

Master Thesis Projects

Topics for master thesis projects available in 2010-2011

The Master's Degree Programme in AgroEnvironmental Management



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Preface

This catalogue of master thesis projects available in 2010-2011 was prepared to help students in their decisions selecting a topic for their master thesis project. A number of project proposals are presented in detail, together with contact addresses and other practical information's.

The project proposals presented in this catalogue are primarily intended for students of the **Master's Degree Programme in AgroEnvironmental Management**, but will also be available for students of Biology, Geography, Geology and other master degree programmes within Natural Sciences, as far as the students have the scientific prerequisites needed to accomplish a specific project.

If you intend to make a master thesis project on a topic not mentioned in this catalogue, please contact and discuss it with one of the course lecturers.

Your thesis work can be performed at the research departments involved in the master's degree programme in Agricultural Management, i.e. departments at the Faculty of Agricultural Sciences, at the National Environmental Research Institute, or at the Institute of Biology. During your thesis work you will be attached to a specific research group.

Three thesis types are offered:

Thesis 30 ECTS credits

Theoretical thesis based on literature studies and/or analysis of issued and edited data sets.

Thesis 45 ECTS credits

Experimental thesis in which the student is responsible for collection and analysis of original raw data. The quality of the data collection, analysis and editing must be included in the overall assessment.

Thesis 60 ECTS credits

Experimental thesis in which the student is responsible for planning of trial design and methods as well as collection and analysis of original raw data. The quality and independence of own trial design, planning of data mining from original data bases or the development of new theories must be included in the overall assessment. The quality of the data collection, analysis and editing must also be included in the overall assessment.

The Master's Degree Programme in Agro-Environmental Management builds on components from four core areas at Aarhus University. You therefore get a broad education with specialized skills. The strong base means that the teaching is undertaken by leading international scientists within the main study areas. During your studies you will get a holistic understanding of the impacts of agriculture on environment, nature and climate, and how these impacts can be managed.

With an MSc in Agro-Environmental Management you will be well equipped to seek a wide variety of jobs. With extensive knowledge and interdisciplinary expertise in the area of agriculture, nature, environment and climate interactions, there are job opportunities in, for example, regional environment agencies, municipal nature conservation offices, agricultural advisory services, consulting engineers, teaching, NGOs in nature and environment, EU institutions, ministries and other public authorities. Research is also an obvious career choice.

For more information, see www.agrsci.org/environmental

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1. Nitrogen availability as influenced by treatment of organic material in a biogas reactor

Main supervisor

Ingrid K. Thomsen, e-mail: ingrid.thomsen@agrsci.dk, phone: 8999 1720

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum

Project start

Spring 2010

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Biogas, carbon, nitrogen, manure, soil,

Additional information

Short project description

Biogas treatment of slurry and plant material affects the carbon balance in soil and changes the carbon content and composition in the residue returned to soil after methane production. The altered carbon distribution after biogas production may change the activity of the soil microbial biomass and by that the nitrogen immobilization/mineralization potential and crop availability. The objective of this study is to determine the nitrogen availability of animal manure and crop residues with and without treatment of the products in a biogas reactor.

2. Grassland carbon sequestration and emissions: Effect of management, age and cultivation

Main supervisor

Jørgen Eriksen, Jorgen.Eriksen@agrsci.dk; phone 8999 1870

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum

Project start

Any time

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Soil organic matter, carbon sequestration, soil fertility, green house gas emission

Additional information

Short project description

Background: Grasslands sequester carbon through build up of soil organic matter. However, in agricultural systems, grasslands are mostly temporary and thus cultivated regularly, creating a loss of C through soil organic matter breakdown.

Aim: To determine controlling factors for C dynamics in undisturbed and cultivated grasslands in order to suggest management practices optimizing long-term storage of soil C.

Method: CO₂ evolution is determined in an incubation study with disturbed and undisturbed soil from a field experiment with grasslands of different age (1-6 and 17 year-old) and different management (cutting/grazing/fertilization).

3. Emissions of methane, nitrous oxide and ammonia during storage of livestock manure

Main supervisor

Søren O. Petersen, senior scientist, Ph.D. Email: soren.o.petersen@agrsci.dk

Physical location of the project

Dept. AgroEcology and Environment, Research Centre Foulum

Project start

The project should start in June-August or, alternatively, in January-February. It has an expected duration of up to 12 months

Extent and type of project

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Manure management, greenhouse gas emissions, agriculture, methanogenesis, nitrification, denitrification.

Additional information

Possibly this Master project will be integrated with other activities, in which case planning of treatments and timing must be coordinated.

Short project description

A new pilot-scale storage facility with 8 storage units (2 m diam., 6.5 m³ volume) and controlled ventilation at Research Centre Foulum will be used¹. It is designed for experiments to quantify emissions from liquid manure (slurry) under realistic environmental conditions, and to evaluate effects of storage conditions or manure treatment processes such as anaerobic digestion or acidification. The greenhouse gases methane (CH₄) and nitrous oxide (N₂O) are products of microbial processes in the slurry and at the interface between slurry and air. The student will, in collaboration with the supervisor, select treatments for a storage experiment to investigate either:

- Effects of climatic conditions on slurry properties and greenhouse gas emissions;
- Effects of a given pre-treatment on emissions.

In both cases the development of microbial processes behind CH₄ and N₂O emissions will be studied with established laboratory assays.

¹ Petersen, S.O., Skov, M., Drøschler, P. and Adamsen, A.P.S., 2009. Pilot scale facility to determine gaseous emissions from livestock slurry during storage. J. Environ. Qual. 38: 1560-1568.

4. Carbon and nitrogen turnover of cover crops as related to developmental stages

Main supervisor

Ingrid K. Thomsen, e-mail: ingrid.thomsen@agrsci.dk, phone: 8999 1720

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum.

Project start

Spring 2010

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Cover crops, carbon, nitrogen, turnover, soil,

Additional information

Short project description

Background: cover crops can be used between two winter wheat crops or before spring sown crops and may thus possess different development stages at the time for incorporation. Hence, they may have different effects on the risk of nitrate leaching after incorporation.

Aim: to investigate the relationship between cover crop development in autumn and carbon and nitrogen turnover in soil after incorporation.

Method: cover crop material harvested at different development stages will be incubated in soil. CO₂ evolution and nitrogen mineralization will be determined.

5. Low temperature effects of plant reactions

Main supervisor

Carl-Otto Ottosen, co.ottosen@agrsci.dk, phone 8999 3313, cell 2290 3105

Physical location of the project

Dept. of Horticulture, Research Center Årslev

Project start

No specific time

Extent and type of project

30 ECTS: Theoretical theses based on literature studies

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Photosynthesis, plant adaptation, global change, stress

Short project description

When plants are subjected to periods on periods of low (not freezing) temperatures which is expected to happen in connection with the global change conditions this can affect the physiology (gas exchange/photosynthesis) and result in changes in sugars and also cause a feed back inhibition of photosynthesis and potentially in changes in quality of the crops. The elevated CO₂ might however counteract this decrease as its constant in contrast to the fluctuations in light, temperature and CO₂.

The project could be made jointly with other students or in collaboration with PhD-students or linked to ongoing projects.

6. Stress in wheat production under global change

Main supervisor

Carl-Otto Ottosen, co.ottosen@agrsci.dk, phone 8999 3313, cell 2290 3105

Physical location of the project

Dept. of Horticulture, Research Center Årslev

Project start

No specific time

Extent and type of project

30 ECTS: Theoretical theses based on literature studies

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Photosynthesis, plant adaptation, global change, stress

Additional information

Ongoing research project

Short project description

Ongoing studies of wheat lines aim to select and predict plant performance under various climate change condition especially focusing on high temperature and water effects of the photosynthesis reaction of plants in different stages of development. There is possibilities for specific studies in the photosynthesis processes using gas exchange or chlorophyll fluorescence when wheat genotypes of various origin are subjected to individual and combinations of stresses.

The project could be made jointly with other students or in collaboration with PhD-students or linked to ongoing projects.

7. CO₂ to counteract stress caused by global change

Main supervisor

Carl-Otto Ottosen, co.ottosen@agrsci.dk, 8999 3313, cell 2290 3105

Physical location of the project

Dept. of Horticulture, Research Center Årslev

Project start

No specific time

Extent and type of project

30 ECTS: Theoretical theses based on literature studies.

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Photosynthesis, plant adaptation, global change, stress

Additional information

Short project description

Ongoing studies of combinations of climate factors show that elevated CO₂ in some cases might alleviate or reduce the effects of heat and water stress. Studies of stomata regulation using gas exchange might help to predict the potential transpiration or water use efficiency of different species – even differences between C₃ and C₄ plants might be relevant.

The project could be made jointly with other students or in collaboration with PhD-students or linked to ongoing projects.

8. Greenhouse gas emission from bioenergy production on organic soil types

Main supervisor

Poul Erik Lærke, PoulE.Laerke@agrsci.dk, phone 8999 1844

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum

Project start

Spring 2010

Extent and type of project

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Bioenergy, energy crop production, greenhouse gas emission (GHG), CO₂, CH₄, N₂O.

Short project description

Conventional agricultural production on riparian peatland involves high risk of nutrient leaching to the water environment. One solution to this problem could be increased production of perennial energy crops. This type of production may remove nutrients from the river valley and produce renewable energy, simultaneously. Potential master projects will involve quantification of green house gas (GHG) emissions. How much methane (CH₄), nitrous oxide (N₂O) and carbon dioxide (CO₂) are produced in the cropping systems during organic matter decomposition in relation to the carbon stored in the soil and removed by the crop? An experimental site has already been established on a cultivated peatland in the Nørreå valley. Plots with willow, reed canary grass, fertilised and non-fertilised grass and spring barley will serve as the experimental platform for the projects.

9. Crop suitability and cropping practices under climate change

Main supervisor

Jørgen E. Olesen, JorgenE.Olesen@agrsci.dk, phone 8999 1659

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum

Project start

Any time

Extent and type of project

30 ECTS: Theoretical theses based on literature studies and/or analyses of issued data sets

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

Main subject area

Climate change, crop suitability, management

Additional information

This proposal is linked to an ongoing European project (EMTOX) and to a new Danish climate change research centre (CRES).

Short project description

Scientific evidence shows that climate change will continue to impact agricultural systems resulting in changes in suitability for growing different crops and in management of these crops (e.g. sowing and harvesting times, fertilisation, crop protection etc.). The suitability for growing crops is not only affected by climate effects on plant growth and development, but also through effects of weather on soils and possibilities for crop management. This study will investigate how crop suitability under climate change will be affected either directly through effects on crop growth and yield and indirectly through effects on crop management. The objective is to improve the basis for improved scenarios of land use change under climate change. The project will make use of databases of land use and crop production in Europe and develop databases for management in different regions of Europe based on existing studies. The data will be integrated in a GIS along with available data on climatic conditions (monthly temperature and rainfall) and soil conditions (soil texture, slope, drainage, etc.). Simple biophysical classification and/or a bioclimatic model will be used to relate cultivation of these crops to temperature and rainfall characteristics as well as to soil, terrain and other suitability criteria across Europe.

10. Effects of legumes in arable organic farming on production and the environment

Main supervisor

Jørgen E. Olesen, JorgenE.Olesen@agrsci.dk, phone 8999 1659

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum

Project start

Any time

Extent and type of project

30 ECTS: Theoretical theses based on literature studies and/or analyses of issued data sets

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Legume, organic farming, environment, greenhouse gases, N leaching, yield

Additional information

This proposal is linked to an ongoing European project (Legume Futures) and to a project funded under ICROFS (CROPSYS).

Short project description

Legumes provide the main source of nitrogen in organic farming systems. They are used as component of grasslands (e.g. grass-clover), in catch crops (e.g. clovers, vetch), green manure crops (e.g. grass-clover, lucerne) or as grain legumes. Each of these types of legumes provides its own challenges in terms of crop cultivation. However, it is the combined effects within the cropping system that determines the consequences for total yield and environmental impacts (e.g. N leaching and greenhouse gas emissions). The objective of this study is to cast light on the contribution of legumes in Danish organic farming systems on total N supply to the cropping system, N use efficiency of nitrogen fixed by legumes, and the contribution of legume crops to N losses (N leaching and nitrous oxide emissions). The basis for this will be the CROPSYS experiment on arable crop rotations conducted at three sites in Denmark. The study can be based on new measurements conducted in the experiment and/or based on the large amount of data collected in the now 14-year old long-term experiment.

11. Soft rush (*Juncus effusus*) as mediator of methane emission in agricultural wetlands

Main supervisor, e-mail/phone

Lars Elsgaard, lars.elsgaard@agrsci.dk, phone 8999 1873

Physical location of the project

Department of AgroEcology and environment, Research Centre Foulum

Project start

2010

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Soil microbiology, greenhouse gas emission, ecosystem analysis

Short project description

Methane, a serious greenhouse gas, is produced in wetland soils under anoxic conditions. During diffusion to the soil surface, much of the methane is re-oxidized in the oxic soil layer, which acts as a regulator of methane emission. The widespread occurrence of soft rush (*Juncus effusus*) on wetland areas, however, may serve as a shunt for methane emission. Thus, the soft rush plant is characterised by its content of aerenchymous tissue that serves as a channel for gas transport from the root system to the atmosphere. This system may short-circuit the methane oxidation in the upper soil layer. In the present project, the M.Sc. candidate will design a series of field studies to investigate the magnitude and pathway of methane emission associated with tussocks of *Juncus effusus*. Different experimental approaches will be tested to directly link an increased methane emission to the occurrence of methane transport in the *Juncus*.

12. Effect of biochar on greenhouse gas emission and microbial ecology in agricultural soil

Main supervisor

Lars Elsgaard, lars.elsgaard@agrsci.dk, phone 8999 1873

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum

Project start

2010

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Soil microbiology, greenhouse gas emission, ecotoxicology

Short project description

Biochar is the carbon-rich residue of combustion of biomass under oxygen-limited conditions. Application of biochar to agricultural soil has been suggested as a method to increase the soil carbon content and thereby mitigate the emission of CO₂ to the atmosphere. In addition, test-results indicate that biochar may reduce the emission of the greenhouse gases nitrous oxide (N₂O) and methane (CH₄) from the soil. So far, however, this mitigation potential has not been convincingly documented, and the potential negative effect of biochar on soil microbial ecology has not been assessed at all. In the present project, the M.Sc. candidate will design a series of laboratory studies to investigate the effect of biochar on greenhouse gas emission and soil microbiology. Different qualities and quantities of biochar will be applied and the effects will be quantified using modern techniques of greenhouse gas measurements and ecotoxicology

13. The effect of the ozonation of animal slurry prior to separation on its separation characteristics and the rate of decomposition of the solid fraction in soil

Main supervisor

Maibritt Hjort, Maibritt.Hjorth@agrsci.dk, phone 8999 1932

Physical location of the project

Department of Biosystems Engineering, Research Centre Foulum

Project start

Autumn 2010

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

Main subject area

Slurry separation, ozone, slurry treatment, carbon, nitrogen, manure, soil,

Additional information

Short project description

Treating slurry with ozone is primarily designed to reduce odour problems. However, this treatment also affects the physical and chemical characteristics of the slurry. The separation of slurry into liquid and solid fractions is foreseen as a method to improve the nutrient use efficiency of slurry. It is therefore interesting to investigate the effect of ozonation on the ease with which the slurry can subsequently be separated and the rate of release of nutrients from the solid fraction in soil. The project will include ozone processing of slurries. The physical and chemical properties of the ozonated slurries will be characterized, such as the nitrogen, phosphorus and particulate content. The slurry will be separated and the separation efficiency of the ozonated slurry will be examined in terms of organic matter, nitrogen, phosphorus distribution. The decomposition in the soil of the solid fractions from the treatments would then be investigated in an incubation experiment. The results will be used to parameterize an existing dynamic simulation model, to assess the consequences of ozonation treatment on soil organic matter dynamics.

14. Reduction of nitrogen losses by leaching from vegetable field production

Main supervisor

Senior scientist Hanne L. Kristensen, hanne.kristensen@agrsci.dk, phone 8999 3233

Physical location of the project

Department of Horticulture, Research Centre Aarslev, AU-DJF

Project start

From spring 2010 to winter 2011, any time from for a 30 ECTS.
Spring/summer 2010 or 2011 for a 45 or 60 ECTS.

Extent and type of project

30 ECTS: Theoretical theses based on literature studies and/or analyses of issued data sets.

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Increase of nitrogen use efficiency of crops and reduction of nitrate losses to the environment by leaching from horticultural field production. Focus will be use of catch crops or optimized fertiliser strategies employed at organic or conventional vegetable growers.

Additional information

The master project will be connected to the EU project **N Tool Box**, where nitrate leaching is monitored and reduced by use of optimized nitrogen strategies at organic and conventional growers of vegetables.

Short project description

Vegetable cropping systems may leach large amounts of nitrate from the root zone to the environment. This is due to intensive use of nitrogen fertiliser, low nitrogen use efficiency of many vegetable crops, and the incorporation of nitrogen rich crop residues after harvest. The aim of this master project is to study the effect of selected nitrogen strategies on the balance of nitrogen in the production of field-grown vegetables. The nitrogen strategies can be the use of catch crops or optimised fertilisation. The nitrogen balance will be estimated by soil sampling and analysis in the root zone and analysis of crop biomass. The experimental work will be performed at organic or conventional vegetable growers, and will be planned in connection to the project **N Tool Box**.

15. Slurry acidification and effects on carbon and nitrogen mineralization during slurry storage and decomposition in soil

Main supervisor

Senior scientist Peter Sørensen, peter.sorensen@agrsci.dk, phone 8999 1748.

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum, AU-DJF

Project start

Autumn 2010 or later

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Animal manure, carbon, nitrogen, C sequestration, manure treatment, turnover, N availability

Short project description

Background: Significant turnover of manure C and N takes place in buildings and storage soon after animal excretion, but we have very limited knowledge about these processes. After acidification the microbial activity in slurry is inhibited.

Aim: To study the effects of acidification on C and N mineralization in stored slurry and effects on carbon sequestration in soil.

Method: Fresh livestock excrements will be stored as a slurry under controlled conditions with and without application of sulphuric acid. The dynamics of carbon and mineral N are measured during slurry storage and after manure application to soil.

16. The effect of N-deposition on natural vegetation

Main supervisor

Professor Christian Damgaard, cf@dmu.dk, phone 8920 1598

Physical location of the project

Department of Terrestrial Ecology, Silkeborg, AU-NERI.

Project start

Anytime

Extent and type of project

30 ECTS: Theoretical theses based on literature studies and/or analyses of issued data sets.

Main subject area

Nitrogen deposition, Natural habitats, Vegetation

Additional information

Short project description

To investigate the effect of N-deposition by coupling the NOVANA database of natural habitats with the calculated N-deposition in the area. The study will be limited to certain geographic areas or habitat types.

17. Crop protection metabolomics: Uptake in a susceptible weed species and mode of action of a biologically active clover flavonoid

Main supervisor

Inge S. Fomsgaard, Inge.Fomsgaard@agrsci.dk, phone 8999 3610 or 2228 3399

Physical location of the project

Department of Integrated Pest Management, Research Centre Flakkebjerg, Slagelse.

Project start

Project start can be decided individually. Two students starting at the same time in each their project will be of advantage both for the students and for the laboratory.

Extent and type of project

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Flavonoids, soil, transformation, degradation, biochanin A, quercetin, formononetin, kaempferol, sorption, bioactivity, green manure, crop rotation, organic farming

Additional information

The use of clover as green manure in crop rotation systems in sustainable agriculture has gained importance, because the use of synthetic fertilizer can be diminished. Additional positive effects can be found, when biologically active secondary metabolites, leached from clover inhibit the development of soil borne diseases and weeds. Knowledge on the structure of these biologically active compounds and their transformation products is needed to be able to optimize the exploitation of their presence in soil for suppressing weeds and soil borne diseases. At the same time knowledge about the compounds and their transformation products is needed for the purpose of assuring that no negative effects on the soil and ground water ecosystem will be happen, if the use of clover as cover crop becomes more extensive.

To be able to exploit the appearance of such compounds in soil, information is needed, not only on the chemical structure of the compound, but also on the microorganisms that carry out the microbial transformation, on the mechanisms with which the compound act, when they suppress weeds and soil borne diseases.

Short project description

Recent studies in our lab have shown high concentrations of flavonoids appear in soil after incorporation of clover as green mulch. This project aims at elucidation the effect of these compounds and/or their degradation products on selected weed species. The uptake of the studied flavonoid compound in a susceptible weed species and its transformation inside the weed species will be studied as a means of elucidating the mode of action. The project will be carried out with the use of state of the art LCMSMS analytical equipment. The student will be trained in the use of the equipment for subsequent independent use, in the set up of the weed effect study

and the data treatment by both the supervisor and our trained laboratory technicians. Compounds of choice will be kaempferol, biochanin A, formononetin and quercetin.

Relevant literature in Danish or English:

<http://www.fateallchem.dk/upload/allelopati.pdf>

Carlsen, S.C.K.; Fomsgaard, I.S. Biologically active secondary metabolites in white clover (*Trifolium repens* L.) - a review with focus on concentration in the plant, plant-pest interactions and transformation. *Chemoecology*, **2008**, 18, 3, 129-170

Fomsgaard, I.S. Chemical ecology in wheat plant-pest interactions. How the use of modern techniques and a multidisciplinary approach can throw new light on a well-known phenomenon: Allelopathy. *Journal of Agricultural and Food Chemistry*. **2006**, 54, 987-990

18. Environmental metabolomics: Profiling of clover secondary metabolites in soil after use of clover as green manure

Main supervisor

Inge S. Fomsgaard, Inge.Fomsgaard@agrsci.dk phone 8999 3610 or 2228 3399

Physical location of the project

Department of Integrated Pest Management, Research Centre Flakkebjerg, Slagelse.

Project start

Project start can be decided individually. Two students starting at the same time in each their project will be of advantage both for the students and for the laboratory.

Extent and type of project

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Flavonoids, soil, transformation, degradation, biochanin A, quercetin, formononetin, kaempferol, sorption, bioactivity, green manure, crop rotation, organic farming

Additional information

The use of clover as green manure in crop rotation systems in sustainable agriculture has gained importance, because the use of synthetic fertilizer can be diminished. Additional positive effects can be found, when biologically active secondary metabolites, leached from clover inhibit the development of soil borne diseases and weeds. Knowledge on the structure of these biologically active compounds and their transformation products is needed to be able to optimize the exploitation of their presence in soil for suppressing weeds and soil borne diseases. At the same time knowledge about the compounds and their transformation products is needed for the purpose of assuring that no negative effects on the soil and ground water ecosystem will be happen, if the use of clover as cover crop becomes more extensive.

To be able to exploit the appearance of such compounds in soil, information is needed, not only on the chemical structure of the compound, but also on the microorganisms that carry out the microbial transformation, on the mechanisms with which the compound act, when they suppress weeds and soil borne diseases.

Short project description

Recent studies in our lab have shown that the degradation pathway for several flavonoids, that appear in soil after incorporation of clover as green mulch is a much more diverse than expected. This project aims at elucidation the degradation pathway of these compounds. The project will be carried out with the use of state of the art LCMSMS analytical equipment. The student will be trained in the use of the equipment for subsequent independent use, in the set up of degradation experiment and the data treatment by both the supervisor and our trained laboratory technicians. Compounds of choice will be kaempferol, biochanin A, formononetin and quercetin.

Relevant literature in Danish or English:

<http://www.fateallchem.dk/upload/allelopati.pdf>

Carlsen, S.C.K.; Fomsgaard, I.S. Biologically active secondary metabolites in white clover (*Trifolium repens* L.) - a review with focus on concentration in the plant, plant-pest interactions and transformation. *Chemoecology*, **2008**, 18, 3, 129-170

Fomsgaard, I.S. Chemical ecology in wheat plant-pest interactions. How the use of modern techniques and a multidisciplinary approach can throw new light on a well-known phenomenon: Allelopathy. *Journal of Agricultural and Food Chemistry*. **2006**, 54, 987-990

19. Analysing and modeling the importance of the bank erosion process as sediment and phosphorus source in small 1st and 2nd order streams in two contrasting river basins – river Odense and river Skjern

Main supervisor, e-mail/phone

Brian Kronvang, BKR@DMU.DK

Physical location of the project

Dept. Freshwater Ecology, AU-NERI, Silkeborg

Project start

Autumn 2010

Extent and type of project

30 ECTS: Theoretical theses based on literature studies and/or analyses of issued data sets

Main subject area

Bank erosion, sediment, phosphorus, catchments, diffuse sources

Additional information

An analysis of existing data from a research project BUFFALO-P

Short project description

Bank erosion is an important fluvial process forming streams and stream habitats. Bank erosion may also play a major role as a diffuse source to phosphorus in surface waters depending on the concentration of P in bank material. Existing data from a research project named BUFFALO-P on bank erosion measurements in two hydrologically contrasting river basins should be analysed for quantifying the loss of sediment and phosphorus. The importance of the bank erosion process should be compared between the two river systems and a model for bank erosion should be tested.

20. Investigation the functionality of SorbiCells for measuring nutrient concentrations under controlled and field situations

Main supervisor

Brian Kronvang, BKR@DMU.DK and Hubert de Jonge, SorbiSense

Physical location of the project

Dept. Freshwater Ecology, AU-NERI, Silkeborg

Project start

Autumn 2010

Extent and type of project

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

New technology, testing, nitrogen, phosphorus,

Additional information

A paired field and laboratory experiment using SorbiCells for measuring nutrient concentrations in running waters

Short project description

SorbiCells are a new technique developed to measure flow-weighted concentrations of nitrate and phosphorus in water. A research project (MONITECH) is currently testing and further developing the new technology. A larger experiment will be conducted in autumn 2010 in flow chambers owned by NERI for testing the cartridges under controlled conditions under different flow conditions and with manipulation of concentrations of N and P. A field testing is ongoing in Oddebæk at three stations and there is possibility for also making controlled tests in the laboratory at SorbiSense company. The student should take part in planning and developing the experiments and in analyzing the outcome of controlled and field tests.

21. Investigation the phosphorus profile and sorption/desorption potential of old and freshly eroded bank material in Danish streams

Main supervisor

Brian Kronvang, BKR@DMU.DK

Physical location of the project

Dept. Freshwater Ecology, AU-NERI, Silkeborg

Project start

Autumn 2010

Extent and type of project

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

Surface water, stream banks, phosphorus, sorption/desorption

Additional information

A paired field and laboratory experiment conducted in a stream system: Odense River.

Short project description

Stream bank material is often high in total phosphorus content and the eroded material is an important source of sediment and phosphorus to surface waters. The phosphorus content of stream bank material may originate from different sources – intruding groundwater or from sorption of phosphate from stream water. An analysis of the total P profiles in different stream banks and studies of the P sorption/desorption potential of ‘old’ and freshly eroded bank material in a coupled field and laboratory experiment should enable to clarify: i) the origin of stream bank material P and ii) the importance of stream bank material as a sink or source of dissolved phosphate in surface waters.

22. Developing agro-ecosystem relationships at catchment scale utilizing GIS and monitoring data on Danish Stream Habitat Index

Main supervisor

Brian Kronvang, BKR@DMU.DK

Physical location of the project

Dept. Freshwater Ecology, AU-NERI, Silkeborg

Project start

Autumn 2010

Extent and type of project

30 ECTS: Theoretical theses based on literature studies and/or analyses of issued data sets

Main subject area

Catchment, stream, reach, habitats, sub-stratum, GIS

Additional information

Short project description

An analysis using GIS data on catchment characteristics extracted as land use, soil type, geology coupled to information from a research project and the NOVANA database on Danish Stream Habitat Index from a large number of reference and impacted type 1 stream sites. The Habitat Index and sub indices should be described for the two groups of streams and relationships between catchment characteristics and the habitat structure of the reaches surveyed should be developed.

23. Calibration of the Daisy model to describe different varieties of catch-crops on losses of nitrate from the root zone

Main supervisor

Christen Duus Børgesen, Senior scientist, Christen.borgesen@agrsci.dk, phone 8999 1731

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum.

Project start

Spring or summer 2010 - or later.

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data

Main subject area

New measures to reduce the environmental effect from agricultural grown areas on water bodies as streams, lakes and the sea have been proposed with the plan "Grøn Vækst". One of the proposed measures is to increase the use of catch crops. To ensure that new varieties of catch crops are efficient to reduce N leaching, field trials has to be conducted and quantification of the environmental effects of the new varieties of catch crops on N leaching has to be obtained. To upscale the effects found in field trials, N leaching models (Empirical and mechanistic /deterministic models) needs to be calibrated to new measurements.

Short project description

DJF are planning to startup new field trials to quantify the effects of different varieties of catch crops on N leaching. Results from the field trials are going to be used for calibration of different models. (Empirical and mechanistic/deterministic models).

This MSc. project will be based on old and new measurements from field trials on the effect of catch crops on nitrogen leaching with the aim to: 1. Calibrate the Daisy model to simulate realistic N uptake in different varieties of catch crops and simulate realistic leaching levels of nitrate. 2: Based on long time series of measurements of N leaching to quantify the long-term effect of catch crops on the nitrogen leaching from defined typical cropping system. 3. Use the calibrated Daisy model to simulate N leaching from different cropping systems under current and future climatic conditions.

24. How to produce maize in Danish future climate, with high yield and low environmental load

Main supervisor

Ib Sillebak Kristensen, e-mail IbS.Kristensen@agrsci.dk, phone 8999 1205

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum, AU-DJF.

Project start

Optimal start date summer 2010 and 2011, with planning-work and sowing field plot trials in the semester prior to start

Extent and type of project

30 ECTS: Theoretical theses based on literature studies and/or analyses of issued data sets.

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Measurements of responses to N-fertilizer and undersown crops in a) ongoing field trials, b) in maize fields in different areas Denmark; c) Phenological studies of development of maize and undersown crops during growth and leaching year; d) investigate environmental load with model studies.

Short project description

You can start your own investigation as a supplement to the ongoing field trials, see Kristensen et al (2010);Mikkelsen (2009): You can, for example

- Investigate the possibilities of growing under sown crops between maize rows/maize row distances in order to lower leaching;
 - Measure the development of root, leaves, stems and crops during the season;
 - Investigate the drought resistance;
 - Investigate the possibilities of organic maize production without weed spraying.
- You can study literature concerning maize production.
 - You can measure feeding quality of the different maize yield components in the laboratory.
 - You can initiate a survey in 50 maize fields on private farms in order to describe the yield development under different conditions.
 - You can model maize growth under different climatic conditions (Cold/present/future climate(+5 degree of C))

Literature

Kristensen, I. S., Thysen, I., and Bøjer, O. Q. 2010: Høstprognose i majs. I Plantekongres 2010: Sammendrag af indlæg, Aarhus Universitet, Det jordbrugsfaglige Fakultet. Se <http://pure.agrsci.dk:8080/fbsretrieve/3036545/hostprognose.pdf> og http://www.landbrugsinfo.dk/Planteavl/Plantekongres/Filer/PL_PLK_2010_shw_C2_2_Ib_Sillebak_Kristensen.pdf. Plantekongres 2010, 50-52.

Mikkelsen, M. 2009: Kvælstof til majs med efterafgrøder. Oversigt over Landsforsøgene, 2009. Se http://www.landbrugsinfo.dk/Planteavl/Landsforsog-og-resultater/Oversigten-og-tabelbilaget/Sider/pl_Oversigten_2009_afsnit_U_Majs.pdf?List={34b6e0a9-5aea-4f65-ac9a-9594e36861a1}&download=true. Oversigt over Landsforsøgene 2009, 388-390.

25. Cover crops as an efficient tool to improve soil physical quality

Main supervisor

Lars J. Munkholm, lars.munkholm@agrsci.dk, phone 8999 1768

Physical location of the project

Department of AgroEcology and Environment, Research Centre Foulum

Project start

Autumn 2010

Extent and type of project

45 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data.

60 ECTS: Experimental theses in which the student is responsible for planning, trial design and collection and analysis of his/her own original data.

Main subject area

Cover crops, soil physical quality, root growth, biopores, tillage, soil compaction

Additional information

Experimental work will be performed in relation to an experiment with cover crops carried out as part of the CoolCrop project (www.coolcrop.agrproject.dk).

Please remark that the main supervisor will be on work leave at University of Guelph, Canada from May until November 11 2010.

Short project description

Soil compaction is a major threat to global agriculture as it decreases yields and lowers crop quality. Simultaneously, compaction increases erosion, the leaching of nutrients and agrochemicals and promotes emissions of greenhouse gasses. Tools are urgently needed for rapid and persistent alleviation of compacted soil. Promising results with deep-rooted cover crops have been reported from USA, Australia and Africa but little is known about their effect under Northern European conditions. In this project, the effect of cover crops will be studied in the in the field using a long-term tillage crop rotation experiment located at Research Centre Foulum. This trial currently includes a cover crop experiment. Deep-rooted *Brassica* cover crops (fodder radish and dyer's woad (*Isatis tinctoria* L.) will be compared with perennial ryegrass (*Lolium perenne* L.) and an untreated reference. The experimental work will include field measurements, soil sampling and laboratory measurements.

Study regulations concerning master thesis projects

Text from the study regulation of the Masters Degree Programme in AgroEnvironmental Management

Objective

The Master's degree programme is concluded with a thesis of 30, 45 or 60 ECTS credits, depending on the extent to which the student prioritizes to plan and carry out his/her own experimental work. The objective of the thesis is to give the students the possibility of colouring their own study programme within a particular area and to enable them to independently uncover, delimit and study a relevant scientific problem.

Learning objectives

Characteristics of the three thesis types:

Thesis 30 ECTS credits

Theoretical thesis based on literature studies and/or analyses of issued data sets.

Thesis 45 ECTS credits

Experimental thesis in which the student is responsible for collection and analysis of original raw data. The quality of the data collection, analysis and editing must be included in the overall assessment.

Thesis 60 ECTS credits

Experimental thesis in which the student is responsible for planning of trial design and methods as well as collection and analysis of original raw data. The quality and independence of own trial design, planning of data mining from original data bases or the development of new theories must be included in the overall assessment. The quality of the data collection, analysis and editing must also be included in the overall assessment.

In the assessment of the thesis importance will be attached to whether the student can:

- Independently uncover and delimit a problem within the chosen area.
- Arrange a relevant project design for analysis of the delimited question.
- Seek and prioritize relevant literature and be critical of different theoretical views and possibly conflicting results.
- Include, discuss and select relevant theories in relation to problems.
- Discuss and be critical of the relevance and quality of the applied literature, the applied theories/models, methods of analysis and possible data, including trial design and statistical methods.
- Carry out an independent and coherent analysis of the chosen problem and summarize the conclusions of the study.
- Communicate in writing and orally the analyses and conclusions of the project, including the problem, choice of method, analysis, discussion, conclusion and putting into perspective, in a clear and relevant way in relation to a defined target group.

Method of instruction

No instruction as such is connected with the thesis work, but the Board of Studies will assign a supervisor to the student; this supervisor will also act as examiner. A thesis contract must also be drawn up at the time of assigning a supervisor; this contract must be approved by the Director of Studies.

The thesis contract must include information about:

- The extent of the thesis (30, 45 or 60 ECTS credits)
- Formulation of the project, delimitation of the subject
- Supervision plan
- Thesis language (Danish or English)
- Deadline

The thesis contract is signed by the student and the supervisor and submitted to the Director of Studies for approval. Once the thesis contract has been approved and the deadline for submitting the thesis has been determined, the student cannot withdraw from the exam. If the thesis is not submitted by the determined deadline, it will be considered as a spent examination attempt. The Board of Studies then approves a changed project formulation within the same subject area and at the same time determines a new deadline of three months. If the thesis is not submitted by this deadline, the student may have a third examination attempt in accordance with the same regulations that apply to the second examination attempt.

METHOD OF EVALUATION

<i>Examinees</i>	<i>Product</i>	<i>Product framework</i>	<i>Duration</i>	<i>Preparation time</i>	<i>Materials permitted</i>	<i>Basis for assessment</i>
Individual	Combined written and oral	-				-

Remarks

A combined oral and written exam with the participation of an external examiner. The written part of the exam consists of a dissertation of 50-100 pages, written in Danish or English with a summary in English. The dissertation must be submitted to the supervisor in 4 printed copies. The oral part is public (exemptions from this cf. the Examination Executive Order, section 19, subsections 2 and 3). The supervisor announces the time and place of the examination in agreement with the student.

In the assessment of the thesis dissertation importance will mainly be attached to its scientific content, but the student's spelling and formulating capacity will also form part of the assessment, irrespective of the language of the thesis. At the oral exam the student will have 30 minutes in which to present the project. The examiner and the external examiner may then ask the student questions for up to 30 minutes whereupon the grade will be determined and announced. The thesis dissertation and the oral exam will be assessed jointly, using the Danish 7-point grading scale. The examiner and the external examiner subsequently prepare a written assessment.

Master Thesis Contract
The Board of Studies of Agricultural Sciences
The Faculty of Agricultural Sciences, Aarhus University
Willemoesgade 15, building 2117, 8200 Århus N

Agreement on Master Thesis Project between:

Student:

Name: _____
Annual card
number : _____
Address: _____

Telephone: _____
Mail address: _____

Supervisor(s):

Main supervisor

Name: _____
Mail address: _____

Other supervisors:

Name: _____
Mail address: _____

Specialization /main subject: _____

Scope of the thesis in ECTS: _____

Thesis statement: _____

Working title: _____

The project is written in: Danish

English

The summary is written in: Danish

English

Physical location of the project: _____

Resource needs/ financing , see instructions item 1

Agreement on the project finances: _____

Specific timetable and plan of supervision, see
instruction item 2

Date of project start:

Deadline for handing in the thesis:

Project plan:

- Outline of the main phases and deadlines
- Extent and structure of the supervision

The thesis can be published at the libraries and homepages of the departments and the faculty.

yes no

The agreement on publishing has been written and understood, see item 3

yes

The section about patent rights has been written and understood, see item 4

yes

The section about plagiarism has been written and understood, see item 5

yes

Signatures

Student

Main supervisor

Other supervisors

The signed contract must be submitted to The Board of Studies of Agricultural Sciences

Approved by the Head of Studies

Date:

Signature:

Instructions for Master Thesis Contract are in the process of being translated....

Deadlines concerning Master Thesis Projects

Thesis 30 ECTS – 6 months

Theoretical thesis based on literature studies and/or analysis of issued and edited data sets.

Project start: 1. March 2011 (course registration: 1-15. November 2011)

Thesis deadline: 1. August 2011

Thesis 45 ECTS – 9 months

Experimental thesis in which the student is responsible for collection and analysis of original raw data. The quality of the data collection, analysis and editing must be included in the overall assessment.

Project start: 1. December 2010 (course registration: 1-15. May 2010)

Thesis deadline: 1. August 2011

Thesis 60 ECTS – 12 months

Experimental thesis in which the student is responsible for planning of trial design and methods as well as collection and analysis of original raw data. The quality and independence of own trial design, planning of data mining from original data bases or the development of new theories must be included in the overall assessment. The quality of the data collection, analysis and editing must also be included in the overall assessment.

Project start: 1. September 2010 (course registration: 1-15. May 2010)

Thesis deadline: 1. August 2011

For all master thesis types: Examination within 4 weeks after delivery of the thesis