

Summary Report

Wise and sustainable rates of Nitrogen fertiliser on hill country

Increasing financial pressure on hill country farming has led to increasing intensification. One feature of this has been increased use of nitrogen fertiliser and the potential environmental impacts of this may alter the nature of intensification in hill country farming.

Experiments at the Ballantrae Research Station and the Invermay Research Centre were established in 2004/2005 to understand the impacts of increasing rates of nitrogen fertiliser on hill country pastures and nitrogen leaching. These experiments measured pasture performance, stocking rate and environmental impacts from nitrogen fertiliser applied at rates of 0 to 750 kg N/ha/annum over the following 4 years. This programme ran in conjunction with the Wise Use of N on Hill Country project.

Results from Ballantrae where rates of fertiliser nitrogen ranged from 0 to 750 kg N/ha/annum demonstrated that pasture production was increased with increasing nitrogen fertiliser application, and ranged from 10,660 to 14,710 kg DM/ha/annum as N application rate increased from 0 to the top rate. Annual response rates ranged from 3-19 kg DM/kg N, averaged 7 kg DM/kg N, and were well below other reported responses of 13-34 kg DM/kg N. In two of the 4 years the summer/autumn periods were particularly dry, which would have limited pasture response to applied N. Clover content was generally very low. Pasture feed quality was high and seldom affected by applied nitrogen fertiliser. The leaching of nitrogen from the soil was measured in shallow (300 mm deep) lysimeters and indicated that applying fertiliser nitrogen at rates of up to 200 kg N/ha/annum did not significantly increase leaching losses. Small differences in soil pH were noted only at the very highest (500 and 750 kg N/ha/annum) nitrogen fertiliser application rates. Stocking rates to utilise the pastures were high, ranging from 19-27 SU/ha, and rotational grazing meant that grazing intensity was high during infrequent grazing events. This may have led to the high concentrations of mineral-N, and the cations potassium, magnesium and calcium in leachate from the lysimeters.

Results from Invermay, where fertiliser rates ranged from 0 to 500 kg N/ha/annum, showed consistently high response rates of pasture to added fertiliser nitrogen averaging 18 kg DM/kg N applied. Pasture production averaged 12,680 kg DM/ha/annum in control plots and peaked at 21,000 kg DM/ha/annum at between 300 and 400 kg N applied/ha/annum. Clover content was significantly depressed by fertiliser nitrogen use, declining to approximately 2% when 300 kg N/ha/annum or more was used. Leaching losses, using lysimeters similar to those used at Ballantrae, were by comparison lower, though showed similar trends with increasing fertiliser nitrogen application. No changes in soil pH were recorded at the rates of nitrogen fertiliser applied. Stocking rates were again high to utilise the extra feed grown, ranging from 16.1 to 25.0 SU/ha/annum. These were grazed on a more traditional hill country system, due to the larger plots (approximately 1 ha). Leaching losses were lower than at Ballantrae with its shallower soil and higher rainfall environment. Results indicated that fertiliser-N supported increases in stocking rates to over 18 SU/ha were liable to increase N leaching losses.

Differences between the experimental sites highlighted the potential impacts of grazing management, soil type and climatic conditions in responses to nitrogen fertiliser, both in pasture production and potential environmental impacts. Results from both sites indicated that rates of fertiliser nitrogen of up to 200 kg N/ha/annum produced more feed, with no significant increase in N leaching losses compared with areas that had not received fertiliser N. Response curves from both trials suggest use of fertiliser N in hill country at normal commercial rates (<100 kg N/ha) will have relatively small effects on N leaching.

The results gathered have raised questions about measurement method and interpretation of N leaching losses in hill country.