Standing dairy cows off pasture – a potential mitigation strategy to reduce nitrate leaching (7-25)

Key points

- Cows can be stood off from pasture to promote future pasture growth rates and can be fed adequate pasture provided good practice is followed (see Farmfacts 1-9a & 1-9b).
- Reducing grazing time on pasture reduces the number if urine and dung (effluent) deposits on pasture.
- If this herd effluent us captured and stored away from pasture, there is the potential to reduce nitrogen (N) leached to ground water from urine patches in pasture.
- Captured nutrients can be recycled and applied as fertiliser at a time of year when it is subject to minimal leaching.

Introduction

A dairy cow typically excretes 25 litres of urine per day from 8-12 urinations. This is 9000 litres per cow per year. Urination is how a cow excretes much of her surplus dietary N. Of the N cows consume while grazing, 65-75% is excreted, mostly in the form of urea in urine. A urine patch on a pasture has a concentration equivalent to 700-1000kgN/ha, excess to requirements for pasture growth. Urea is converted to nitrate (NO$_3^-$) which moves down through the soil with surplus rainfall. Nitrate is relocated below the root zones of the plant and ends up in the water table. This process is called leaching. Typically a quarter of the urinary N is leached and is a source of nitrate in NZ’s rivers and lakes.

One way of decreasing the number of urine patches is restricting the grazing time of cows. With less time on pasture and more time on standoff pads, feed pads and animal shelters, there is less direct return of urine and dung to pastures. While this means greater quantities of excreta collected as effluent or stored manure, this can be returned to soils at a more suitable time of the year, more evenly and at lower concentrations compared with urine patches and dung pats. Studies at DairyNZ, Hamilton, by AgResearch in Southland and also Massey University have quantified the potential to reduce nitrate leaching through restricted grazing and standing off compared with a conventionally grazed system.

DairyNZ trial

In the DairyNZ study cows were grazed according to three treatments in late lactation (autumn, April):

- 1x8, 8 hours of available grazing between am and pm milking in a 24 hour period
- 2x4, 4 hours of available grazing after each milking in a 24 hour period
- Control, representing the normal situation of 24 hours of available grazing excluding milking time.

When not grazing, the 2x4 and 1x8 groups were stood-off on a plastic-lined, loafing area with a woodchip surface. The distribution of urinations over 48 hours in two separate weeks was determined using urine sensors (AgResearch, Palmerston North, New Zealand) and a global positioning system (GPS) collar to monitor the cow’s location (pasture, race, pad, milking) when it urinated (see photo). Urinations were classified as ‘captured’ if they occurred on the stand-off pad and dairy yards, or ‘uncaptured’ if on pasture and races.

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Results: Urinations on pasture and laneways were reduced from 85% of daily output (Control) to 56% (1×8) and 50% (2×4) of total urinations.

Discussion DairyNZ, AgResearch and Massey trials

- The estimated amount of urine captured on the loafing pad or in the dairy effluent system, rather than on pastures and laneways equals 4-5 urination events per cow per day or 9-11 litres of urine volume per cow.
- At standard concentrations of urinary N-nitrate, up to 119 g/cow/day less urinary N will be subjected to subsequent winter drainage as a result of diversion from pasture by restricted grazing during autumn.
- Reduction in urine patches from restricted autumn grazing reduced nitrate leaching losses in the following drainage period by 40% in a study in Southland. A similar figure was measured at Massey University.

The results show restricted grazing time or duration controlled grazing is a potential mitigation strategy to reduce NO$_3^-$ N leaching from dairy farms.

See also Farmfacts 5-40 Pugging and compaction, 8-4 and 8-5 Stand-off pads and 1-9a Standing cows off - how cows change grazing behavior and 1-9b Standing cows off - impact on pasture intake and milk production.