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**MacKenzie G.H., Taureau J.C. Recommendation Systems for Nitrogen -A Review**, p. 5

**Abstract**

Attempting to optimise the use of nitrogen (N) fertilisers has commanded the attention of many agronomists and others for at least the last hundred years. The complexity of the nitrogen cycle, which involves numerous soil nitrogen transformations and the effect of weather on these and on crop growth and hence nitrogen demand, make accurate prediction very difficult. In the past, farmers and growers tended to "en on the high side" with nitrogen applications to avoid the risk of yield loss, but they are now under pressure from a UE quarters not to do this because it might lead to excessive nitrate in the produce and in the soil at harvest. This paper considers the basis of nitrogen recommendations and also the main methods of predicting optimum levels of fertiliser nitrogen. The UK Ministry of Agriculture, Fisheries and Food (MAFF) N-Index system, which was developed from extensive tri ais data, has been an important step forward in quantifying nitrogen recommendations for aU crops in the UK. Soil mineral nitrogen (SMN) measurement was used widely for recommendation purposes on the continent where winters were generally colder, more predictable and consequently effective mineralisation did not occur until early spring. In the UK, measurement of SMN is now becoming more widespread, not just for research purposes but also on commercial farms because a number of trials have shown that better fertiliser N recommendations can be made particularly where there are high soil N residues. There is a problem, however, in assessing the level of nitrogen mineralisation during the growing season unless numerous soil N measurements are taken. Also, most recommendation systems rely on an accurate prediction of crop yield and errors lead to an incorrect nitrogen recommendation. More recently, computer models have been developed to quantify the various nitrogen transformation processes. These were originally used to quantify changes in field trials but now are being developed as potential advisory tools.

**Archer J.R., Marks M.J. Control of Nutrient Losses to Water from Agriculture in Europe**, p. 52

**Abstract**

Nitrogen and phosphorus in waters cause concern because they may result in failure to meet the 50 *mg/I* nitrate drinking water standard or in eutrophication of fresh and marine waters. Agriculture is the main source of nitrate in water and the second most important source of phosphorus after waste water from sewage treatment works. A range of control mechanisms are available to national governments and international fora to reduce nutrient losses from agriculture and help meet environmental objectives. These are financial (output prices, incentive payments, taxes, levies), regu1ation and advice. Within Europe, the regulatory options has been used by many countries. Others have relied mainly on information and advisory programmes. Within the EU, the EC Nitrate Directive which was adopted in 1991 is the main legislation. This requires mandatory controls on farmers in areas where nitrate pollution is occurring. Various other international agreements deal with aspects of nutrient loss from agriculture. National policies and implementation of EU and other agreements vary considerably. Countries with longstanding marine eutrophication problems have usually taken the greatest and most widespread action. Denmark, Netherlands, Germany and Belgium (Flanders) are all designating the whole of their territory under the Nitrate Directive. They have mor e and stronger national 1egislation than other countries. But they also have the highest densities of housed livestock, particularly pigs. By contrast France, UK and southern European countries generally have less problems and have taken less action. All are committed to local Nitrate Vulnerable Zone designations under the Nitrate Directive rather than designation of all their territory. Greater reliance in these countries is put on information and advice. Countries with high quality lake and river waters such as Ireland and Finland are most concerned about phosphorus limited eutrophication. Their policies reflect this concern.

**Wollring J, Reusch S., Karlsson C. Variable Nitrogen Application Based on Crop Sensing**, p. 79

**Abstract**

Although nitrogen (N) is the most interesting nutrient for spatially variable application with the highest economic and environmental potential, other nutrients (P, K and lime) are in the forefront of precision farming. The re ason for this is that appropriate methods which can correctly and quickly predict the N fertilizer requirement at the required high resolution and cost efficiency are still missing. For cost reasons, deep soil sampling on a grid basis is not

regarded as a realistic approach for site-specific N management. Plant monitoring or sensing is seen as the future method to determine the crop's N demand on a spatial basis. This is because, direct or indirect measurement of crop's N status has the advantage that the actual plant-available N from the soil is indicated, whereas soil analysis measures an N potential which is thereafter influenced by several factors which affect final plant availability. In1987 Hydro Agri started to develop instant in-field methods to determine N fertiliser rate. Methods which were investigated started with the Nitrate Sap Test, the Hydro PrecisioN-Tester (PNT) and the PrecisioN-Sensor (PNS), a recently released system for tractor-mounted crop sensing. PNT and PNS indirectly determine the N fertiliser demand based on chlorophyl! measurement by transmittance and reflectance respectively, and are calibrated in field triais for cereals.
The PNT, which is a small handy device used for field-specific uniform N application, has been shown to have a good performance regarding yield, grain quality and environment, and is already recommended in governmental-funded environmental programs. The PNS, a traetor-based remote sensing system, allows real-time spatially variable N application. Using the PNS, a large variation of the rate required in a single field between Oto 120 kg N/ha for the second N dress

**Leifert C., Golden M.H. A Re-Evaluation of the Beneficial and Other Effects of Dietary Nitrate**, p. 99

Abstract

Current or proposed legislation to limit nitrate levels in drinking water and foods have resulted from concern about negative human health effects of dietary nitrate intake. However there is no doubt that the legislation, in the EU and elsewhere, has had an additional benefit to the environment by encouraging the reduction of losses of nitrogen to water from agricultural systems. Elevated nitrate levels in surface waters can encourage algal blooms and eutrophieation of marine ecosystems, and this is currently a major focus of attention (de Meeus, 2000). Illegal limit on the nitrate eon tent of surface waters, although imposed in response to issues concerning public health, has a positive role to play in the protection of the environment.

**Watson C.J., Nitrogen Cycling in Grassland Systems**, p. 119

**Abstract**

Agricultural intensification of production from grassland has led to serious imbalances between inputs of nitrogen (N) (in purchased fertilisers, feeds and atmospheric deposition) and outputs (mainly milk and meat). Large quantities of N are recyc1ed to land during grazing or application of organic manures. Excess nutrients are lost into the wider environment with consequences for water, soil and atmospheric quality. The processes leading to loss s of N are described and strategies to minimize losses are discussed. To meet current and/or proposed environmental targets with respect to N emissions, farmer s are under pressure to better target N inputs to meet crop and livestock requirements and to improve management of farm wastes with respect to storage and application. Combining a range of management strategies has a significant impact on the flow and excesses of N in grassland systems. However, the implementation of improved management strategies will be dependent on legislation, the applicability of new techniques and the financial implications.

**Recous S. Dynamics of Soil and Fertiliser Nitrogen in Arable Systems** , p. 153

**Abstract**

The research done over the past few years on the use of nitrogen (N) fertilizers on crops in the intensively farmed areas of Northern Europe, has attempted to improve the efficiency of N uptake by crops, and to identify and quantify the "unused" N. This unused N can have several effects on the environment depending on the processes involved. To follow the fate of N in soil-plant systems, 15N-enriched substrates have been widely used in many studies. The findings are used here to examine i) the availability of inorganic N in soil after fertiliser-N application in time and space, ii) the short-term competition between plant uptake and other soil processes, iii) the interactions between added N and the soil N mineralization immobilisation turnover (M.I.T.) with respect to carbon (C) dynamics, and their short and long term consequences.

**Rolston D.E., Venterea R.T. Gaseous Loss of Oxides of Nitrogen from the Agricultural Nitrogen Cycle**, p. 165

**Abstract**

One consequence of the intensification of fertilised agriculture in the 20th century has been enhanced emissions of nitric oxide (NO) and nitrous oxide (N20) from soils to the atmosphere. These trace gases are critical in regulating important processes including global warming, tropospheric and stratospheric ozone chemistry, and N deposition to downwind ecosystems. Understanding the mechanisms responsible for NO and N20 production and transformation in soil are important in order to better assess present sources, predict future trends, and develop mitigation strategies.

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We review the mechanisms responsible for NO and N20 production in soil and discuss the soil and environmental factors affecting these processes. Field techniques for measuring emissions of NO and N20 from soi l to the atmosphere are described. Existing empirical, deterministic and stochastic emission models are discussed, and important research needs are proposed.