

Protected urea – effects on pasture production and emissions mitigation

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Summary

- Across multiple sites and years, there was no difference in grass yield from using protected urea versus CAN as fertilizer N type
- Grass production was reduced by using 100% standard urea application
- Protected urea reduces greenhouse gas emissions compared to CAN, and ammonia emissions compared to urea.

Effects of fertiliser nitrogen type on herbage production

In a multi-site experiment conducted over two years Forrestal *et al.* (2017) reported that grassland plots fertilised with urea+NBPT had the same herbage yields and nitrogen (N) recovery as calcium ammonium nitrate (CAN) fertilised plots. Nitrogen recovery in the herbage was lower for urea plots. A trial by Krol *et al.* (2020) found that herbage yields of plots fertilised with NBPT or NBPT+NPPT protected urea matched CAN herbage yield performance. Subsequently, a multi-year grazed plot research study conducted by Murray *et al.* (2023) at four sites again found that herbage yields from Urea+NBPT treated grazed plots matched CAN yields. However, lower yields were detected when using standard urea. Field trials conducted by Teagasc at Johnstown Castle, Co. Wexford in 2024 found no significant difference in the herbage production from plots fertilised with CAN, standard urea and urea protected by NBPT, NBPT+NPPT or 2-NPT (Figure 1). The site suffered wet and saturated conditions spring and soil moisture restriction over the summer.

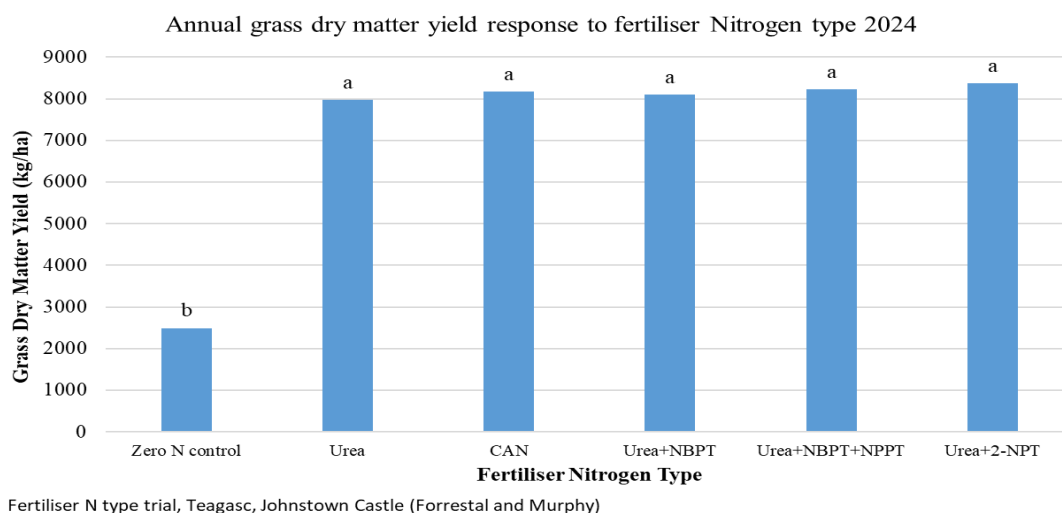


Figure 1. Effect of fertiliser nitrogen source on grass dry matter yield in 2024. Treatments with differing lettering are significantly different at ($P \leq 0.05$).

Effects of fertiliser nitrogen type on emissions

Although herbage yield response to different fertiliser N types is similar in Irish grassland there are important differences in emissions of the greenhouse gas nitrous oxide (N_2O). The N_2O emission factor of urea based fertiliser is approximately 70% lower compared with CAN (Harty *et al.*, 2016). Additionally, recent research has shown that ammonium-N has an N_2O emission factor that is 66% lower than the emission factor for nitrate-N highlighting the role of nitrate in grassland emissions (Rahman and Forrestal, 2021) (Figure 2a and b, respectively).

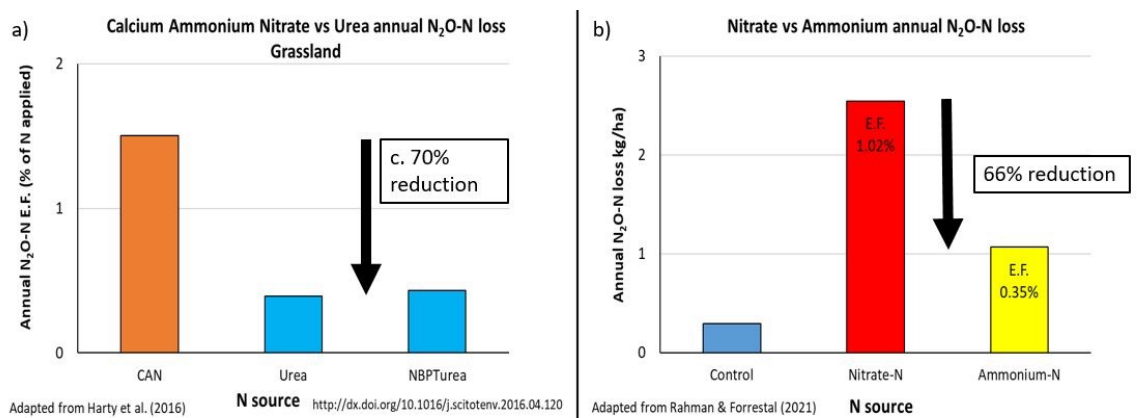


Figure 2. a. The effect of calcium ammonium nitrate (CAN) compared to urea and urea protected with NBPT on the nitrous oxide (N_2O) emission factor in Irish soils. **b.** the effect of zero N, nitrate only and ammonium only fertiliser N on N_2O emissions and emission factors.

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