Maximising Slurry Crop Available Nitrogen Utilisation in Grassland Systems

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Introduction In the UK, approximately 90 million tonnes of animal manure containing *ca* 450,000 tonnes of nitrogen (N) are recycled to agricultural land each year. The efficient utilisation of manure N can save farmers money and reduce diffuse air (ammonia) and water (nitrate) pollution. For slurries, bandspreading techniques (e.g. trailing shoe and trailing hose) can improve N utilisation by reducing ammonia volatilisation losses compared with conventional broadcast applications. They also provide increased spreading opportunities in spring/summer as slurry is placed in a band on the soil surface limiting herbage contamination, which can reduce the need to apply slurry in the autumn/early winter period that can exacerbate nitrate leaching losses. However, spring/summer application timings (when temperatures are higher and soils are drier) may lead to increased ammonia emissions compared with autumn/winter applications under cooler and moister soil conditions. This paper reports results from a project to investigate the effects of contrasting slurry application timings on ammonia volatilisation and nitrate leaching losses and grass N utilisation.

Methodology Experiments were set up on two commercial dairy farms; Betley (Cheshire) and Inkberrow (Worcestershire) in autumn 2002. Ammonia emissions and nitrate leaching losses (autumn timing at Betley) and crop dry matter yields and N uptake were measured following different slurry application timings (Table 1). There were 3 replicates of each slurry application timing along with accompanying fertiliser N response treatments (0-250 kg/ha N) to quantify the fertiliser N replacement value of the slurry dressings.

Table 1 Slurry application timings

Site	Application method	Application timing
Betley (Cheshire)	Tanker with 12m trailing hose boom	October 2002, February, March and April 2003 (first cut) Early June and late June 2003 (second cut)
Inkberrow (Worcestershire)	Umbilical system with 6m trailing shoe boom	February, March and April 2003 (first cut)

Results and discussion At Betley, ammonia emissions were highest (P<0.05) following the slurry application in early June (before second cut) at 17% of the total N applied and lowest following the October timing at 4% of the total N applied. The higher ammonia losses following the early June timing were most probably due to a combination of higher soil temperatures (15°C), 'dry' soil conditions and lack of grass cover (<5cm height) compared with the other application timings (soil temperature range 1-10°C and grass heights > 7.5 cm). Nitrate leaching losses following the October application were not different from the untreated control (P>0.05), indicating that slurry N had been taken up over winter by the grass sward. At both first and second cut, there was, surprisingly, no response (P>0.05) to either fertiliser or slurry N additions. At Inkberrow, ammonia emissions were similar (P>0.05) following each of the three spring application timings at between 6 and 8% of the total N applied. The fertiliser N replacement value of the slurry applications (based on crop N offtake) was 70 kg/ha, 63 kg/ha and 54 kg/ha for the February (91 days before cutting), March (63 days before cutting) and April applications (43 days before cutting), respectively. The number of days slurry could be spread was estimated to increase from 55 days/year for surface broadcasting to 145 days/year with the trailing shoe (bandspreading) machine. This was mainly because reduced herbage contamination allowed grazing to occur within a few days of application (rather than waiting 3-4 weeks following surface broadcasting) and a greater spreading window before silage cutting (rather than finishing applications 6-8 weeks before cutting with surface broadcasting).

Conclusions There is a need to ensure that slurry management policies that aim to reduce nitrate leaching (i.e. moving from autumn application timings to late spring/early summer) do not exacerbate ammonia losses through increased emissions under warmer and drier soil conditions. An integrated approach to slurry N management is needed that considers all N loss pathways and aims to maximise crop N utilisation.