Master Thesis Projects

Topics within Agroecology

AgroEnvironmental Management & Agrobiology
MSc Programmes 2015-2016

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Preface

This catalogue of master thesis projects available in 2015-2016 was prepared to help students in their decisions selecting a topic for their 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**, and in **Agrobiology** but will also be available for students of Biology, Geography, Geology and other master degree programmes within Natural Sciences, and for bachelor thesis students as far as the students have the scientific prerequisites needed to accomplish a specific project.

If you intend to make a master or bachelor 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 Department of Agroecology or one of the other research departments involved in the master's degree programmes (see also catalogues from these departments). During your thesis work you will be attached to the specific section within this department, where the main supervisor is situated.

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 two Agroecology Master's Degree Programmes, Agro-Environmental Management and Agrobiology (see http://agro.au.dk) builds on components from multiple disciplines at Aarhus University. Therefore, studies in relation to both environmental, social and economic sustainability, and the interactions between agroecology, management, economy and environmental sciences are encouraged. You therefore get a broad education with specialized skills. The strong research 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. Read more at**:** http://kandidat.au.dk/en/agro-environmental-management/

Read more about the **MSc i Agrobiology** at http://kandidat.au.dk/en/agrobiology/, and the MSc thesis catalogues from Department of Animal Science and Department of Food Science.

Contents

4. Designing food plants for the future

Department and supervisors
Katrine Heinsvig Kjær, Katrine.kjaer@food. au.dk, + 45 8715 8337, + 45 3029 6592
Morten Rahr Clausen, MortenR.Clausen@food.au.dk, +45 8715 8318
Department of Food Science
Faculty of Science and Technology
Aarhus University
http://food.au.dk/

Physical location of the project and students work
Department of Food Science, AU, 5792 Aarslev

Project start
Autumn 2015, Spring 2016

Main subject area
Plant chemistry
Plant physiology
Metabolomics

Short project description
Plants produced in greenhouses are continuously exposed to changes in light intensity and quality. The irradiance from the sun changes during the year, and the quality of the light from greenhouse lamps is not always optimal for the production of plants. However, a new technology of light emitting diodes (LEDs) is making it possible to design specific light environments and to manipulate the quality of light in the greenhouse. In the future these lamps will make it possible to design the light environment in order to reach specific production goals in terms of size, form, taste and color of the plant food product. However, there is still much to learn on how plants respond to changes in the light environment.

This project will focus on how specific light environments affect primary metabolism in food plants. Depending on your interests you can choose to focus on:

- short term responses (hours) and/or long term responses (days)
- changes in growth, appearance or taste of the plants
- different methods for investigating plant metabolites

You will learn basic principles of setting up plant experiments in controlled environments using the newest technology of LED lighting. You will learn how to analyze plant physiology using standard methods and plant metabolomics using NMR and LC-MS. Furthermore, the project offers an opportunity to learn multivariate statistics for analyzing large datasets.

Extent and type of project

45 or 60 ECTS: Experimental theses in which the student is responsible for collection and analysis of his/her own original data

5. A 3D model for plant growth under drought stress

Department and supervisor
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Karen Koefod Petersen, Karenk.petersen@food.au.dk, + 45 8715 8336
Department of Food Science
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http://food.au.dk/

Physical location of the project and students work
Department of Food Science, AU, 5792 Aarslev

Project start
Autumn 2015, spring 2016

Main subject area
Plant physiology
Plant methods
Phenotyping, modeling

Short project description

High trough put methods for measuring plant growth non-invasively is becoming more and more feasible and less expensive for the plant breeding industry. These methods can be used to screen large populations of plant genotypes for climate tolerance using less labour, however there are also some challenges in terms of validating the methods under extreme climate conditions and calibrating the methods to different plant species.

At the Institute of Food we are working with a 3D laser scanner (PlantEye, http://phenospex.com) in the determination of plant growth non-invasively and we have successfully developed a simple linear model for rapeseed growth under ambient climate conditions.

In the present project you will continue our work with the 3D laser scanner and learn the basic principles of plant phenotyping and the challenges in using high through put methods for plant growth determination. You will get the opportunity to validate the growth model for rapeseed when grown under drought stress conditions using the 3D scanner in combination with other methods for measuring drought stress in plants.

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

17. Nitrogen dynamics and root growth in organic vegetable production with controlled traffic

Main supervisor:
Hanne Lakkenborg Kristensen, hanne.kristensen@food.au.dk, +45 8715 8354.

Physical location of the project:
Department of Food Science, AU Årslev, 5792 Årslev.

Project start:
1 August 2015.

Extent and type of project:
30 ECTS: Theoretical thesis 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:
Horticulture, organic vegetable cropping systems, conservation tillage, nitrogen dynamics, root growth

Additional information:
The master project will be linked to the project Organics in the Trail (Innovative organic cropping systems) granted by GUDP (NaturErhvervStyrelsen) with several national partners: Vegetable growers, technology companies, advisory service.

Short project description:
The aim of the Organics in the Trail project is to develop cropping systems with permanent tracks and without ploughing to improve soil fertility, crop growth development and yields. Two field trials are running on a sandy loam at the company Skiftekær Økologi and on a sandy soil at the company Vostrup Øko. The master project will aim to investigate the root growth of crops (cabbage and root vegetables) and nitrogen dynamics of the plant-soil system in the field trials comparing the effect of random traffic + ploughing and GPS controlled traffic - ploughing.

18. Effect of growing conditions on cabbage inner quality

Main supervisor:
Hanne Lakkenborg Kristensen, hanne.kristensen@food.au.dk, +45 8715 8354.

Physical location of the project:
Department of Food Science, AU Årslev, 5792 Årslev.

Project start:
1 August 2015.

Extent and type of project:
30 ECTS: Theoretical thesis 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:
Horticulture, vegetable quality, bioactive compounds, glucosinolates, cabbages, plant nutrition, traditional Nordic vegetables.

Additional information:
The master project will be linked to the project MaxVeg (Maximising the taste and health value of plant food products) granted by the Strategic Research Council. Within this project the master student will be part of a cross disciplinary research team.

Short project description:
The growing conditions and genetic background are of major importance for the inner quality of vegetable products. Traditional cabbages are healthy and in focus due to the success of the new Nordic cuisine. Cabbages, like other *Brassicas*, produce secondary metabolites like glucosinolates that are important for the health and sensory properties of the products. The aim of the master project is to investigate the relationship between selected growing conditions and glucosinolates and other compounds in traditional cabbage varieties. The methods will be greenhouse or field experiments, plant and soil sampling and analysis.

48. Evaluation of European blueberry (*Vaccinium myrtillus*) clonal collection for cultivar development.

Department and supervisor
Department of Food Science, Martin Jensen, senior scientist, Martin.Jensen@food.au.dk, 87158331, mobile 40594286

Physical location of the project and students work
Department of Food Science, AU-Aarslev, 5792 Aarslev.

Project start
Any time

Main subject area
Domestication of European blueberries, development of cultivars: plant physiology, phenotypic and genetic variation, ploidi levels, modelling growth, flowering, fruit yield, plant freezing hardiness, disease resistance.

Short project description
AU Food have been working on the domestication of European blueberries (EB) for some years and have established a clonal archive with more than 100 selected Danish clones planted in two Danish locations with replications. We have two years of recordings of the performance of these clones and want another year data, and a statistical calculation of all the data with description of variation and recommendations of clones to be developed as the worlds first selected cultivar of EB. Further in-depth studies of flower induction and modelling yield and yield components, understanding phenology of frost resistance and/or understanding metabolite background for difference in resistance to leaf diseases may be included dependent on size of study and individual wishes.
The outcome of a MSc study is a scientific manuscript ready for submission.

Extent and type of project
30 ECTS: Theoretical thesis based on literature studies and/or analysis of issued and edited 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

Additional information
The study will exploit results from two recent projects on EB, one on collection and establishment of the genetic resources experimental planting and one on propagation and cultivation of EB finished at end of 2014. Int. cooperation in future Nordic research projects on EB is anticipated. Project may be done on all three levels of ECT, but a 45 or 60 ECTs project will be preferred.

49. Understanding and screening sour cherry genetic resources for resistance to leaf spot disease (*Blumeriella jaapii*) and correlations to leaf phenolic profile.

Department and supervisor
Department of Food Science, Martin Jensen, senior scientist, Martin.Jensen@food.au.dk, 87158331, mobile 40594286

Physical location of the project and students work
Department of Food Science, AU-Aarslev, 5792 Aarslev.

Project start
Any time

Main subject area
Disease resistance in sour cherry against leaf spot disease. Screening gene pool for different degree of attack and symptoms development, correlation between leaf phenolic compounds and disease resistance.

Short project description
AU Food has a breeding population of almost 3000 sour cherry seedlings of 8-10 years age. In an ongoing GUDP project we want to study the variation in the degree of resistance to cherry leaf spot disease, which is detrimental to a future organic production of sour cherry. In addition we will study the metabolite profile (NMR metabolomics a.o. methods) of leaves and correlate these to the quantitative and qualitative degree of resistance to the disease. Methods to artificially inoculate and screen for symptom development including digital picture analysis of symptoms will be part of this. In addition aspects like genetic variation (seedlings from controlled crosses), seasonal variation in susceptibility and symptom development, and lab testing of leaf extracts for inhibition of fungus disease may be included. A master study could focus on selected issues of these experimental objectives depending on size of study and individual wishes.
The outcome of a MSc study will be a scientific manuscript ready for submission.

Extent and type of project
30 ECTS: Theoretical thesis based on literature studies and/or analysis of issued and edited 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

Additional information
The study will be aligned to the ongoing GUDP project on using NMR metabolomics to correlate metabolite profile to disease resistance to develop a new screening platform and identify more resistant cultivars. A project may be done on all three levels of ECT, but a 45 or 60 ECTs project will be preferred.