An investigation of the spatial distribution of N_2O emissions from sheep grazed hill country pastures in New Zealand

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Abstract

New Zealand's (NZ) greenhouse gas (GHG) profile is unique amongst developed countries as almost 50% of GHG emissions are derived from agriculture. In contrast, agricultural sectors of other developed countries typically contribute <10% to the national total GHG profile. In NZ, agricultural GHG emissions are dominated by methane (CH_4) from enteric fermentation and nitrous oxide (N_2O) from excreta deposition and nitrogen (N) fertiliser application. Nitrous oxide emissions from agricultural soils are largely affected by N inputs and soil moisture conditions, and contribute 33% of agricultural GHG emissions. In pastoral hill country these factors are inherently more variable than in flat land pastures due to topography-driven differences in excretal N returns and in soil moisture. This limits the application of N_2O emission data collected from trials conducted on flat land to hill country situations. The objective of this thesis was to determine the influence of topography and fertiliser N inputs to soil on N_2O emissions in hill country. Small scale trials were conducted to measure these aspects of N cycling.

Three trials were conducted to measure the effect of slope and fertiliser N input on nitrification potential (NP) and N_2O emissions. The results of these short term trials suggested that slope class and fertiliser N rates significantly affected nitrification rates and N_2O emissions in hill country due to differences in N inputs and moisture status, as affected by slope. Both NP and N_2O emissions were highly spatially variable during the measurement periods and the results presented in this thesis suggest that the majority of N_2O emissions in sheep grazed hill country are produced from low slope/stock camping areas. Based on our findings it is recommended that mitigation options to reduce the risk of N loss from sheep grazed hill country should be targeted at low slope/stock campsite areas. Due to the significant relationship between slope class and N_2O emissions, slope class may be a suitable parameter for up-scaling estimates of N_2O emissions from sheep grazed hill country.

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Table of Contents

List of Tables and Figures