

Supplementary Material

Ammonia emissions from nitrogen fertilised agricultural soils: controlling factors and solutions for emission reduction

Catrin Rathbone^A and Sami Ullah^{A,}*

^ASchool of Geography, Earth and Environmental Sciences, and Birmingham Institute of Forest Research, University of Birmingham, UK

*Correspondence to: Email: s.ullah@bham.ac.uk

Table S1. Papers included in this study, with the land-types of the experiment sites, fertilisers that were applied and the total number of fertilisation events extracted from each paper.

Reference	Land type	Fertilisers applied	Total number of fertilisation events
Carswell <i>et al.</i> (2019)	Grassland	AN, U, UI	15
Chadwick <i>et al.</i> (2005)	Grassland & Arable	AN, IUAN, U, UAN, UAS, UI	80
Cowan <i>et al.</i> (2019)	Grassland	AN, U, UI	9
Dampney <i>et al.</i> (2004)	Grassland & Arable	AN, CAN, U, UAN, UAS, UI	60
Forrestal <i>et al.</i> (2016)	Grassland	CAN, NI, U, UI, UINI	60
Krol <i>et al.</i> (2020)	Grassland	CAN, U, UI	4
Sanz-Cobena <i>et al.</i> (2011)	Arable	U, UI	4
Van der Weerden and Jarvis (1997)	Grassland	AN, CN, U	18
Watson <i>et al.</i> (1990)	Grassland	CAN, U, UI	3
Watson <i>et al.</i> (1992)	Grassland	U	15
Watson <i>et al.</i> (1994)	Grassland	U, UI	30

References

- Carswell A, Shaw R, Hunt J, Sánchez-Rodríguez AR, Saunders K, Cotton J, Hill PW, Chadwick DR, Jones DL, Misselbrook TH (2019) Assessing the benefits and wider costs of different N fertilisers for grassland agriculture. *Agronomy and Soil Science* **65**(5), 625–639. <https://doi.org/10.1080/03650340.2018.1519251>
- Chadwick D, Misselbrook TH, Gilhespy SL, Williams JR, Bhogal A, Sagoo L (2005) *NT2605 WP1b Ammonia emissions and crop N use efficiency*. DEFRA, London, UK.
- Cowan N, Levy P, Moring A, Simmons I, Bache C, Stephens A, Marinheiro J, Brichet J, Song L, Pickard A, McNeill C, McDonald R, Maire J, Loubet B, Voylokov P (2019) Nitrogen use efficiency and N₂O and NH₃ losses attributed to three fertiliser types applied to an intensively managed silage crop. *Biogeosciences* **16**(23), 4731–4745. <https://doi.org/10.5194/bg-16-4731-2019>
- Dampney P, Chadwick D, Smith K, Bhogal A (2004) *NT2603 The behaviour of some different fertiliser-N materials*. DEFRA, London, UK.
- Forrestal PJ, Harty M, Carolan R, Lanigan GJ, Watson CJ, Laughlin RJ, McNeill G, Chambers BJ, Richards KG (2016) Ammonia emissions from urea, stabilized urea and calcium ammonium nitrate: insights into loss abatement in temperate grassland. *Soil Use and Management* **32**, 92–100. <https://doi.org/10.1111/sum.12232>
- Krol DJ, Forrestal PJ, Wall D, Lanigan GJ, Sanz-Gomez J, Richards KG (2020) Nitrogen fertilisers with urease inhibitors reduce nitrous oxide and ammonia losses, while retaining yield in temperate grassland. *Science of the Total Environment* **725**, 138329. <https://doi.org/10.1016/j.scitotenv.2020.138329>
- Sanz-Cobena A, Misselbrook T, Camp V, Vallejo A (2011) Effect of water addition and the urease inhibitor NBPT on the abatement of ammonia emission from surface applied urea. *Atmospheric Environment* **45**(8), 1517–1525. <https://doi.org/10.1016/j.atmosenv.2010.12.051>
- Van der Weerden TJ, Jarvis SC (1997) Ammonia emission factors for N fertilizers applied to two contrasting grassland soils. *Environmental Pollution* **95**(2), 205–211. [https://doi.org/10.1016/S0269-7491\(96\)00099-1](https://doi.org/10.1016/S0269-7491(96)00099-1)
- Watson CJ, Stevens RJ, Laughlin RJ (1990) Effectiveness of the urease inhibitor NBPT (N-(n-butyl) thiophosphoric triamide) for improving the efficiency of urea for ryegrass production. *Fertilizer Research* **24**, 11–15.
- Watson CJ, Stevens RJ, Laughlin RJ, Poland P (1992) Volatilization of ammonia from solid and liquid urea surface-applied to perennial ryegrass. *The Journal of Agricultural Science* **119**(2), 223–226. <https://doi.org/10.1017/S0021859600014155>
- Watson CJ, Poland P, Miller H, Allen MBD, Garrett MK, Christianson CB (1994) Agronomic assessment and N-15 recovery of urea amended with the urease inhibitor nBTPT (n-(n-butyl) thiophosphoric triamide) for temperate grassland. *Plant and Soil* **161**, 167–177. <https://doi.org/10.1007/BF00046388>