

SOLUTIONS TO ENVIRONMENTAL CHALLENGES

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Abstract

Leaching of nitrogen (N) from farmland not only reduces soil fertility and plant yield but can also create adverse impacts on the environment. Legislation has therefore been introduced that requires farmers to reduce nitrate leaching losses and this is a significant challenge. This workshop describes the latest research to discover new ways to help farmers to reduce nitrogen losses and increase the sustainability of dairy farming.

Introduction

Examination of the nitrogen cycle enables potential solutions to be identified that could be used to reduce nitrogen losses from farmland.

Potential Solutions

Plant traits

Latest research indicates that animal diets that include plantain (cv Tonic) 'Ecotain™' can reduce the concentration of N in animal urine; which can reduce the risk of nitrate being leached from soil.

Recent lysimeter studies have confirmed that nitrate leaching losses from animal urine patches are significantly lower under plantain/Italian ryegrass/white clover forages compared to standard perennial ryegrass/white clover forages. This is attributed to: (i) lower urinary N load due to the plantain in the diet, (ii) greater plant uptake of N during cooler months by the Italian ryegrass and, possibly, (iii) a biological nitrification inhibitor in the plantain.

Farm systems trials conducted at Lincoln University's Ashley Dene Research and Development Station indicate that milk production is not adversely affected by the inclusion of plantain in the forage.

Farm system change

Farm systems research has shown that lower input systems can reduce N loss and still be profitable. Nitrogen leaching losses from Lincoln University Dairy Farm (LUDF) have been calculated to be c. 25% below LUDF's historical baseline when N fertiliser was reduced from 350 kg N/ha/y to 150 kg N/ha/y, imported supplement was reduced from 430 kg DM/c/y to < 300 kg DM/c/y, and stocking rate was reduced from 3.9 c/ha to 3.5 c/ha. Milk solids per cow was increased due to better feeding but milk solids per hectare was lower.

Nitrification inhibitors

Research has proven that nitrification inhibitors can significantly reduce nitrate leaching losses from soil. Nitrification inhibitors slow down the rate that ammonium is converted into nitrate in soil. Ammonium can be held by soil particles but nitrate cannot; so slowing the rate of nitrate production can reduce the risk of N leaching. Nitrification inhibitors can also reduce the emissions of the greenhouse gas nitrous oxide from soil.

Catch crops

Recent research shows that sowing a 'catch crop' after winter grazing of fodder beet or kale can significantly reduce nitrate leaching losses compared to leaving the soil bare until the next main crop is sown. Oats can germinate and grow at low soil temperatures and this removes nitrate and water from the soil; reducing the leaching loss.

Standoff pads

Standoff pads can be used to take stock off wet soil during winter and thus reduce the amount of urinary nitrogen deposited on the soil and thus reduce the potential leaching loss.

New effluent treatment system

A new effluent treatment system has been developed by Lincoln University and Ravensdown to treat farm dairy effluent in order to reduce the environmental impacts of effluent and recycle wash water at the dairy shed. The ClearTech[®] system can reduce water use at the dairy shed by up to c. 50% and this can reduce the rate that effluent ponds fill; giving greater control of effluent application to land. The new treatment process also helps to reduce the risk of *E. coli*, phosphate and nitrate losses occurring from effluent applied to land.