

EU-Rotate_N: Six month progress report

Objectives:

The overall aim of this project is to develop and evaluate a novel model-based decision support system to optimise nitrogen use in both conventional and organic field vegetable rotations across Europe. This will help Member States to minimise hazards to the environment by adopting consistent approaches to improved efficiency of nitrogen use for different production systems and climatic regions of Europe, and to optimise production of quality crops while enhancing the economic sustainability of horticultural production within the EU.

Results and Milestones:

The project commenced on the 1st January 2003. During the first six months, two full participant meetings have been held, both to familiarise the participants with each other and more fully with the requirements of the project. HRI have set up a project website at www.hri.ac.uk/eurotate. The first project newsletter was published in month 7. All milestones and deliverables during the first 6 months have been met. The research was divided into 5 workpackages the progress of which is described.

Workpackage 1 involves the compilation and integration of recent theories and knowledge of soil-crop-atmosphere interactions. PLANTEFORSK, using existing Norwegian models and data, work has started on the development of a freeze/thaw routine. The existing water subroutine is being assessed by IVIA, using data sets from different environments (Norway, Germany, Holland, and Spain); this will then be compared against other existing simulation models LEACHM, CropSyst, BUDGET, and CROPWAT, in order that their best features might be included in our new model. PLANTEFORSK and IVIA are collaborating to ensure that any new algorithms, for example transpiration, are suitable for both freeze/thaw and water movement subroutines. DIAS has performed a literature review on existing root growth equations. Using their own data, they have already defined some basic relationships for the new model, and have begun stand-alone evaluation. HRI have consulted with the participants on the inclusion of new crops, and have agreed a list of twenty-one crops, which we will aim to include in the model. The existing nitrogen mineralisation routine is unable to simulate N release from soils accurately in either very cold or very warm climates, so IGZ has performed a literature review to establish what alternative models are currently available. IGZ has also reviewed existing models that simulate the release of nitrogen from manures. Participants at the second meeting agreed that we should try and incorporate algorithms from the (ADAS) MANNER model into the new Decision Support System. Extending N_ABLE to include organic rotations will require better simulation of fertility building crops. However in the first instance populating the model database with information on the normal practice and use of fertility building crops will be advantageous.

Workpackage 2 deals with the evaluation of the effects of varying levels of nitrogen supply on product quality and farm income. Incorporating an 'economics' sub-model into the new model, will require new relationships to be established between total dry matter production and marketable yield for optimal and sub optimal levels of nitrogen. HDRA are collecting data on dry matter yield and marketable yield, which will form the basis for the new model routines.

Workpackage 3 will amend and develop the existing model to facilitate the improved management of N fertiliser and cropping practices in crop rotations. HRI have reviewed the original 20,000 lines of code in the N_ABLE model, and are in the process of breaking it down into obvious sub-models. These sub-models, along with the new sub-models will be incorporated a new the decision support system shell. The shell was designed by, Tessella (sub-contractors) in conjunction with HRI. As part of this process a requirements analysis was undertaken upon which the structure of the new model was based.

Workpackage 4 will assess the new decision support system for fitness of purpose across cropping rotations in Europe. To enable this to take place large and suitable datasets will be required, so the early part of this workpackage will be to set up and run rotation field experiments. Field experiments have been established by NCRI, DIAS, ISOR and IVIA, while in Germany, IGZ are

monitoring 10 conventional rotations and BOLAP are monitoring 12 conventional and 2 organic rotations.

Workpackage 5 will evaluate agricultural strategies with respect to N losses and economics. Whilst the main activity within this workpackage will take place later, until the decision support system is completed, certain aspects of the new model construction require discussion. IGZ reviewed the concept of optimising management practices and presented their findings to the second meeting. Discussions at that meeting defined the need for datasets from representative 'model' farms which could be scaled up region or country level. Discussions also took place to define meteorological and soil data that would be required.

Benefits and Beneficiaries:

The decision support system is intended to benefit growers by allowing rotational planning and optimisation of nitrogen use efficiency, government policy makers on improving Codes of Good Agricultural Practice and key public bodies on developing more effective environmental protection measures.

Future Actions (if applicable):

The next reporting period covers months 6 to 12. The main focus of the work will be to re-factorise the existing model into manageable sub-routine units for insertion into the new Decision Support System created jointly by Tessalla and HRI.

In addition, significant progress will be made towards deriving algorithms to update and extend the capabilities of the existing model. These will include work on sub-routines to simulate root growth, water movement, N mineralisation and freezing and thawing of soils. Parameter values for the key vegetable crops will have been discussed and where possible defined.

Data will have been collected which will allow the effects of sub-optimal amounts of nitrogen on marketable production response curves to be defined for conventional and organic cropping systems. As part of the economic modelling, information will be gathered of the value of crops sold through the major marketing channels in each of the participant countries.

In order for the Decision Support System to be used to test management scenarios, definitions for representative model farms in each country will need to be defined. The process of gathering data to support these definitions will be started in the next reporting period. In addition, the first season of the cropping experiments to provide validation data for the model will have been completed and their results will be in the process of being formatted for that purpose.