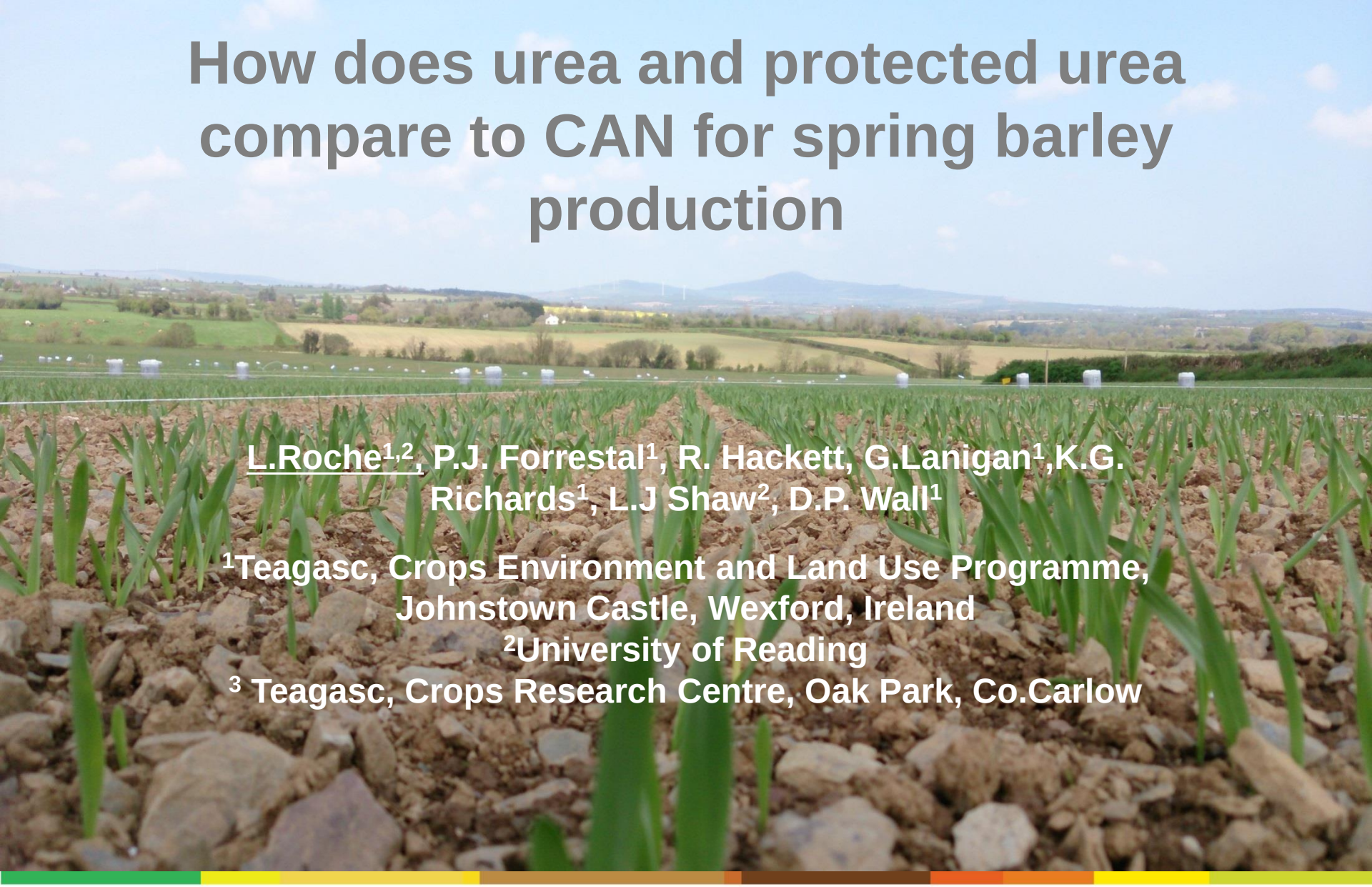
How does urea and protected urea compare to CAN for spring barley production



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Teagasc Agriculture and Food Development Authority

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Department of Agriculture, Food and the Marine An Roinn Talmhaíochta, Bia agus Mara

Agricultural Greenhouse Gas Research Initiative - Ireland

Agricultural Catchments Programme

Background

- **Greenhouse gas emission (GHG) reduction targets**
  - Agriculture is responsible for 33% of GHGs
  - N fertiliser contributes to GHGs

- **Ammonia emission reduction targets**
  - Agriculture is responsible for 98% of ammonia emissions
  - Urea contributes to ammonia emissions

- **Water Quality**
  - Losses of N fertiliser is damaging to water quality
  - Requirements under Water Framework and Nitrates directives

- **Food Wise 2025**
  - Increase the value of primary production by 65%

Background – N Fertiliser

CAN

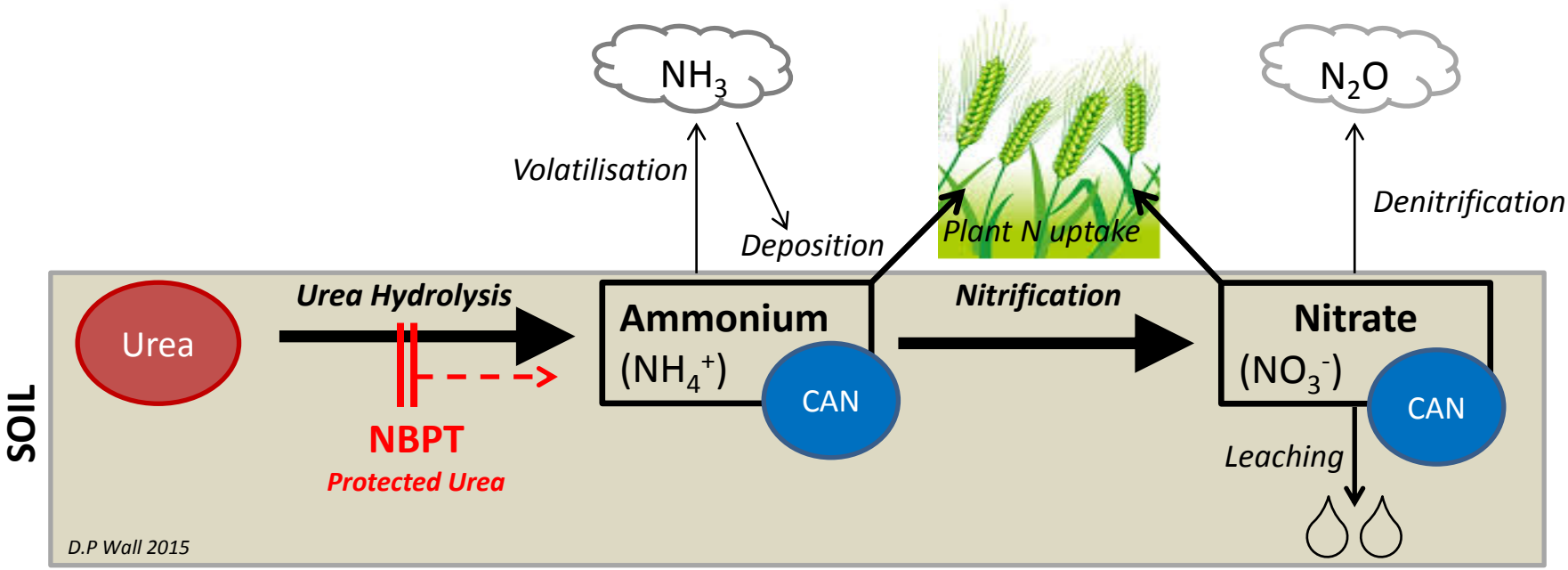
- 27% N
- 13.5% of N in CAN is nitrate and can be easily lost
- N losses as nitrous oxide (potent greenhouse gas) and nitrate leaching
- Using urea could reduce these losses

Urea

- 46% N
- Urea must go through two conversions before N converts to nitrate
- N loss as ammonia volatilisation (indirect greenhouse gas)
- Use of protected urea

Protected Urea

- Protected urea fertilisers are now available on the market in Ireland
- In this study – urea + N-(n-butyl) thiophosphoric triamide (NBPT) is used
- The protected urea product used in these trials contained NBPT at 660 ppm.



Experimental Design

- Field site
  - Marshalstown, Co. Wexford – free draining loam
  - >20 years spring barley production

- Randomised block design with 5 replicates of each treatment

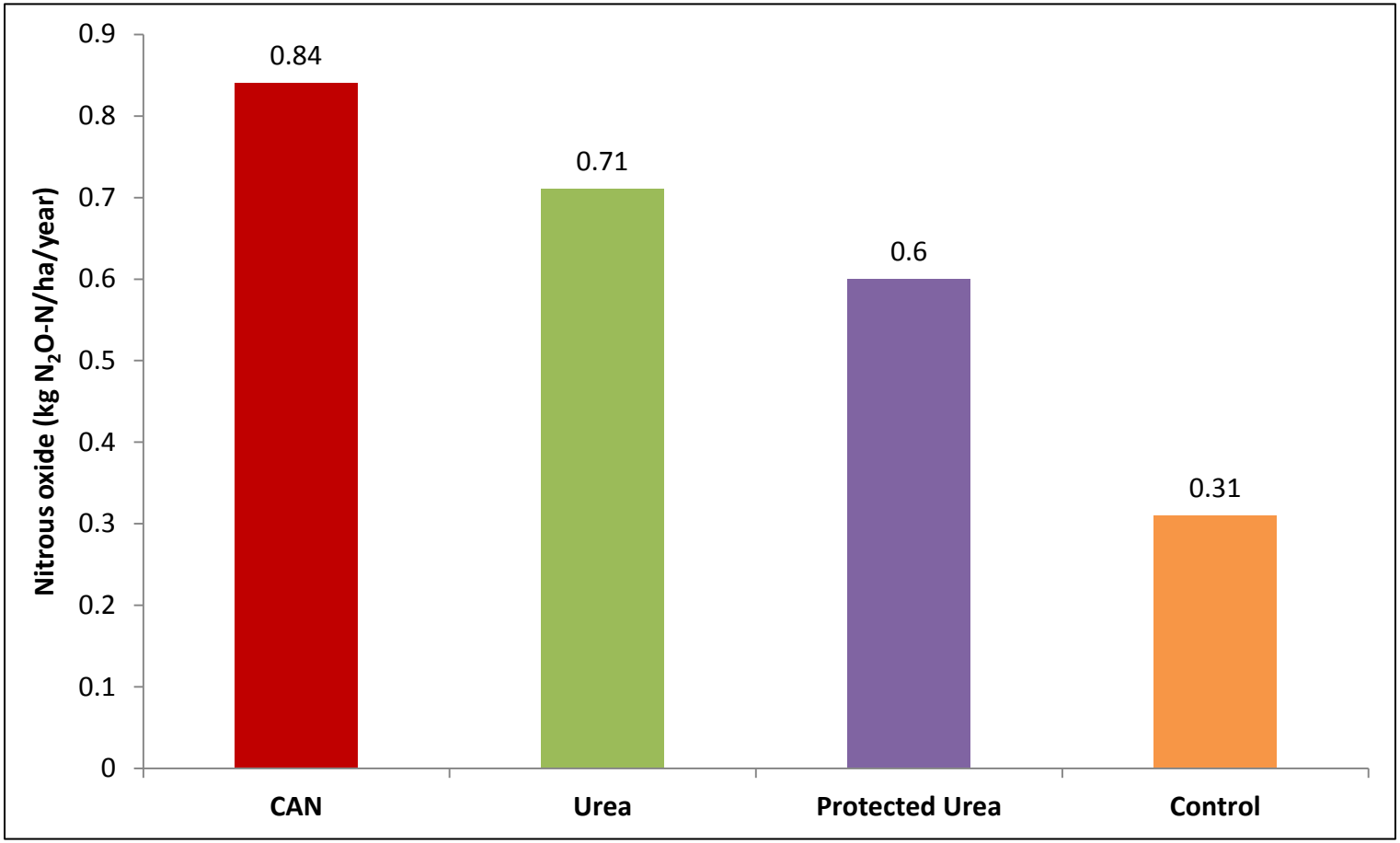
- N fertiliser treatments used (N rate 150 kg N/ha)
  - Unfertilised control
  - CAN
  - Urea
  - Protected urea (Urea + NBPT)

- Fertiliser N applied in 2 splits
  - 1st split – 30 kg N/ha applied at sowing
  - 2nd split – 120 kg N/ha applied at mid-tillering

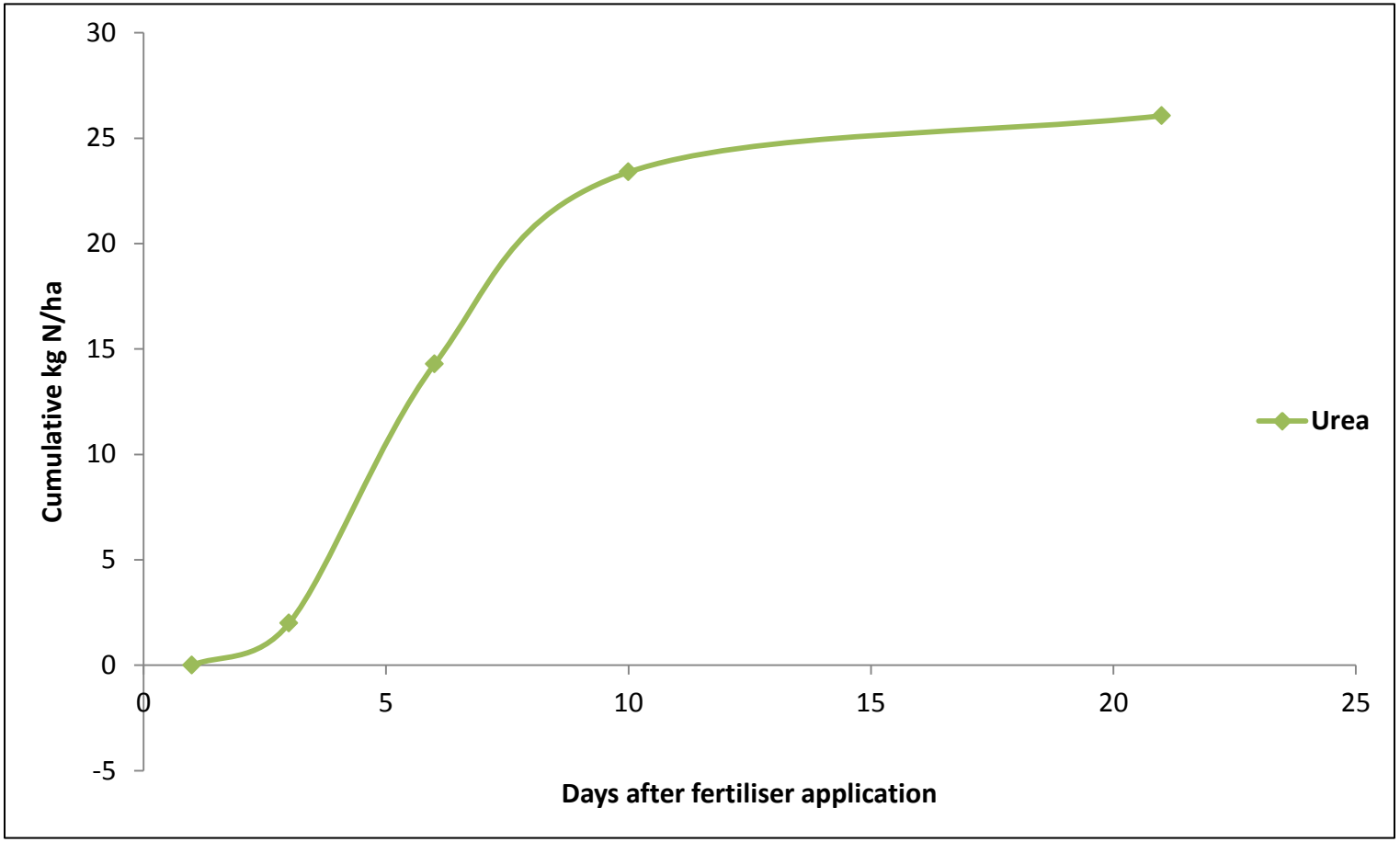
- Nitrous oxide emissions measured after N application
- Crop Harvested in late August each year

Results

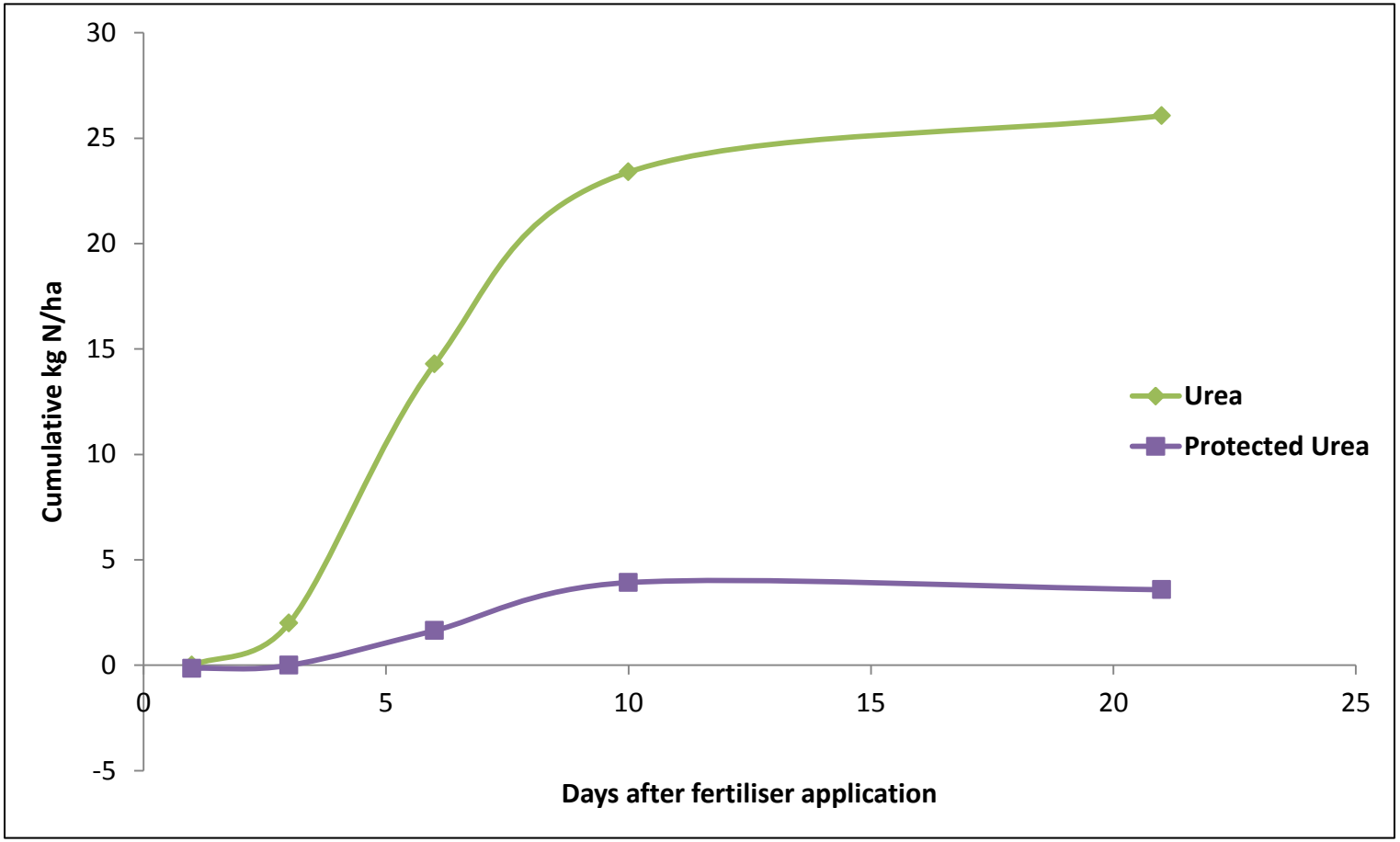
Nitrous Oxide emissions



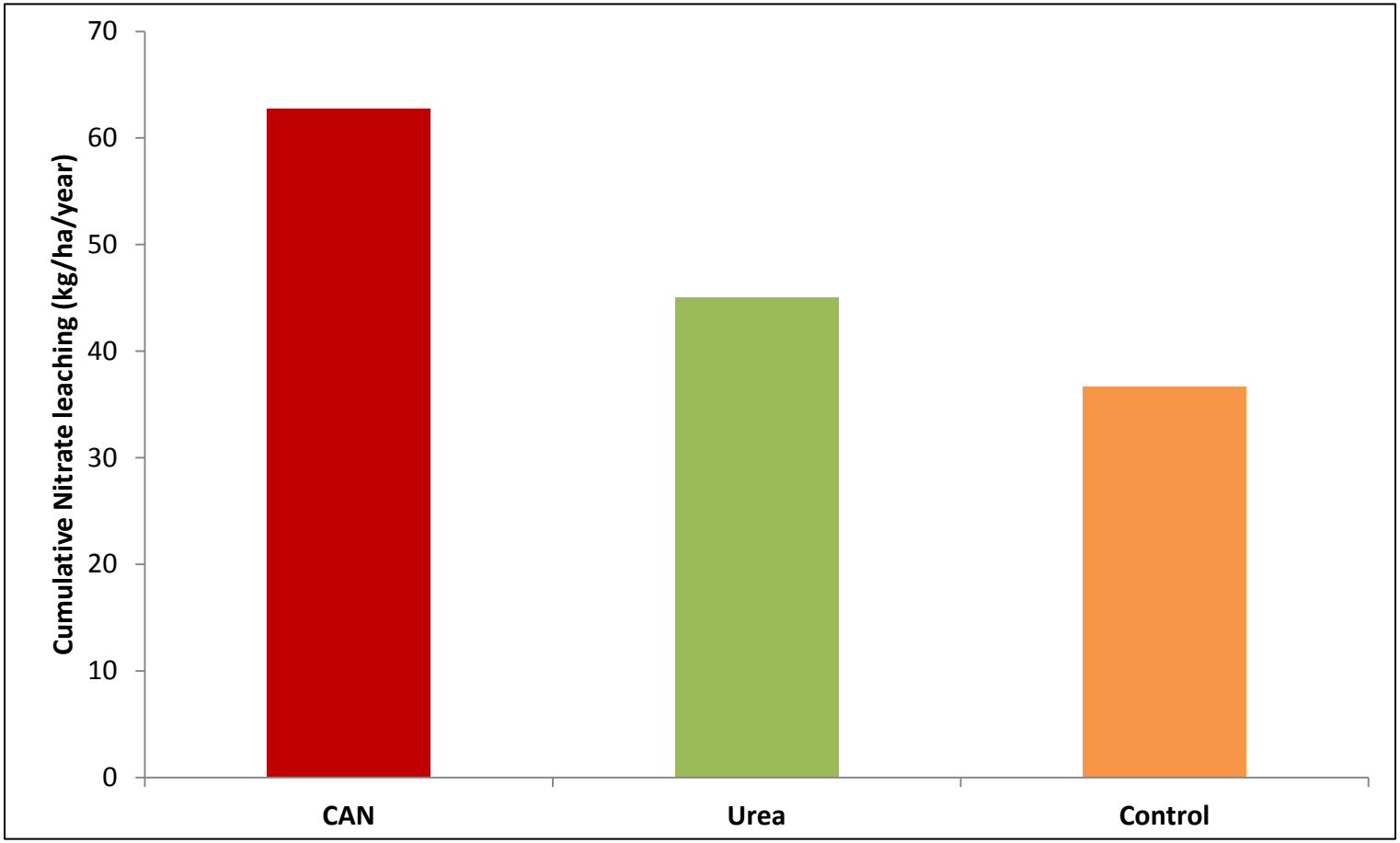
Ammonia Emissions



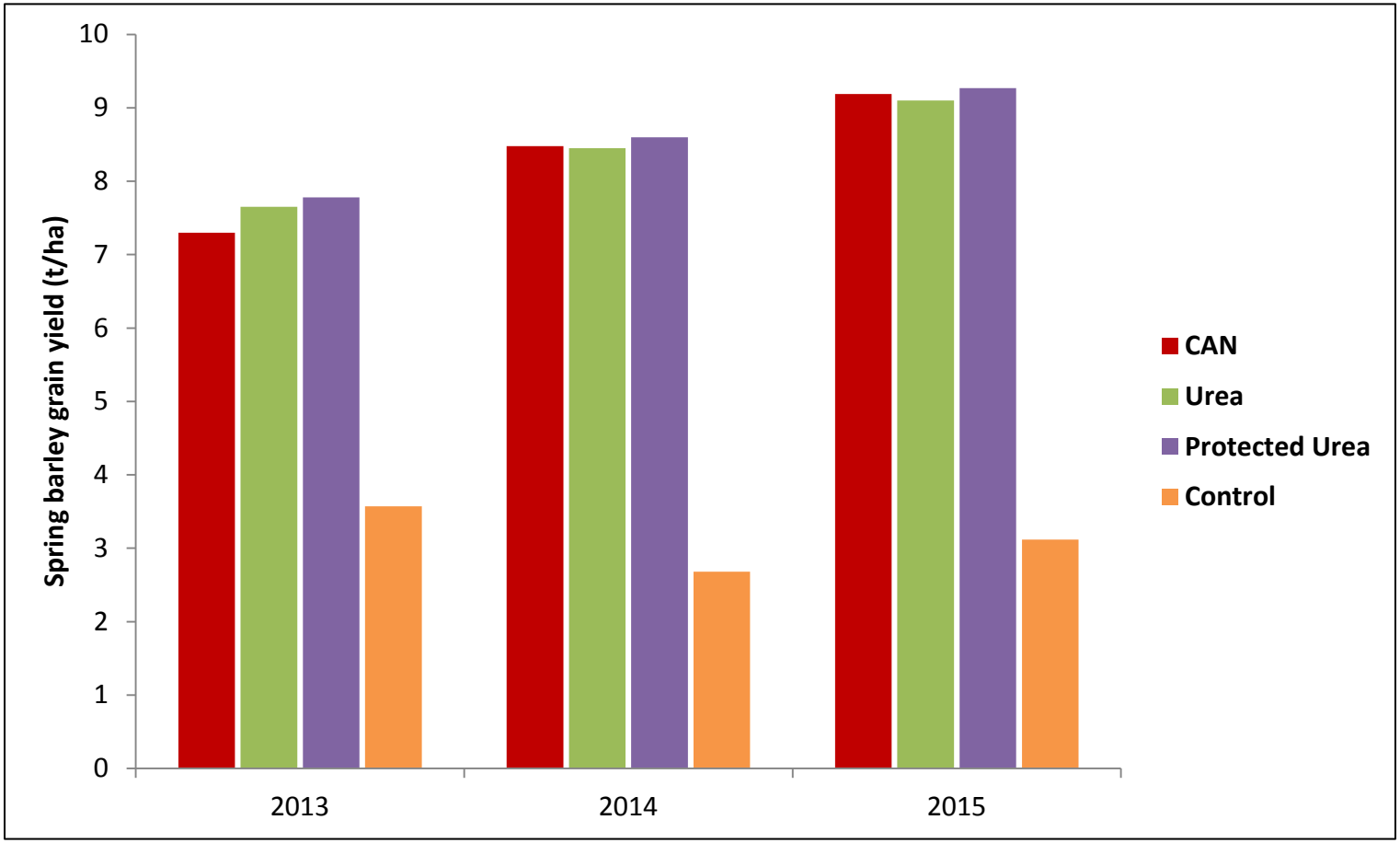
Ammonia Emissions



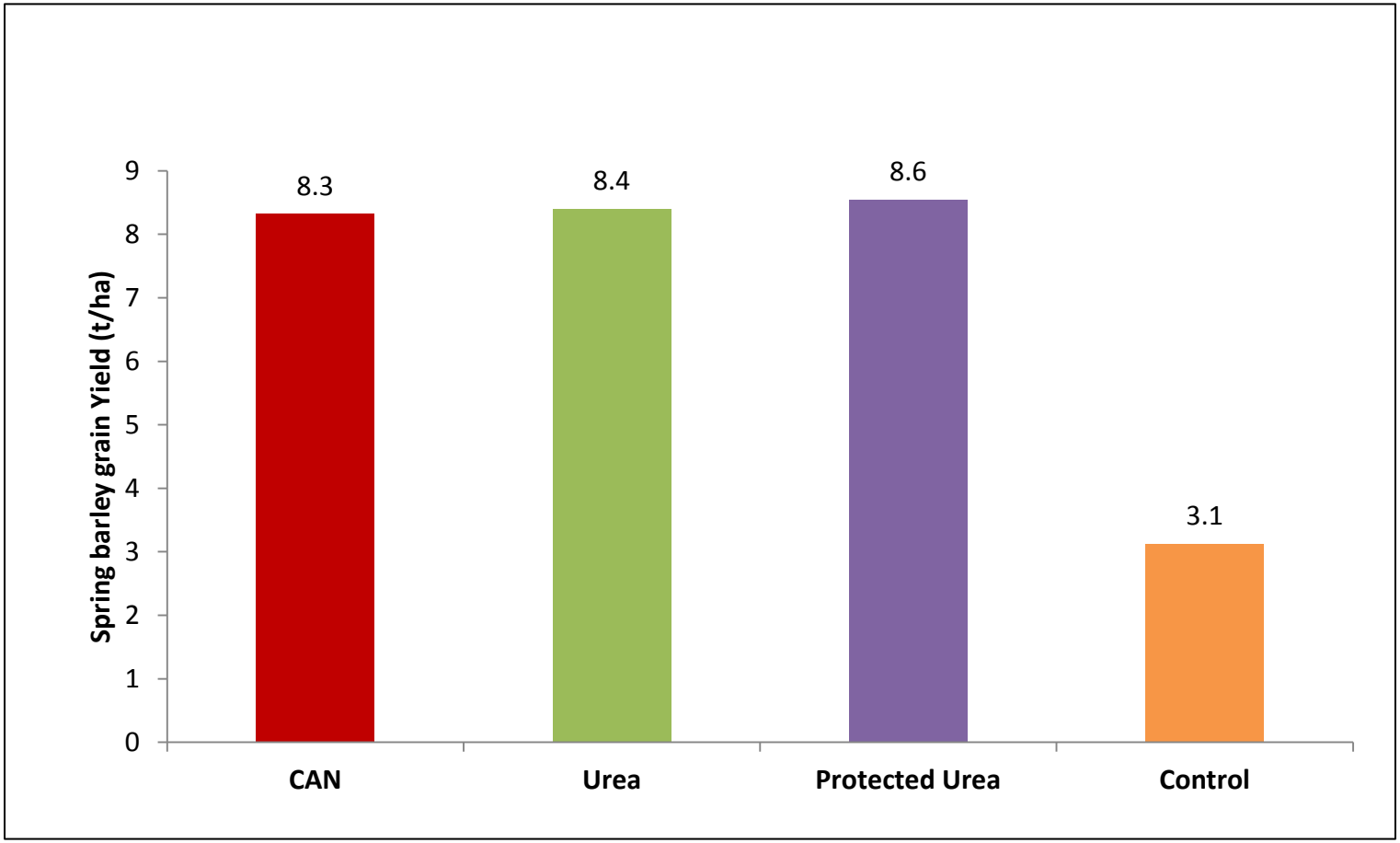
Nitrate Leaching



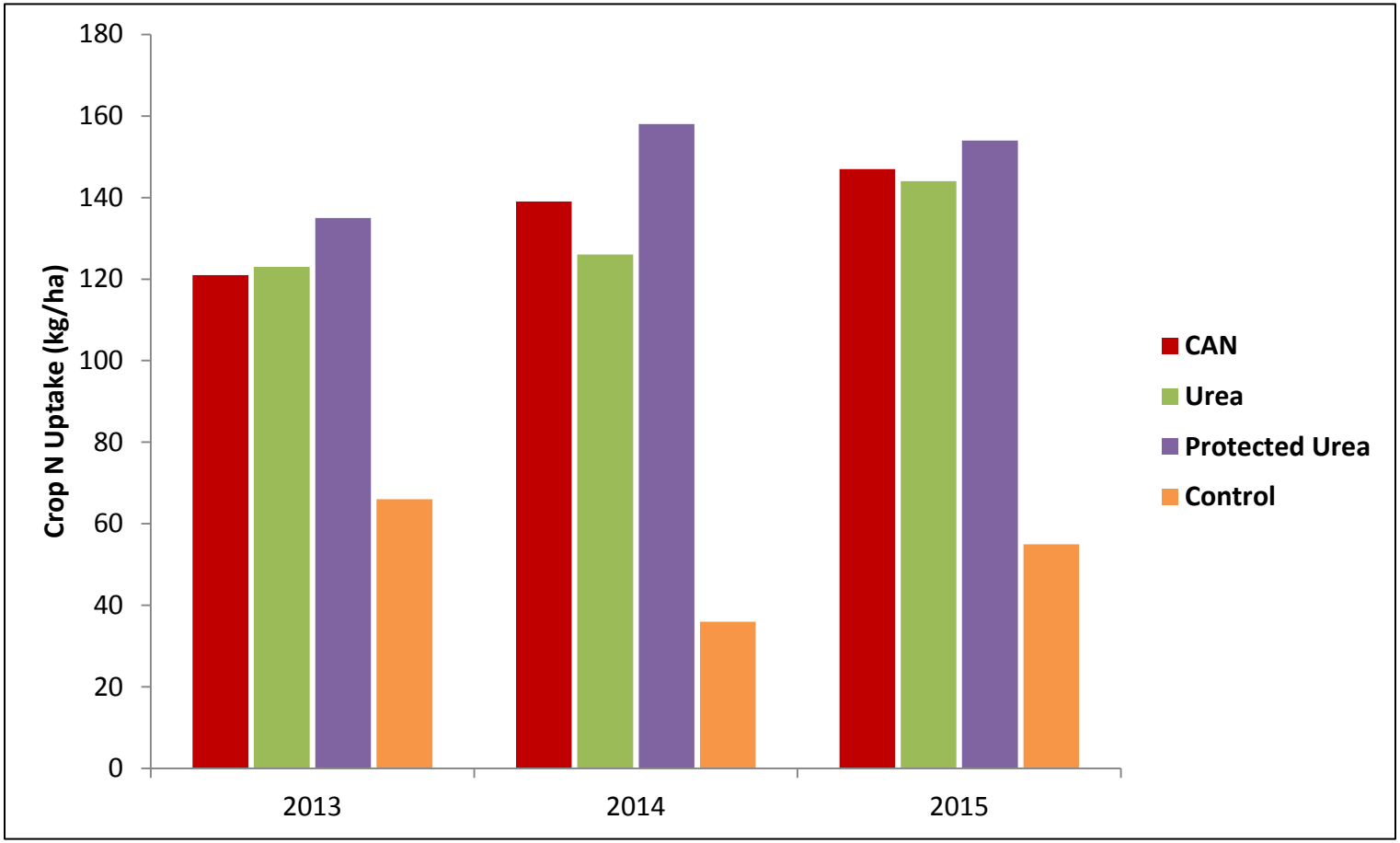
Grain Yield over 3 years (2013, 2014, 2015)



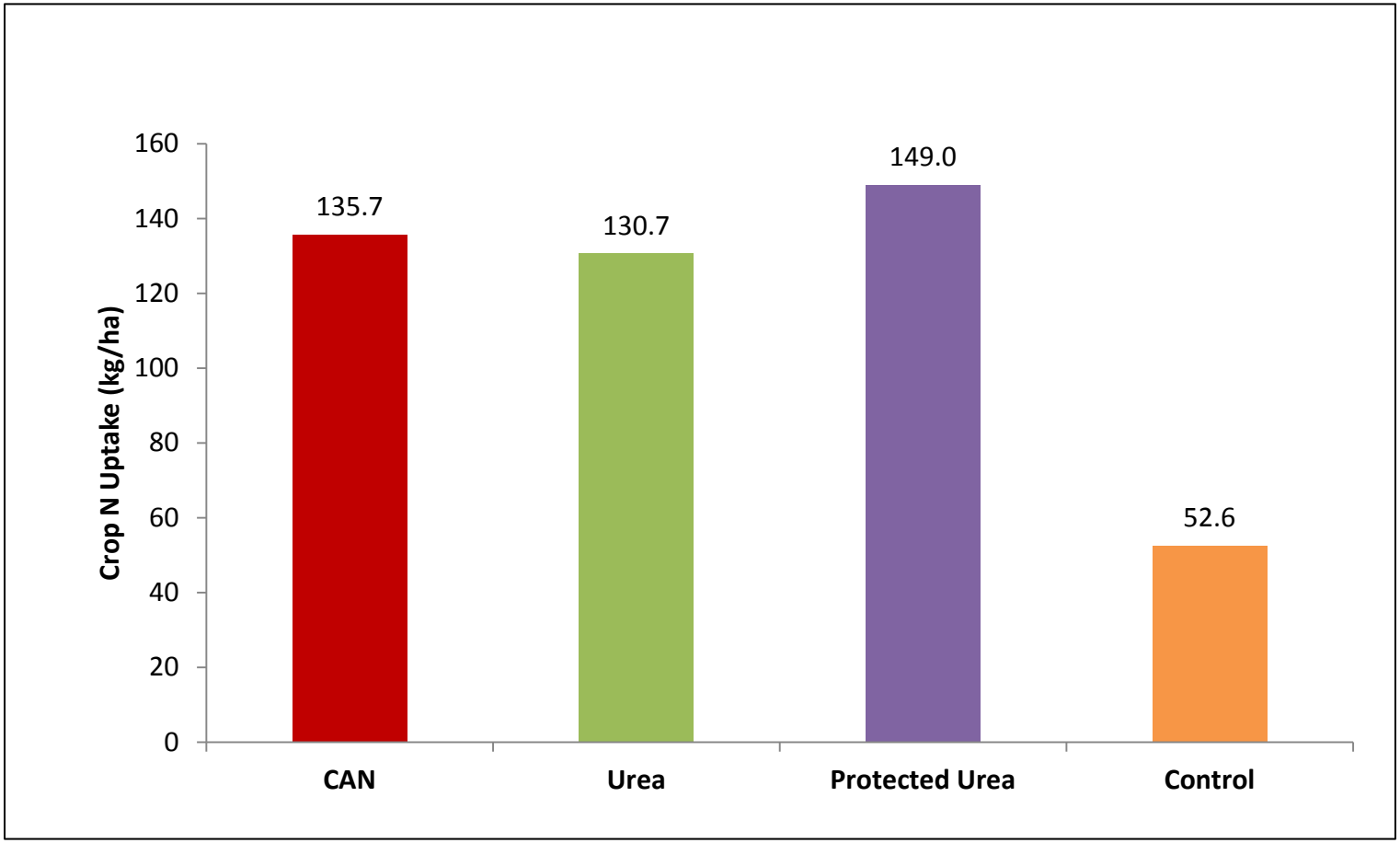
Average Grain Yield over 3 years



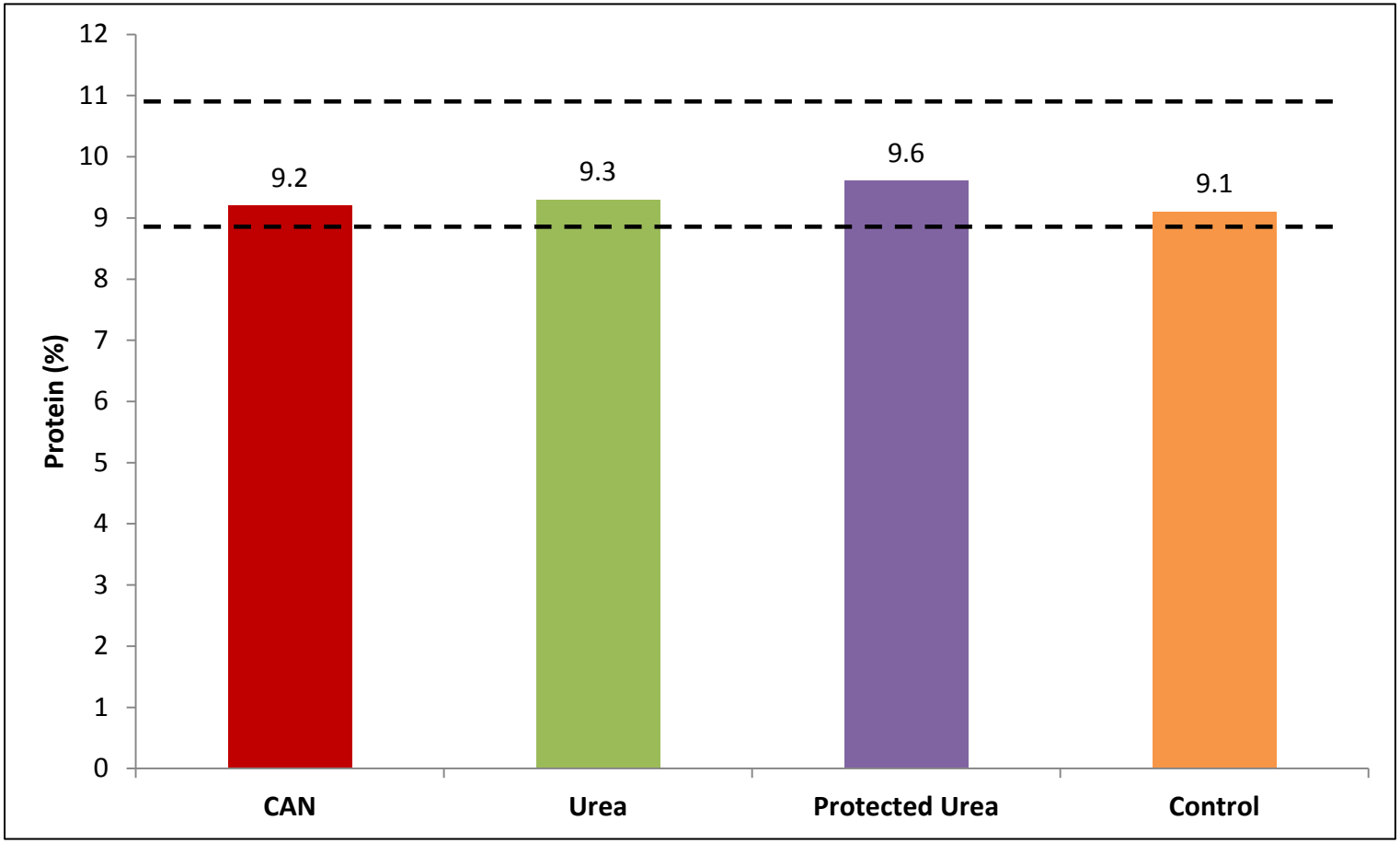
N uptake over 3 years (2013, 2014, 2015)



Average N uptake over 3 years



Average Protein % over 3 years



Relative Star rating of CAN, urea and protected urea

	CAN	Urea	Protected Urea
Cost of N			
Yield			
N Uptake			
Nitrous oxide			
Ammonia			
Leaching			*Not available

Conclusions

- **Greenhouse gas emissions**
  - Overall N_2O was low from all fertilisers
  - Protected urea had lower emissions than CAN

- **Ammonia Emissions**
  - Ammonia loss from urea approximately 25kg
  - Protected urea reduced ammonia loss to < 5 kg

- **Grain Yield**
  - Grain Yield similar for all fertilisers
  - On average 0.3 t/ha more yield with protected urea

- **N Uptake and Protein**
  - N Uptake and protein highest with protected urea

Overall, using protected urea is a win-win for farmers and environment

Thank you for your attention

Acknowledgments

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James Masterson for access to the field site

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