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The effect of decreasing fertilization on agricultural nitrogen leaching: a model study

Keywords agriculture, nitrogen, fertilizer, model, leaching, climate,

Abstract

In Finland, the use of agricultural nitrogen (N) fertilizers has decreased since the beginning of the 1990's but there is not yet any clear response in observed water quality in the monitored agricultural catchments and river basins. It is therefore important to analyse how the reduction in N fertilization affects N leaching at the root zone scale. In this study the nutrient leaching model ICECREAM was used to demonstrate the effects of climatic conditions and decreased N input on N leaching. Ten years (1991–2000) of climatic input data from five stations located in different parts of the country were used as input to simulate nitrate N (NO₃-N) leaching from barley cultivation with i) constant N fertilization (Baseline simulation, 90 kg N ha⁻¹) and ii) decreasing N fertilization (N Reduction Scenario simulation: annual linear decrease from 110 to 90 kg N ha⁻¹). The annual and regional variation of simulated N leaching was considerable in both the Baseline and N Reduction Scenario simulations. In the Baseline simulation the average annual NO₃-N leaching was 24% of the N fertilization amount. From 1991 to 2000, the annual N leaching decreased close to Baseline leaching values in the N Reduction Scenario simulations, but the decrease was not linear due to high variability in N losses caused by changes in annual weather conditions. The model results indicate that it is possible to achieve a reduction in root zone N leaching by adjusting the fertilizer levels.

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