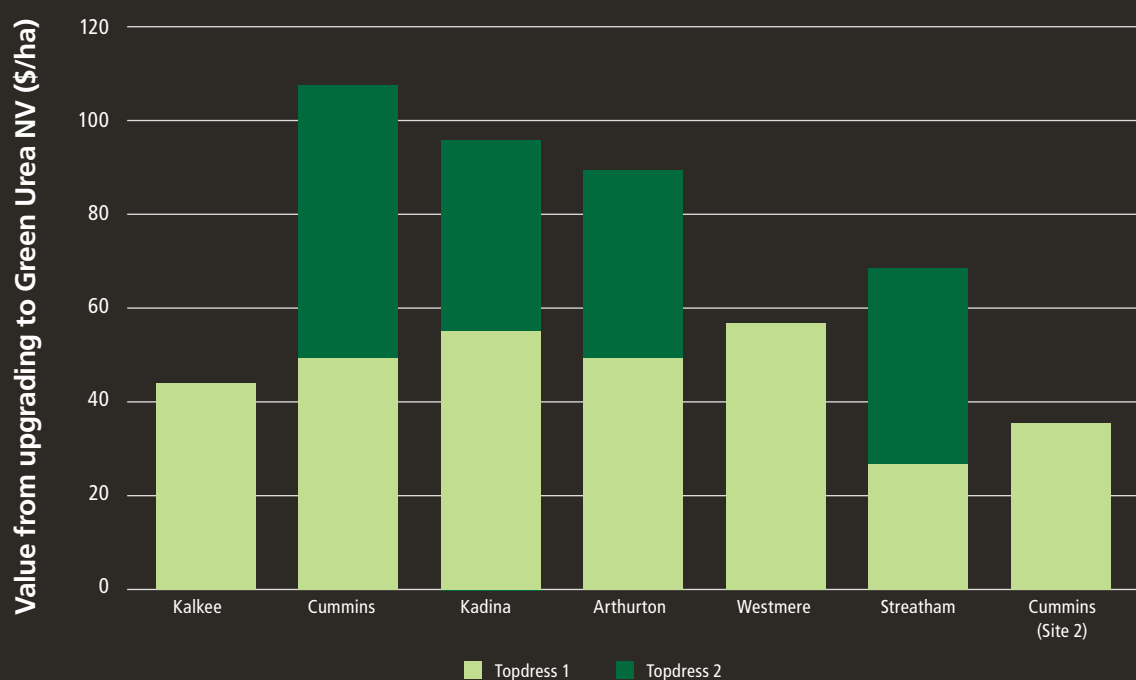
Figure 5 shows the results of applying the economic logic from Table 3 across all sites. Sites with multiple topdresses are shown in cumulative benefit.

**Table 5: Example of the economic analysis on the cost of ammonia loss including the loss associated with yield from the June topdress at the Westmere site.**

Factor	Standard Urea	Green Urea NV®
Urea Cost	\$800/t (\$1.74/kg N)	\$853.70/t (\$1.85/kg N)
Nitrogen Loss	9.66 kg N/ha	1.91 kg N/ha
Cost of Lost Nitrogen	9.66 kg N x \$1.74/kg = \$16.80/ha	1.91 kg N x \$1.85/kg = \$3.53/ha
Loss in Production (Grain Yield)	9.66 kg N/ha x 20 kg grain/kg N = 193 kg/ha lost grain production	1.91 kg N/ha x 20 kg grain/kg N = 38 kg/ha lost grain production
Cost of Lost Production	193 kg x \$0.35/kg = \$67.55/ha	38 kg x \$0.35/kg = \$13.3/ha
Investment in Green Urea NV®	N/A	\$5.37/ha
Total Losses	\$84.35/ha	\$22.2/ha

*Analysis based on Urea valued at \$800/t, Green Urea +\$53.70/t RRP applied at 100kg/ha. Wheat \$350/t. 1kgN produces 20kg grain.*

**Figure 9: Economic outcome for each site for each topdress.**





## THE GREEN UREA NV VALUE CALCULATOR

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The new Green Urea NV Value Calculator can be used to see how much you could save by using Green Urea NV. It's a useful tool that allows you to:

- Estimate nitrogen losses from standard urea.
- Compare the investment vs. return of upgrading to Green Urea NV.
- Get a customised assessment based on your crop and conditions.

The calculator can be found on the Incitec Pivot Fertilisers website.

## GENERAL COMMENTS

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The trials have demonstrated the loss of N from the system and the lost yield opportunity are both real and significant from an economic perspective and something growers need to consider. Up to 22% (10 kg N/ha out of the 46 kg N/ha) of N applied as Urea was lost through NH<sub>3</sub> volatilisation over two weeks. You can grow up to 20 kg of cereal grain for every kilogram of N available, so every kilogram of N loss is lost yield potential.

Topdressing with IPF's Green Urea NV consistently reduced the volatilisation of NH<sub>3</sub> by up to 83% across a range of soil types and geographical areas in different Southern cropping regions. Compared to Urea, the Green Urea NV reduced NH<sub>3</sub> losses across all trial sites by an average of 76% across all applications. The urease inhibitor in Green Urea NV slows the conversion of urea to NH<sub>4</sub><sup>+</sup> which can be lost as NH<sub>3</sub>.

# Appendix

Site: Kalkee

Figure 10: Total ammonia lost (kg N/ha) at the Kalkee trial site. Bars represent standard error of means (n = 4).

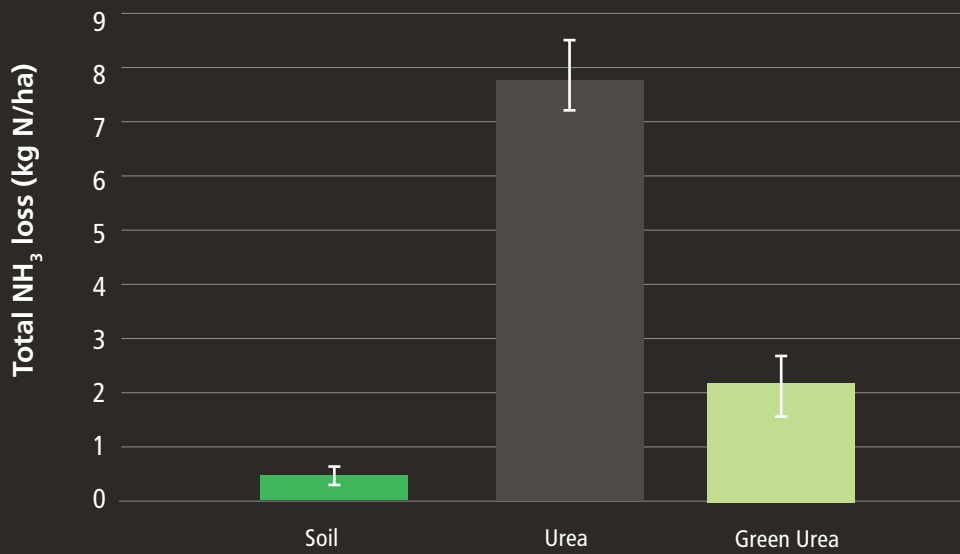


Table 6: Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Kalkee trial site.

	Urea	Green Urea
Nitrogen lost (% of application)	16.2	3.9

Site: Cummins (Site 1)

Figure 11: Total ammonia lost (kg N/ha) at the Cummins trial site. Bars represent standard error of means (n = 4).

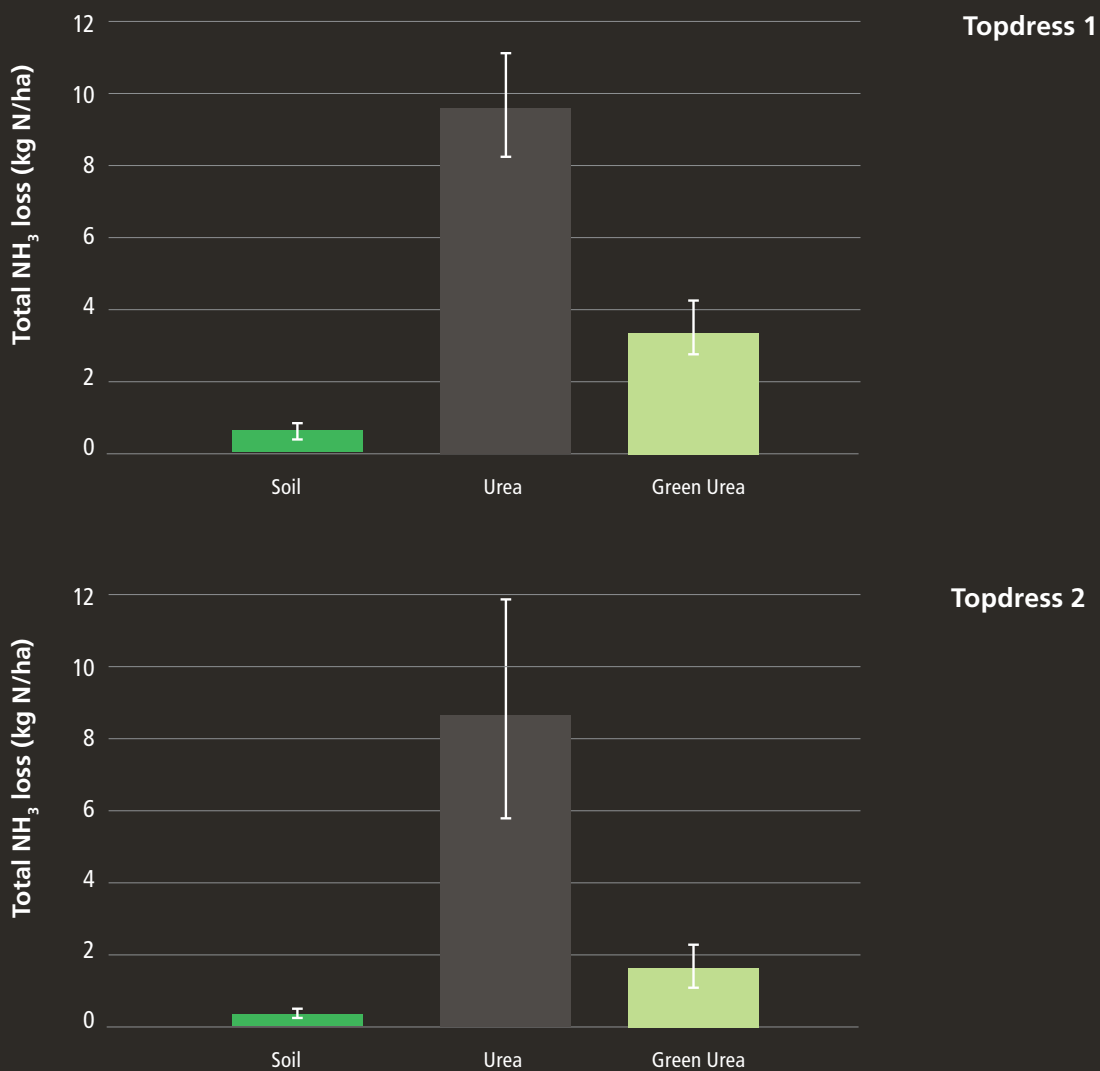


Table 7: Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Cummins trial site.

	Topdress 1		Topdress 2	
	Urea	Green Urea	Urea	Green Urea
<b>Nitrogen lost (% of application)</b>	16.2	3.9	19.2	5.5

Site: Kadina

Figure 12: Total ammonia lost (kg N/ha) at the Kadina trial site. Bars represent standard error of means (n = 4).

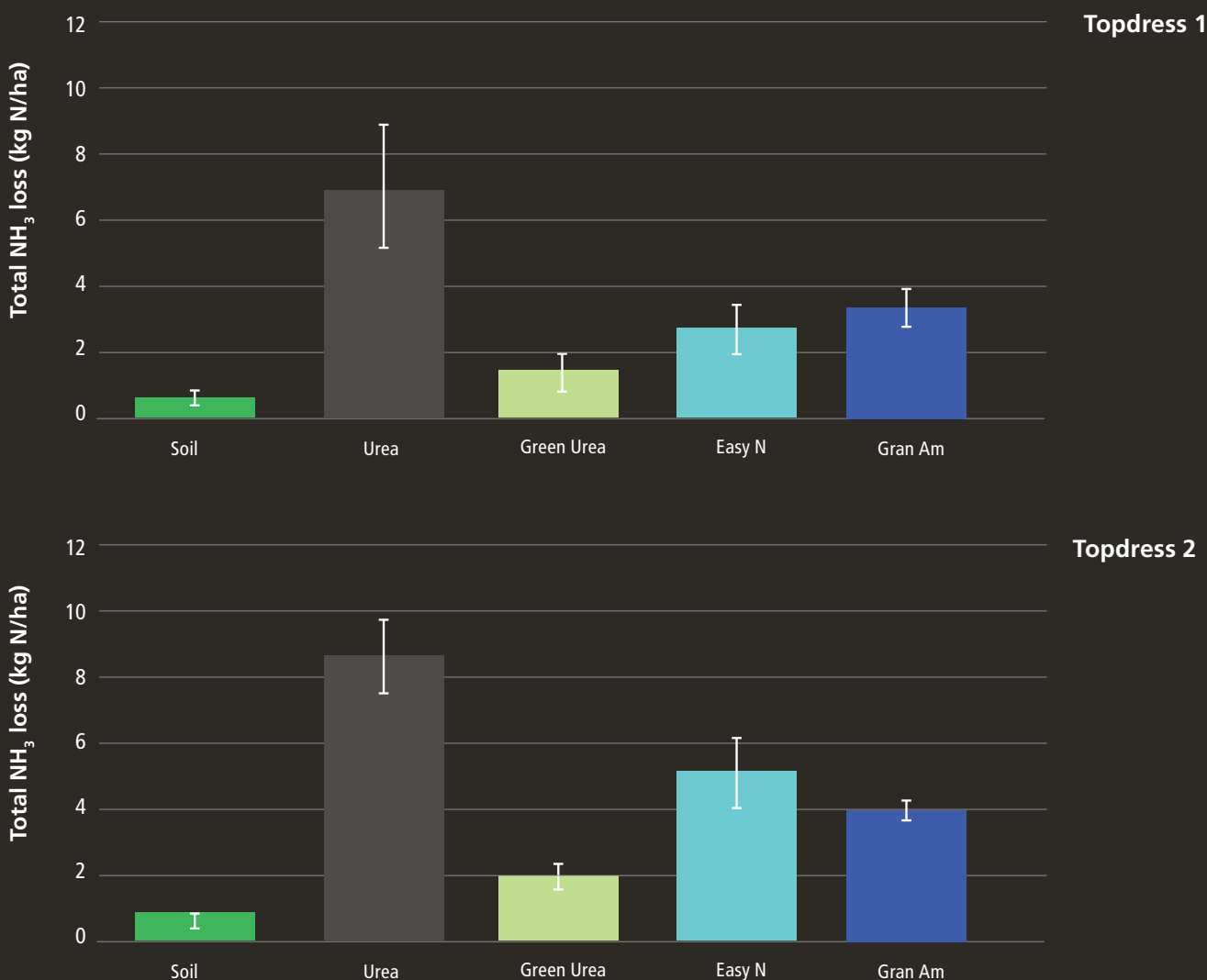


Table 8: Amount of nitrogen lost (% of applied) for all products at the Kadina trial site.

	Topdress 1				Topdress 2			
	Urea	Green Urea	Easy N	Gran Am	Urea	Green Urea	Easy N	Gran Am
<b>Nitrogen lost (% of application)</b>	14.0	2.2	4.8	6.4	17.9	3.3	9.9	7.3

Site: Arthurton

Figure 13: Total ammonia lost (kg N/ha) at the Arthurton trial site. Bars represent standard error of means (n = 4).

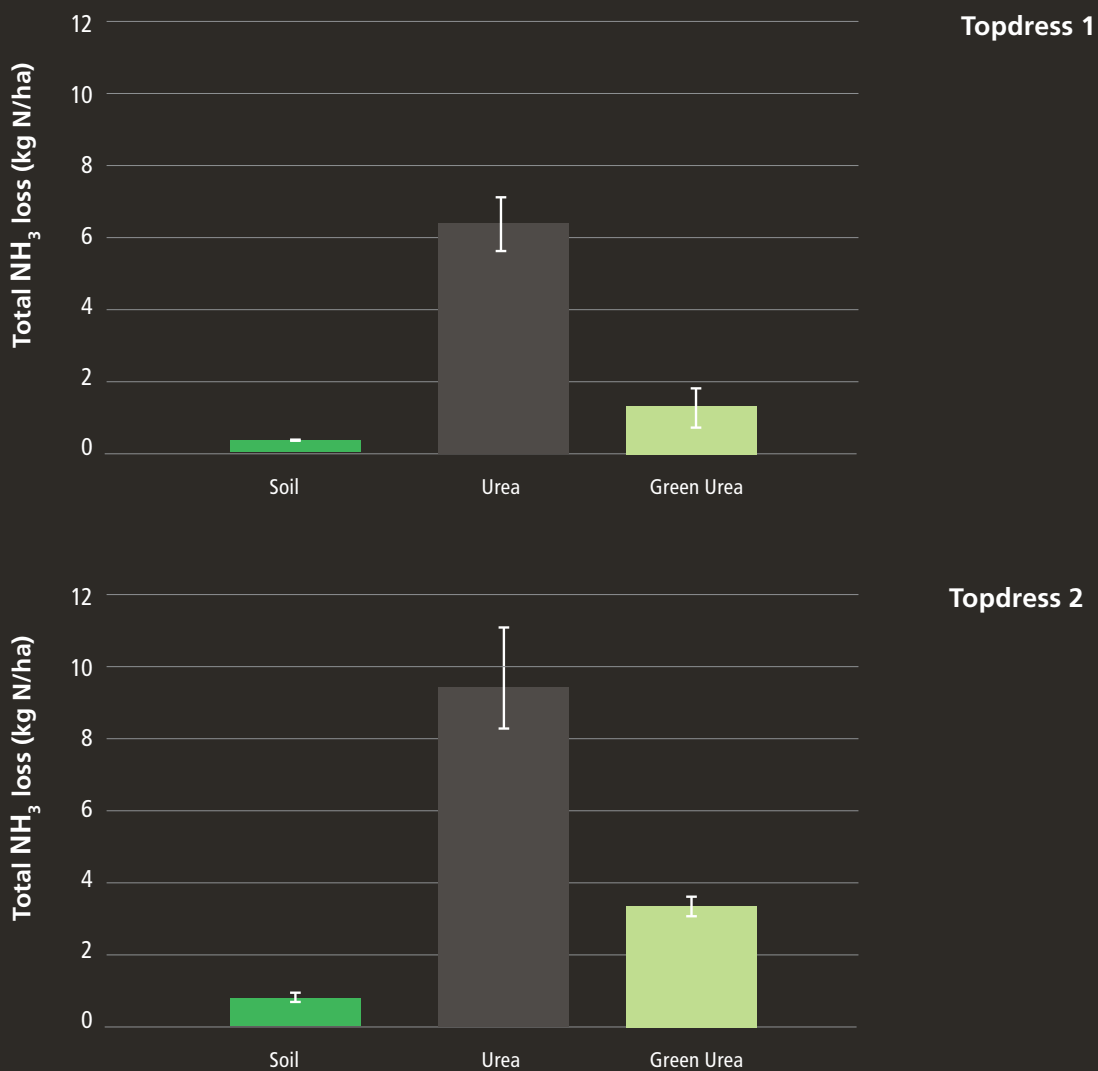


Table 9: Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Arthurton trial site.

	Topdress 1		Topdress 2	
	Urea	Green Urea	Urea	Green Urea
<b>Nitrogen lost (% of application)</b>	13.9	2.5	18.8	5.1

Site: Westmere

Figure 14: Total ammonia lost (kg N/ha) at the Westmere trial site. Bars represent standard error of means (n = 4).

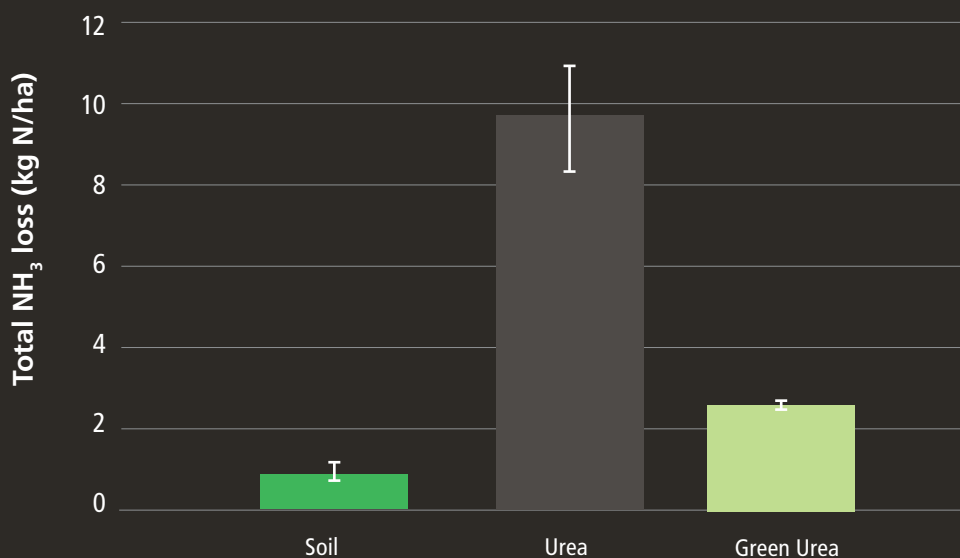


Table 10: Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Westmere trial site.

	Urea	Green Urea
Nitrogen lost (% of application)	19.2	4.2

Site: Streatham

Figure 15: Total ammonia lost (kg N/ha) at the Streatham trial site. Bars represent standard error of means (n = 4).

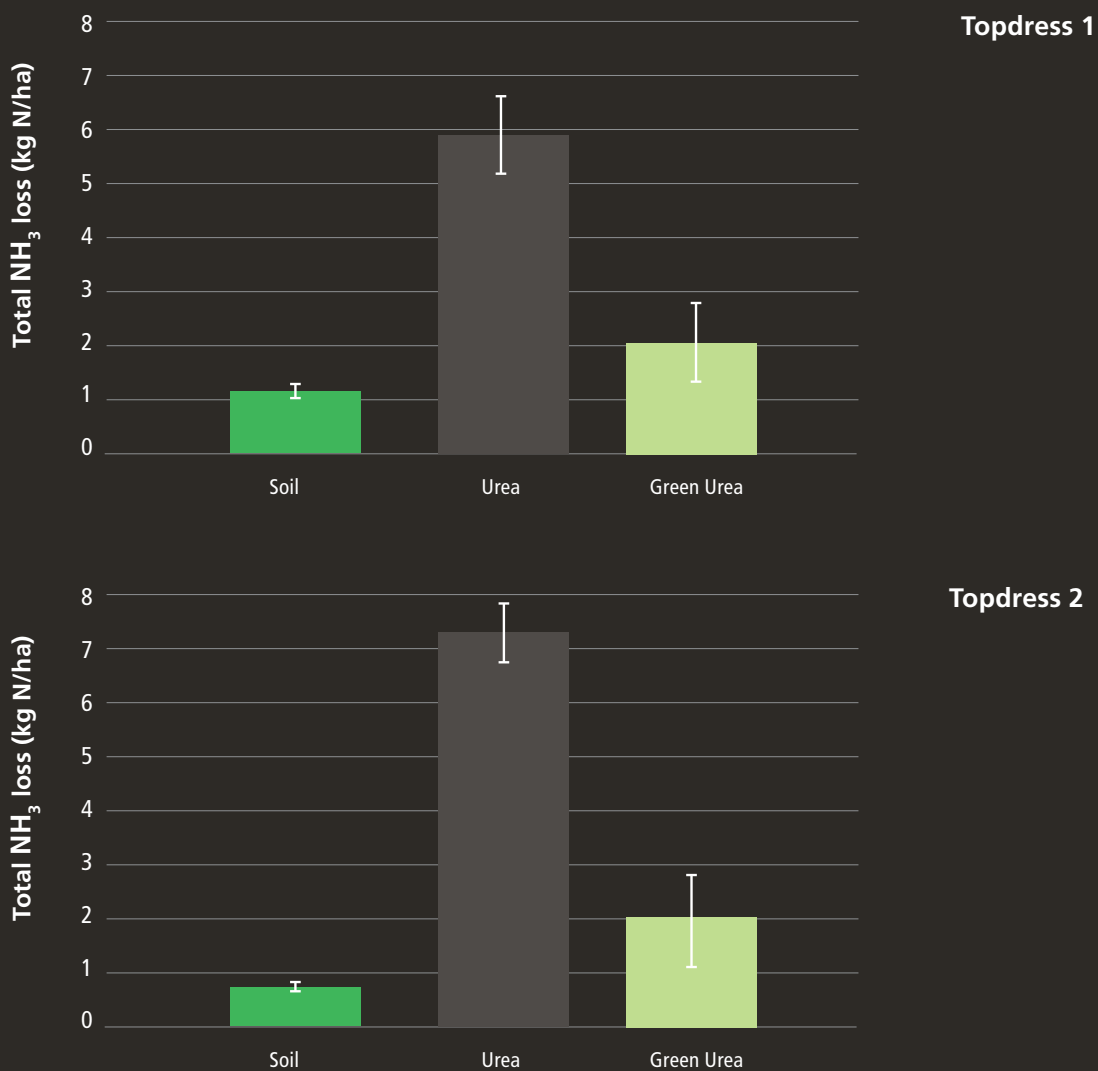


Table 11: Amount of nitrogen lost (% of applied) for Urea and Green Urea NV at the Streatham trial site.

	Topdress 1		Topdress 2	
	Urea	Green Urea	Urea	Green Urea
<b>Nitrogen lost (% of application)</b>	10.2	2.0	14.5	2.9

## COOPERATORS

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**Table 12: List of co-operators involved in the ammonia volatilisation research trials**

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<b>Trial site</b>	<b>Co-operators</b>
Cummins (Site 1)	Cummins Ag
Kadina	YP Ag
Kalkee	SMS Rural
Cummins (Site 2)	Carr Seeds & Bawden Rural
Arthurton	Central Ag
Westmere	Gorst Rural
Streatham	Southern Farming Systems

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