The Spatial Distribution and Area Coverage of Urine Depositions in Grazed Pastures in New Zealand

Context and Rationale

- In grazed pastures systems the majority of ingested nitrogen (N) is excreted in animal urine, resulting in high N loading in the animal urine patch. This creates a ‘mosaic’ effect of nutrient return and plant growth in grazed pastures.
- The total area receiving urine deposits in any time period is critical to the understanding of nutrient cycling and nutrient loss in grazed pasture systems.
- Quantitative field spatial data of urine patch area coverage value is scarce.
- Consequently, variability and uncertainty still surrounds the current estimate of annual urine patch area coverage in grazed pasture systems, and how area coverage varies with different stocking rates, stock type and season.

Objective

- The objective of this study was to develop a new method to quantify seasonal and annual urine patch area coverage under dairy and sheep and beef farming systems.

Methodology

- Accurate location and area measurements of urine patches over a period of twelve months were made for two farm types, which are typical of New Zealand grazed pasture systems: (i) a dairy farm in Canterbury and (ii) a sheep and beef hill country farm in Taupo, N.Z.
- Eighteen 100 m² plots were established and monitored on typical grazing areas at the two field sites, with the hill country farm plots located on either flat areas (0 – 3°) or on medium slopes (7 – 15°).
- All urine patch areas within each plot were visually identified from the enhanced pasture growth in those areas and their area and spatial location recorded with global positioning system (GPS) technology at regular time intervals throughout the year.
- Grazing information (grazing frequency, date, stock numbers and stock type) for all trial areas was recorded in order to relate area coverage data to stocking rate, grazing days and farming system type.
- The GPS data was analysed using geographic information system (GIS) software to calculate seasonal and annual urine patch coverage in the paddocks on an area basis.

Results

- On the dairy farm at an effective stocking rate of 3.5 cows ha⁻¹ (c. 32 standard stock units [ssu] ha⁻¹) the observed annual urine patch area coverage was 21.9% (Fig. 1B) with a mean urine patch radius of 30.5 cm. Urine patch coverage was shown to increase with increased stocking rate (cows ha⁻¹ or cow grazing days).
- For the sheep and beef farm at an effective stocking rate of 15.1 ssu ha⁻¹ the observed annual urine patch area coverage was 16.8% (Fig. 1D) for the study paddock, with a mean urine patch radius of 25 cm. Average urine patch coverage was 19.3% and 14.3% on flat areas (0 – 3°) and hill slopes (7 – 15°) respectively (Fig. 1D). This result confirms that a higher grazing pressure occurred on flat areas than on hill slopes.

Conclusions

- This study has successfully used GPS and GIS technology to make accurate measurements of the spatial distribution and area coverage of urine depostions in grazed dairy and sheep and beef pastures in New Zealand.
- Initial results from this study indicate that annual urine patch area coverage was 22 % for Intensive dairy farming and 15 % for sheep and beef farming systems.
- Long-term measurements are also required and the field measurements are therefore continuing.

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Figure 1 Average seasonal (A) and annual (B) urine patch coverage (% of plot area) for all field plots on the Dairy Farm and Hill Country farm (c. 2/5).