SWTICHING TO AMMONIUM BASED FERTILISER CAN REDUCE N_2O EMISSIONS FROM WET GRASSLAND SOILS

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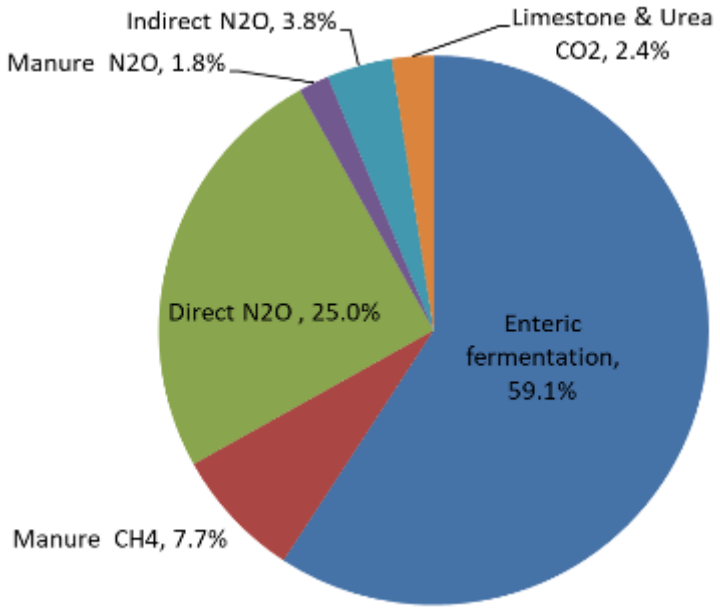
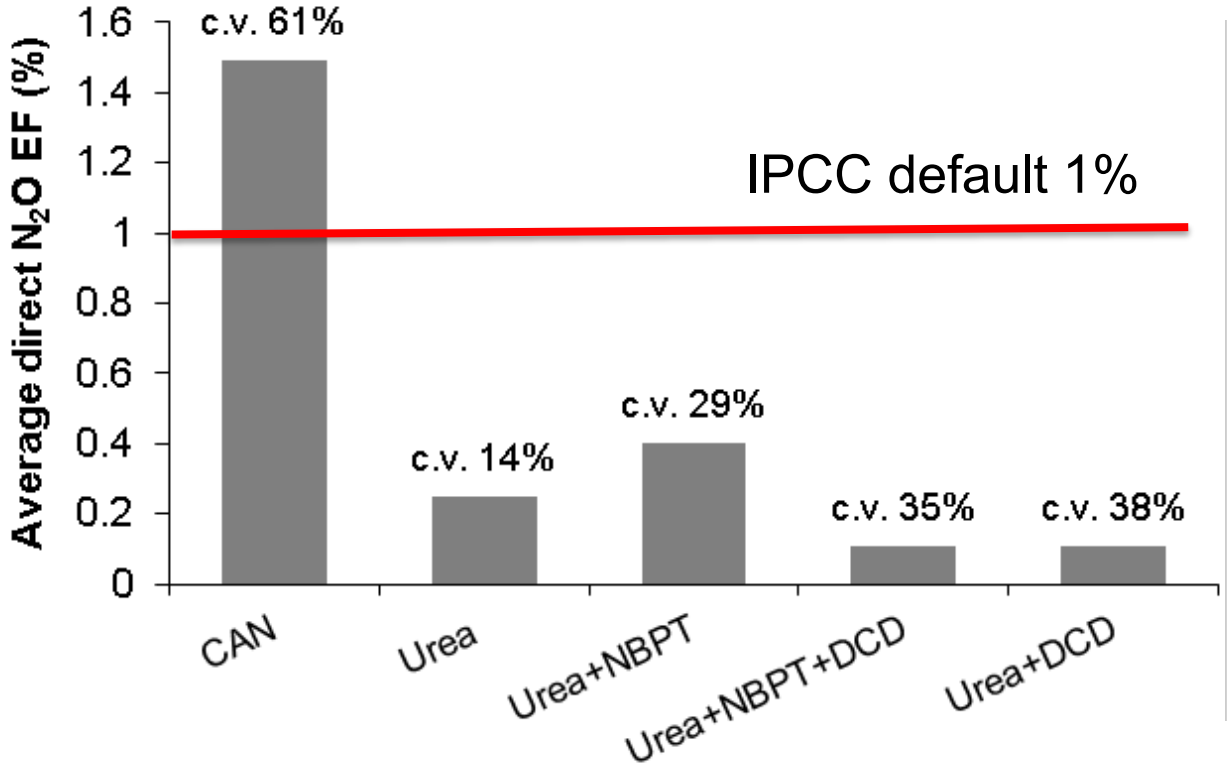
Introduction

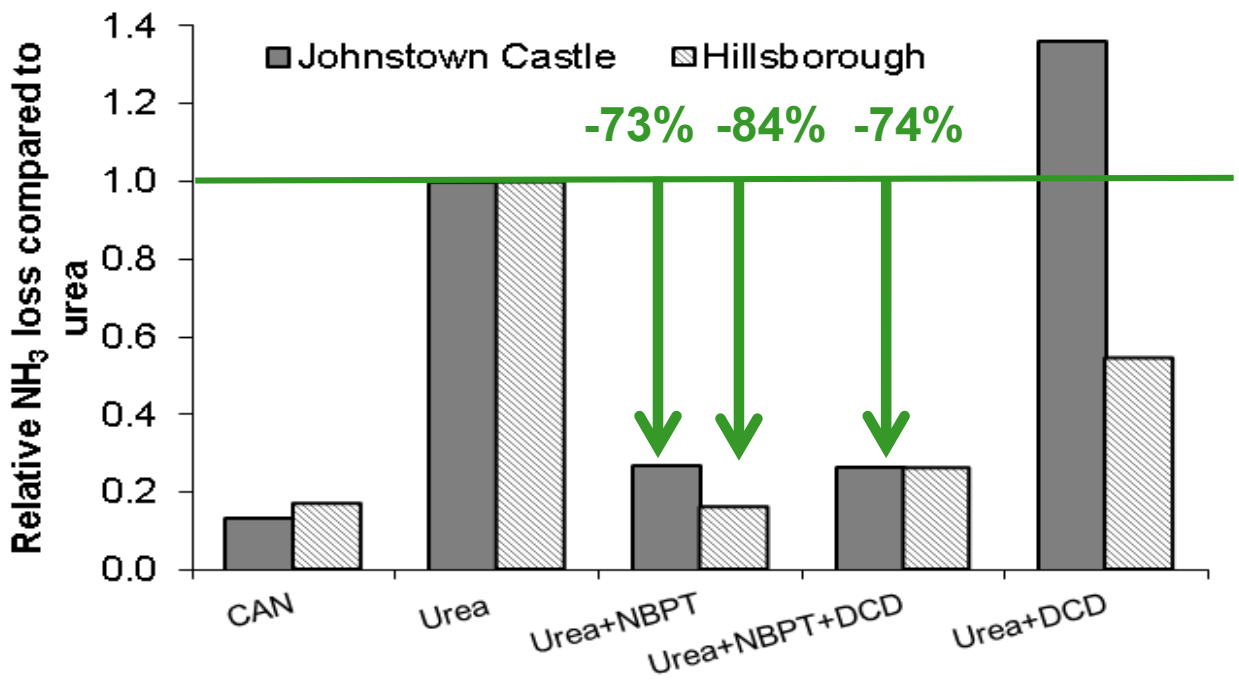
- Dominant grazed grasslands c. 90% UAA
- Grasslands receive up to 250 kg N ha^{-1} yr^{-1}
- Irish uses c. 400,000 T N yr^{-1} 50% straight N and 50% compound NPK
- Irish agriculture 36% of national GHG emissions (23% CH_4 and 13% N_2O)
- Agriculture to reduce GHG emissions by 22-30% by 2030
- The objective of the study was to evaluate and refine the emission factor (EF) for a range of N-P-K compound fertilizers



Background – Move from nitrate to urea fertilisers



Harty *et al*. (2016) *Science of the Total Environment*. 563-564: 576-586



Forrestal *et al*. (2016) *Soil Use & management* 32: 92-100

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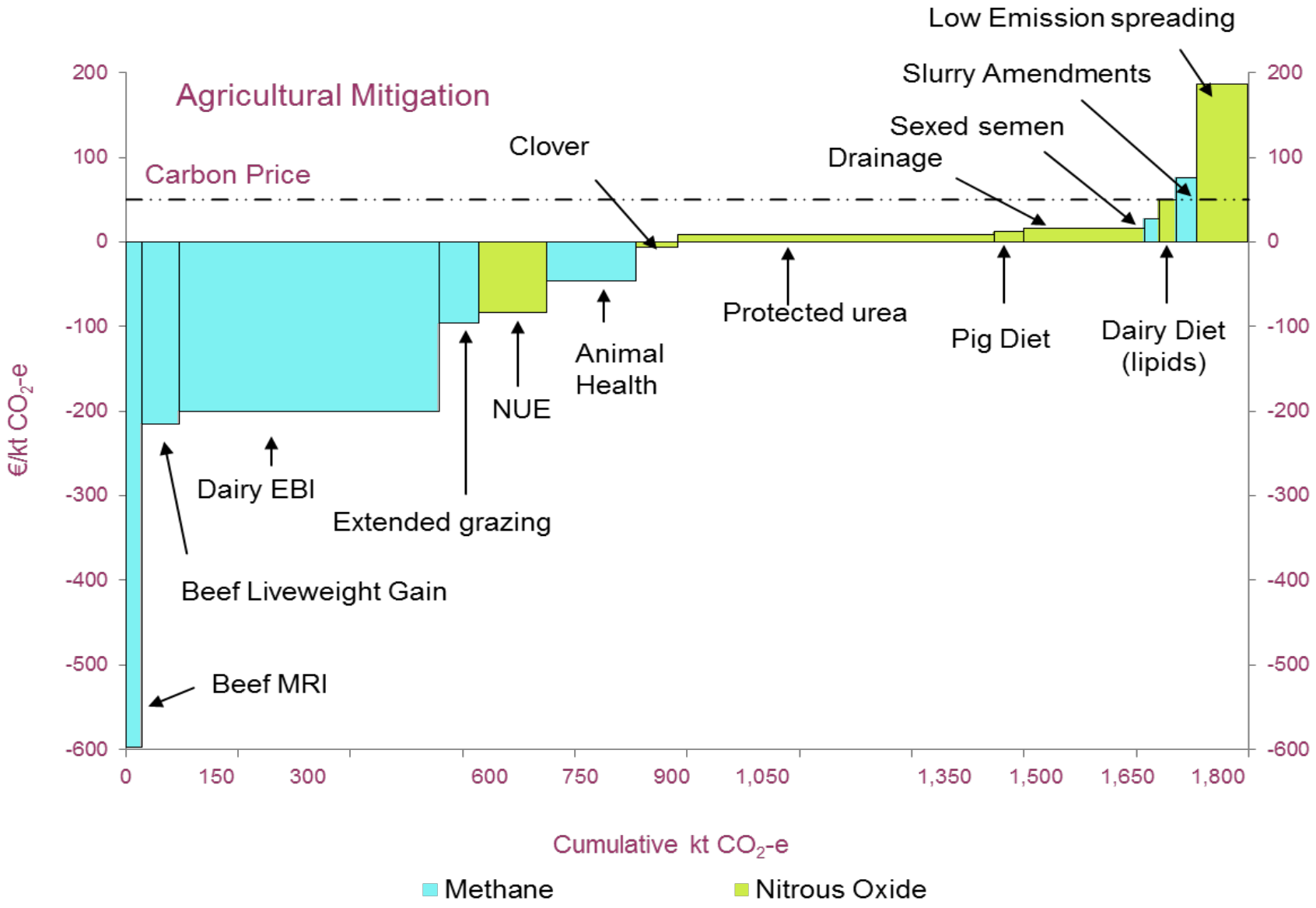
Background – MACC



Lanigan G.J. et al. 2018. An analysis of abatement potential of Greenhouse Gas emissions in Irish agriculture 2021-2030. Teagasc.

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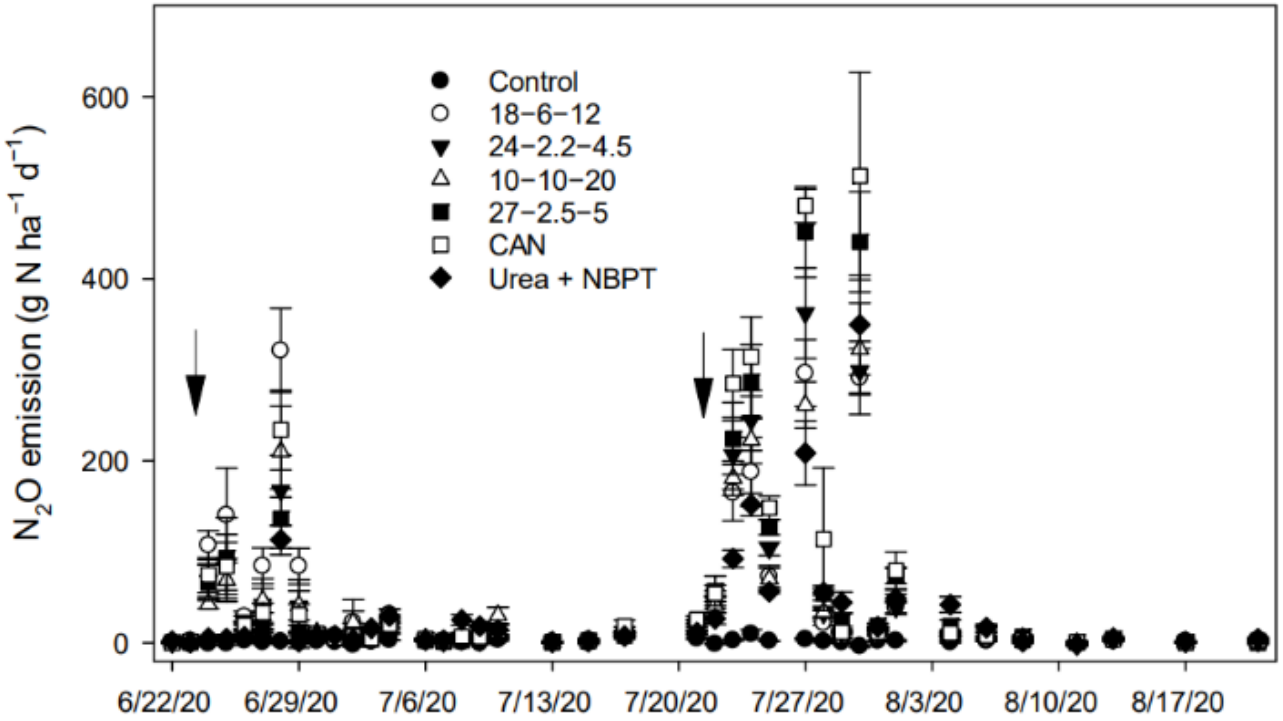
Materials and Methods

- Cut permanent grassland
- 80 kg N/ha – Silage June & July
- 7 fertiliser treatments
    1. Control (no fertiliser)
    2. 18-6-12 (ammonium-based)
    3. 10-10-20 (ammonium-based)
    4. 24-2.2-4.5 (nitrate-based),
    5. 27-2.5-5 (nitrate-based)
    6. CAN (nitrate-based),
    7. Urea + NBPT
- N_2O measured using static chambers for 3 months
- Measurements were made frequently after fertilizer application.
- Cumulative N_2O emissions GLMM (fertiliser type and timing fixed effects) in R

Results – application timing

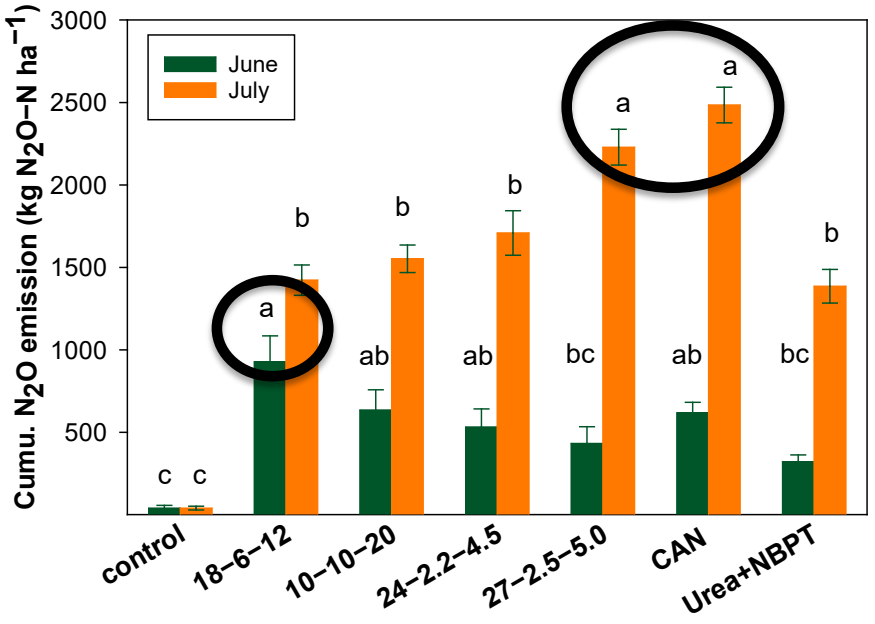
- N_2O emissions significantly different between application times (July>June)
- June (WFPS 58%) 0.35 to 1.11%
- July (WFPS>70%) 1.7 to 3.1%
- Higher N_2O losses July due to denitrification

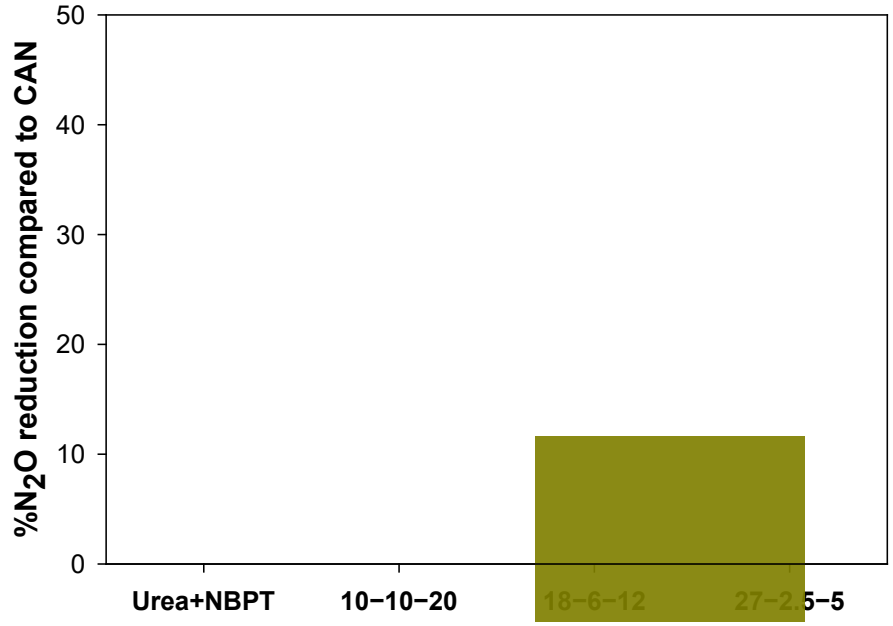


Gebremichael et al. 2021. **Agronomy**, 11, 1712.

Results – Fertiliser type

- June – emissions < 1 kg N_2O-N ha^{-1}
  - 18:6:12 > 27-2.5-5 & urea+nbpt
- July – emissions >1.5 kg N_2O-N ha^{-1}
  - CAN& 27-2.5-5 had higher N_2O emissions
- Under denitrifying conditions NH_4 based fertilisers reduced N_2O by 37 to 44%





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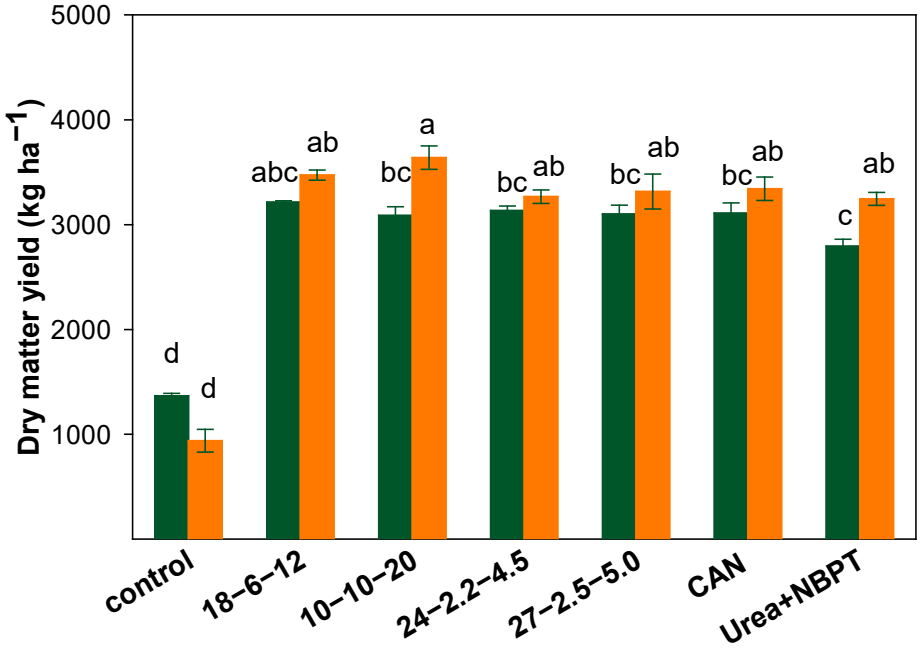
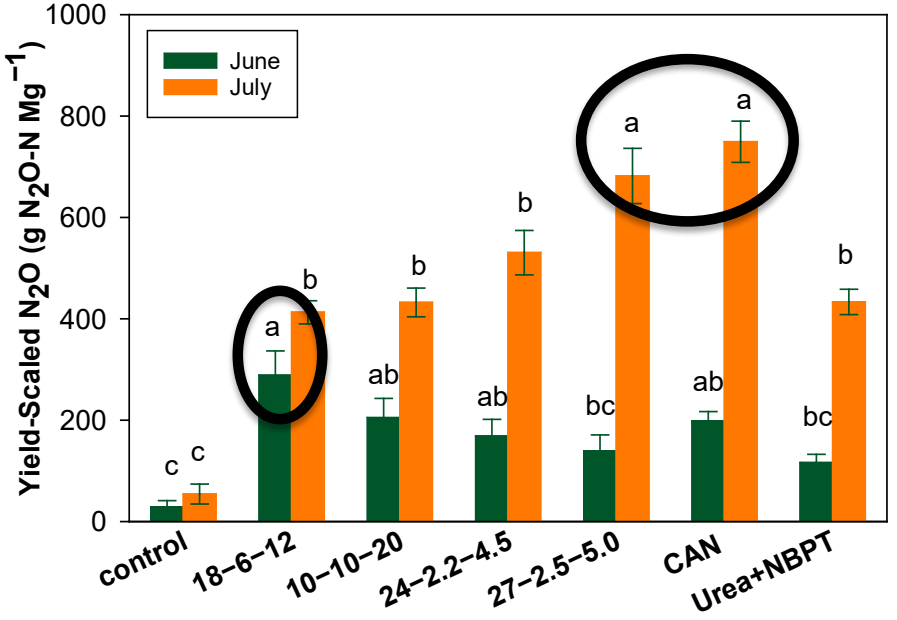
Results – Grass Yields

- Grass yields
  - Control 940 to 1340 kg DM ha^{-1} yr^{-1}
  - Fertilised 3100 to 3600 kg DM ha^{-1} yr^{-1}
- Fertiliser treatments > control
- No significant effect of fertiliser type on DM yield or NUE
- Yield Scaled N_2O
  - June – 18:6:12 >yield scaled N_2O
  - July – CAN & 27:2.5:5 significantly > than other fertilisers





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Summary

- N_2O emissions highest when soil >70% WFPS
- Under wet conditions nitrate based compound fertilisers had higher N_2O emissions compared to ammonium based compounds
- Moving to ammonium-based compounds may reduce N_2O emissions
- Fertiliser type effect on NH_3?
- New multi-site & multi-year project underway to provide new national N_2O and NH_3 EFs for compound fertilisers

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References – Fertiliser type & N_2O abatement

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Opportunities

Teagasc is recruiting 18 new permanent greenhouse gas researchers and technical staff this summer. Keep an eye on the web: **https://www.teagasc.ie/opportunities/**

Acknowledgements

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