

Sensor technologies for detection of urine patches in livestock-grazed pastures

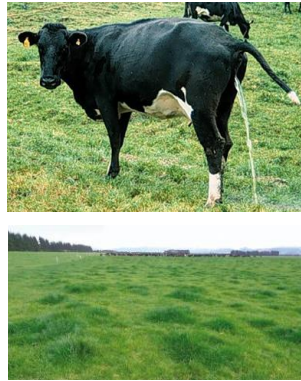


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Introduction

- Urine patches in grazed pastures are hotspots for nitrogen (N) losses through leaching and nitrous oxide (N₂O) emissions.
- A New Zealand designed ground-based sensing machine, Spikey®, can detect urine patches through spiked disks.
- The disks, acting as electrodes, measure the change in soil conductivity caused by urine deposition.



Results

- Spikey® could detect freshly deposited urine patches, giving similar patch configurations, at 2, 4, 24 and 48 hours after application of urine (Fig 2).
- The urine patch area calculated using data from both Spikey® and the thermal imagery generally increased with the volume of urine deposited, i.e. 1, 2 or 3 L.
- At the Manawatu, Waikato and New South Wales sites most (i.e. > 80%) patch measurements made using the Spikey® fell within +/- 30% of the area as detected by the thermal imagery approach (Fig 3). However, in Wexford the average patch size from Spikey® was almost double that generated by the thermal imagery.
- Soil moisture effect on urine patch areas was different between sites e.g. soil moisture below or at field capacity had no significant effect on patch area at Manawatu and New South Wales sites. However, larger patch areas were observed on the wetter soil at the Waikato site.

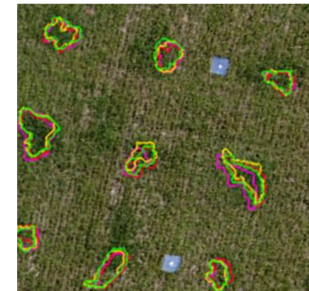


Fig 2. Urine patches detected by Spikey® at 2 (green), 4 (yellow), 24 hours (red), 48 hours (magenta) after urine application.

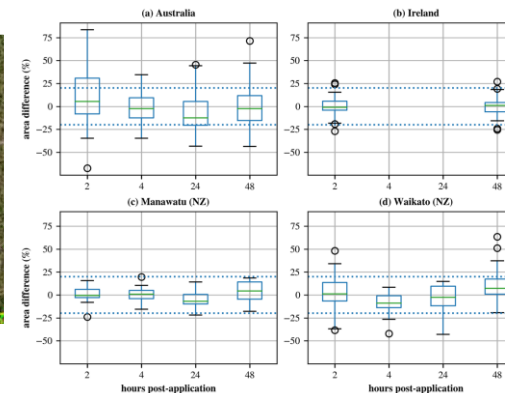


Fig 3. Difference in urine patch area detected by thermographic image and Spikey® approaches.

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Conclusion

Spikey® technology reliably detected urine patches under a wide range of soil and climatic conditions. Urine patches were detectable up to 48 hours after deposition.

Implications

This technology enables targeted application of N transformation inhibitors or other mitigation measures to the urine patches, avoiding the need for indiscriminate application across large pasture areas.

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Department of Primary Industries



Research Questions

- How reliable is the developed Spikey® technology in detecting shapes, sizes and locations of urine patches under varying conditions?
- How long after deposition can the urine patch be detected?

Methodology

- Urine patches (1, 2, 3 L) were applied to pastures in Manawatu and Waikato regions, New Zealand; New South Wales, Australia and Wexford, Ireland, to soils at or below field capacity.
- Urine was applied at 40°C, then a thermographic image was taken after 30 sec to record size and shape of each patch.
- The ability of Spikey® to detect the created urine patches was tested by towing the device over the urine patch areas at 2, 4, 24 and 48 hours after urine application (Fig 1).
- Spikey® data was compared with the locations, sizes and shapes of the urine patches determined from the thermographic images.



Fig 1. Spikey® identifying urine patches.