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

Karl G. **Richards**, A. Gebremichael, N. Rahman, D. Krol, P. Forrestal, & G.J. Lanigan

*Teagasc, Crops, Land Use and environment, Johnstown Castle.*
*Email: Karl.Richards@Teagasc.ie*

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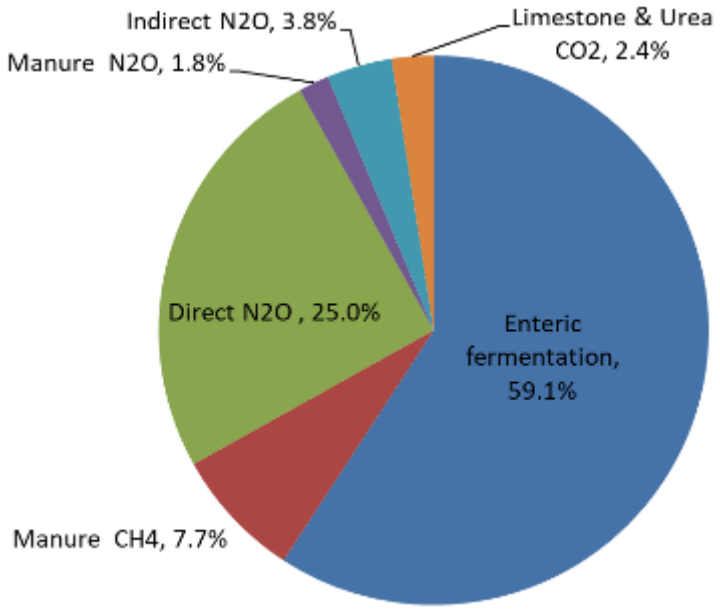
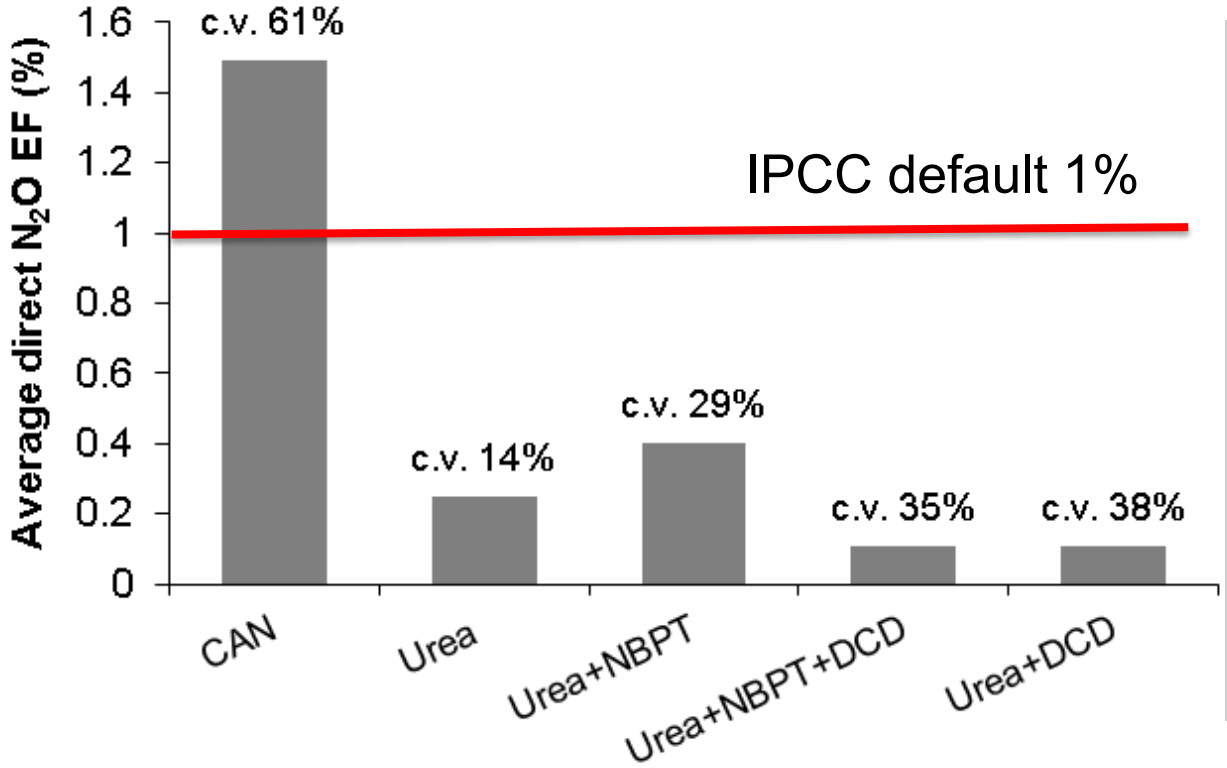
# Introduction

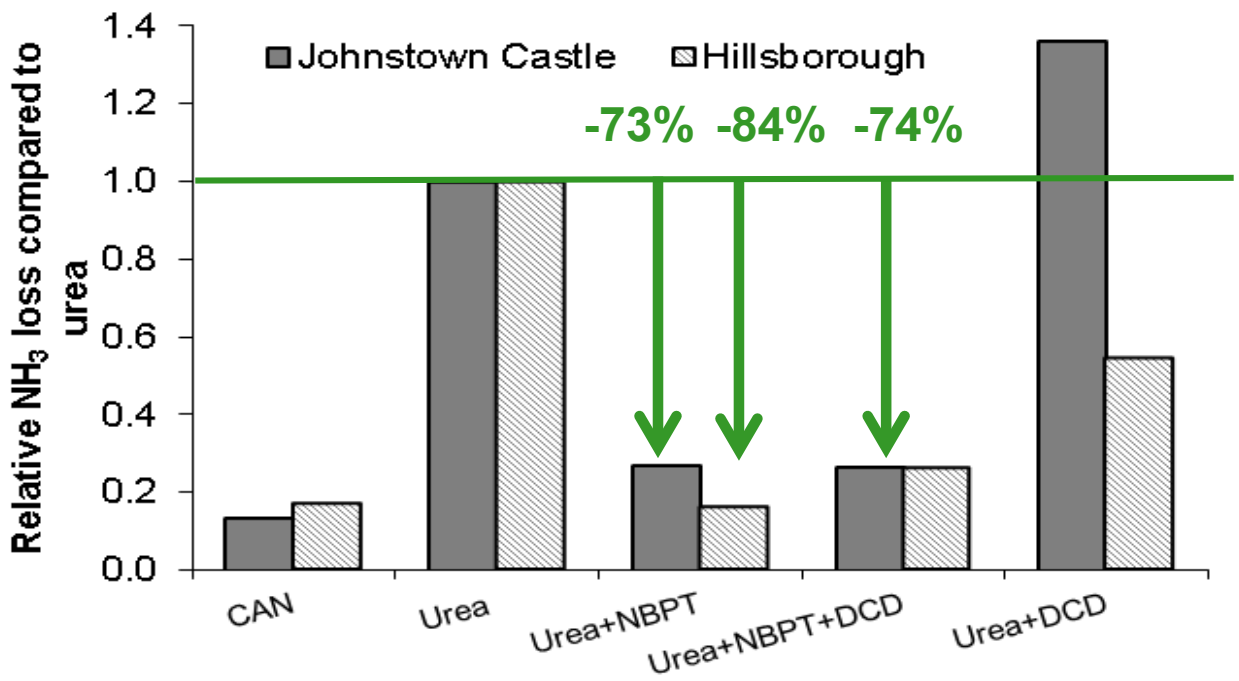
- Dominant grazed grasslands c. 90% UAA
- Grasslands receive up to 250 kg N $ha^{-1}$ $yr^{-1}$
- Irish uses c. 400,000 T N $yr^{-1}$ 50% straight N and 50% compound NPK
- Irish agriculture 36% of national GHG emissions (23% $CH_4$ and 13% $N_2O$)
- Agriculture to reduce GHG emissions by 22-30% by 2030
- 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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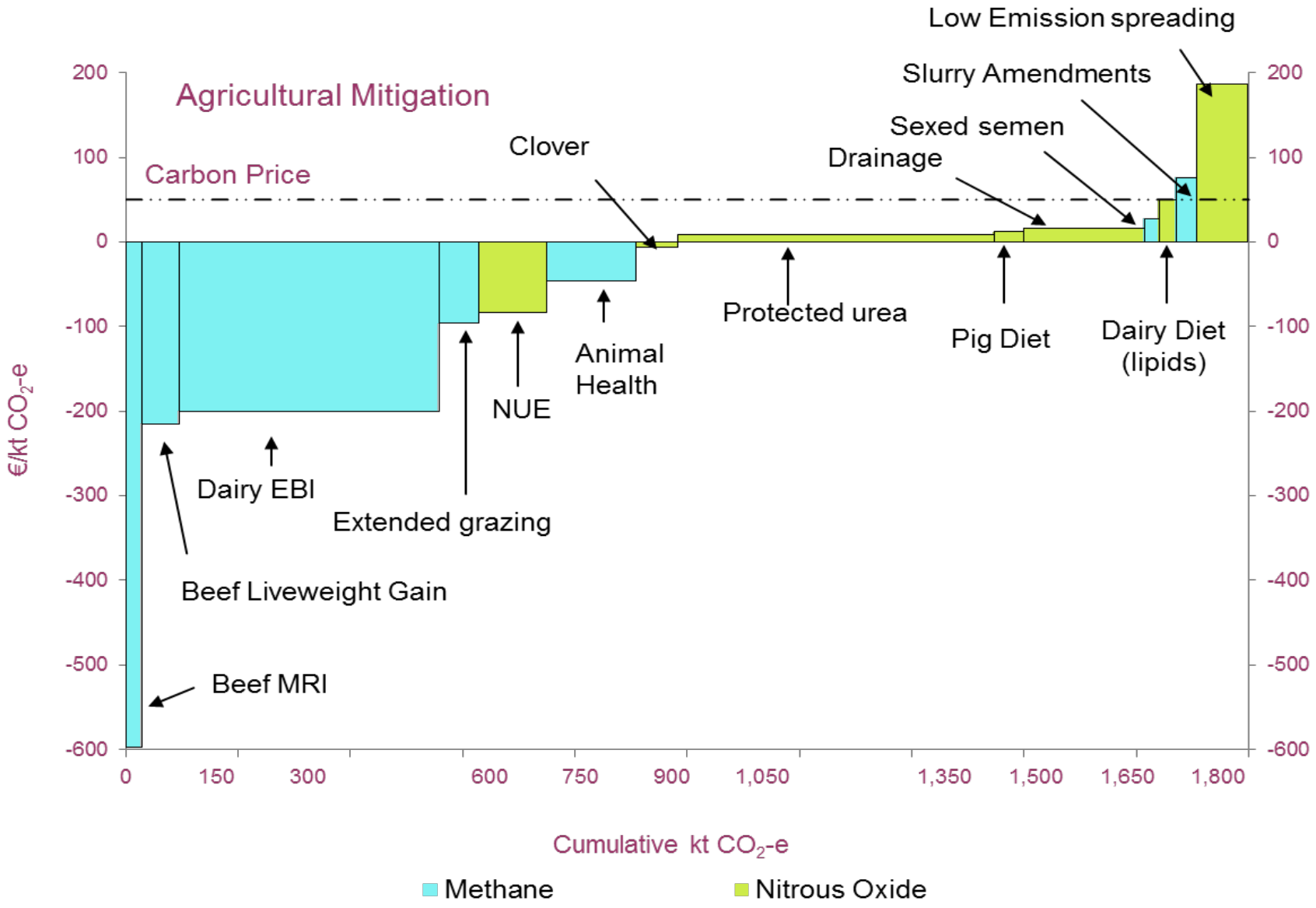
# Background – MACC




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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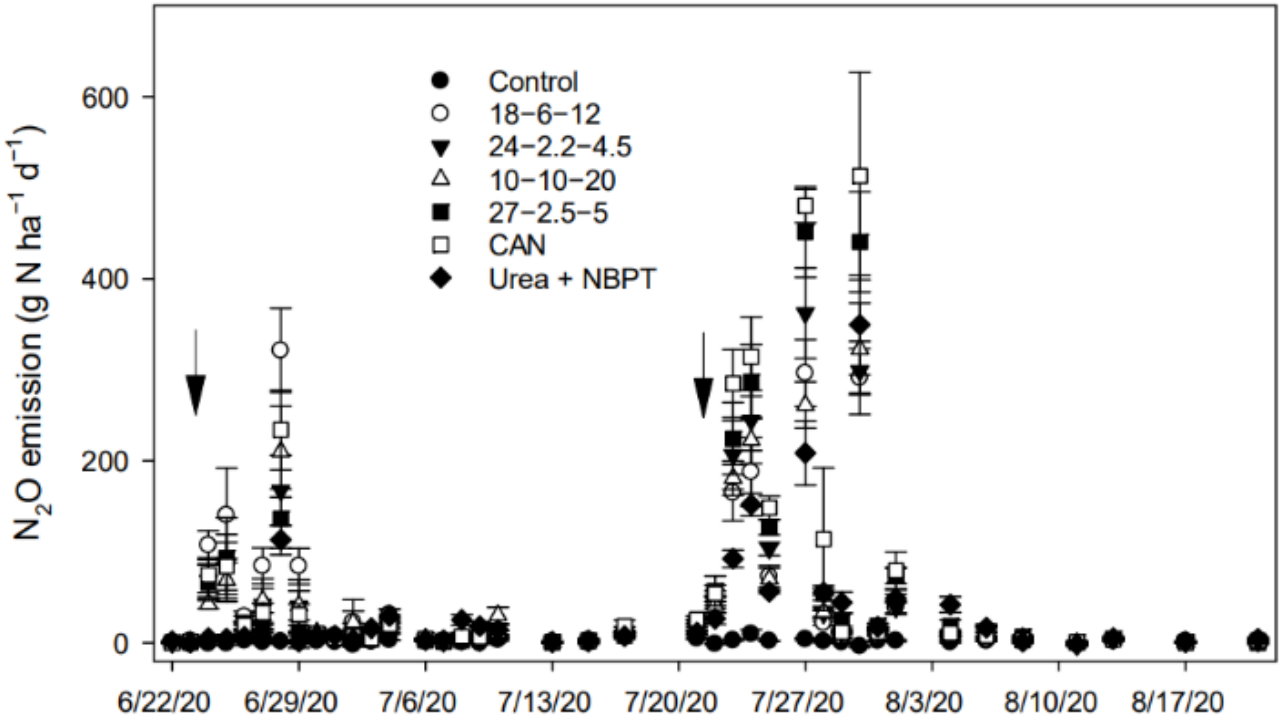
# Materials and Methods

- 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

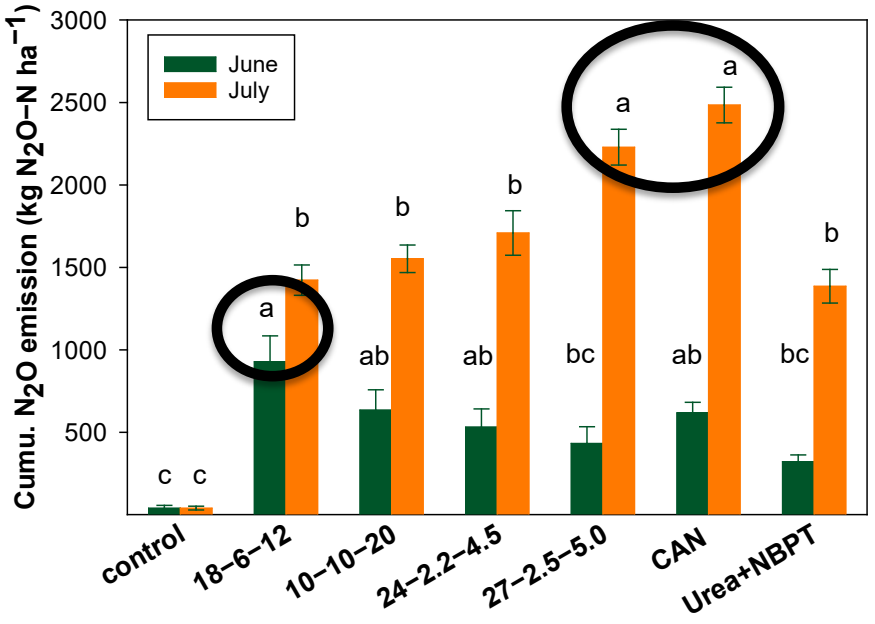


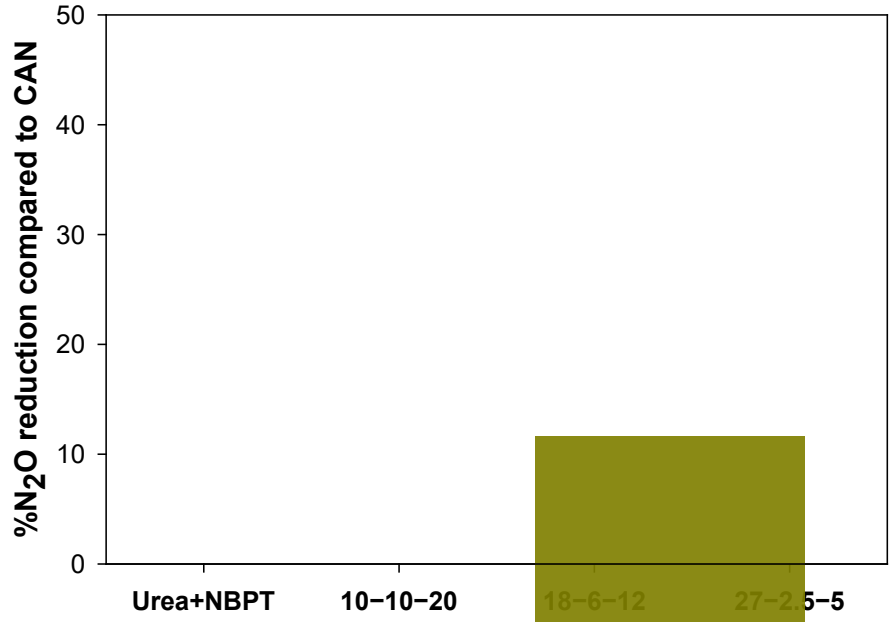



Gebremichael et al. 2021. **Agronomy**, 11, 1712.

# 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%



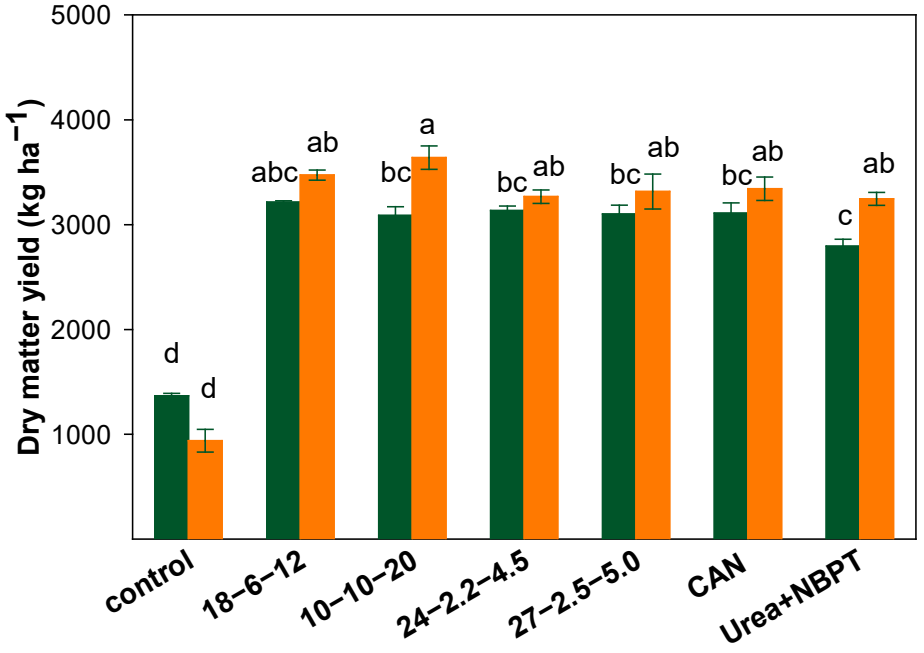



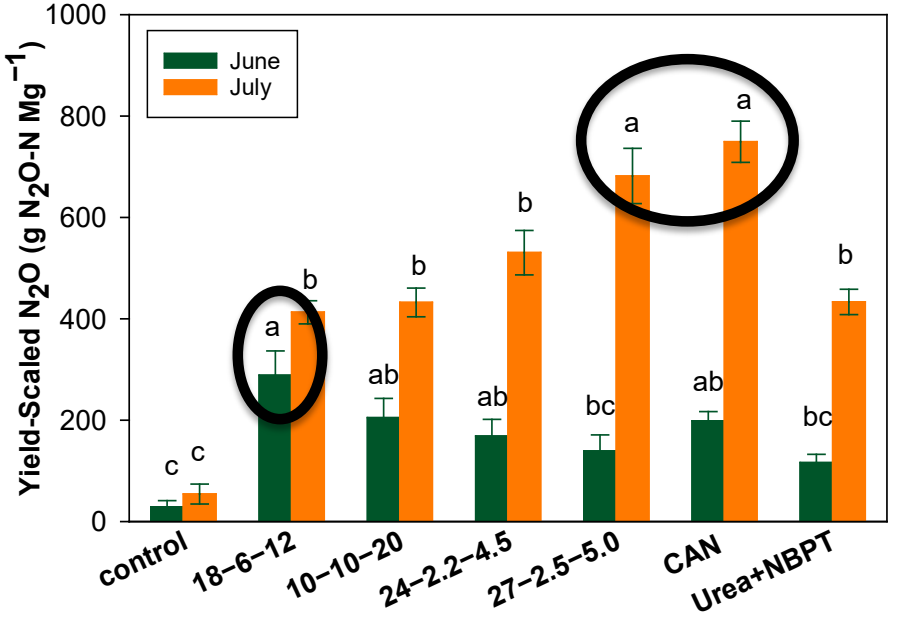



Gebremichael et al. 2021. **Agronomy**, 11, 1712.

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


# 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


This research was financially supported under the National Development Plan, Research Stimulus Fund, Department of Agriculture, Food and the Marine Grant numbers RSF15S655 and 2021R550.


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