Improving the Sustainability and Mitigating Environmental Impacts of Grazed Grassland

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Introduction In New Zealand , the predominant land use is grazed pastures where animals graze outdoor pastures all year . In such systems , a major nitrogen (N) cycling process is the excretion of N in dung and urine by the grazing animal , returning 70% -90% of the N ingested to the soil . The N loading rate under a dairy cow urine patch can be as high as 1000 kg N ha^{-1} . This urine-N is the major source for both nitrate (NO_3^-) leaching and nitrous oxide (N_2O) emissions in grazed pasture systems (Di and Cameron , 2002a , 2002b) . Consequently , mitigation technologies have been developed to reduce both NO_3^- leaching and N_2O emissions from grazed pasture systems using nitrification inhibitors .

Materials and methods The effectiveness of a nitrification inhibitor , dicyandiamide (DCD) , in reducing NO_3^- leaching and N_2O emissions in grazed pastures was assessed in different soils across New Zealand . Nitrate leaching was measured using undisturbed soil monolith lysimeters (50～80 cm diameter ; 70～120 cm deep) . Nitrous oxide emissions were determined using closed chamber methods on top of the lysimeters . Pasture yield was measured on the lysimeters by cutting and weighing dry matter yields .

Results and discussion Nitrate leaching was significantly decreased by treating the grazed pasture soils with the DCD nitrification inhibitor (Di and Cameron , 2002b , 2004) . For example , NO_3^--N leaching losses from a Templeton soil were reduced from 85 to 20-22 kg N ha^{-1} yr^{-1} (equivalent to 74% -76% reductions) (Di and Cameron , 2004) . N_2O emissions from the urine patches were reduced by an average of 70% in four different soils (Di and Cameron , 2006 ; Di *et al* . , 2007) . Pasture yield was also significantly increased by the inhibitor treatment (Di and Cameron , 2002b , 2004 , 2005) . Therefore , treating grazed pasture soil with the DCD nitrification inhibitor provides both environmental and agronomic benefits by reducing NO_3^- leaching and N_2O emissions , and increase pasture production .

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