

FARMING, FERTILIZERS AND THE NITRATE AND PHOSPHATE PROBLEMS

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ABSTRACT

Concern over the environmental impact of excess nitrate and phosphate in the environment, especially in rivers, lakes and seas, means that there is an urgent need to achieve tighter cycling of N and P in farming systems. The processes comprising the nitrogen cycle are well understood in general terms but there is a need for more quantitative measurements of each process in specific agricultural situations. Some processes, such as denitrification and mineralization, are extremely difficult to measure under realistic field conditions. Various methods are available for measuring nitrate leaching but again all methods have limitations and must not be used uncritically. Data collected from such measurements can be used to test and extend existing mathematical models of the nitrogen cycle. Such models are valuable in assessing the likely impact of different possible changes to agricultural practice. Although decreased use of inorganic N fertilizer has a part to play in devising more environmentally friendly systems, the major source of the nitrate leached from agricultural land is usually mineralization of soil organic matter, crop residues or animal manures. Mineralization is not easily controlled and increased reliance on nitrogen from biological fixation or organic manures may exacerbate the problem because of poor synchronization between nitrate production and crop uptake. Some of the agricultural practices that are effective in limiting nitrate leaching, such as early sowing of crops in autumn or maintenance of crop cover during winter, conflict with practices designed to control pests, diseases and weeds.

Unlike nitrate, phosphate is strongly held on soil colloids and is much less subject to leaching. Most P losses are due to movement of particulate material from soil to waterways, for example by erosion. Surface run-off can also contribute to P loss especially where organic manures are applied to soil under unsuitable conditions. There is currently increased interest in the role of organic forms of P in phosphate transport and also in the movement of intact micro-organisms to drains.