

Decision support system for sustainable nutrient management on the farm level. MAINTAIN III, Editors Fotyma M., Shepherd M.

Fotyma M., Jadczyzyn T., Pietruch Cz. A decision support system for sustainable nutrient management on the farm level „MACOBIL „, p. 7

Abstract

A Decision Support System (DSS) for sustainable nutrient management at the farm level is presented. The system is based on soil surface nutrient balance. The system is composed of input data sheets, the model MACROBIL and the internal database of standard reference values. The calculation procedures have been written in the programming language Visual Basic for Application as a set of macro-instructions for MS Excel that was chosen due to its easy manageability. The flow of information in the model, the most important data files and the most essential algorithms are de-scribed. The model calculates the balance difference for nitrogen, phosphorus and potassium and evaluates the „correctness" of these differences with respect to the sustainability of nutrient management.

Key words: nutrient balance, nutrient management, modeling of nutrient flows, sustainability in agriculture.

Karklins A., Lipenite I. Validation of standard values for crop nutrients off take, p. 27

Abstract

A statistical analysis was made of data obtained in field trials during the last decade to calculate plant nutrient off-take. Method of development of plant nutrient off-take reference values, calculation of the data probability and validation of the results are discussed. As an example, nitrogen content and off-take calculation were made for several spring barley varieties grown in Latvia, which were fertilized by different nitrogen fertilizer rates. The following mean parameters for barley were determined: nitrogen content in grain and straw, grain/straw ratio. These are significant for nutrient management optimization.

Key words: nitrogen off-take, nitrogen content in yield, spring barley

Klir J., Kunzova E., Cermak P. Validation of the model MACROBIL with respect to manure composition, p. 35

Abstract

A preliminary approach to validation of the MACROBIL model is presented. Calculated concentrations of N, P and K in manure were compared with both the concentration estimated by laboratory analysis and with the standard figures of manure composition. The model seems to underestimate the concentration of phosphorus and nitrogen in solid manure (FYM) and to overestimate it in liquid manure. The best fit was found for slurry. As a result of this initial validation, the course of model development in its essential module SFOM is clearly defined.

Key words: manure composition, standard values, MACROBIL model, model validation

Boghal A., Shepherd M., Williams J., Jadczyzyn T., Bujnovsky R., Karklins A., Kunzova E., Cermak P. Evaluation of the Agros meter for on-farm measurement of slurry composition, p. 43

Abstract

Rapid techniques for manure nutrient analysis could appreciably enhance manure management and fertilizer planning at the farm level. The Agros meter and hydrometer were therefore evaluated for the determination of slurry ammonium nitrogen ($\text{NH}_4\text{-N}$), phosphate (P_2O_5) and dry matter (DM) contents in a number of Central European countries. Good relationships were observed between standard laboratory determinations of the $\text{NH}_4\text{-N}$ content of pig and cattle slurries and Agros meter readings ($r^2 > 0.75$). The combined relationship for all the countries (including data from an earlier study in the UK), had a slope close to 1.0 and non-significant intercept ($r^2 = 0.91$). The hydrometer provided a good assessment of the dry matter content of slurries ($r^2 > 0.78$), but was not so good for P_2O_5 ($r^2 = 0.58\text{-}0.78$). The relationship between DM and P_2O_5 content of slurries sampled from the Central European countries tested was very different to that provided with the Agros meter to calibrate the hydrometer readings.

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Unlike the Agros N meter, the hydrometer should therefore be calibrated for P assessment at a country, regional or even farm level prior to use.

Key words: Agros N meter, slurry, ammonium- N, phosphorus.

Bujnovsky R., Igras J. Nutrient balances for representative farms in the Czech Republic, Latvia, Poland and Slovak Republic, p. 53

Abstract

Soil surface and farm gate nutrient balances (NPK) from pilot representative farms in the Middle and Eastern Europe are presented. Most of the farms were mixed, with both crop and animal production: there were fewer with purely crop production, and a few biological farms were included in the Czech Republic dataset. The data for calculation of the nutrient balances were collected on uniform data sheets in EXCEL format. The data were processed into elements of the soil surface and farm gate balances using units values (off-take of nutrients per yield unit, amount of nutrients in animal excrements etc.) previously collated in the MAINTAINE project. In the soil surface balances most of the nutrients originated from manure and fertilizers. The balances showed surpluses of nitrogen for all countries and deficits of phosphorus and potassium for most of the countries, except phosphorus for Latvia and Poland. The most critical situation appears to be in the Slovak Republic where nitrogen was almost balanced but phosphorus is in deep deficit. The nutrient balance was always more positive at the farm gate, compared with the soil surface. Balances calculated at the farm gate were, for all nutrients and in all countries, positive except for potassium in the Czech Republic. Regression analysis showed close relationships between both balances for nitrogen and phosphorus, but was rather weak for potassium.

Key words: soil surface nutrient balance, farm gate nutrient balance, representative farms.

Shepherd M., Green G. A prototype Decision Support System for manure application strategies at the field level, p. 66

Abstract

As a part of the MAINTAINE project, a prototype Decision Support System (DSS) has been designed to advise on best distribution of manure around the farm. It is based on a Microsoft Excel 97 workbook. Using details of fields (size, cropping, nutrient status, and suitability for manure spreading), it suggests the order in which manures should be used and to which fields when. The prototype is seen primarily as a tool to provoke thought and discussion when planning a strategy for a farm, rather than a single solution to the problems. This paper describes the principles underlying the DSS.

Key words: manure application, decision support system, prototyping in agriculture

Berge ten H., Fotyma E., Cermak P., Bujnovsky R., Karklins A., Pogulis A., Bos J. Using crop nitrogen response functions in fertilizer recommendations at field and farm level, p. 77

Abstract

Data from nitrogen (N) fertilizer response trials on 11 crop species, conducted at various sites in Poland, Latvia, Slovak Republic and Czech Republic, were summarised by parameterization of a simple descriptive model expressing both crop biomass and crop N-yield in response to applied N rates. A parameter set was calculated for each of the 430 response trials analysed, and mean parameter values were then assessed. Large variation in the parameter values was found between crop-country combinations (means), and several parameters showed also large coefficients of variation (cv) within crop-country combinations. Crop N responses thus parameterized can be used in multiple goal, whole farm nutrient management optimisation, taking into account field and farm balances of N, phosphorus (P), and potassium (K). The linear optimisation model NUT-Match developed for this purpose is briefly presented, and output examples are given for different user-defined goals: maximisation of farm net cash return, and minimisation of N-, P- and K-surplus.

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Key words: nitrogen response functions, fertilizer recommendations, NUT-Match model, QUAD MOD model.

Fotyma M., Shepherd M. An evaluation of the MAINTAIN project, p.95

Abstract

MAINTAINE: 'Managing input of nutrients to avoid insufficient or excess\ The original objective was 'to assess the current nutrient status of farming systems and to utilise fully the nutrients and organic matter from animal manures and mineral fertilizers to avoid nutrient depletion or excess in soils'. Manure management is a particularly challenging task and is often associated with pollution of the wider environment, especially through nitrogen (as ammonia, nitrate and nitrous oxide) and phosphorus. The timing of the Project (starting in 1998) was right, as the participating Central European States started to develop environmental policy acceptable to the EU in readiness for their inclusion in the European Community.