

**Project title: Simulation of root growth with mechanistic crop models to improve a better prediction of nitrogen use efficiency in organic vegetable production**

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**Timescale:** 01/09 2003 – 31/12 2006

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**Masteres degree:** Master of Agronomie

### **Background**

Plant soil and atmosphere models are commonly used to predict crop yield and environmental consequence. Such models often include complex modelling modules for water movement, soil organic matter turnover and, above ground plant growth. However, the root modelling in these models are often very simple, partly due to a limited access to experimental data.

### **Objective**

The aim of the Ph.D.-project is to improve the modelling of root growth. The focus is to investigate organic vegetable crop rotations, and open up for a better understanding in nitrogen use and to avoid leaching of nitrate into the environment. The main thing to study will be, root penetration rate and root proliferation in different soil layer, and modelling the ability of different root systems to take up nitrogen from different places in the soil profile.

In this project we will improve model for root growth and proliferation. The model focuses on annual crops, and attempt to model root growth of the crops and its significance for N uptake from different parts of the soil volume. At DJF Aarslev we have access to experimental data for root growth, root proliferation, and crop production from a range of cereals and vegetables. Those data will be used to evaluate the model. The model will be used for constructing a decision support system for N utilization in cropping systems, to ensure high nitrogen use efficient and avoid nitrogen leaching.

### **Plans – 2004 - 2005**

Rest of 2004: Be on leave from Ph.D. study

Ph. D. Courses:

Finish two Ph.D. courses at The Royal Veterinary and Agricultural University.

Participation in part 2, (SwOFF) November 2004. "Agroecology with emphasis on horticultural cropping systems Part 2".

Take part of Norfa or other Ph.D. course in summer 2005.

Work:

Implement a new root model in N-able crop model for EU-rotate\_N project. In close co-operation among the European countries, where others made organic matter turn over, water and soil nitrogen movement, I will contribute with knowledge of root growth into width and depth for row crops.

Test and validate parameters for new crop species which not are included in Daisy simulation models, but are necessary to simulate the organic rotation at DJF Aarslev. This model work will end up with a publication for the organic self-sufficient vegetable rotation in DJF Aarslev.

Developing a decision support system for crop rotations in different regions in Denmark. By simulations in the crop soil model Daisy I will analyse the effect of climate regions, soil type and using of catch crop in crop rotations. The effect will be the amount of yield, and nitrogen leaching below root zone.

### **Meetings 2003/2004**

November 13 - 14 2003: Flakkebjerg, Danish Institute of Agricultural Sciences, Biannual seminars in SOAR.

December 03 2003: Forskningscenter Foulum, Integritet i økologisk jordbrug – og i forskningen.

February 02 - 04 2004: Valencia, Project meeting in EU-rotate\_N project.

April 29 - 30 2004: Tine Landboskole, DINA workshop, XML technologies for storing and exchanging data.

September 12 – 17 2004: Munich, Germany. International Congress, Rhizosphere and Challenges, A Tribute to Lorenz Hiltner.

September 19 - 24: SwOFF. Alnarp, SLU, Sweden. Ph.D. Summer School. Agroecology with emphasis on horticultural cropping systems, Part 1.