ROTHAMSTED RESEARCH

The Brimstone Farm Experiment

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6: Phosphorus Leaching in Phase II

Rothamsted Research

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6. PHOSPHORUS LEACHING IN PHASE II

6.1 BACKGROUND

Early work on the composition of drainage waters from arable soils at Rothamsted and elsewhere had shown that they contain very little phosphate, because most of the P applied in fertilizer but not taken up by crops is effectively fixed by most soils. For many years the eutrophication of surface waters was consequently attributed to P from sewage outfalls, which often contained the residues of P-rich detergents. However, minimizing P inputs from sewage in the late 1980s and early 1990s did not eliminate the problem of eutrophication, and the possibility remains that low levels of diffuse agricultural P contamination of surface waters is at least partly responsible for the continuing increase in eutrophication.

Measurements of soluble (molybdate reactive) and total (perchloric-nitric acid extractable) P in water samples from the mole and pipe drain system and cultivated layer flow of Brimstone plots were begun in February 1990. Initially losses in selected flow events were monitored, but since November 1993 soluble P has been determined on all water samples simultaneously with nitrate, nitrite and chloride using a SHENA multichannel flow injection analyser.

6.2. RESULTS

6.2.1 Drainflow

Amounts of soluble P in drainflow are fairly constant (0.03-0.15 mg P/l), and like nitrate often show a dilution effect with increasing flow rate. In contrast, total P is more variable (0.06-1.31 mg/l), the concentration depending strongly on flow rate, presumably because much of it is in particulate form and water samples collected during storm conditions are often turbid.

Losses in the cultivated layer flow (0.05-0.72 mg soluble P/l; 0.07-3.13 mg total P/l) are usually greater than in drainflow.

Concentrations of soluble P and total P in both drainflow and cultivated layer flow show few differences between runoff events at different times after P fertilizer applications. For example, the concentrations in drainflow in November 1991, one month after an application of 56 kg P/ha, were 0.05-0.10 mg soluble P/l and 0.07-0.23 mg total P/l, whereas the ranges for winter 1993/94, more than 2 years after this fertilizer application, were 0.03-0.15 mg soluble P/l and 0.06-0.75 mg total P/l. This suggests that the losses of P are controlled by processes in the soil not directly related to fertilizer applications. Nevertheless they are usually greater than the minimum concentrations (0.02-0.035 mg P/l) thought to cause eutrophication (OECD 1982).

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