Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

Editors:
Fenneke Brascamp
Judith van Niekerk

20 October – 21 October 2011
Wageningen
The Netherlands

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Euroleague for Life Sciences (ELLS)

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Swedish University of Agricultural Sciences (SLU), Sweden
Wageningen University and Research Centre (WUR), The Netherlands
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University of Natural Resources and Life Sciences (BOKU), Austria
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Contents

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- Prof. dr. Pim Brascamp
- Fenneke Brascamp BSc
- Prof. dr. Wim Heijman
- Judith van Niekerk
- Hedy Wessels

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Welcome by Chair Euroleague for Life Sciences (ELLS)

Euroleague for Life Sciences (ELLS) Welcomes You to its Tenth Anniversary – and to the Third Scientific Student Conference

Welcome to the tenth anniversary of the ELLS network and the third Scientific Student Conference (SSC). On behalf of the ELLS network I would like to say that we are very happy to see that there is a growing interest in the SSC among the students from the ELLS partner universities. It was with great pleasure that we at the Faculty of Life Sciences (LIFE), University of Copenhagen hosted last year's SSC and I would like to thank Wageningen University and Research Centre for hosting this year's conference.

The SSC is one of many ELLS activities, but it is one which the ELLS network is particularly proud of because it has provided the network with a forum where we can work more closely with the ELSA students – as well as a forum in which the students from ELLS partner universities can participate actively and experience a closer connection to the network.

As Chairman of ELLS I would like to seize this opportunity to thank ELSA for their hard work and the commitment they have shown the network and the SSC over the years. ELSA is a great and valued asset to the network and I am very happy to announce to you that ELSA has been chosen to receive this year's ELLS Award. Please join me in congratulating ELSA on this achievement.

We look forward to sharing the third SSC with you all and to celebrating the tenth anniversary of ELLS.

Enjoy the conference and thank you all for coming.

Best wishes,

Per Holten-Andersen
ELLS Chair
Dean of the Faculty of Life Sciences, University of Copenhagen

Welcome by Rector Magnificus Wageningen University

Ten Years ELLS and Three Years Scientific Student Conference

Ten years ago the Euroleague of Life Sciences was founded during a meeting in Wageningen. For that reason the 10th annual conference of ELLS is in Wageningen again and the 3rd Scientific Student Conference as well.

I am very happy to host the Scientific Student Conference. I consider it as one of the most important and most successful activities of ELLS. Important, because it is one of the first steps for students to work on an international network. Now a network of students, but for many growing to a network of scientists or other professional in the field. Also important because it offers an opportunity for students to familiarize with the topics addressed at the partner universities of ELLS and to receive feedback on presentations on oral presentations and posters. Successful, because students obviously appreciate the conference. Students participate actively in organising it and many students submit an abstract for presentation or poster. Clearly the first two conferences in Hohenheim and Copenhagen were successful in these respects and the prospects look very good for the Wageningen version as well.

I hope you will use the opportunity not only to participate actively in the conference and enjoy the social events around it, but also that you will look around at our university to get a fair idea what is going on. We will be happy to tell you about our study programs and other facts about Wageningen.

But first of all**: I wish you an inspiring conference.**

Prof. dr. Martin Kropff,
Rector Magnificus Wageningen University

General Information

Conference Venue

The conference will take place at the university campus in the Forum building. Hotel accommodation is at the *Hof van Wageningen*, conveniently located in the heart of Wageningen, at walking distance from the main shopping area and the market square, where bars and restaurants can be found. To get at the conference location there is a good connection by bus 88 from the main busstation, which is near *Hof van Wageningen,* to the campus, exit Droevendaalsesteeg.

Abstracts

This book contains the abstracts of keynote speakers, followed by the abstracts of oral presentations, and finally the poster abstracts. Abstracts of oral presentations are numbered with two digits, which refer to session number and order of presentation. The posters are divided in the three main parallel sessions and numbered on alphabetical order of the first author.

Affiliations are provided only for the presenting authors, whose names are underlined. The organising committee does not take any responsibility for scientific or typographical errors.

Posters

Posters will be on display on the ground floor of the Forum building during the whole conference. The location of the posters is navigated through numbers in this abstractbook and more information will be given at the registration desk during the conference. In order to stimulate discussions, there are two poster sessions on Friday 21 October where authors can answer questions of the audience.

Program

Program / Conference schedule				
Thursday 20 October				
Time	***Plenary***	***Parallel session*** **Innovation and Technology**	***Parallel session*** **Economy and Society**	***Parallel session*** **Ecology and Ethics**
08.30 - 09.30	Pre-registration			
09.30 - 12.00	Excursion			
12.00 - 13.00	Lunch			
13.00 - 13.30	Registration			
13.30 - 15.00	Opening by Rector Magnificus of Wageningen University: Prof. dr. Martin Kropff Keynote speaker: Dr. Hervé Guyomard, INRA, France			
15.00 - 15.30	Coffee break			
15.30 - 16.30	Parallel session	1.1 Potential food production *Chair: Hakan Asp*	2.1 Consumer behaviour *Chair: Edwin Kroese*	3.1 Ecological footprint *Chair: Martin Dieterich*
16.46 - 17.45	Parallel session	1.2 Plant Production *Chair: Ulrike Anhalt*	2.2 Governance of international trade *Chair: Irena Pokorna*	3.2 Animal welfare *Chair: Christoph Winckler*
19.00 - 21.00	Dinner at Hof van Wageningen			
21.00 - ...	Student party at Hof van Wageningen			

Friday 21 October				
Time	***Plenary***	***Parallel session***	***Parallel session***	***Parallel session***
		Innovation and Technology	**Economy and Society**	**Ecology and Ethics**
09.00 - 10.00	Keynote speaker: Prof. dr. Rudy Rabbinge, Wageningen University			
10.00 - 10.30	Coffee break			
10.30 - 11.30	Parallel session	1.3 Urban agriculture *Chair: Lone Soderkvist Kristensen*	2.3 Food safety *Chair: Walter Vetter*	3.3 Natural resource management *Chair: Michal Zasada*
11.45 - 12.45	Poster session 1			
12.45 - 13.45	Lunch			
13.45 - 14.45	Poster session 2			
14.45 - 15.15	Coffee break			
15.15 - 16.15	Parallel session	1.4 Food and health *Chair: Saeed Bawa*	2.4 Rural developement *Chair: Hans Karl Wytrzens*	3.4 Soil fertility *Chair: Lubos Boruvka*
16.30 - 17.30	Parallel session	1.5 Food and health *Chair: Lutz Graeve*	2.5 Rural development *Chair: Bjarne Strobel*	3.5 Environmental pollution *Chair: Wilko van Loon*
17.30 - 18.30	Award ceremony and closure			

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

Keynote Lectures

Room C 222

Can Agriculture Feed the World? Lessons from the Agrimonde Foresight Study

Dr. Hervé Guyomard

INRA, Paris, France

Since 2007 Hervé Guyomard is scientific director for agriculture at the French institute for agronomic research (INRA) where he is director of research. He was previously head of the economics research division in the same institution during 9 years. He is agronomic engineer (1983) and statistician-economist (1986). He holds a Ph.D. in agricultural economics from the University of Rennes (1988). Research interests include agricultural production economics, agricultural trade and agricultural policy, more specifically the CAP (Common Agricultural Policy) and WTO (World Trade Organization) agricultural trade negotiations and agreements. They also include the interface between world food security, food diets, agricultural production, trade and policy, and the environment. He was involved in many foresight studies, notably the "Agriculture 2013" project on the EU agricultural sector after 2013, the "France 2025" project (for the agricultural part) and the first phase of the "Agrimonde" project; he is currently one of the leaders of the second phase of this "Agrimonde" foresight study which focuses on land use. He is expert for many French and international organizations, notably the French ministry of agriculture, the European Commission and the OECD.

He will present the main results of the first phase of the "Agrimonde" foresight study. One of the key questions facing the planet is how to safely feed at an acceptable cost an estimated nine billion people in 2050 whilst protecting the environment, limiting the effects of agriculture on climate change and coping with the effects of climate change itself. This is the question behind the "Agrimonde" foresight project. He will explain why (and how) Agrimonde has adopted a foresight approach in which two scenarios describing sharply contrasting futures are considered. From the analysis, he will highlight the strategic domains for policy action as well as the main priorities for agronomic research.

Can agricultural feed the world? Current agricultural produce in relation to its potential

Prof. dr. Rudy Rabbinge

Wageningen University, Wageningen, The Netherlands

Rudy Rabbinge is university professor at Wageningen University with focus on sustainable development and food security. His career is characterised by sustained mediator between science, societal needs and polical realities. Already as a student he was politically active and in later years he was member of the Dutch Senate from 1999-2007. While active for Wageningen University during his entire career he occupied numerous positions of which a few be mentioned because they most closely relate to his speech at the conference. Currently he is among others deputy chairman of the Netherlands Commission for Environmental Assessment, chairman of the High Level Panel Experts, Committee Food Security of the United Nations and advisor of the United Nations Commission on Sustainable Development. From 2007-2011 he was chairman of the Science Council of the Consultative Group on International Agricultural Research (CGIAR) and from 2002-2007 he was co-chair of the Panel InterAcademy Council on Food security for Africa. Apart from this selection of international activities he also plays a prominent role in The Netherlands, being a policy advisor for many successive Ministers in areas like agriculture, the environment and science and education. Recently he chaired a committee developing a vision on the future of biological science as the science of the 21st century and he is for example chairman of the Committee for International Policy of the Royal Netherlands Academy of Arts and Sciences, but also member of the Steering Committee Regional Development Fund 2007-2013, region Northern Netherland and chairman of the Board of the Carbohydrate Competence Center.

His speech will focus on the basis processes of crop and animal production and he will underpin his vision that agriculture can feed the world pointing out the societal and polical conditions required to achieve this. Application of the basic principles of production ecology at all integrated levels, the micro level of crops and cropping systems, the farm level, the reginal, continental and global level, will demonstrate that there is ample opportunity to guarantee food security, limit use of external imputs and safeguard biodiversity.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

1. Innovation and Technology

Session 1.1: Potential Food Production

Room C 222

Fog Collection System: Design, Performance and Assessment of Prospects. A Case Study from the Chilean Northern Regions

Santiago Santos Valle

University of Copenhagen, Faculty of Life Sciences, Frederiksberg, Denmark

In some arid areas, where water is a scarce resource due to the lack of rainfall and ground water sources, fog is a constant meteorological phenomenon. Fog collection technology enables water condensation from fog, based on simple geographical and meteorological principles, and then become a water source in these arid locations. The collected water of the studied systems is mainly used for small-scale irrigation or water supply, which opens new possibilities for locals in order to explore new economical and environmental activities given the climate of the area.

This study's objective is establishing a critical global overview of the characteristics of and experiences with this technology based on published scientific texts and articles and a location specific case study in Chile. Literature focuses on experiences in places like Chile, Yemen, South Africa or Saudi Arabia (where fog collection yields reaches an average of 6,21 l/m2 of collecting surface per day in the latter), including analysis of particular aspects like geographical and meteorological conditions of the considered location. However, an updated worldwide review on the performance as well as global perspectives analysis in a developing country context is needed, since this technology is reported to have been successful in some places. Suggesting that this technology can provide an alternative water source under adequate scientific and social planning.

In addition, a case study from the northern regions of Chile on the design, performance and perspectives of existing systems was undertaken. Data was collected in the field for five fog collection systems, about meteorological conditions, fog collection yield, uses and management. In this area average annual rainfall ranges 78 to 163 mm/year while fog collection reaches up to 2,98 l/d·m2 (El Tofo). A model for estimating the potential of fog collection depending on climate and other conditions is under development and investigation.

Effects of Lower Animal Product Consumption in OECD Countries on the Global Food Balance: A Partial Equilibrium Analysis

Nuray Duman

University of Hohenheim, Stuttgart, Germany

Keywords: Animal consumption, dietary change, health, environment, global food security

Livestock farming is highly resource intensive and causes several adverse environmental effects such as contributing to climate change, soil degradation, and deforestation. Moreover it increasingly competes with the production of food crops, leading to higher prices of food staples. At the same time consumption levels in the OECD are unnecessarily high from a nutritional perspective. A shift towards lower animal consumption in industrialized countries (ICs) may imply positive effects concerning health of OECD consumers, relax resource use and environmental pressures and improve global food security. With a self-developed partial equilibrium model, rooted in microeconomic theory, I simulate effects of a tax-induced decrease in animal demand in ICs on the global food balance. The model covers 5 animal (beef, pork, poultry, eggs, milk) and 5 plant products (cereals, pulses, roots, oilmeals, grass). The world is modelled via two country aggregates: OECD and the rest of the world (ROW). Taxes are implemented on consumption, reducing demand for beef (-45.6%), pork (-19%) and milk (-10.5%) in the OECD. Results show an increase in OECD egg, poultry and food crop demand, a decrease in global feed demand, substantially lower world market prices for animal and plant products, higher animal and food crop consumption in the ROW and lower global production of animal and plant products. Conclusions will be drawn concerning potential improvement of nutritional quality of OECD diets, effects on resource use (release of land) and the environment (change in GHG emissions) and the improvement of food equity between OECD countries and the ROW. Moreover, results show that - due to inelastic demand in the OECD - tax-levels need to be substantial to induce significant demand changes. Therefore, a policy-mix (e.g. taxes, consumer information campaigns, health-labelling, development and promotion of improved meat substitutes) is more likely to reduce animal product demand.

Biocontrol Activity of *Meyerozyma guilliermondii* against Mould Growth and a Study of Local Post-harvest Systems for Maize in Cameroon

Sofia Ny

Swedish University of Agricultural Sciences, Uppsala, Sweden

Post-harvest loss is a major problem for farmers in sub-Saharan Africa. Substantial amounts of cereal grain are lost each year due to factors such as exposure to rain, extreme drought, physical damage and invasion of microorganisms. This decreases the availability of food/feed which in turn increases prices and the consumption of unsafe food. Therefore storage systems need to be developed to ensure a safe food supply with low losses.

The project aimed to evaluate the inhibiting effects of *Meyerozyma guilliermondii* against mould growth on maize under local conditions in Cameroon. This was in order to determine if *M. guilliermondii* could be used for biocontrol storage of moist maize under airtight conditions. Previous studies have shown this system, together with the yeast *Wickerhamomyces anomalus* as biocontrol, to be very effective for grain preservation.

Mini silos were inoculated with different moulds and yeasts. *W. anomalus* was used as a control since it has previously been shown to have an inhibiting effect on mould growth. Furthermore the project aimed to do a study of local post-harvest systems for maize in two different areas of Cameroon. This was done by means of visiting farms and interviewing farmers. The new biocontrol system of moist grain was also explained to the farmers in order to introduce the idea to them and see if they were willing to try a new storage system. A hygiene study of the storages was also done by microbial quantification and calculation of colony forming units (CFU).

No inhibition of mould growth was detected for either *M. guilliermondii* or *W. anomalus*. Several factors such as low moisture content, too much mould and the size and the material of the mini silos made the results questionable.

The storage method and hygiene varied between different farms in the Nforya-Bamenda area. However none of the local storage systems seemed to have better hygienic status for yeasts and moulds. The biocontrol system seemed suitable for introduction in Nforya-Bamenda for several practical and socio-economic reasons. With current storage technology it would be no use increasing yield per hectare for maize in this region since farmers already produce more than they can store. Moreover, the change in maize storage technology could prove essential to improving women and children's health in Cameroon, since many farmers smoke their maize indoors using fire-wood.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

1.Innovation and Technology

Session 1.2: Plant Production

Room C 103

Fine Mapping of *Ol-1*, a Resistance Gene to Tomato Powdery Mildew (*Oidium neolycopersici*)

Wosene Gebreselassie, Alireza Seifi and Yuling Bai

University of Hohenheim, Institute of Plant Breeding, Stuttgart, Germany

Keywords: Fine mapping, Ol-1, tomato, Oidium neolycopersici

Tomato powdery mildew caused by Oidium neolycopersici is one of the most important diseases causing damage to the tomato plant. Ol-1 is one of the resistant genes obtained from wild relative Solanum harbochytes G1. 1560 conferring incomplete resistance. This gene was mapped between markers P13M49 and H9A11 on chromosome 6 of tomato. The objective of this study was to fine map the Ol-1 gene. The methodology used was first saturating the region of gene of interest by generating more markers in addition to the already existing ones, followed by recombinant screening using disease test. In the mean time, BAC library screening was done in order to fill a gap in BAC clones around the region of Ol-1 on chromosome 6. Twenty one molecular markers were developed during the study period in the region of gene of interest and beyond the region. These markers were used in order to genotype plants during recombinant screening using disease test, determine the introgression region between the susceptible parent (Moneymaker) and the donor of Ol-1 gene (Solanum habrochites G1.1560). Four BAC clones were identified to be positives (overlapping) to the already available ones. Three of them, namely 2G04, 102B23 and 326B14 were found to be positive to 215M16 and one BAC clone, namely 161G17 was found to be overlapping to 123G17. Molecular markers flanking the introgression region (10.5cM) between Moneymaker and the donor of Ol-1 gene (S. habrochites) were determined. In this study, after recombinant screening and disease test of BC1S2 population, Ol-1 gene was mapped between markers P13M49 and H9A11 with genetic distance of 0.26 cM on the long arm of chromosome 6 of tomato.

Assessment of Sweet Potatoes as an Adaptation Strategy to Climate Change in Embu District, Kenya

Willemijn Drok

Wageningen University, Wageningen, The Netherlands

Embu district is situated on the slopes of Mount Kenya and can be divided into several agroecological zones (AEZ) as temperatures decrease and rainfall increases with altitude. Agriculture in Embu consists mainly of small scale, rain fed agriculture with main crops maize and beans and cash crops tea and coffee in thehigher AEZ, while mango production is an important source of income in the lower AEZ. Climate change is a problem for the small scale farmers since rainfall gets less reliable. This thesis assesses sweet potato as an adaptation strategy to climate change, since sweet potatoes are thought to be drought resistant and give a relatively high yield with low inputs. First 'farm maps' were made to show the within farm variability. Second a general survey was done to get the spatial pattern of perceptions of climate change and reasons for (not) growing sweet potato. Finally the Trade-off minimum data (TOA MD) model was used to compare the current production system to a system with an increased share of sweet potato in the current and expected 2050 climate. The surveys show that farmers in all agro-ecological zones experience climate change. According to farmers rains have decreased and temperatures increased, but the main problem is a poor distribution and increased gaps in the rainy seasons. Farmers grow only a small portion of sweet potato because the crop is often damaged by sweet potato weevils. Trade-off analysis shows that, event though projections of global circulation models present very different future climates, the impact on the farmers is similar. Climate change has a negative impact of the income of more than 80% of the Embu farmers. Sweet potato can be an adaptation strategy for half of the farmers, but is most suitable for farmers in the upper agro-ecological zones.

Induced Resistance - a Way to Reduce Fungicide Usage? – Experiments with BABA against Potato late blight

Oskar Hansson

Swedish University of Agricultural Sciences, Uppsala, Sweden

Keywords: Potato late blight, Induced resistance, Fungicide, BABA

Potato late blight caused by the oomycete *Phytophthora infestans* ranks as the most destructive plant disease worldwide. Today the only efficient management method to control late blight is by frequent use of fungicides, which may have a negative impact on the environment and costs enormous amounts of money for the potato industry. Activation of the plants own defenses, so called induced resistance can be an important tool for helping to control late blight.

ß-aminobutyric acid (BABA), a non-toxic amino acid, induces resistance in many different plants and has been proven to have an effect in potato against *P. infestans*.

To investigate to what degree the applied dose of fungicide can be reduced if it is combined with BABA, greenhouse experiments were carried out. Two different potato cultivars, Bintje and Ovatio were used and they were treated with the fungicides Ranman or Revus in different combinations with BABA. The leaves were inoculated with *P. infestans* and the lesion diameter was measured.

The result shows that the fungicide dose can be reduced in both cultivars. Although Ranman alone was highly effective, the combination effect with BABA became clear at the lowest reduced dose. The combination of 5 % of full dose Ranman combined with 95 % of full dose BABA was as good as full dose Ranman alone.

A secretome analysis was made to find out if there were any proteins related to the plant defense secreted in potato leaves treated with BABA. The results showed that PR1-protein and 1,3-ß-glucanase, involved in plant defense, was produced to a higher extent in BABA-treated plants. Thus, it shows that the defense is activated early after BABA treatment, even before further challenge with the pathogen.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

1. Innovation and Technology

Session 1.3: Urban Agriculture

Room C 103

Growing the City: Institutionalizing and Legitimizing Urban Agriculture in Copenhagen, Denmark and Dar es Salaam, Tanzania

Afton Marina Szasz Halloran

University of Copenhagen, Faculty of Life Science, Copenhagen, Denmark

Keywords: Urban agriculture, multi-stakeholder processes, urban food systems, food production, urban development

Cities contain over half of the global population, yet they are often overlooked for their ability to produce food. More than 800 million people are engaged in urban farming worldwide demonstrating that cities in both the global North and South can contribute significantly to local food systems. However, there are numerous barriers that hinder the recognition of urban food production as a legitimate urban activity, such as by-laws, which prevent the selling of urban grown vegetables, and access to land, as well as soil quality. In order for cities in the both the developed and developing world to be more inclusive of urban agriculture all relevant stakeholders should be involved in the process; A coordinated effort is needed to ensure greater success, expansion and support of urban agriculture initiatives, both the top-down and bottom-up6. Although not the ultimate solution to feeding the world, this research examines the current and potential possibilities, as well as the aforementioned barriers, to urban agriculture as an economic, social, and ecological activity. Two cities, Dar es Salaam, Tanzania and Copenhagen, Denmark are used in action research-based case studies, which analyse the development of urban agriculture in each city. Although agriculture exists in both cities, municipal recognition of the practise has remained minimal until recently. However, with the help of not-for-profit
organizations, as well as grass-roots groups, more discussion about the future of urban agriculture has transpired. In Dar es Salaam the first draft strategic plans have been completed, which include potential areas of development for urban agriculture, as well as existing areas that should be conserved. In Copenhagen, the funding for grass-roots initiatives has been the main mechanism of municipal involvement. Long-term access to cultivatable land and clear visions for urban agricultural development remains the most prominent barriers.

Planning for a Robust Development of Urban Agriculture

Peter Davids & Evelien de Olde

Wageningen University, Wageningen, The Netherlands

Keywords: Urban Agriculture, Spatial Planning, Municipality, Alternative Food Geography

After WOII, high productive plant varieties and animal breeds started to dominate in food production to ensure the availability of food. Recently, concerns are being raised about the potential environmental, health and security implications of global food commodity chains (FAO, 2008 in Kortright & Wakefield (2011)). As a response to the current food system, different alternatives appeared (Renting et al., 2003; Sonnino & Marsden, 2006).

Urban agriculture is an example of an alternative food system and can be defined as *'the growing of plants and the raising of animals for food and other uses within and around cities and towns, and related activities such as the production and delivery of inputs, processing and marketing of products'* (FAO, 2007, page 1). Urban agriculture takes place in both developing as developed countries but fulfils different goals. Next to food supply and income generation in the cities urban agriculture also plays a role in recreation, biodiversity, environment, social cohesion, and landscape management (FAO, 2007). Also the scale of urban agriculture can vary largely from backyard and community gardens to greenhouses (Pearson et al., 2009).

In this research the broad scope of urban agriculture is studied to look at how planning and urban agriculture relate to each other and what can be done to encourage a sustainable food system with urban agriculture through spatial planning.

Four cities Almere, London, Helsinki and Malmö have been studied to gain insight in the characteristics and developments of urban agriculture. The high diversity of projects found in these cities results in a different needs per type of project. Where smaller projects require access to water, land and good quality soil, larger projects are more concerned with permits, legislation, infrastructure and land ownership. In general projects require a facilitating role of municipalities rather than financial involvement.

The Vertical Farm – Why has the Idea Arisen and How is It Meant to Operate?

Erik Fälth

Swedish University of Agricultural Sciences, Alnarp, Sweden

The invention of agriculture was the start of civilization and humans have increased in numbers ever since, which has demanded more and more land area for cultivation. Today we incubate the majority of the arable land available on the planet and the population continues to grow.
Agriculture's impact on the environment is vast. Loss of natural ecosystems through deforestation is one example. The destruction of rivers and marine ecosystems through eutrophication is another. The scientific community warns that the long-term consequences are worse, both for man and environment.
One vision that claims to be able to turn these dark prospects is Vertical farming, which simplified means that instead of spreading patches of farm land over the globe like the approach today, there is the option to stack them upon each other through the construction of extensive greenhouses.

By immersion in the situation of the food production today and a historical study of how past development has led us to this point, one goal of this essay is to discuss whether the current way of farming can be applied in a sustainable future. Another objective is to study the vision Vertical farming as an alternative approach and give as comprehensive a picture as possible.
The paper, thus, seeks to broaden the views for alternative approaches regarding a well-established method which we often take for granted and also to initiate a discussion around the need to also take radical ideas in regard if we want to face the future in a sustainable manner.

The method is a qualitative literary study, discussing the issues: why has the idea of Vertical farming arisen, what is Vertical farming and how is the Vertical Farm meant to operate? Does Vertical farming have a place in the sustainable city of the future?

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

1. Innovation and Technology

Session 1.4: Food and Health

Room C 222

GDA - Useful Information or Burdensome Disinformation

Agata Białecka, Anna Zyła, Natalia Puciłowska, Patrycja Sadecka

Warsaw University of Life Sciences, Warsaw, Poland

Keywords: GDA, nutritional labeling, portion size

Introduction

GDA, stands for Guideline Daily Amount is indicating recommended daily intake. This is a voluntary labeling program for nutritional value used by the food industry in European Union. In Poland, this labeling system was implemented by Polish Federation of Food Industry (PFPZ). GDA contain reference values of energy and nutrients' level which are concluded in a portion of food or beverage. Each amount is presented as a percentage of a person's daily dietary needs.

Materials and methods

The study researched 800 food products from different groups, including bread (25products), dairy products (250), packaged meats (30), sweets (60), juices (55), soft drinks (40), salty snacks (40), ready-to-eat meals (120), frozen foods (100), breakfast cereals (40), pasta and groats(40). Observations were carried out in 4 supermarkets (Auchan, E. Leclerc, Real, Carrefour). Also online survey, about the knowledge of the GDA, was conducted among the 66 consumers.

Results and conclusions

The analysis showed some abnormalities in GDA labeling system, including lack of homogeneous labeling of products, different values for portion sizes, lack of ratio beween portion size and the number of pieces in packaging, incomplete information on the GDAs or selective feeding information on the packaging. One of the main problems in the food products' labeling by GDA system is to determine portion sizes. Products within the same group do not have a homogenous system for determining portion sizes. However, on the market are food products that are properly labeled, targeted at the needs of the consumer. Online survey showed that despite the knowledge of the GDA (75% of respondents know the concept of GDAs) only few people read the information given on the packaging (38% of respondents). It seems to be necessary to give a homogenous presentation of GDA markings and to educate consumers how to interpret it.

Application of Fractional Programming in Construction of Food Frequency Questionnaires

Aleksander Banasik

Wageningen University, Wageningen, The Netherlands

Keywords: epidemiology, mathematical programming, reformulation approach, Mixed Integer Linear Programming, Mixed Integer Fractional Programming

Epidemiological studies investigate the relation between diet and chronic diseases such as obesity, diabetes or cancer. One of the tools used in epidemiology for assessing respondents' diet are Food Frequency Questionnaires. FFQs consist of a set of questions asking respondents about the consumption frequency of several food items during a given time period. The contribution of mathematical programming in this field is to support the construction of a questionnaire by selecting a predefined number of questions out of a set of possibilities in such a way, that the amount of information obtained on multiple nutrients is maximized. Recently a Mixed Integer *Linear* Programming (MI*L*P) model was introduced for selecting questions, but new functionality of asking questions gave rise to a Mixed Integer *Fractional* Programming (MI*F*P) model with special characteristics. Existing literature does not provide a solution method for this problem so new solution technique had to be found. By exploiting the structure of the problem, an existing reformulation approach was extended to one that transforms the "hard" problem into an equivalent "easy" to solve problem. The new FFQ model (MIFP) has been compared with the model initially used in the FFQ design (MILP) in terms of the objective function value obtained and the optimal solution. The time needed to solve the (MIFP) problem is short and it turns out that the intended new functionality has potential provided that the structure of the data changes. This research demonstrates that the motivation to solve real-life FP problems provides the basis for new approaches in new contexts that have an added value of their own, even outside the given application area.

Dietary Intake of Zinc and Iron within the Female Population of Two Agricultural Villages in the Red River Delta, Vietnam

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Keywords: Anemia, Contamination, Iron, Malnutrition, Zinc, Vietnam

Malnutrition is a major issue affecting public health in many developing countries. Around 50 % of anemia cases worldwide are caused by iron (Fe) deficiency and the amount of Fe-rich foods consumed is related to wealth. For example, in Vietnam 28 % of the women aged 15-40 years were considered anemic (2004). Deficiency of micronutrients such as zinc (Zn) is very widespread and often called the hidden hunger since the symptoms are many and difficult to diagnose. This clearly demonstrates the magnitude of the problem. The consequences of malnutrition are compounded by contamination of the food chain with potentially toxic elements such as cadmium (Cd). Contamination can result from rapid industrialisation and the increasing use of contaminated water for irrigation. Studies have shown that individuals with low Fe and Zn status absorb larger quantities of Cd than those of adequate nutritional status.
The purpose of this study was to investigate and compare the Fe and Zn intake from the foods consumed by women (15-45 years) in two agricultural villages in Vietnam; in one of them subsistence farming was combined with metal recycling. Another objective was to investigate the prevalence of and the knowledge about anemia and compare with national anemia data. In total, 59 women were interviewed about their food intake and anemia experience. The result showed that the women reached the national and international Zn recommendations, while their Fe intake was lower than the recommendations. For this reason, the women in this study may be both more prone to environmental contamination, e.g. of Cd, and afflicted by anemia. 14 and 32 % reported that they suffered from anemia in the metal recycling and reference villages, respectively.
The situation needs to be improved both in relation to diet and nutrition and protection of the environment and food chain.

Scientific Student Conference 2011
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Can Agriculture Feed the World?

1. Innovation and Technology

Session 1.5: Food and Health

Room C 104

Effect of Coffee Consumption on Blood Pressure and Heart Rate in Normotenstive Young Adults

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Keywords: blood pressure, coffee, caffeine, heart rate

Caffeine has been known as a psychoactive stimulant for ages. Today, however, its popularity is growing due to the typical twenty-first century high pace of life and striving to maximize the efficiency of human labor. The influence of caffeine on human body is very complex - this substance acts on many tissues and organs. The aim of the study was to determine how caffeine present in coffee affects blood pressure (BP) and heart rate (HR). Twenty-nine healthy normotensive volunteers – 15 women and 14 men – with an average age of 21.9 ± 1.5 years participated in this study. They had abstained from caffeine intake for 24 hours before study. Systolic blood pressure (SBP), diastolic blood pressure (DBP) and HR were measured using an Ambulatory Blood Pressure Monitoring method (Schiller BR – 102 plus) with 10 minutes intervals for 180 minutes. The first measurement was made during fasting state and the next after the consumption of coffee containing 200 mg of caffeine. The research showed that caffeine had a significant influence on BP and HR. Mean increase in SBP (_ 3.99 ± 1.48 mmHg) and in DBP (_ 4.46 ± 0.79 mmHg) as well as decrease in HR (_ 8.72 ± 1.36) were observed. Significant differences in SBP between men and women were also noticed (125.78 ± 2.13 versus 117.56 ± 2.54). Caffeine was effective immediately after consumption and its influence on analyzed parameters was noticeable throughout the study period. Further studies are needed to determine long – term effects of caffeine.

The Apoptic Effect of Bacaba (*Oenocarpus Bacaba)* Phenolic Extract on MCF-7 Cells

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Keywords: Bacaba, MCF-7, apoptosis, annexin V, JC-1

Epidemiological evidence shows that high consumption of fruit and vegetables are correlated to non-communicable diseases prevention. Phenolic compounds are phytochemicals reported to have antioxidant, antiproliferative and anti-inflammatory properties. Bacaba is a traditional Brazilian fruit from the Amazon Rainforest which is locally consumed. The possible biofunctional properties of Bacaba have not been investigated until recently. The present study investigates the apoptotic effect of Bacaba (*Oenocarpus bacaba*) phenolic extract on MCF-7 breast cancer cells. Apoptosis was assessed by FITC-annexin V/propidium iodide assay and JC-1 assay by flow cytometry. The apoptotic process was investigated by analyzing the activity of caspase-9. Furthermore, chromatin condensation, an additional apoptotic event,
was determined by fluorescence microscopy using DAPI staining assay. The results showed that Bacaba extract induced apoptosis in a dose dependent manner (0 – 1000µg/mL) on MCF-7 cells after 24 h of treatment. The decrease of mitochondrial membrane potential was also observed by the JC-1 assay in a time (1, 3, and 6 h) and dose-dependent manner (0 – 1000µg/mL). An increase of caspase-9 activity was shown in a dose-dependent manner (0 – 1000µg/mL) after 24 h of incubation with the bacaba phenolic extract. The DAPI staining assay revealed an initial chromatin condensation process after 6 h of incubation with 1000µg/mL of the extract. Altogether, the outcomes indicate that bacaba phenolic extract induces apoptosis in MCF-7 breast cancer cells by the intrinsic mitochondrial pathway.

The Effects of Quercetin, Ambient Temperature, and Combination on Gene Expression Involved in Fatty Acid Catabolism in Mice fed a High Fat Diet

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Keywords: quercetin, lipid catabolism, environmental temperature, thermoneutrality

Quercetin is one of the most studied food-bioactive, polyphenolic compounds and seems to have promising health effects. Previously, rats chronically fed a low-fat quercetin-supplemented diet showed that a high amount of quercetin was distributed to the lungs, affecting its fatty acid catabolism.
The aim of this thesis was to study the *in vivo* effects of quercetin in lung of mice chronically fed a high-fat quercetin-supplemented diet, and to compare the effects with the former results in rats. The effects of higher environmental temperature (thermoneutrality) on metabolism were also studied, both in quercetin-fed mice and controls.
Tissues from two murine studies were used, performed at 22°C and 28°C respectively. Gene expression of six genes involved in lipid catabolism pathways were analyzed with qRT-PCR. Serum ketone bodies were measured colorimetrically and the tissue levels of quercetin and its metabolites in lung and liver were determined with HPLC.
Quercetin supplementation did not have a significant effect on gene expression levels of the six genes in lung. Quercetin seemed to have a significant effect on the systemic levels of ketone bodies. Thermoneutrality, on the other hand, significantly increased ketogenesis at the level of gene expression, but this was absent at the systemic level. Relatively high levels of quercetin and isorhamnetin were measured in lung versus liver tissue, comparable to levels found earlier in rats.
It can be concluded that there might be effects of quercetin and isorhamnetin in murine lung tissue, however not involving the same genes which were shown to be regulated in rat lung tissue. Furthermore, thermoneutrality did not seem to alter these effects.
It would be interesting to perform a microarray analysis on these murine lung tissues in order to elucidate the pathways affected by quercetin and its metabolites, and compare it with the hepatic microarray results performed earlier.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

2. Economy and Society

Session 2.1: Consumer Behaviour

Room C 103

Greenwashing as a Marketingtool in Businesses

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Keywords: Ethical marketing, greenwashing, environmentally friendly company

Nowadays ethical marketing is widely discussed in both media and the companies. We can see a lot of appropriate advertisements aiming to persuade that a company or manufacture is environmentally friendly. But what goes beyond the factors that affect such behavior? What motivates the companies to take care of the environment and people around, their customers and other stakeholders?

In a current market, due to strong competition, companies, in attempt to increase the revenues, use different instruments to market their products, and often those policies go well beyond what is known as ethical marketing. One of the most common examples is greenwashing. It is the strategy when company promises to enhance environmental or social issues if the customer buys the product. It increases attractivity of the product to the customer; however the company may not behave as environmentally friendly as advertised. For instance there was launched a new model of the car that is less harmful to the nature. "One print ad says, "Green vehicles. Cleaner factories. It's the right road for our company, and we're well underway." They tried to gain an image of environmentally friendly company. But they didn't mention that it is planned to produce only 20 000 of these cars per year, while producing 80 000 trucks per month.

Motivation of such a company is increased revenues, so it is very hard to change the situation through appealing to conscious of companies. So, what can be done to change the existing situation? Being environmentally friendly is all the times more expensive, but more attractive to customers. So what do the companies do? The companies create some image to the customer which is not relevant to the reality at all. The paper discusses several proposals to avoid misuse of ethical marketing. The paper evaluates how the state regulations, customer's support or changing the way of doing business can affect ethical marketing misuse.

Functional Food in Japan

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Over the years our interest in food grew to be more than just the seeking for tasty repletion. In longing for a healthy and wholesome lifestyle the concept of "Functional Food" was born and with it an important and evolving market segment emerged. Functional Food, Novel Food or Designer Food are hypernyms for foods which come with certain health benefits. These terms are much discussed in Europe but taken to a much more serious level in Japan, where strict certification- and regulation laws have been established years ago to maintain the quality FOSHU-Products (Foods of Specified Health Use.

This thesis concentrates on the "birthplace" of Functional Food, Japan. The Regulation procedures of FOSHU-Products are presented, different categories thoroughly explained, market trends annotated and illustrated through product examples. As a contrast to the Japanese market the European Functional food market, which is relatively young but quickly growing, is also shown in this thesis with its recently established Health Claim regulation and its development.

Since its beginning in the 90's the market of Functional Foods in Japan underwent a lot of changes. Just recently the whole Japanese "Health Foods" regulation-system was audited and moved to a whole different department, the Consumer Affairs Agency. With its ageing population and the correlating interest in the improvement of health and life quality, Japan seems the perfect country for such a market to establish itself. The steadily increasing number of FOSHU-Products (Foods of Specified Health Use) reached 960 registered products in October 2010. A number which seems quite big but is actually very small compared to the market-segment of the "so-called Health foods", which are, unlike FOSHU, uncertified products without any health-claims. The differences between Japanese FOSHU and Health Foods are also explained in this thesis, as well as products and their labeling compared to the European Health Claim System which is still under heavy development.

Genetically Modified Organisms (GMOs) as Potential Solution to Food Insecurity: Socially Relevant Stakeholders and Socioeconomic Factors to Consider for a Sustainable Application

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Keywords: Genetically modified organisms (GMOs), Actor-Network Theory (ANT), multiple equilibria approach, food security, socioeconomic factors.

The aim of this paper is to show that the increase in yield due to GMOs crops could become a potential solution to food insecurity only if decisive social, conceptual, ethical factors will be deeply evaluated together with economic, environmental, and institutional implications. From the social perspective the evaluation has been carried out considering firstly the Actor Network Theory (ANT), and the idea that concepts and artifacts are heavily influenced by the cultural and social context in which they develop, and ultimately they are the result of a coproduction of particular relevant social groups. This analysis aims at finding out the values, expectations, needs of food insecure stakeholders in order to define whether the meanings that these actors share coincide with the aims, the design, and the way of implementing concretely GMOs. Such a consideration will enable a shared and socially shaped co-design of the technology, valuable to meet and adapt to the needs of undernourished people. The result of this analysis is the critique of linear models that consider technologies as mere given objects, easily transferable to different contexts while neglecting that economic, social, ethical, and environmental implications are still either unexplored or controversial. From the economic perspective, the dynamics behind GMOs technology have been analyzed through a Multiple Equilibria Approach in which ex ante, the undervaluation of socioeconomic aspects may be the cause of failure, making ex post the rural economies move towards unfavorable equilibria. This theory implies that, case-by-case analyses are needed in order to shape the technology to local needs, social norms, interests and expectations. This implies to settle locally agreements about the goals, potentials and security of GMOs in order to increase the likelihood of a sustainable application.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

2. Economy and Society

Session 2.2: Governance of International Trade

Room C 222

Analyzing the Environmental Effects of Agricultural Trade Policies – A Case Study for the Marchfeld Region

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The relationship between trade and environment has received considerable attention in the last decades. Although studied by many, it remains disputed if trade enhances or decreases the production of negative externalities, especially at the regional and local level. This thesis aims to contribute to this field of study by analyzing the environmental effects of different trade policy scenarios for the agriculturally important region Marchfeld in Austria. The research focuses on how changes in trade policies may influence nitrate concentration in percolation water. I developed a linear land use optimization model that integrates environmental outcomes (e.g. crop yields, percolation runoff, nitrate leaching…) from the bio-physical simulation model EPIC (Environment Policy Integrated Climate).

The model results show that tariff reductions are not likely to influence nitrate pollution of groundwater in the Marchfeld region. But if trade liberalization is accompanied by the abolishment of single farm payments some land on low-quality soils becomes unprofitable (ca. 7%) and will be abandoned. This reduces nitrate pollution moderately. In contrast, producer support is rather likely to increase than decrease nitrate pollution. I was also able to show that agri-environmental payments have a far more significant effect on nitrate pollution than trade policies. Without agri-environmental payments nitrate concentration levels would rise by at least 30%.

These findings indicate that policy makers should concentrate on identifying efficient domestic environmental policies that are in accordance with World Trade Organization trade rules. Furthermore, trade and environment research should focus on countries that lack the institutional capacity to cope with possible negative side effects of trade liberalization (e.g. low-income countries).

The Future of the EU Common Agricultural Policy (Czech View)

Pavel Pokorný

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Based on the data of Eurostat (2010) and the Czech Statistical Office (2010), this study reveals history of Common Agricultural Policy (CAP) direct payments, sources of CAP money, CAP reforms and how financial funds are redistributed within CAP, using perspective of Czech agricultural entepreneurs. Over time, CAP is becoming more costly while at the same time agricultural subsidies are redistributed unequally. Therefore, some countries have competitive advantage while others do not. Differences between the new EU and old EU countries are analyzed. Major focus is given to the CAP reform for the new financial Framework 2014-2020 from the viewpoint of Czech agribusiness. Opinions of Czech farmers are incorporated into the research in the form of expert opinions and surveys. Implications of new CAP policies for Czech agricultural businesses such as Capping and Greening are researched.

Marketing Channels of Horticulture Products in The Netherlands

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Keywords: Supply Chain, Marketing Channels, Horticulture, Netherlands

Subject of research is trade of horticultural products (fruits, vegetables and flowers) in the Netherlands – country with great traditions in Horticultural production, nowadays focused mostly on production for export. Moreover Netherlands is huge centre for trade of products from abroad, like tropical fruits which are mostly re-exported.
Study is done mostly by literature review. Information is collected from scientific articles analysing structure and performance of distribution channels of horticultural products produced in the Netherlands. Moreover statistical data collected from Dutch government and non-government organizations for production and trade of horticultural products is used. In mentioned articles lot of attention is paid to modern ways of Supply Chain Management for food products
Result of research will be overview of situation in distribution channels of horticultural products in the Netherlands. However not only current situation will be investigated – there will be space for analysis of changes in the past and trends and expectations for the future.
I am sure that this research suits perfectly to one of topics of planned conference – governance of international trade. There is no country in the world with such experience with international trade as the Netherlands. Other (especially developing) countries can learn a lot from Dutch experience in trading and logistics of food products.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

2. Economy and Society

Session 2.3: Food Safety

Room C 222

Towards the Development of a Novel immuno-PCR Application for the Detection of Hazelnut Proteins

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Keywords: food allergens, hazelnut, ELISA, quantitative PCR

Hazelnut is a common cause of food allergy and thus subjects to mandatory labeling. The detection of allergens is of increasing interest to verify proper labeling and to ensure consumer protection since even low amounts of allergenic residues can provoke an immune response.
The quantitative immuno-PCR (qiPCR) is a novel approach to detect even trace amounts of hazelnut proteins. It combines the specific binding event of an antibody to its target with the amplification power of the PCR. The qiPCR is based on an enzyme-linked immunosorbent assay (ELISA) where hazelnut is detected on a protein-level. However, signal generation and quantification is performed on a DNA-level by using a 120 bp DNA fragment coupled to the detection antibody. The linkage between ELISA and quantitative PCR is achieved by labeling the detection antibody with streptavidin while the used DNA fragment is biotinylated. The DNA functions as a marker to be amplified via PCR and replaces the enzyme which is normally used in an ELISA.
In this study a sandwich format assay was performed with polyclonal rabbit antibodies against hazelnut as capture and detection antibody. Polycarbonate plates were used as plate material which meets the requirements of protein binding capacity and compatibility to the shape of the heating-block of the PCR-termocycler.
The qiPCR-assay was carried out by analysing a standard dilution series of extracted hazelnut proteins in a range of 5000 ng mL^{-1} to 0.5 ng mL^{-1} (10-fold dilutions). The comparision of the results obtained by qiPCR and the corresponding ELISA (biotinylated HRP-enzyme instead of biotinylated DNA-fragment) revealed a 10- to 100-fold increase in sensitivity.

Efficacy of Sanitizing Agents and Microbiological Quality Parameters of Fresh-cut Produce

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Keywords: fresh-cut produce, decontamination, *L. monocytogenes,* inoculation;

Fresh-cut produce is particularly susceptible to microbial attack due to widespread contamination possibilities (pre- and postharvest) as well as environmental and physiological factors. The need for efficient decontamination strategies to reduce these high microbial populations in fresh produce, intact or minimally processed, becomes more important. These sanitizing treatments vary in the desired effect due to different reasons, such as intervals between contamination and washing, surface inhomogeneities of produce and type of microorganism attached to the product surface.

The current study aimed to evaluate quantitatively the general microbiota of commercial pre-packed leafy salad products, including pathogens such as *Listeria monocytogenes* and *Salmonella*. After the assessment of the microbial load in the products, isolates were characterized qualitatively in order to emphasize their characteristics and etiologic provenience.
A selection of isolates and well characterized reference strains were exemplarily applied for inoculation trials with leafy salads to evaluate the efficacy of certain washing and decontamination treatment strategies in laboratory scale. Based on the findings, potential influencing criteria (agent applied, bacterial species and /or strains) for efficient decontamination of these critical products were assessed.

Detection and Identification of Blueberry Viruses on Polish Plantations and the Determination of the Optimal Time for Virus Detection Using the Serological ELISA Test

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The problems in the cultivation of highbush blackberry are diseases caused by infectious factors, particularly by fungi: *Godronia cassandrae*, *Botrytis cinerea*, *Colletotrichum gloeosporioides*, and lately also by viruses. This paper presents the detection and identification of viruses in the bushes of the highbush blueberry on plantations located in the central Poland and cranberry growing in the separate parts of plantations in the central region of part of the country using the serological ELISA test and the molecular biology techniques.

The results of the performed serological ELISA test showed the presence on the bushes of various cultivars of the *Blueberry shoestring virus* (BSSV) and *Peach rosette mosaic virus* (PRMV) (central and south-eastern Poland) and the *Blueberry scorch virus* (BlScV) and *Tobacco ringspot virus* (TRSV). It was established that a good material for detecting BSSV using the serological DAS-ELISA test are leaves and flowers. Using the serological DAS-ELISA test it was demonstrated that in the bushes of the highbush blueberry the better material for the detection of BlScV are leaves and in the case of TRSV – flowers. The detection of viruses was also possible in the phloem + periderm + cortex parenchyma samples. It was also demonstrated that the alternative host for BlScV is cranberry. In Europe it is the first report concerning the presence of the virus in cranberry. It was established that the application of the PCR technique allows the detection and identification of BRRSV in the bushes of the Darrow and Herbert cultivars. In Poland it is the first report on the occurrence of the virus in the bushes of the highbush blueberry following the reports published in the Czech Republic and Slovakia in Europe.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

2. Economy and Society

Session 2.4: Rural Development

Room C 103

A Dual System - Subsistence Farming and Diversified Cash Cropping Reducing Vulnerability in Sarawak, Malaysia

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Keywords: Income Diversification, Cash Crop, Vulnerability, Livelihood strategies, Malaysia

The contribution will treat the question of, how subsistence farming along with diversified cash cropping schemes can reduce vulnerability and provide a basis for innovation. It will be based on two reports from our field work carried out in two villages of southern Sarawak during the 'Interdisciplinary Land Use and Natural Resource Management' course in 2011. The studies are based on qualitative and quantitative methods such as a questionnaire surveys, focus group interviews and on in depth case studies, soil and water samplings. The livelihood strategy among the households differ in terms of diversification. Wealthier families have more off farm activities and a broader range of crops to meet their needs as opposed to poorer families with fewer crops and income sources. Farmers diversifying their cash crop income take investment risks as e.g. in birdsnest production. Indigenous ethno botanical knowledge is especially present among the older generation and generates an important source of nutrition. The present livelihood strategy is in many ways sustainable because it can cope with stresses and shocks such as fluctuating prices on cash crops and natural disturbances such as river floods. However, farmers dependency on government fertilizer subsidies is a serious concern for e.g. pepper production, as current level of subsidies will most likely not be maintained. For rubber and (traditional) upland rice, fertilizer dependency is less significant. Whether the young generation follow the official governmental plan, i.e. taking an education, earning money in the urban areas and return to their village and invest in agriculture depend on whether future land reforms can secure tenureship.

Importance of Genetically Modified Organisms (GMOs) in Suppressing the World Famine and Related Ethical Issues

Martin Taschner

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Keywords: Genetically modified organisms (GMO), food sufficiency, trends, threats, food prices

Agriculture efficiency and its ability of feeding the world has always been a greatly discussed topic. Nevertheless, the increasing population, proceeding urbanization and continuous decrease of highly fertile soil currently open a question of potential solutions and farming yield improvements. As a highly effective, but also very controversial tool having chance to change the beaten track appears the topic of GMOs.

Green revolution in Mexico and other developing countries have proved that scientific method of genetic modification could lead to the increased yield, higher resistance and increased nutritional value of crops. However, ethical issues and considerable number of drawbacks (e.g. increased costs for organic and conventional farmers due to difficult and costly segregation of GM and non-GM crops rising the price of final production - food) and potential threats (where noticeably predominate the fear of potential impacts on human health) have implicated many concerns about the contemporary widespread of such practices. Since the potential biological changes caused by GMOs (in the negative scenario often suggested by proponents) could be irreversible, the thorough procedure of following action should be done right at the initial stage of the wide distribution.

The present study aims to discuss arguments of both, proponents and opponents of these genetic solutions; and to analyse a number of case studies, investigating, whether the benefits of the use are sufficiently compensated by relevant assets. At last, how serious the threats really are.

An Outline of the Consideration of Social Sustainability in Modern Food Production, from the Perspective of Today's Dutch Farmer.

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Keywords: Communication, Dairy Farming, Farmer's Perspective, Food Production, Social Sustainability

The future of food production sector is one of today's hot topics in the Netherlands. Nearly every day newspapers, films, books, discussions and debates are drawing attention to modern production methods- regularly with an accent on shortcomings (in, for instance, animal welfare).
The Dutch ask for more values of their food than just „quantity" or „safety". The amount of attention drawn on the topics, shows there is a discrepancy between the ideals of the society (social sustainability) in the light of modern production systems, and what the society actually perceives from the systems.
The social debate about sustainability in the sector of food production is expanding, but commonly lacking the mind of the modern farmer. In this report the farmer's view is carefully reviewed.
The first part of the report exists of a literature study, describing the historical background of the farmers' role in systems of agricultural produce. Trends in economics and stimulating policy have triggered agricultural produce to turn into large scale and high-tech. This influenced the way of working of the farmer, and thereby the functioning of the sector as a whole. The same trends influenced consumer behaviour and perceptions of food (production). Such description declares how visions of farmer and consumer concerning social values of Dutch dairy farming formed themselves.
The second part contains the results of in depth interviews with farmers. Consumers expect them to have the same values on sustainability issues. The farmers choose to deal with problems in a certain way. They are in a split between consumer wishes, their own wishes and their practical possibilities.
The two parts together give an impression of how today's farmer stands to making food production more socially sustainable. It describes the discrepancy between consumer and farmer ideals, and to what extent it is possible to diminish this discrepancy at farm level. This will positively influence an equivalent communication on designing a sustainably accepted food production sector.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

2. Economy and Society

Session 2.5: Rural Development

Room C 103

Does Participatory Market Research Develop Entrepreneurial Culture among Organic Smallholder Farmers? Evidence from Uganda

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Keywords: Enabling Rural Innovation, Participatory Market Research, entrepreneurial culture, organic agriculture, agri-business development

Entrepreneurial culture among farmer groups is a precondition for the commercialisation of small-scale, subsistence agriculture. This case study examines the effects of the Enabling Rural Innovation approach and associated participatory market research methods on the development of entrepreneurial culture in the context of organic agriculture in Uganda. Farmers who underwent training in participatory market research were compared with farmers who have had no exposure to the method and the Enabling Rural Innovation approach. Data collection took place at farmer group and household level. Data was analysed using descriptive and analytical statistics. The analysis shows that participatory market research contributes to the development of an entrepreneurial culture among farmer groups. This manifests as higher levels of entrepreneurial attitudes, knowledge and skills. Farmers in the trained group show more signs of entrepreneurial behaviour than farmers from the control group. Such entrepreneurial behaviour is reflected in the ability of farmers to take pro-active agro-enterprise decisions and seize new business opportunities. We conclude that participatory market research trainings strengthen the role of farmers in organic value chains.

Reflexive Modernities. Food Production Practices of New Communities in Rural Brazil

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Keywords: modernity, food production, socio-environmental risks, new rural communities.

The negative consequences of modernity as demonstrated by the current outcomes of conventional food production methods, can no longer be denied. Western consumers are increasingly confronted with 'risky' food in their supermarkets and rural producers worldwide find themselves forced to keep increasing scale. Processes involved have increased environmental risks, alienated men from living nature and left many at the margins of society. If the challenges are to '*increase the food production and improve the distribution of and access to food*', unorthodox methods have to be used. The real challenges are to feed the world with proper food, using proper manners. This requires a shift in mentality. In Brazil, where the outcomes of modernity are harsh realities for many producers and a heavy burden for most others, a consciousness is being expressed in direct action by uniting and creating a change from within. This thesis is based on research done on new rural communities in Brazil. The three studied cases show a collection of histories, worldviews and practices that naturally comprise multiple perceptions and reactions on the social and environmental problems related to the production of food. Some characteristics of the studied practices are remarkable and form a challenge for many of societies institutions to resolve food issues and improve the quality of life. Decentralization and diversification of food production, the technologies used and a shift towards cooperation reduce drastically the distance between producer and consumer, increase access, improve distribution, improve the quality of the food, restore needs, natural resources and the nature of relationships and increase production on the long run.

The Impact of an Organic Food Production and Life Skills Training Program on Food Security and Livelihoods of Unemployed Rural Women in South Africa– A Case Study

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Keywords: food production, food security, sustainable livelihoods, women, South Africa

South Africa faces severe poverty, high income inequality and high unemployment which are considered as main causes for food insecurity. Considering the fact that women play a vital role in agriculture and improving the quality of life and household food security, especially in rural areas, women's empowerment, education and participation in household income generation seems to be an urgent requirement in reducing their vulnerability and overcoming poverty and food insecurity. This research investigates the impact of a very new agricultural training program, initiated by the non-profit Grootbos Foundation, on food security and livelihoods of unemployed rural women in the Western Cape, South Africa. The project entitled "Growing the Future" (GTF) is a one-year organic food production, agricultural extension and life skills training program, teaching organic food production, computer literacy, maths and English. A qualitative research approach was used applying participant observation and continuous reflections, interviews and focus group discussion.

Data was analysed both manually and with the qualitative data analysis software. Results demonstrate that in its start-up year, the GTF project has improved certain livelihoods assets of the participating women, such as human capital, through gaining of knowledge and skills. Organic agriculture, as it is based on the use of locally accessible resources and low need of external input and financial capital, is an alternative to conventional agriculture and highly relevant for the GTF graduates. The lack of motivation that could be observed among the women, as well as their elaborations on future livelihood options, reflect the huge gap these women are facing with regard to access to livelihood assets and support structures. To start a small-scale agricultural project after this course the women face constraints such as limited access to other livelihood assets and productive resources, still largely being dependent on support from GTF and also the government for social grants.

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Can Agriculture Feed the World?

3.Ecology and Ethics

Session 3.1: Ecological Footprint

Room C 104

Nitrogen Self-Sufficient Arable Farms

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Keywords: nitrogen self-sufficiency, nitrogen efficiency, reallocation, green manure, mulching

We are investigating the implementation of an innovative concept for nitrogen self-sufficiency on arable farms. At the core of the concept is that green manure that is in the crop rotation should be kept on the farm rather than sold, and reallocated rather than mulched. We claim that in doing so, arable farms can become nitrogen self-sufficient. Former studies suggest that farmers may have a net nitrogen loss when selling green manure and buying animal manure. Also, on-farm use of fixated nitrogen is essential because animal manure contains more phosphorus per unit of nitrogen than the crops that are exported from the farm, and as a result many Dutch soils are oversaturated with phosphorus.

New to this concept is that, in terms of nitrogen efficiency, it is advantageous to reallocate the green manure. When the green manure, which is mown multiple times, is mulched, the plants will use the nitrogen from the mulch for regrowth, reducing nitrogen fixation from the air. Secondly, reallocation allows for freedom in application in timing and quantity.

We are stepwise implementing this idea on the Van Strien farm in Ens, Noordoostpolder. By use of the model NDICEA an arable rotation has been designed. Former studies have shown that freshly cut grass clover, alfalfa and silaged alfalfa perform at least as good as animal manure in terms of yield (Van der Burgt, 2010). This season we compare crop performance for various amounts of nitrogen application lower than normally used, aiming to find the lower limit of nitrogen application needed. We are confident that the concept is conceivable and are planning on further studies enabling us to work this out in more detail.

Analysing Greenhouse Gas Emissions from Agricultural Crop Production Using the Kaya-Porter Identity

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Keywords: Agriculture, greenhouse gas, mitigation, crop production, energy

To feed the world we need innovative thinking on how to increase agricultural production while mitigating climate change at the same time. Agriculture is responsible for app. 33 % of total anthropogenic greenhouse gas (GHG) emissions and increased production will be accompanied with increased GHG emissions, which is crucial to address. It is well demonstrated that agriculture holds a significant potential for climate change mitigation but still many barriers keep agriculture from entering the climate change negotiations and become a part of the mitigation policy. One major barrier is the difficulties and uncertainties in estimating and monitoring emissions from agriculture and current estimates leave out many emissions from the agricultural sector to be accounted for in others sectors and do not include the agricultural production. This study proposes the Kaya-Porter Identity as an innovative idea on how to analyse GHG emissions from agricultural crop production. The idea emerges from the well acknowledged Kaya Identity, which is used to analyse GHG emissions from nations by the economy sector. The Kaya-Porter Identity links agricultural production and energy as the basis for estimating emissions per unit area and creates a link between the area available for food production and associated emissions. This identity enables an analysis of how different components in the land-use and production system affect GHG emissions and mitigation scenarios' can be appraised. This study applies the Kaya-Porter Identity to Danish crop production and results show that the crop, area, soil type, farming system and management practices all have effects on the emissions and the effects can be recognised in the Kaya-Porter Identity. It is concluded that the Kaya-Porter Identity offers additional analytical potentials but how to integrate all agricultural activities, incl. animal production, in the identity is still an unresolved issue.

Greenhouse Gas Emissions of Cultivation and Distribution of Strawberries in Context of Economic Interactions

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Keywords: Greenhouse Gas Emissions, Strawberries, Sustainability, Life Cycle Assessment

The effects of global warming are already proofed and forecasts for the new future are even worse. Life cycle assessment gives us the opportunity to create a greenhouse gas balance. By observing the complete product cycle, from cradle to gate, all emissions are taken into account and while doing so, the chance to compare different opportunities is given. The value of sustainability for this research was measured on the amount of carbon dioxide emissions, which are primarily responsible for the climate change. Based on the ISO standards 14040/44 the life cycle assessment of the food chain strawberry was analysed closely. The research was differentiated in two main processes of planting, which were followed by another main process of cultivation, two main processes of selling and lastly by the opportunity of recultivation or starting a new plantation. Furthermore thesemain processes were classified in single processes, with the chance of varieties.

As a result of this paper, the emission variety per kilogram strawberries is between 0,49 and 1,05 kg CO2 equivalent. The most influence on the balance has the costumer with the transportation means for getting to the point of sale. Other aspects, like the environmental friendly usage of a hail protection net, or the higher ecological costs of a drip irrigation system, are evaluated in this research paper. Another way to reduce the level of CO2 emissions is a two year cultivation of the plantation. Longer cultivation periods are actually not possible. This is caused by the plant physiology, which is a main factor of diseases and fruit growth.

The observation is showing chances to reduce the CO2 emissions for the producer, the retailer and the consumer.

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Euroleague for Life Sciences

Can Agriculture Feed the World?

3. Ecology and Ethics

Session 3.2: Animal welfare

Room C 104

Ethological and Electrophysiological Assessment of Sleep in Adult Cattle

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Keywords: sleep, cattle, electrophysiological recordings, behaviour observations

The aim of this study was to assess sleep of adult dairy cattle using a non-invasive technique and to investigate possible correlations between the electrophysiological recordings and different behaviours, which may refer to sleep. The experiments were carried out using seven dairy cows of the breed Ayrshire at the experimental barn of the Veterinary Faculty of the University of Helsinki and three cows of the breed Swedish Red in Sweden (SLU). For each cow EEG, EMG and EOG measurements were carried out. Parallel direct observations were done in order to assess the activity (lying or standing), the position of the head (head supported by the neck and still, head lies on the ground or on the flank, head moves), the position of the eyelid (open, half-closed, closed) and muscle twitches of the ears, the eyes, the limbs and the muzzle. For the Finnish data, the highest sensitivity (> 80%) was found comparing the behaviour 'lying' with the different sleep states and with the total sleep. However, 'lying' was not specific in predicting sleep (45-71%) and led to a major overestimation of the different sleep states respectively total sleeping time. This was especially the case for REM sleep (predictability 150 – 2978%). All other behaviours showed a lower sensitivity compared to the behaviour 'lying'. The behaviour 'lying plus head lying on the ground/on the flank' achieved a sensitivity of 87% but this wasn't very specific too (12%) and led to a six fold overestimation of the REM-sleep proportion. This may be explained by the fact that cows showing the above mentioned behaviour also were diagnosed with NREM sleep by 41% (15-80%, n=5 measurements), although this behaviour has earlier been described as typical for REM-sleep in earlier studies. Similar results were found for the Swedish data. In this study it was possible to non-invasively assess different resting and activity phases of adult dairy cattle using a polysomnograph. Behaviour observations alone did not provide sufficient information about the different sleeping states and their duration in dairy cattle.

Physical Characteristics of Suckling Piglets and Their Impact on Piglet Survival in Loose Farrowing

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Keywords: Piglet, survival, farrowing pen, physical characteristics

Achieving rates of mortality in farrowing pens that are comparable to those in crates is a challenge in modern pig production. Identifying characteristics of suckling piglets that are related to mortality can be used to identify piglets at risk of dying and help improve management of piglets in pens and thereby improve survival. The aim of this study was to associate physical characteristics with survival until weaning in farrowing pens for loose housed sows. At birth, all 3,402 piglets from 203 litters were weighed (BW0), crown-rump length (CRL) measured and a score was given for the degree of growth retardation (IUGR). In addittion, other measures were calculated and analysed, including body mass index (BMI), ponderal index (PI) and relative weight within litter (REL).
Results showed that characteristics of piglets differed between stillborn piglets, piglets dying on day 0-1, piglets dying on day 2-28 and piglets surviving to weaning. The most important variables with respect to survival until weaning were BMI and PI followed by BW0, REL and IUGR. Litter size was insignificant and so were gender, CRL, sow parity and length of gestation. The results indicate that the risk of stillbirth is related to different individual characteristics of piglets than the risk of dying between birth and weaning. Furthermore, deaths amongst live born piglets were related to different characteristics of the neonates, depending on which period of the preweaning stage was in focus. As for importance of individual characteristics, birth weight should not be the only variable considered when discussing improvements of piglet survival as parameters like BMI and PI serve as better predictors of survival to weaning. Steps taken to improve piglet survival in the first 0-1 day should differ from steps taken to improve survival during the remaining preweaning period.

Profitability of Animal Production and the Influence of Animal Welfare on the Meat Prices in Poland

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Keywords:Animal production, Animal welfare, Living conditions, Meat prices, Profitability

Low profitability of animal production in Poland necessitates maximizing production. Also, the living conditions of farm animals have changed since Poland's accession to the EU. Upgrading production facilities using EU assistance funding is required by applicable regulations. Production under non-standard conditions has become subject to veterinary inspections leading to closing down the production entities. Nevertheless, the conditions of animal use have improved unequally with respect to each type of animal production. For instance, live pig production is where modern standards have been implemented significantly slower. The higher rate of changes is observed in milk production. However, investments are limited by the requirement to provide own resources. Despite assistance related to subsequent structural funds, many farmers were forced to change their business profile as they were unable to fund the improvements in animal welfare in their farms. In terms of macroeconomics, improving the living conditions of animals supports concentrating production, specialization and restricting production surpluses which the UE finds difficult to use.

Based on the statistical data provided by the Central Statistical Office (GUS) and the materials published by the Agency for Restructuring and Modernisation of Agriculture (ARiMR) and the Institute of Agricultural and Food Economics, National Research Institute (IERiG_ PIB), one can determine the welfare changes since 2004. The use of the EU aidmeasures for upgrading farms, including animal housing facilities, have risen since 2004. The best situation is found in milk production farms. Low profitability of live pig productionhinders investments in this sector. The analysis of the u se of animal housing facilities according to GUS data shows that the number of such facilities in specialised entities with high concentration of production is increasing. The prices of basic animal products show that the welfare has no significant effect on the farmgate prices. The profitability of animal production in Poland is still determined by its scale; in the future large producers will support welfare, leading to increased cost per unit.

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Can Agriculture Feed the World?

3. Ecology and Ethics

Session 3.3: Natural Resource Management

Room C 104

Does the Natural Resource Management Contribute to Sustainability and Enhanced Food Security within the EU?

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Keywords: Sustainability, food security, environmental impact, natural resource management.

The importance of food security has been admitted on the world-wide scale. Continuous growth of the world population and the economic development increasing the purchasing power represent significant factors implying, among other things, a considerable increase in the demand for food. Agriculture plays an indispensable role while providing the society with the basic agricultural commodities. However, enhanced demand for food, drifted by the population expansion, could evoke a serious threat to the environment, especially with the view of quality and attainability of the natural resources such as fresh water or arable land.

Thoughtless agricultural processes, as experienced for instance in the case of Green revolution, resulting in deforestation, soil erosion or water pollution, largely contribute to the degradation of the environment. Such approach is not sustainable. Therefore, in order to combat the world poverty; to ensure food security and the access to the food; to reduce the negative impact of the agriculture on the environment and to ensure sustainable use of natural resources, serious changes have to be done promptly.

Therefore, the main aim of this paper is to provide analysis of all possible ways leading towards sustainable use of natural resources, especially in the areas of land and water management in the European Union. The current environmentally friendly practices as proper crop rotations, extensive use of arable land, keeping species rich meadows, appropriate use of fertilizers and pesticides, usage of dripping irrigation, land levelling and agroforestry techniques will be assessed. The advanced management of natural resources that helps to enhance environment does not always have to bring higher yields. The question whether improved management techniques that minimise impact on the environment can contribute to the enhanced food security and sustainable future will be critically discussed.

Quinoa on the Bolivian Table versus Quinoa on the Global Market - A Case Study of Dietary Patterns among Bolivian Farm Households Producing Quinoa for Export

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Keywords: quinoa, diet, nutrition, household, rural, socio-economic

Quinoa is a highly nutritive crop, which has been a staple food for high Andes inhabitants during centuries. Recently it has gained popularity in developed countries (Rojas, 2004). Rural households of Bolivian highland specialized in quinoa production have experienced substantial change in their socioeconomical conditions following that he demand for quinoa in developed countries has led to rise of its market price.

The opportunity of selling their product at higher price has prompted quinoa producers to take new decisions regarding their household economy and diet. Attracted by higher prices, farmers may sell whole their harvest and buy food which, in comparison with quinoa, has lower nutritional value. Consequently, the nutritional quality of their diet may deteriorate and may lead to undernutrition(Brett, 2010; Hellein & Highman, 2005). However, this phenomenon has not been dee ply studied anddocumented in the existing literature.

This study has analyzed dietary choices of marginal rural households generating its income from quinoa production, in relation to its socio-economical conditions. The study was conducted from January to April 2011, in the remote municipality of Salinas de Garci Mendoza (Bolivian highland). Fifty households were selected using convenience sampling method and surveyed. The respondents were women responsible for household cooking. The survey was followed by observations of meal preparation and consumption, PRAs (Participatory Rural Appraisals) with women and children and key informant interviews. The diet of the women were surveyed using repeated 24-hour dietary recall method. The recall was conducted twice.

Data showed that quinoa is consumed by all of the respondents. The reported dietary history showed that quinoa is being replaced in the diet by other foods, especially rice and pasta. In general, the nutritional quality of the woman's diet is low, being deficient in calcium and vitamin A. Quinoa consumption was found to be positively correlated with respondent's age and with amount of quinoa stored in a household, and negatively correlated with owned land size and harvest size, indicating that
quinoa consumption decreases with increasing socio-economic status. This work contributes to understand linkages between quinoa produced for export and farmer's
nutritional status.

Differently Processed Canola Meal Affects Performance and Organ Size in Pigs

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Keywords: Canola meal, extraction process, performance, pigs, thyroid gland

Canola meal is a residual product from canola seeds after extraction of the oil for human consumption or production of biodiesel. The current experiment was conducted to investigate the effect of different processing methods in the oil mill on the nutritional value of canola meal for pigs measured by productivity and organ weights. Two varieties of canola seeds differing in glucosinolate contents (Lioness 20.1 µmol/g oil-free seed and Excalibur 44.2 µmol/g oil-free seed) were obtained and successively processed. The resulting canola meals were then mixed into pig diets (~10%) and subsequently a total of 3435 commercially cross-breed piglets weighing 7.0±0.8 kg were used in a randomized block experiment lasting 50 days with six treatments and 58 replicates (one replicate = one pen). The dietary treatments were: 1) control – no canola meal; 2) Lioness, expeller extraction at low temperature; 3) Lioness, expeller extraction at high temperature; 4) Excalibur, expeller extraction at high temperature; 5) Lioness, cold pressed and 6) Lioness, dehulled and cold pressed. On day 47 internal organs were harvested from six randomly selected pigs per treatment (except for group 6).
The high temperature expeller processes reduced the measurable content of glucosinolates in the meals with about 40% immaterial of the initial glucosinolate contents in the seeds, and these meals contained relatively higher proportions of alkenyl-glucosinolates.
Pigs fed expeller extracted canola meals, irrespective of process temperatures and glucosinolate contents, grew identical to control pigs. However, performance was reduced in pigs fed cold pressed canola meals ($P<0.01$). Livers and thyroid glands were enlarged ($P<0.05$) in all pigs fed diets containing canola meal. Enlargement of the thyroid gland indicates intoxication caused by the glucosinolates resulting in reduced function of the organ. Therefore care should be taken when formulating piglet diets containing canola meals and cold pressed meals should probably be avoided.

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Can Agriculture Feed the World?

3. Ecology and Ethics

Session 3.4: Soil Fertility

Room C 104

Impacts of Different Soil Amendment Strategies on Changes in Soil Phosphorous Content

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Keywords: long term field experiment, soil phosphorus, Hedley fractionation

Phosphorus (P) is a scarce nutrient, essential for all living organisms. The use of Pfertilization led to notable increases in crop yield, but created dependency on a finite resource. Since P it not substitutable, questions are rising upon its future availability. Studies suggest that the global reserves of phosphate rock may last for 50 - 100 years, reaching the peak of production around 2030. At the long-term field experiment site in Ultuna, Sweden, different soil amendments strategies and their impacts on P-concentration in soil will be analyzed.
During the last 55 years different treatments were proceeded regularly at the research site. A closer look will be taken at the a) well-decomposed animal manure, b) peat, c) sewage sludge, d) Ca(NO3)2, e) continuous bare fallow treatments. Using the Hedley fractionation method, various forms of soil P will be analysed. Gaining a deeper understanding of the impact of different soil amendments on the P-content of soils, in comparison to untreated soil, is the final goal of this study. Furthermore the different distribution of P-pools in soil will be analyzed. Finally, P availability for plants and P mobility will be another focus of the project.

Influence of Mango Trees in North-Vietnam on Soil Fertility in Intercropping Systems

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Keywords: soil fertility, intercropping system, soil erosion, agroforestry, sustainability

The conservation of soil fertility and the prevention of soil erosion are necessary for a sustainable food production in the future. However, given the limited expansion possibilities of the farming land cause an overexploitation of this natural resource.
In Yen Chau district, Northwest Vietnam the production of economical beneficial cash-crops, like maize even at steep slopes, is common to ensure additional income. The consequencesa re soil erosion, degradation of soil fertility defined as soil organic carbon (SOC) and nutrients, which leads to a decline in yields. In NW Vietnam mango (*Mangifera indica* L.) is a common and widely distributed fruit tree. The trees are often intercropped with maize at steep slopes. The mango trees have a high potential to conserve the soil fertility because of their evergreen leaves as well as above- and
belowground inputs of biomass. Other benefits of agroforestry systems are extra income from the sale, lower cost income ratios and faster turn-over times of litter.
The aim of this study was to describe the effect of mango trees on soil fertility at six sloping locations. For comparison, the sites were similar in all soil forming parameters and soil type. The land history and soil management was elaborated by interviewing the farmers. To investigate the influence of the age of the mango trees, three different ages of the trees were chosen. Preliminary results show that SOC values are higher under the tree crown than on the open field, esp. for medium old trees. We therefore assume that mango will increase soil fertility only at optimum conditions (growth stage and distance). Further the trees could be used to maintain soil C and ensure a sustainable agriculture.

Biochar as Soil Amendment: a Comparison Between Plant Materials for Biochar Production from Three Regions in Kenya

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Keywords: Biochar; Kenya; soil fertility; pyrolysis; pot trial; interviews; soil amendment

Soil quality reduction due to erosion and nutrient depletion due to limited addition and maintenance of nutrients is a common problem in sub Saharan Africa. One feasible measure to increase soil fertility is addition of biochar, charcoal produced during pyrolysis.
This Minor Field Study is a BSc thesis based on studies of biochar as soil amendment in Kenya. The project had three main objectives. The first aim was to, through visits, describe smallholder farming systems in three areas in Western, Central and Eastern Kenya. The second aim was to measure whether biochar application to soil can increase crop yields and if so, if there are any differences between biochar originating from different feedstock organic materials. The third aim was to return to the involved farmers and discuss and present the results.
The farming systems were similar in all three areas, though some differences were found, e.g. dominating types of crops. Most of the farmers were interested in using biochar as soil amendment- if it would be proven to have beneficial effects and be economically viable.
The results from analyses showed that nutrient concentration correlated with the yield from pot trials where three treatments stood out: biochar from cassava stems, coffee leaves and fresh banana leaves. Biochar from these materials in general had the highest nutrient concentration as well as pot trial crop yield, indicating a fertilizer effect. Plant materials with different properties may be important for plant growth, but biochar rate seems to be a more significant factor, confirmed by the statistical test.
The great need of improvement in soil fertility and the farmers' interest towards biochar indicate that this approach might be possible to use in the future. However, more research on the subject is necessary if it is going to be implemented in the field.

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Euroleague for Life Sciences

Can Agriculture Feed the World?

3. Ecology and Ethics

Session 3.5: Environmental Pollution

Room C 222

The Influence of Air Pollution on Soil Mineral Weathering-Soil Acidity

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CCE (Coordination Centre for Effects) stated that the knowledge about the interrelation between air pollution, climate change and biodiversity has already progressed. They emphasized that also atmospheric pollution in general, and nitrogen deposition in particular causes adverse effects to biodiversity. According to some researches (Van Breemen et al., 1983; Van Breemen et al., 1984; De vries and Breeuwsma, 1986; De vries and Breeuwsma, 1987), the high input of sulphur and nitrogen leads to soil acidification in forests. The elevated input of nitrogen may have various other negative effects on natural ecosystems (Bobbink et al., 2002; De Vries et al., 2007a; De Vries et al., 2009).

In Austria, the knowledge of nitrogen effects in forest is very scarce, but the studies carried out by Zechmeister et al. (2009), Environmental Agency of Austria (2007), Hüber et al. (2008), Dirnböck et al. (2009) Dirnböck & Mirtl (2009), and Diwold et al (2010) obtained some conclusions: Chronic nitrogen deposition has already affected soils, forest ground vegetation, epiphytic lichens and mosses.

In this study, several types of soils from different years (1994 and 2004) were investigated from ICP[1] forest level plots in limestone Alps of Austria (National park-Kalkalpen). Total soil mineral analyses as well as clay mineral analysis were conducted to evaluate soil weathering processes related to air pollution effect.

[1] International Cooperative Program

Factors Controlling the Temporal Variability of Mercury in Runoff from Seven Catchments in Northern and Southern Sweden

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Keywords: Mercury; temperature; flow, forestry; TOC

The increased input of anthropogenic mercury in the environment has lead to the accumulation of mercury (Hg) in the aquatic food chain and poses serious problems to ecosystem and human health. Forest management might cause increased mercury mobilization from the terrestrial to the aquatic ecosystem. However, studies about the impact of forest management on mercury mobilization reported large differences in the sensitivity of study sites. In order to determine the factors that influence the spatial and temporal behavior of mercury, a closer assessment of the climatic impact is needed. In this study three catchments in northern (Balsjö) and four sites in southern (Örebro) Sweden with different forest treatments (clear cut, site preparation, stump harvest and reference) were compared regarding the seasonal influence and chemical controls on Hg dynamics. The annual mean runoff and mean temperature was significantly higher at the Örebro sites (Wilcoxon-test, $p<0.05$). MeHg concentrations were about three times higher at the sites in Örebro. Partial least square (PLS) analysis and the application of the Riparian Profile Flow-Concentration Integration Model (RIM) indicated that temperature had a higher influence on Hg dynamics in the south, whereas flow seemed to be more important in the north. Also, the THg-TOC relationship was very strong at both sites, indicating that organic carbon plays a major role in Hg mobilization, transformation and transportation and was able to explain up to 85 % of the THg variation.

Potentially Toxic Elements in Slag Originating from Silver Smelting

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One of the anthropogenic sources of hazardous materials is slag - the waste left after ore processing. Slag particle interactions with the environment may lead to the release and transport of toxic elements into the environment. The experimental part of this work was aimed to clarify the behaviour and the distribution of risk elements in soils affected by slag deposit. Studied slag heap is located in the vicinity of Kutná Hora near the river Vrchlice. In total, 25 samples were collected from 9 soil sampling sites covering the study area. These sampling sites were divided into two groups: Sites located directly on the heap and sites from around the heap. For the collected samples basic soil characteristics and contents of selected risk elements (Cu, Pb, Zn, Ag and Cd) were determined. The structure and mineralogical composition of selected soil samples were examined by means of scanning electron microscopy and X-ray powder diffraction.

The amount of risk elements in soil depends on the distance from the slag heap main body. The amount of risk elements also depends on the depth of the soil profile, mainly in a case of slag heap. Scanning electron microscopy revealed significant heterogeneity of the material collected from the body of the slag heap and high variability of the composition of different slag grains. The main determined minerals are fayalite (Fe_2SiO_4) and wurtzite (ZnS). The rate of leaching of risk elements from the slag will be investigated in the consequent study.

Scientific Student Conference 2011
Euroleague for Life Sciences

Can Agriculture Feed the World?

Poster Session A. Innovation and Technology

Ground floor Forum building

Algal Growth in Horizontal Tubular Reactors

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Keywords: microalgae; tubular reactor; modeling

Micro-algae are sunlight-driven cell factories that convert carbon dioxide and water into biomass, which contains lipids, proteins and carbohydrates. With this potential microalgae have become an emerging source for the production of food products, biodiesel and biochemicals. Many decision variables are involved in designing and evaluating different algae production systems. For a tubular system i.e. species, latitude, tube diameter, biomass concentration, length of the tubes and the distance between the tubes. To predict yearly biomass production, a model is made to study the effect of these parameters. This model uses reactor characteristics, dynamic sunlight and algae species as inputs. Shading, reflection from the ground and surface, light penetration between tubes and penetration of direct and diffuse light in the algae culture are taken into account. Each tube diameter has a specific optimal biomass concentration for which yearly production is optimal under given conditions. Maximal tube length is limited by oxygen accumulation. When the influence of CO2 and O2 are known, this could also be integrated in the model and maximal tube length can be determined. For large scale cultivation multiple tubes are placed parallel to each other and the production per hectare per year could be estimated.

Effects of Elevated Soil Temperature on Nutrient Availability and Uptake by Oilseed Rape (*Brassica napus L.*)

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Keywords: climate change, elevated soil temperature, plant nutrition, nutrient availability

Understanding the effects of climate change on European agriculture is critical for future adaptations and system adjustments. This master thesis analyzes effects of elevated temperature on the availability of plant nutrients in soil and their uptake by plants. The experimental site is the Hohenheim Climate Change (HoCC) experiment, established in summer 2008, which simulates climate change in terms of elevated soil temperature. Soil temperature is increased by 2.5 °C throughout the top 4 cm using heating cables placed on the soil surface. A data logger, controlling the electricity supply to the heating system, is connected to temperature probes at 4 cm depth. Winter oilseed rape (*Brassica napus L.*) was sown in autumn 2010 on eight 1 m² experimental plots; four elevated and four ambient temperature plots. The following analyses are being done on samples taken approximately every three weeks during the vegetation period 2011. Soil analyses include CNS-elemental analysis, CAL for P and K, Nmin, CFE, arylsulfatase, and acidic and alkaline phosphatase. The analyses of plants include biomass, CNS-elemental analysis, and total P and K. At each sampling date two plants and two soil samples (0-15 cm depth) are taken from each plot.
Plants are divided into root, stem, and leaf fractions, and, for the final harvest, pods. Every week five plants per plot are rated for phenological development stage (BBCH-code) and senescence behaviour (SPAD-measurements). Early results from the plant rating show accelerated plant development in the elevated temperature plots. Final results will be presented in October 2011.

Detection of Lactic Acid Bacteria in Wine Using Culture-Independent Methods

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Keywords: Lactic Acid Bacteria, Wine, PCR, DGGE

Winemaking is a complex microbial process in which primarily yeasts but also lactic acid bacteria play pivotal roles. Hence, lactic acid bacteria are of dual importance: On the one hand they are the main effectors of malolactic acid fermentation, but on the other hand they can cause wine spoilage.
Thus, the objective of this master thesis was to investigate the diversity of lactic acid bacteria involved in wine making using culture-independent, molecular-biological tools. The main reason for the use of culture-independent techniques to study the genetic diversity of a microbial community is the fact that microorganisms and interactions were detected, not found by traditional, cultured-dependend, microbiological methods until now. Denaturing gradient gel electrophoresis (DGGE) is the most commonly used cultureindependent fingerprinting technique for the analysis of microbial communities. This technique is used to separate a mixture of PCR products, amplified from DNA extracted from samples, yielding patterns that visualise the genetic diversity of the investigated microbial community. Therefore five different primer-systems were initially reviewed and compared to each other. The best method was subsequently chosen for the following analysis of several wine samples.
Based on the obtained results, it can be concluded that DGGE is an effective and comparatively low-cost procedure to analyse and monitor lactic acid bacteria in wine. Furthermore, this method is characterised by its rapidity and reliability. The technique is of avail to get a common idea about the microbial diversity of different wine samples. Nevertheless, further improvements concerning the identification of isolates using PCR and sequencing are needed to analyse the microbiota of wine at strain level.

Economic Dimension of the Milk Consumption (the Links between the Health and Costs in the Case of Milk to School Program)

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It is generally known and regarded as a fact, that the consumption of milk is good for our health. Milk is one of the nutrition components of the majority of all the people on earth every day, because it contains many proteins, calcium and other substances required by our body. There are many various kinds of programmes that support the milk consumption even more, e.g. 'Milk to Schools' in the Czech Republic. However, "some scientific studies have found that contrary to popular belief, drinking milk may do more harm to our bodies than good". The effects of milk consumption can trench even illnesses like cancer or heart disorders. The question is, if the subsidized 'Milk to Schools' program leads to desired health benefits and at what costs. In order to understand rationale behind this subsidy program, the dairy market is analyzed accounting for both positive and negative health externalities of milk consumption.

Genome Wide Detection of Epistasis in *Arabidopsis thaliana* Is Regarding Genes as Team-Players the Next Level of Marker Assisted Selection?

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Keywords: association mapping, epistasis, Arabidopsis, flowering time, plant breeding

Plant breeding has to large extent led to proceedings in agricultural productivity, contributing an estimated yield increase of more than 50% in the past 50 years. Future agricultural requirements, especially in developing countries, however will imply to produce stably and high yielding varieties under increasingly severe conditions of climatic change and reduced nutrient availability. To meet these demands, more sophisticated methods for the exploitation of genetic resources by means of quantitative genetics will be necessary. A large part of genetic variance is
the the result of an interacting network of genes (epistasis). The resulting vast number of theoretically possible gene-interactions however made this variance hard to utilize for traditional plant-breeding approaches due to methodological and technological limitations. *Arabidopsis thaliana* is the most commonly used model organism in plant science, often preceding crops in terms of technological applications and basic understanding. This fact enabled us to implement and test at the same time a potential future association mapping approach for additive and epistatic quantitative trait loci (QTL), using flowering time (FT) data from a diverse set of 200 *A. thaliana* ecotypes, grown in a controlled greenhouse experiment, since extensive knowledge about FT in *A. thaliana* is available. This includes knowledge about the underlying physiological pathway as well as about two involved epistatic genes, *FLC* and *FRIGIDA*. Furthermore, state of the art genotyping technology could be used and database and co-expression network information was available for candidate gene pairs choice to narrow down the vast number of possible pairwise gene-by-gene interactions to a feasible number. If our method succeeds to detect epistatic QTL and as genotyping and computational technologies evolve rapidly, this method could be applied soon in future plant-breeding programs and therefore could help to more efficiently exploit yet unused potential within current crop genetic resources.

Incorporation of O/W Emulsions in Liposomes Incorporated in a Pectin Gel

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Keywords: Liposomes, Gelation, Stabilization, CLSM, Rheology

Insufficient kinetic stability is a key problem that prevents widespread use of liposomes containing functional ingredients. The aim of our study was to incorporate an O/W-emulsion as functional ingredient in liposomes and stabilize the liposomes by incorporating them in a pectin gel.

Emulsions (10% rape seed oil, 1% whey protein, 10mM NaCl) were homogenized in a microfluidizer at 25.000psi with mean droplet diameters of ~230nm. A low-methoxylated pectin solution (citrus pectin, 1%) was prepared by dispersing the pectin in water. Liposomes were prepared by the solvent evaporation method, where 0.2g soybean lecithin was diluted in 10mL ethylacetate in a circular flask and evaporated in a rotary evaporator. A mixture of emulsion and pectin solution (1:1) was incorporated in the liposomes by adding it to the flask containing adsorbed lecithin monolayers. Samples were examined by confocal laser scanning microscopy (CLSM) after staining with rhodamine B (green, whey protein isolate stain) and V03-01136 (yellow fat and phospholipid stain).

Structural analysis of CLSM images revealed that emulsion droplets (green) were not completely incorporated in the liposomes (orange area), and instead were either attached to the surface of liposomes or had formed aggregated flocs that were dispersed in the liposomal external phase (see Fig. **1**) suggesting that the pectin had caused depletion and/or bridging flocculation. Subsequently CaCl2 was added to the system to induce gelation of the outer phase to prevent liposomes from merging into larger ones. The gelled liposomal system was examined using an oscillatory heometer. After addition of calcium, elastic and loss moduli increased indicating formation of a pectin network. Microscopy images suggested that liposomes stayed intact after gelation and were part of the pectin gel network. Results of our study suggested that incorporation of liposomes containing a functional ingredient in the form of O/W emulsions is feasible that may improve stability.

Hansenula anomala versus *Meyerozyma guilliermondii* in Inhibition of *Enterobacteriaceae* and Evaluation of Maize Storages in Cameroon

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Keywords: *Hansenula anomala*, *Meyerozyma guilliermondii, Enterobacteriaceae*, biocontrol storage, Cameroon

In sub-Saharan Africa post-harvest losses constitute a major problem. In order to preserve food and feed in a safe and sustainable way new methods needs to be investigated and introduced. One system to store grain in a secure and energy saving way is by using a biocontrol organism. The yeast strain *Hansenula anomala* J121 is known to inhibit growth of moulds and bacteria from the *Enterobacteriaceae* family in stored cereal grain and is therefore regarded as a biocontrol organism.

In this study *H. anomalas* inhibitory effect on two *Enterobacteriaceae* species was compared with *Meyerozyma guilliermondii*, a yeast found in Cameroon. Different combined inoculations with yeast and *Enterobacteriaceae* were made. The maize was then put in test tubes with lids penetrated by a syringe to simulate air leakage and incubated in 25°C in the dark for 5 ½ weeks.

No comparison could be made between the yeasts due to increases in log colony forming units (CFU)/g maize of *Enterobacteriaceae* in all inoculations.

The study also explored the possibility of introducing a new storage system in Cameroon. Seventeen farmers in two regions were interviewed about their current problems during storage of maize and their openness to try a new storage system using a biocontrol organism. The most common way of preserving maize was drying with smoke. The biggest problems in both areas were insects followed by lack of firewood. All but one farmer was open to try a new storage system.

Samples were also taken from ten farmers maize storages and analyzed for the presence of *Enterobacteriaceae*, yeasts, moulds and total number of aerobic bacteria. All storages were contaminated with moulds (3.09-6.99 log CFU/g maize) and yeasts (2.96-8.38 log CFU/g maize). Plates with aerobic bacteria were smeared and most plates with substrate selective for *Enterobacteriaceae* had odd dilutions due to contamination.

Activated Water and Its Effects on Sensory and Textural Properties of Cucumbers and Tomatoes

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Keywords: Ellmauer, cucumber, tomatoes, sensory

Aim of this work was to test if a special water treatment has effects on important attributes of tomatoes and cucumbers, which were watered with it. Therefore we used one variety of cucumbers and one of tomatoes which were split up to be treated in two separate growing processes. The plants were grown under the same conditions in separate greenhouses 100 meters apart. Process 1 was a normal growing process with normal untreated water of the same well as the treated water. Process 2 was identical to process 1 except the use of water activated by the method of Dr. Ellmauer.

There were two harvestings per vegetable from both processes. All vegetables were measured and weighed on the day of harvesting and on each day of analysis. The days of analysis and measurements and proper storing were harvesting, +2, +4, +6, +10 days. We performed sensory tests and physical measurements. Directional paired comparison tests should show if there are significant differences between the treated and the non treated vegetables. Textural measurements (cutting, cracking, compression and penetration tests) using the Texture Analyser TA XT (Stable Micro Systems) were combined with an acoustic analyser. Color measurements were done with a Dr. Lange Microcolor analyser.

We found significant differences in a few attributes between treated and non treated cucumbers/tomatoes. However those differences appeared to be very little and cannot be taken as relevant differences. Therefore we could not verify the hypothesis that the Ellmauer treated water improves any of the investigated attributes.

Vitamin E and Carotenoids in Different Varieties of Wheat

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The wheat is an important food crop which provides not only high amount of proteins but also colour pigments (carotenoids) and vitamin E. They are known because of their antioxidant effects which protects the cells of human bodies against the influence of free radicals. The most represented carotenoids in the wheat are licopene, zeaxanthin and β - Carotene. Out of 8 various forms of vitamin E, the most represented in the wheat are: β- tocotrienol, α-tocopherol a α- tocotrienol. The investigated items of the analysis were determined through the method of high performance liquid chromatography (HPLC) in 5 various types of *Triticum monococcum* L., 5 various types of *Triticum dicoccon* Schrank and for the comparison also in 5 various types of *Triticum aestivum*. The statistically significant differences in the contents of the analyzed items of some of the investigated varieties were found. It is valid especially for the content of lycopene in *Triticum monococcum* L which was in average 5 times higher than in *Triticum aestivum* and 7.8 times higher than in *Triticum dicoccon* Schrank.

Baculoviruses: Progressions in the Development of a Natural Enemy in Insect Pest Control

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Key words: Baculovirus, biopesticide, BBMV, PIF-complex, membrane fusion-assay

The family *Baculoviridae* contains insect viruses that are being used as biopesticides in crop production. One commercial example is the baculovirus *Spodoptera exigua* multicapsid nucleopolyhedrovirus (SeMNPV), which is being used against beet armyworm in greenhouse culture. Insect host larvae ingest viral occlusion bodies (OBs) by feeding on contaminated leaves or cadavers. In the alkaline insect midgut the OBs dissolve, thereby releasing occlusion derived viruses (ODVs). The ODVs subsequently bind to and fuse with midgut epithelial cells and initiate virus infection. This finally leads to insect liquefying and new OB spreading.
To use baculoviruses as biopesticides it is important to understand the determinants of host specificity and infectivity. Binding and fusion of ODV envelope proteins to midgut epithelial cells plays a large role in these, but how this works is still enigmatic. Recently a complex of ODV proteins crucial for oral infectivity (*per os* infectivity factors, PIFs) was discovered that is involved in binding.
In this thesis project an easy and quantifiable binding- and fusion-assay is being developed to study the processes of binding and fusion. The assay is based on fluorescent labelling of ODV membranes with a self-quenching dye. Self-quenching means that only when viral and cellular membranes fuse the dye is diluted enough to allow fluorescence. The ODVs are mixed with vesicles derived from microvilli of host midgut cells, so-called Brush Border Membrane Vesicles (BBMV's) and fluorescence is measured. With this assay, mutant (knock-out) baculovirus ODVs will be tested to identify the proteins required for this process. This will improve our understanding for the development of baculovirus products for insect pest control.

Safety of Artificial Sweeteners, particularly Neotame, and Sensory Evaluation in Cola and Orange Soft-Drinks

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Keywords: Neotame, Sweeteners, Soft drink, Sensory evaluation, Flavor, Consumer acceptance

Because of highly complex sweetener-matrix interactions in beverage systems no general answer to the question: "How much sweetener can be substituted by neotame?" can be given. Individual sweetener system optimization is required to achieve desired results in analytical discrimination tests and hedonic consumer tests. The aim of this work was twofold. The first part was to determine the percentage of commonly used sweeteners in cola and orange carbonated soft-drinks that could be substituted with neotame without any significant change in taste. Twenty seven formulations with different sweetener combinations and substitution levels were developed and evaluated in triangle tests. In the second part several formulations were evaluated in hedonic consumer acceptance tests.

Up to 50% of the sweeteners can be substituted with neotame without any significant or relevant change in taste. The subsequent consumer tests of eight elected formulations measured the hedonic liking and showed some statistically significant differences.

The Evaluate of Suitability of Capacitance Throughput Sensor for Sugar Beet Throughput Measurement

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Keywords: capacitance throughput sensor, sugar beet, throughput

The yield mapping is an important component of the precision agriculture. The main aim of this paper is to evaluate the suitability of capacitance throughput sensor for sugar beet throughput measurement. Two testing stands were designed and built for that aim, one for static laboratory measurements and second one for dynamic laboratory measurements.
Two measurements were made in total, one on static laboratory equipment and one on dynamic laboratory equipment. The first measurement task was to examine the stability and sensitivity of measuring circuit. The task for the second measurement was to check the sensor on the conveyor. Both measurements showed a good linear relationship between mass flow and output voltage, with coefficients of determination 0.99.

Interaction Between *Bacillus thuringiensis* and *Nosema lymantriae* in their Host *Lymantria dispar*

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Keywords: biological control, insect pathogens, *Bacillus thuringiensis, Lymantria dispar, Nosema lymantriae*

There is increasing interest in replacing conventional pesticides by biological pest control in both agriculture and forestry. Microbial pest control using naturally occurring pathogens is one important option. In my master thesis, I am studying the interaction between two specific pathogens in their host insect, the gypsy moth larva. The gypsy moth, *Lymantria dispar,* is an important forest defoliating species; oaks are its mainhost plants in central Europe. Outbreaks leading to defoliation occur regularly, particularly in warmer regions. *L. dispar* is a host for various parasitoids and pathogens, such as braconids, tachinids, viruses, bacteria, and microsporidia. Microsporidia are unicellular, obligate and intracellular parasites. The transmission occurs horizontally and vertically and they are potential candidates for classical biological pest control. *Bacillus thuringiensis* var *kurstaki* (B.t.) is a spore forming, endotoxin producing bacterium. The crystal endotoxin causes gut damage in lepidopteran larvae and can lead to fast mortality. B.t. is widely used as bio-pesticide against various lepidopteran pests including *L. dispar*.
The aim of the work is to find out, if a simultaneous infection of B.t. and micorsporida (*Nosema lymantriae*) influences the development of *L.dispar* as well as the reproduction of *N. lymantriae* is affected in its host. Therefore, I have been carrying out laboratory bioassays. *L. dispar* larvae in different instars are infected with different dosages of B.t. and *N. lymantriae* alone or in combination. After infection following parameters are recorded: development, weight increase, mortality of larvae as well as the number of *N. lymantriae* spores to find out if combined treatment leads to faster mortality and which consequences exist for the reproduction of *N. lymantriae*. The latter is important for the success of transmission of the pathogen in the host population. Currently, my final experiment is close to finish and data analysis is in progress.

Ethnobotany of Medical Plants of Northern Ethiopia, Mekele, Tigray Region

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The research evaluated the ethnobotanical knowledge of medicinal plants in two areas near Mekele city, northern Ethiopia using semi-structured questionnaires. The ethnobotanical survey showed that medicinal plants are widely used among indigenous people. In scope of presented study, 58 plants belonging to 27 families and 44 genera were recorded to be used by local people as remedies. More medicinal plants could have been documented if the study continued for longer period covering wider areas as plants used in local medicine for treatment are mostly found in nearest surrounding of the farms.
Fabaceae (9 species) and *Solanaceae* (6 species) were the most frequent families used as remedies. Most commonly used plants were *Achyranthes aspera, Heliotropium steudneri, Solanum incanum, Withania somnifera, Carissa edulis and Maytenus arbutifolia*. Mostly used plant parts were roots (65%) and leaves (38%). The surveyed plants were recorded to heal or alleviate a wide range of illnesses and pains, while the most plant species were used to cure stomach problems (22%), sprain of joint (20%) and bronchitis (12%). Literature review showed that some curative plants of Mekele region are used in different parts of the world in treatment of similar or different diseases. From research is obvious that the research was meaningful and that medicinal plants might have use in pharmacological industry. It is believed that further studies may contribute to research on both indigenous ethnobotanical knowledge and the sourcing of raw materials for the development of commercial pharmaceuticals. The project was supported by grant of ITS CULS Prague and Internal Grant Agency of ITS, ITS CULS Prague (51110/1312/51/3105 and 51110/1312/3111).

Proteolysis of Lactoferrin *in vitro* and *in vivo*, with Focus on Release of the Biologically Active Peptide Lactoferricin

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Keywords: lactoferrin, lactoferricin, peptide, antimicrobial, infant

The glycoprotein lactoferrin (LF) is a main antimicrobial and immune-stimulating component of colostrum and milk. The biological active peptide lactoferricin (LFcin) is released from LF through proteolysis by pepsin under acidic conditions. This happens naturally in the stomach of human adults, but little is known about the reaction in infants. This was studies through *in vitro* and *in vivo* experiments with piglets used as an animal model for human infants. In the *in vitro* experiments LFcin was released from LF at conditions corresponding to those found in the stomach of human adults. No LFcin was released at conditions corresponding to human infants. LFcin was released at low pH (2.0) at both low and high pepsin concentrations (53-1068 PU/100 mg protein). The release of LFcin decreased with increasing pH. *In vivo* experiments showed no release of LFcin from LF in piglets. The animal model was found to be feasible as the pig enzyme chymosin, which is not present in human infants, did not release LFcin. Furthermore gastric juice from an adult pig released LFcin, which is also observed in human adults.

LFcin is not released in the stomach of piglets and consequently might not be released in the stomach of human infants. It might still be beneficial to add LF to infant formula, as LF has antimicrobial activity even when it is not degraded.

Influence of Site-specific Management on the Changes of Within-field Soil Variation

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The main idea of precision agriculture is to equalize the quantity of nutrients inside the agricultural fields and achieve higher yields. It is a way how to combine modern technologies with agriculture production. The biggest attention in this presentation is focused on comparison of nutrients contents and distribution in five fields of the company Agropodnik Hradec Králové, a.s. In the year 2007, 62 soil samples were collected from these fields and analysed for pH and contents of available nutrients (Ca, K Mg, P). The same was done in the year 2010, so we have two maps for each nutrient to compare. In most cases there are better and more homogeneous contents of nutrients in 2010 than in 2007. Parts with excessive nutrient supply, as well as parts with insufficient supply, mostly disappeared thanks to site-specific application of fertilizers. Additionally, an attempt was made to find relationship between soil nutrient contents and soil spectral features measured by FieldSpec3 apparatus. It should enable relatively easy prediction of nutrient content. The best prediction was obtained for available K.

A Growth Experiment Evaluating *Moringa stenopetala* Leaves as an Alternative Protein Source for Farm Based Aqua-Feed in a Rural Semi-Intensive Culture System for (*Oreochromis niloticus baringoensis L.*) in the Rift Valley, Kenya

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Keywords: Protein substitution, rural aquaculture, *Moringa stenopetala, Oreochromis niloticus baringoensis,* Lake Baringo, Growth study

The indigenous *Moringa stenopetala* (MS) tree was used as an alternative protein source in a growth experiment using omnivorous–phytoplanktonophagous tilapia *Oreochromis niloticus baringoensis*. The aim was to make an accessible protein for rural subsistence farmers around Lake Baringo, Kenya. It had three objectives of determining a benchmark protein level. Furthermore the experiment was *in situ* to highlight the practical differences between laboratory and field studies. Finally this study also pioneered research using the endemic *O. n. baringoensis*.

Sixteen square concrete tanks in a Latin square desi n with a recirculation system were built and stocked with 20 fingerlings per pond. Four diets were formulated with maize meal, fishmeal and MS with intentional total protein of 31% (dry weight), and with different levels of dry meal MS (0, 20, 30, 40 % DW), with 4 replicates. Diets were tested over an 8 week growth period. Fingerlings were fed at 3% body weight per day, twice daily. Pond oxygen, temperature, pH, conductivity, phosphates and ammonia were tested daily. There was an overall poor growth rate shown by various growth parameters. The 40% MS substitutions was significantly lower than the control. This is attributed to anti-nutrients, low energy contents, poor ingredients quality, 10±1.2 % lower protein content in feed due to sand contamination in the FM, low lipid content, high fibre, insufficient feed ration, poor pond productivity and poor seed stock. Growth rates were not economically viable; however, when removing the limitations, MS becomes an economically viable protein source.

Endogenous feed dynamics were proposed as an avenue for further research. MS was also paralleled to the innovation diffusion theory. In conclusion aquaculture is being implemented in Baringo, where MS is a very viable candidate as a sustainable protein substitute.

Possibilities of Use of the Biological Active Substance in Soya Growing

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Keywords: soya seed, biologically active substance, 24-epibrassinolid, Lexin, Lignohumate B, seed treatment, seedlings

Seed treatment has been for a long time used as one of methods of plant protection from plant disease and animal pest. Seed treatment can be used in the application of biologically active substances, particularly to stimulate the early stages of plant growth. The process of soybean seed treatment by the biologically active substances may be helpful to merge with seed inoculation, which is usually done with soya. Brassinosteroid (24-epibrassinolid), Lignogumate B (preparation based on humic acids and fulvic acids) and Lexin (mixture of humic acids, fulvic acids and auxins) application is one of the ways, how to achieve a better initial plant growth. This method of seed treatment has been performed under laboratory conditions, where we have monitored: seed emergence, dynamics of emergence, opening of cotyledonous leaves, percentage of plants with genuine leaves, biomass and dry matter formation. Experiment results show, that the best biologically active substance (for initial soya growth) is Lexin and 24-epibrassinolid. This preparations supported most of all seed emergence, cotyledonous and genuine leaves formation and biomass formation. 24-epibrassinolid reached somewhat lower, but very similar results as Lexin. Lignohumate B had the lowest influence nevertheless a positive effect on the initial soya growth, similar influence had also treatment with water, which was used in the experiments as one of the controls. Regarding soya emergence and its early growth phases, chemical treatment of seeds by preparation Lexin can be evaluated as highly economically effective. In the case of 24-epibrassinolid it is not yet available due to its high manufacturing cost, considering the economy, but in the ÚOCHB AV ČR there are a many of years worked out considerably cheaper new synthesis of brassinosteroids, which will be for use in crop production economically feasible.

Power Requirement to Cut of Energy Plants for Biogas

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The aim of this study was the experimental designation of power needed to cut of energy plants by forage harvester equipped with flywheel chopping unit. The plants of: switchgrass (*Panicum virgatum*), big bluestem (*Andropogon gerardi*), giant miscanthus (*Miscanthus sinensis gigantean*), polygonaceous (*Polygonum sachalinense*), spartina (*Spartina pectinata*), Virginia mallow (*Sida hermaphrodita*) and topinambour (*Helianthus tuberosus*) were taken as research material. These plants are cultivated on the plots of Experimental Station in Skierniewice belonging to Faculty of Agriculture and Biology of Warsaw University of Life Sciences. The biometric characteristics of plants were taken and plant material moisture content was determined by dryer-weight method. Plants were shredded on the test stand, equipped with trailed forage harvester connected with Ursus 1234 tractor with an engine power of 85 kW. The chopping unit of the forage harvester was equipped with 10 knives and straight thrower blades with a sharp tool rake and also with a smooth-surface bottom plate. The cutting disc rotational speed amounted to 1000 rpm. The set working parameters allowed for cutting frequency 167 Hz and theoretical length of chopped plant material particles 4.4 mm. Working parts of the machine were equipped with transducers to measure of torque and rotational speed, and those that were powered by hydraulic motors – were equipped in pressure and flow transmitters of hydraulic oil. Power needed for cutting of plants material in chopping unit was calculated from the difference of power measured at PTO of tractor, and power measured on draw - thickeners rollers, determined measurement errors, which values not exceed 1%.The results was presented in the form of changes in the dynamics of the torque and rotational speed depending on the mass flow rate of plants, which wasmonitored continuously using an electronic weight. The statistical analysis on the obtained results was performed and the average power values with standard deviations for the species of energy crops was showed graphically. In order to compare test results for plants with different moisture content the specific cutting energy which was related to dry plant material was determined.

Antioxidant Activity of Herbs from Organic and Conventional Farming

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Medicinal and aromatic plants contain a number of nutritionally valuable substances with antioxidant effect, which content also depends on the method of cultivation. The antioxidant activity of selected plants of the *Lamiaceae* family from organic and conventional farming was compared. Antioxidant activity was evaluated using the DPPH method, the Schaal test and by the content of total phenolic compounds determined spectrophotometrically.

Determination of Lysozyme in Breast Milk

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Keywords: Lysozyme, Human milk, Lysis method, ELISA

Lysozyme is an antimicrobial enzyme that is active mainly against Gram-positive bacteria. Lysozyme is found in many body fluids, including breast milk providing a range of health benefits to infants including a favourable effect on the intestinal microflora.
The aim of this study was to determine the concentration of lysozyme in breast milk. Lyso-plate and Elisa methods were used. Lyso-plate method was tested 60 samples with an average concentration of lysozyme 26.73 μg.ml-1. ELISA method was tested 35 samples with an average concentration of lysozyme 66.14 μg.ml-1. The methods are statistically significantly different. The average concentration of lysozyme was measured by ELISA probably be higher because of the nature of the test, since the ELISA method detects all human lysozyme present, while Lyso-plate method is able to determine only antibacterially active lysozyme.

Changes of Fat in Fish According to Intravital Effects

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Freshwater fish meat (carp and rainbow trout) composition and quality changes were monitored during the year. The carcass yield, the pH values and the basic component analysis (water, fat and protein content) were determined. Fatty acids profile of both species of fish was evaluated by means of GC/FID method. The content of SFA, MUFA, PUFA as well as the ratio of (n-6):(n-3) fatty acids were calculated.

The Effect of Bacaba Phenolic Extract (*Bacaba Oenocarpus*) on the Differentiation of 3T3-L1 Preadipocytes into Adipocytes

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Keywords: Antiadipogenic effect, 3T3-L1 cell line, Bacaba (*Bacaba Oenocarpus)*

Obesity is a growing problem all over the world and therapies are not yet so much successful. High consumption of fruits, berries and vegetables has always been associated with health benefits such as body weight maintenance and lower risk for developing cardiovascular diseases, cancer and diabetes. Bioactive compounds, such as phenolics, having the potential either for inhibiting adipogenesis or stimulating lipolysis in adipocytes could be an effective prevention or therapy without side effects against obesity. Bacaba (*Bacaba Oenocarpus)* is a native fruit from the Brazilian Amazon, rich in phenolic compounds. Indeed, it has a relevant role to local communities regarding income generation, being also an important component in their food patterns.
In this study, the antiadipogenic effect of the phenolic extract of Bacaba on the murine 3T3-L1cell line was investigated. The antiadipogenic effect was evaluated by the Oil Red O staining assay after differentiating preadipocytes to mature adipocytes over ten days in absence or presence of bacaba extracts (0 – 1500 µg/mL). MTT assay was applied to assess cytotoxicity and cell proliferation. Oil Red O staining assay showed a significant effect of Bacaba extract (from 1000 µg/mL) on the differentiation process of 3T3-L1 pre-adipocytes to adipocytes ($p<0.05$). Bacaba had no effect on pre-adipocytes proliferation after 96 h with the extracts and no cytotoxic effects were observed when either preadipocytes or adipocytes were incubated with Bacaba phenolic extracts for 24 h.
Results suggest that bacaba phenolics possess biofunctional activity and reinforce follow up studies to unfold the biochemical process involved in the antiadipogenic activity. The results could be a great improvement in the prevention or therapy for obesity and its associated diseases. Besides, studies on native fruits from threaten regions can help to biodiversity preservation and rain forest regions, like the Brazilian Amazon.

Comparison of Milk from Goats Fed with Algae

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Samples of milk from goats fed with algae at a dose of 5 and 10 g per day were compared with the control group. After extraction and alkaline hydrolysis of milk fat, fatty acids profile by GC / FID was monitored.

Culture-Dependent Techniques for the Analysis of Lactic Acid Bacteria Associated with Viennese Wine

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Keywords: Wine, Lactic Acid Bacteria, Culture-Dependent Methods, PCR Based Identification Techniques, Malolactic Fermentation

Lactic acid bacteria have an important role in many fermentation processes in the food and feed area. During the process of wine-making, indigenous or added lactic acid bacteria convert malic acid into lactic acid. In the frame of this malolactic fermentation the total acidity is reduced, thereby enhancing the complexity and flavour of wine. The aim of this work was to describe the development of the malolactic fermentation in Viennese wines by cultural microbiological techniques. Therefore several wines from two different wineries were monitored during the whole process of vinification. The samples were taken continuously and analysed using different media, which are mainly specific for lactic acid bacteria. After counting the colonies grown on these two media, colonies with different morphologies were picked up for further molecular identification. Different PCR-based methods were evaluated for this purpose. Malolactic fermentation was evident in all red wines, while this metabolic activity could not be found in white wines, except with "Chardonnay". Concerning this cultivar, malolactic fermentation is of importance as it creates the "butter-ness" that is a typical attribute. Furthermore parameters like pH-value or the starter-culture applied have an impact on the process of malolactic fermentation. For the identification of various bacterial isolates from wine different PCR-based techniques could be successfully adapted. Although culture-dependent techniques are labour-intensive and require experience, the results obtained are reproducible and allow quantitative conclusions. Thus, they still constitute effective tools for verifying the process of malolactic fermentation in wine.

Mechanisms of Induced Resistance against the Fungus *Bipolaris oryzae* in Rice after Seed Treatment with an Extract of *Cymbopogon citratus*

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Keywords: *Bipolaris oryzae, Cymbopogon citratus*, lemon grass, induced resistance, rice

Brown spot, caused by *Bipolaris oryzae* Shoemaker (teleomorph *Cochliobolus miyabeanus*), is a major disease of rice. The disease may be controlled by seed treatments with fungicides, but these are harmful to the environment. Therefore, alternative control measures are sought, e.g., seed treatment with plant extracts. The application of a plant extract for disease control represents a potentially sustainable and broad spectrum strategy, which can possibly be implemented in integrated pest management programmes. Preliminary results have shown that treatment of rice seeds with an extract of lemon grass (*Cymbopogon citratus*) is able to control brown spot occurring on the leaves. The working hypothesis is that induced resistance is the principal mechanism responsible for suppressing the fungus and at the same time stimulate growth of the rice plants. Induced resistance describes the phenomenon that the inherent defences of a plant can be stimulated in terms of earlier recognition or enhanced defence reactions. This means that the plant can defend itself
successfully against pathogen attack after inducer application. In order to verify whether induced resistance is involved in the protection against disease, light and scanning electron microscopy will be used to study the infection biology to show when infection is arrested. Since induced resistance involves activation of defence responses, a range of defence reactions will be studied, focussing on accumulation of H_2O_2 and deposition of callose, which can be detected by means of specific staining followed by light microscopy. Furthermore, the accumulation of PR-proteins (β-1,3-glucanase, chitinase) will be studied by activity assays. In order to further substantiate the biochemical investigations, quantitative real-time PCR will be used to study expression of defence-related genes.

Explain Overyielding of Wheat-Maize Intercropping by Modelling

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With a population of 1.4 billion people and only 0.1 ha per capita land, China is always under a big pressure of food production. Food demand, however, is expected to increase sharply in the next decades because of increasing population and changing diet. Moreover, agricultural systems in China are usually criticized for high input levels of nitrogen(N) and phosphorous(P), and also for contributing severely to environmental problems. Intercropping, defined as a multiple cropping system with two or more crops grown simultaneously in alternate rows in the same area, offers alternatives for a more sustainable agriculture with reduced input and stabilized yield. Studies showed increased yield of maize and wheat intercropped with legumes: chickpea facilitates P uptake by associated wheat, and faba-bean increases its N uptake when intercropped with maize. While intercropping is widespread, the exact underlying crop physiological mechanisms that make intercropping advantageous may vary widely from one place to another, and in many cases they are quantitatively not well understood.
Intercropping of wheat and maize is widespread in northwest China. This system is more productive than single crops. The yield advantage is around 30%. It is hypothesized that enhanced radiation capture is the key mechanism for this intercrop overyielding. In part, this enhancement is related to the relay aspect of the system: wheat is sown before maize, and maize keeps growing after wheat is harvested. Thus, over the entire year, the intercrop system can capture more light. However, this temporal niche differentiation may not be sufficient to account for the productivity advantage in intercrops. A further mechanism that may play a role is adaptive response of plants to the available space and resources. These adaptations determine the share of the light captured by the components in an intercrop system. We adopt a functional-structural plant modelling approach to quantitatively characterize these plant responses and to design crop systems that maximize light interception and yield.

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Poster Session B. Economy and Society

Ground floor Forum building

Agroforestry Experiences in the Semi-Arid Zone of Brazil: Quality of Life, Food Security and Nature Conservation

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Keywords: Agroforestry, food security, biodiversity conservation, small farming, quality of Life

The Brazilian semi-arid zone and its *Caatinga* is one of the most depredated and least protected area of the country. Despite the difficult geoclimatic characteristics (e.g. limited and irregular rainfall regime, high evaporation rate, crystalline sub-soil), the region is densely populated (12 millions of inhabitants) and rely considerably on farming activities. Besides, decades of socioeconomic inequalities, environmental degradation and inadequate policies have left a great part of the population in precarious and vulnerable socioeconomic situations. This study aims to analyze the different benefits provided by *sucessional agroforestry systems* – model based on the observation of the local ecosystem and imitation of the natural succession processes - in small family farms of the region. We studied the effects on the food and economic security of these families and on the conservation of the *Caatinga*, and also tried to capture the farmers' perceptions of their quality of life. From April to July 2009, semi-structured interviews with six families of farmers were conducted in Bahia, Pernambuco and Ceara. We registered their techniques and made an inventory of the species cultivated. For the analysis of the quality of life of the families, we used the definition of the World Health Organization Quality of Life (WHOQOL), i.e. evaluating the farmers' perceptions of their physical and emotional conditions, their environment and, finally, the quality of their social relations and role in the society. We observed a direct link between this agricultural model and the environmental, food, economic, health and social security of these farmers. An average of 86 species were cultivated in each of the six farms, demonstrating an important agrobiodiversity and a less economically and environmentally vulnerable system. We also observed a positive change in the farmers' perceptions of their role and responsibility in the society (provision of healthy food and preservation of nature).

Consumer Preferences for Soy Food among Students of Warsaw Universities

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The work presents characteristics of soya bean. Particular attention was paid to the soy protein and amino acids that they contain. Due to their high content, soya bean is highly recommended in a vegetarian diet. The legume was also described as a feedstock to the production of soy products like soy milk, tofu, miso, tempeh or soy sauce. According to numerous health benefits of soya beans, the work also presents the impact of this plant on functioning of the human body. Soya bean and it's processed products can be classified as so-called "pro-health" food. Not only the favorable impact was presented, but also the possible negative effect of consuming these foods. Attention was also drawn to the problem of genetic modification of leguminous plants. This work consists of a conduction, an analysis and interpretation of a survey carried out among students of Warsaw universities. The test results show a greater consumer awareness of the students, whom studies are related with food.

Can Agriculture Feed the World by 2050? Organic Agriculture and Society: Ghazvin Province as a Pilot for OA in Iran

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Keywords: Global Farming, FAO, Developing Country, Food production

The world population is expected to reach nine billion people by 2050 and if the current conditions evolve, we can depict the starvation of at least 1.5 billion people due to food shortages[2]. Studies also reveal that workers in the agricultural sector are being declined around the world due to land degradation, water shortages and low market access.

How to expand the food production in a sustainable way?

Imagine a large land area as an agricultural pilot in the rural area of a developing country under FAO's strategic planning, with World Bank financial support and governmental aids in mechanizing its agricultural systems. This results in the development of local industries which can be beneficial to the economy and to the eventual supply of agricultural products to the world markets without any fear over the global competition.
Planning ahead and improving the basic variables include; land, water, and energy, as the first stage, and educational steps towards energy-saving manuals and habits as well as improvements in the distribution process, as the second stage.

Developing sustainable agriculture to feed the world needs global determination, reconstruction the public culture, targeting the world support and reframing the national policy. In this regard, the FAO under support of the World Bank and the aid of potential and regional organizations such as; ASEAN and ECO, will play a role in the projects and academic research centers. The creation of regional pilot farms; in order to attain economic prosperity and further local benefits, would be the main goal, and reliance on organic farming in rural areas of the developing countries is the main focus here. Macro-economic planning and the granting of incentives and support for increased production based on the completion of the global market needs to be done.

"Think globally, plan regionally and act individually".

[2] http://www.ells-ssc2011.wur.nl/UK/

Environmental Regulation and Innovation – the Example of the European Union Pesticide Regulation

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Keywords: environmental regulation, innovation, pesticide, Council Directive 91/414/EEC

The implementation of Council Directive 91/414/EEC concerning the admission of plant protection products to the market has led to a sharp decrease in the number of available plant protection agents on the EU market. This paper retrospectively analyses the innovation effects of Council Directive 91/414/EEC on agriculture and the pesticide industry. Up to now, the production of new plant protection agents could not replace in number those withdrawn due to Council Directive 91/414/EEC. However, as many of the removed agents had not been in use anymore at the time of their withdrawal, the gaps between demand and supply for plant protection agents remained small. The pesticide industry has primarily replaced agents featuring relatively broad application fields (indications) with new ones. Niche products have been neglected for economic reasons. For some indications, a drastic reduction of available agents has led to problems with resistances. Additionally, this paper analyses the potential innovation effects of future EU pesticide legislation, i.e. of regulation (EC) 1107/2009, which replaces Council Directive 91/414/EEC, and those of Directive 2009/128/EC on the sustainable use of pesticides. Predictions on their potential innovation effects vary substantially between different stakeholder groups. Nonetheless, experts expect further barriers to the development of new plant protection agents and an aggravation of the problem concerning resistances when Directive 2009/128/EC enters into force in 2011. These barriers are expected to arise mainly from increasing cost and duration of the agents' development and registration process, and the uncertainty regarding the new regulations. The paper concludes that established theories on the innovation effects of environmental regulation, namely those of Porter, Ashford and Wildavsky, can only partly be applied in the case of the EU pesticide regulations. Furthermore, no clearly positive or negative relationship between these regulations and various forms of innovations in agriculture and pesticide industry can be postulated.

Microbiological Monitoring of Colostrum and Colostrum Serum

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Keywords: Bovine colostrum, colostrum serum, viable count, pathogens, ISO and IDF standards, immunomagnetic separation

During recent years, bovine colostrum became increasingly popular as a valuable food supplement, since it is a powerful source of bioactive proteins. These proteins are claimed toimprove gastrointestinal health, to inhibit the growth of pathogens and to enhance the immunological conditions of the body. The technology of this type of products is challenging, as it excludes any heat treatment in order to maintain the native status of the relevant proteins. Although such products may exert beneficial effects to the human body, it is of course necessary to guarantee their microbiological safety. In this context, the absence of relevant pathogens is of primary importance. In our study, we screened samples of raw colostru m and corresponding serum products for their microflora. Indicator microorganisms such as coliforms and E*nterobacteriaceae* as well as yeast and moulds, total and anaerobic sporeformers were analyzed. In addition, *E.coli*, enterococci, *Salmonella* spp., *Listeria monocytogenes*, *Campylobacter* spp., *Bacillus cereus, Clostridium perfringens* and *Staphylococcus aureus* were monitored using culture methods according to ISO and IDF standards. Complementarily, chromogenic selectiv media as well as API Listeria and API 20E (bioMérieux) were applied to presumptively confirm the detection of *L. monocytogenes* as well as *Salmonella* spp. and *E.coli*, respectively. For the selective enrichment of *L. monocytogenes* and *Salmonella* spp. the immunomagnetic separation technique was used in parallel, followed by PCR typing and/or culture methods.

Total mesophilic counts of raw colostrum samples ranged between 4.0 x 105 and 3.0 x 106 cfu/ml with a mean of 9.6 x 105. It was demonstrated that sample treatment with nano- and ultrafiltration technology led to a pronounced viable count reduction to < 10 cfu in the serum. Results have also shown that processing of colostrum eliminated raw colostrumborne pathogens.

Can Chinese Agriculture Feed Chinese Population? Analysis of Food Security Aspects of One Child Policy

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Keywords: agriculture, population, future development

China has a population of 1.34 billion people, what represents 20% of world population. In 2010, China had approximately 122 million hectares of arable land (Worldwatch Institute) This represents 0.27 hectares per capita. In comparison with rest of the world, it is one-eighth the U.S. level, and one-half Indian level. As Yin Chengjie (2010), a former Chinese vice-minister of agriculture argues only by guaranteeing the availability of enough arable land can the country guarantee its food security. Between 1997 and 200, roughly 755,000 hectares were lost each year due to problems such as urban development, erosion and desertification (Van Kotten, 2002). In this research, impact of "One Child Policy" (OCP) upon food security, agriculture as such as well as rural development is analyzed. Chinese first modern census in 1953 counted population of 583.000.000, this number has more than doubled before 2000 up to 1,252,800,000. In 1979, OCP was announced as a response to rapid population growth. Even though the policy has been successfully implemented, it has brought up the problem of ageing. In 2000 people over 60 represented only 3% of society, in 2008 it was already 13.3% and this number will sharply increase as the number of potential workers, especially from rural area, will shrink. On the other hand, when the policy is removed, population growth may be restarted and food security may be threatened.

An Outlook of World Food Prices and Macroeconomic Indicators in 2020 - A Sensitivity Analysis of Different Baseline Scenarios using GTAP

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Keywords: World Food Prices; Macroeconomic Indicators; Baseline Scenarios; GTAP

1 billion people are suffering hunger in our planet. And recent performance of world food price puts more threatening to those people. The sky-rocketing price of major agricultural commodities in the year 2007/ 2008 aroused this topic unprecedentedly. And recently, the crisis arrived again, with soaring prices of major staples, driving plenty of the poor on the edge. Effort has been made through amount of academic researches to explain the underlying determinants of the price fluctuation in order to prevent crisis and explore the future trend. This paper will tempt to contribute to those analyses.

The main perspective of the paper is to summarize the underlying factors influencing the world food prices and to construct different baseline scenarios of the world food prices in the year 2020 with GTAP (Global Trade Analysis Project), sensitivity analysis will be provided under alternative development of decisive macro indicators. To forecast the future, the past has to be introduced. Therefore, the paper will start with describing the significance and controversies of world food prices issue, analyzing the fundamental and stochastic drivers of the volatility of prices based on the major development of macroeconomic indicators worldwide. Then, how those indicators are integrated in economic models will be provided and the sophisticated CGE model- GTAP will be selected to construct the baseline scenarios in year 2020. Accordingly, sensitivity analysis will offer alternative prospects into the future. Finally, results and possibilities of combining other factors into the scenarios will be discussed and conclusion will be drawn.

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Poster Session C. Ecology and Ethics

Ground floor Forum building

Economic Analysis of Elements Influencing Equine Welfare

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One of the favourite domestic mammals, except a dog and a cat, is a horse. The trend of breeding horses is increasing all over the world. In the Czech Republic the number of horses rose up significantly from 18 800 in 1993 to almost 74 000 in 2010. Most of them are kept for leisure time activities. Around 5000 are starting in equestrian competitions, sponsored by Czech Equestrian Federation and around 1300 in races according to data from The Jockey Club. The horse has become a symbol of luxury, friend or sports tool.

Even though the number of horses has grown up over the past two decades, there is only little improvement in terms of the animal welfare. Strong evidence suggests that horse life expectancy in man care in Europe is about 1/3 of the natural lifespan. There are several factors that contribute to a short life of horses on farms such as unnatural stereotypic behaviour imposed upon horses, nutrition as well as care for hooves. In this poster, animal welfare of horses is analyzed from the economic standpoint of view, using hedonic price method. Analysis provides necessary information for horse owners in order to improve efficiency and cost-effectiveness in the equine farms.

Phytoremediation of Heavy-metal Contaminated Soils. Which Requirements do Suitable Plants have to meet?

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Phytoremediation comprises generally different methods of plant utilisation to purify contaminated soils. Because of its versatility and cheapness this form of remediation is considered to be promising, but as most of the methods are still in an early stage of development, there is mostly insufficient information available to assess the possibilities of phytoremediation of heavy-metal contaminated soils on a broad spectrum efficiently. For compliance to EU's soil thematic strategy a high diversity of methods on various and differently contaminated sites is necessary, but each of these methods is adaptable only with a combination of appropriate circumstances and specific plant species. This thesis deals with these requirements as well as mechanisms behind these and interactions between different application methods. The goal is to compile an overview to estimate the potential of application of various plant species on three different contaminated sites in Austria and make recommendations for the future.

Can Algae Cultivation Contribute to World Agriculture?

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Keywords: algae, anaerobic digestion, nutritional suplements

Algae can be used to produce biomass from nutrient rich by-products that would otherwise be wasted or even generate environmental problems. At the same time, they could also function as a carbon sink, for climate change mitigation. The biomass can be used as animal feed, or nutritional supplements. In our project we have tested the possibility of growing algae on digestate from a pilot biogas plant.

Accumulation of Carbon and Nitrogen in Swedish Forest Soils over Stand Age

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Keywords: Soil organic carbon, Nitrogen, Stand age, Decomposition, Litter input.

Clear cut harvesting can affect the C stored in the forest soils. The amount of soil C decreases after harvest and recovers gradually when the new stand develops. Earlier chronosequence studies have suggested a 50% decrease of the forest floor carbon within the first 15 years after harvest. Increased decomposition rates and decreased litter input are considered to be the main drivers of C modulation in the soils.

Our study utilizes data from the Swedish National Forest Inventory and the Forest Soil Inventory from all forested land in Sweden. The aim of the study is to estimate the rate of gains and losses of soil organic C and nitrogen (N) over stand age. The objective is to provide detailed information of C and N turnover rates at a national scale and further compare the results with previous studies. In our analysis, we considered climate, tree composition, site index and soil moisture to be the major variables that can affect litter input and the rate of decay. We separated the given data in two different categories for each variable, namely; south-north, spruce-pine, rich-poor, moist-dry for each variable respectively. Comparisons of the two categories of each variable was made; and the results showed lower amounts of C in northern sites, pine dominant forests, poor SI and dry soils by 44%, 24%, 30 % and 10% respectively compared to southern, spruce rich SI and moist soils. The same comparison suggested lower values of N for the same sites by 64%, 44%, 60% and 12% respectively.

Functions parameterized the different datasets to evaluate the effects of the variables. For all datasets, the regressions followed the same trend, but significantly different rates, with the initial amounts of C and N in the O-horizon decreasing within the first 29 to 50 years of the stand by 9 up to 30%. At stand maturity the carbon amount had recovered to pre-harvest levels. Differences in climatic conditions and tree composition are the key factors that might change the rates.

Microbial Degradation of *para*-Nitrophenol in Sand - The Possibility of *Citricoccus Nitrophenolicus* sp. nov. (Nielsen *et al.* 2010) to Enhance Mineralization in Sand from Harboøre Isthmus

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Keywords: Aerobic biodegradation; Bioremediation; Environmental pollution; *para*-Nitrophenol; *Citricoccus nitrophenolicus*; Bioaugmentation

During the years 1957-1962 the pesticide factory Cheminova dumped chemical wastes at a deposit site on the beach of Harboøre Isthmus, on the west coast of Jutland, Denmark. Today, approx. 170 tons of the insecticide parathion still remains in the deposit. Remediation plans for the area are under development. The first step will be to mobilize parathion by sodium hydrolysis. One hydrolysis product is the toxic, but very hydrophilic compound *para*nitrophenol (PNP). Most of which will be flushed out of the sand using asses amounts of water after ended hydrolysis. To ensure 100% cleanup bioremediating bacteria will be inoculated into the sand.

This is a study of indigenous bacteria in sand and the bacterial strain *Citricoccus nitrophenolicus* sp. nov.'s ability to mineralize PNP in sand from different locations. Mineralization of *para*-nitrophenol by indigenous microorganisms has been tested in microcosms with 3 different sands. Two of the sands were collected at beaches near Copenhagen and one was collected at Groyne 43, only 150m from the highly contaminated site on Harboøre Isthmus. In microcosm tests with sand from Groyne 43 0.5, 5 and 50 mg PNP/kg was mineralized by indigenous microorganisms within 2, 3 and 15 days respectively. In sand from the other locations mineralization of 0.5 mg/kg proceeded in sand from Amager, however not as fast as in sand from Groyne 43. The bacterial strain *C. nitrophenolicus* was inoculated at cell densities of 3·106 CFU/g to sand from Groyne 43 and to sterilized sand from Groyne 43. It was able to accelerate initial mineralization in nonsterilized sand but not enhance total mineralization significantly. In sterile sand, *C.nitrophenolicus* could mineralize PNP to the same extent as the indigenous microorganisms in the non-sterile sand. Models were fitted to describe all data to indicate what type of microbial degradation was taking place.

Physical Characteristics of Suckling Piglets and Their Impact on Piglet Growth Performance in Loose Farrowing Pens

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Keywords: Piglet, weight gain, farrowing pen, physical characteristics

Growth performance of piglets in loose farrowing pens has not been studied systematically and little is known about the impact of physical characteristics of suckling piglets on their growth performance. In this study, physical characteristics of neonate piglets born in loose farrowing pens were associated to piglet growth until weaning to identify piglets at birth that were at risk of experiencing poor growth from birth to weaning. Piglets were from a Danish production herd with loose housed sows in all units. Within the first hours after birth, all piglets were weighed and the crown-rump length (CRL) measured. These measures were used to calculate the body mass index (BMI) and the ponderal index (PI) were calculated as well as the relative weight within the litter. Moreover, the gender was noted and the degree of growth retardation was assessed. All piglets were weighed again on day 14 and day 28 and all movements and treatments with antibiotics for disease were registered.
Of 3,402 piglets born, 2,555 survived to day 28. Average weight of weaned piglets was 1.5±0.3 kg at birth, 4.4±1.1 kg on day 14 and 7.1±1.6 kg on day 28. Average daily gain (ADG) was 205±0.06 g day 0-14, 248±0.08 g day 14-28 and 223±0.06 g day 0-28. Antibiotic treatment affected growth performance ($P<0.001$), and so did BMI ($P<0.01$), relative weight within litter ($P<0.01$) and PI ($P<0.01$). Assuming all other parameters were constant, antibiotic treatment had the greatest effect and reduced ADG with 38.4 g. When BMI increased with 1 unit ADG increased with 4.8 g and when PI increased with one unit ADG was reduced with 0.7 g. For each 10 % increase in weight above the mean weight of the litter, ADG increased with 0.4 g.

Spatial Distribution of Artemisinin in Soil and its Impact on Soil Microorganisms

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Keywords: *Artemisia annua* L., artemisinin, sesquiterpene lactone, malaria

Worldwide, the mosquito-borne infectious disease malaria challenges people all around the globe. Long-since have conventional drugs reached a high level of resistance in the responsible pathogen *Plasmodium falciparum*, making extensive research for alternatives necessary. *Artemisia annua* L., an old constitute of traditional chinese medicine, has been found to produce a secondary metabolite artemisinin (Qinghaosu), which have led to significant improvements in the treatment of the disease. The in-vitro production of artemisinin is economically not feasible. Thus, the area under cultivation of *Artemisia annua* L. has been largely expanded. This bears implications for potential high soil transfer of the active compound with associated impact on soil micro-organisms leading to a decrease in soil quality. This presumption is supported by the finding that artemisinin shows physico-chemical properties similar to the pesticide atrazine in terms of lipophilicity and persistence. This project anticipates to gain an understanding of the magnitude of artemisinin soil input and to get a conception of the possible environmental consequences of *Artemisia* monocultures. For this purpose the soil-artemisinin concentration originating from five
Artemisia annua L. plants is monitored throughout the growing season at five different lantdistances (0.1, 0.25, 0.5, 1, 2 m) and two soil depths (0-5 cm and 5-10 cm). Furthermore impacts on bacterial activity is investigated using the 3H-Leucine incorporation method. Agarplate counts are used to support the findings. So far, the results of soil analyses have shown a decreasing trend over time. The highest
artemisinin concentration was detected two weeks after planting. Furthermore, the data suggests an accumulation of artemisinin in the subsoil. After heavy rainfalls, artemisinin could hardly be detected.

Non-state Cooperation in Environment Protection Area in Developed and Developing Countries: The Case of Waste Management in Moldova

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Keywords: waste management, waste hierarchy, cooperation, Moldova

Waste management has the largest share of the global environmental market. This is also one of the most progressing and profitable areas of "green" business.
However, this is mostly true for developed countries, where there are appropriate incentives, conditions, and market established. The majority of developing countries do not have such market or it is functioning improperly. Therefore, their waste management remains limited to the lowest levels of the waste hierarchy: landfill and incineration. Such actions have certain negative impact upon their economy and society, including agriculture. Valuable land that could be allocated for farms is used for waste sinks, and the waste dumped there pollutes the soil and crops grown nearby. In the end, most hazardous chemicals from the waste end up in locally produced food that is both consumed within the country and exported abroad.
Possible solution might be the cooperation between corporate and non-corporate sectors in addressing the issue and in establishing the effective market for it. By working together, companies and non-government organizations are able to achieve synergetic impact, that would be obtained more costly or slowly in case they do it separately. The research is focused on the analysis of the waste management situation in a developing country, in particular, Moldova. Bottlenecks in establishing a well functioning waste market, as well as non-state-driven cooperative initiatives to address this issue are assessed. Specifics of the technology, socio-economic factors, as well as opportunities and restrictions of legislation are taken into account. The conclusion includes proposals, recommendations, and theoretic waste management development model for a developing country, such as Moldova.

The Changes in the Water Quality in the Vltava River during its Watercourse Through Prague

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The rivers in urbanized territories are continually exposé to the pressures of various interests and the ways of their use. This bachelor degree thesis analyzed the samples from the Vltava river in various places in Prague according to the watercourse of the river. Consequently the samples were analyzed in order to determine the changes in the water quality in the Vltava River during its course in Prague.

Characteristic of Dead Wood Resources in Forests of Chornobyl Exclusion Zone (CEZ), Ukraine

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Keywords: dead wood, woody detritus, coarse woody debris (CWD), woody debris, line intersect sampling (LIS)

The aim of the paper was to define chosen characteristics of dead wood in forests, in which forest management was stopped 25 years ago. The fieldwork took place in Chornobyl Exclusion Zone. Analyses of coarse woody debris and standing dead trees were undertaken in three age classes on three most common site quality classes. Every habitat had got different dominating tree species (Scotch pine, Oak and Adler).
The line intersect sampling method was used for estimation of lying dead wood resources. Standing dead wood resources were determined by using the sample plots, height curves and empirical formulas of form factors. The observed large amount of dead wood in forests of CEZ is many times higher than resources found in the economy stands in Poland. The similar amount of CWD was observed each age class in alder and oak stands; pine stands are characterized by the highest abundance of dead wood, a large number of standing dead trees in the class III and V of age, with a small amount of class IV. The values of the characteristics obtained from the surveys could be a result of the silviculture treatments carried out in the CEZ stands, as well as environmental and anthropogenic factors affecting forests of the Chornobyl Exclusion Zone.

Temperatures and Heat Fluxes in Vertical Gas Heat Exchanger

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Scientific work on "Temperatures and heat flows in the vertical earth heat exchanger," deals with the wells as a source of energy for heat pump and it validates the potential of such land resources. For a description of the temperature field, which takes place in boreholes in the heat pump energy consumption of the Earth's mass, measurements were carried out on the land of VESKOM al. Ltd. Here, measurements took place during the period from 7.6.2010 to 24.2.2011. Temperatures were measured in five levels deep in a total of five wells, one of the wells was equipped with a temperature probe and thus served as a reference. At the same time intervals in which measurements are conducted and recorded outdoor temperature. Signals from the sensors were presented to the cabinet of which were regularly deducted each week is always between 15 and 16 hours. From the measured values resulted in findings for attenuation depth, temperature curves in all the wells and depths, the temperature differences between the selected one borehole and borehole and a reference to the life of wells in terms of optimum temperature of the rock massif. All results are graphically supported. At the conclusion of the work I present recommendations for further measurements.

Land-use Change in the Middle Hills of Nepal with Special Interest on Shifting Cultivation: Factors of Change and Local Perceptions

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Keywords: Shifting cultivation; Chepang; land-use change; environmental perception

Shifting cultivation or swidden agriculture is a common land-use in the tropics that involves temporary agricultural practice in forests after clearing and burning of indigenous vegetation. It has often been criticized for causing deforestation and biodiversity loss in many tropical developing countries, but at the same time it is also plays a critical role in the subsistence and food security of many rural farmers. Nepal, being situated on the foothills of Himalaya has been experiencing rapid land-use changes in the last years mainly due to changing government policy, local developments, growing concern about environmental issues and changes in local perceptions. The country is also one of the most vulnerable countries to climate change due to its fragile environmental and socio-economic context. In the middle hills of Nepal shifting cultivation is quite a common land-use practice amongst communities belonging to the ethnic group known as *Chepang*. We performed an exploratory survey in two mid-hill districts of Nepal, Jogimara and Chitwan, by interviewing 51 *Chepang* farmers to investigate their land-use practice, patterns and factors of land-use change and local perceptions associated with land-use(s). The study revealed that, although local land-use practices are changing rapidly in both areas, there exist differences in available land-use options between the studied districts. People from Jogimara reported less land-use options than the people from Chitwan. Educational and economic backgrounds of the households greatly influence households' land use decisions, preferences and access to different facilities like micro-credits from E-NGO's. Although, most of the interviewees hold strong perceptions about their indigenous shifting cultivation and its possible negative impact on certain environmental services and conservation of biodiversity, households' choice of more environmentally suitable land-use(s) was restricted by land-tenure and access to government support. The findings of the study emphasised the role of more equitable land-use options, access to government support and tenure security in allowing rural *Chepang* farmers to perform long-lasting, environment friendly land-use (here for example, terrace agriculture, community and lease-hold forestry) in the studied regions.

Development of Forest Stands on the Former Agricultural Lands in the Condition of Czech-Moravian Highland

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Keywords: aforestration of agricultural lands, Czech-Moravian Highland, soil conditions, stands conditions

The presented thesis evaluates the production and soil forming characteristics of forest stands established in the 1960ies on former agricultural lands and compares them with stands on the forest ones. The studied stands are located close to village Krucemburk in the Czech-Moravian highland on water-affected sites in the 6th vegetation altitudinal zone. The set of permanent research plots was established in 5 Norway spruce stands, 1 larch and 1 sycamore stands. In selected stands, the soil conditions were described and the humus form restoration was documented, comparing with the meadow and arable soil sites in the vicinity.

The standing volume inventory documents high production potential of stands on former agricultural lands. The highest standing volume was quantified in the Norway spruce stand on site LT 6O1, 866 m^3/ha at the age 53 years, exceeding the model production of respective species by 50%. For compared pairs of spruce stands, in one case was documented higher standing volume compared to steadily forested site, in the other this characteristics being comparable. There were determined the surface humus layers at amount of 60-80t/ha in the coniferous stands. The effects of former agricultural use are still visible, especially the lowering of humus content and higher macronutrient contents. The most favorable effect was documented under sycamore, the Norway spruce has to certain extent pioneer character, owing to rapid restoration of the surface humus.

The results document the fact, that the afforestation of agricultural lands is a highly economical treatment comparing to traditional use. Their production is high, they need a care because of rot danger, as well as qualified thinning for higher stability. The lowering of rotation period, sooner regeneration start and completing with site corresponding stabilizing and soil improving species represent proper management.

Impact of N Fertilization on Subsoil Properties Soil Organic Matter and Aggregate Stability

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During the last century mankind has been able to boost food production with fertilization and improved cultivation techniques. Crop biomass production has been increased both, above and below ground. Due to this fact it is expected that highly yielding crops may also influence the soil organic carbon pool in the subsoil through increasing root production. The goal of this thesis was to investigate the impact of low and high yields (no N vs high N fertilization) on (1) the soil organic matter pool (2) soil stability and (3) related chemical and physical interactions.
Soils of three Swedish long-term field experiments (Fors, Kungsängen and Örja) were sampled to a depth of 0.40 m and analyzed. The organic carbon content decreased with depth at all three sites. Nitrogen addition through organic manure and inorganic fertilizer slightly increased the soil organic carbon content (SOC) in the topsoil, but in the subsoil (0.30-0.40 m) only the soil from Fors showed higher SOC contents in N fertilized treatments. Nitrogen fertilization (organic and inorganic) resulted in lower pH values compared to control without fertilization at all three experimental sites. Manure had an important influence on aggregate stability at the site Fors. The soil treated with manure showed a higher soil aggregate stability (SAS) and a lower amount of readily dispersible clay (RDC) than no manure treatment. At Kungsängen, the soil stability was governed by the high clay content of 56%. No stabilizing effect of fertilization was detected. The acidifying effect of biological N fixation was observed in Örja soil. Samples with lower pH showed lower stability. Inorganic N fertilizer significantly stabilized the Örja surface soil layer (0-0.20 m). Multiple regressions revealed that the factor clay seems to have the most impact on soil stability.
In conclusion, it has been shown that small differences in soil management practices (organic and/or inorganic fertilization, cultivation of N fixing plants) have an impact on soil properties in the long-term.

The Influence of Plant Growth on Pesticide Disappearance from Soil

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The degradation rate of chlorotoluron in soil and effect of different plant growths on the chlorotoluron disappearance from the soil was studied. The bucket experiment took place in greenhouses under controlled conditions. Chlorotoluron was applied pre-emergently on the soil surface into the buckets with different plant growths. All soil from the buckets with wheat, poppy, weed (*Geranium pusillum*) growth and control bare soil samples were analysed during the experiment to determine the chlorotoluron concentration in the soil. The soil samples were dried by lyophilisation, grinded, sieved through 2 m sieve and homogenized. Chlorotoluron was extracted from the soil samples by methanol and the chlorotoluron concentration in the extracts were determined by the HPLC. The chlorotoluron half life will be calculated for all the studied growth and control samples and the effect of different growths on chlorotoluron disappearance from the soil will be evaluated.

Comparing Breeding Methods of Pinnigrades (Sea lions and Seals) and their Value in Czech Zoological Gardens

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Keywords: *Arctocephalus*, *Otaria*, *Zapophus*, *Phoca*, welfare, zoo animal husbandry, water treatment, disease prevention

This paper describes and characterizes the breeding conditions of sea lions (*Arctocephalus*, *Otaria*, *Zapophus*) and seals (*Phoca*) in selected zoological gardens in the Czech Republic.
Legislation and standards for maintaining appropriate conditions for these animals have a wide influence on their husbandry. Establishing and especially maintaining their natural environment requires providing a number of special conditions, for instance high-quality food supply, a large enclosure, water quality maintenance systems and special veterinary care. Regarding the fact that especially the water environment for pinnipeds is extremely hard to maintain for technological reasons and economic process, breeding strategies, animal welfare situation and disease prevention of pinnipeds were monitored and evaluated in each captive facility in the selected zoological gardens of the Czech Republic.
All information used in the literature review parts were found among the scientific articles in the scientific databases (ScienceDirect, Wiley Online Library), but also in websites of European Association of Zoos and Aquaria. Practical data, information and photos about each breeding were gathered and collected from each selected zoological garden during my personal visitation mainly in February and March 2011. The way chosen for collecting information was personal interviews with pinniped caretakers. A sort of questionnaire for gathering all data and information was used during the visitation.
Results were processed, compile and then evaluate by comparing for the most part in tables with other zoological gardens and information from literature sources. Despite establishing standards and regulations common for each institution having pinnipeds, there are differences in breeding kinds of technologies methods and husbandry techniques. What is happening behind the walls of enclosures, which are used and how keepers provide complete care to these sympathetic animals around the Czech zoological gardens was the intention of my thesis.

The Effect of Buffer Strip Width on Cost Efficiency: a Swedish Case Study

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The objective of this study is to analyze the cost-efficiency of buffer zone schemes in Sweden in the context of European Directives, national agri-environmental support programmes and environmental targets to be achieved. The study includes a comprehensive overview of the scientific literature on the effectiveness of buffer strips in retaining pollutants and a modeling exercise. The exercise evaluates the effect of buffer zone width on reducing phosphorus losses using the model ICECREAM DB and Swedish data. The study then analyzes how the parameters that influence the effectiveness of different widths may impact the cost-effectiveness of policy
alternatives. What emerges is that the width of a buffer might not be that influential as other site conditions when looking at the cost-efficiency in reducing the load of phosphorous from agricultural fields. Eventually, a more down-scaled and differentiated payment scheme for buffer strips (of different designs) based on more localized and easy-to-establish parameters (such as climate and soil type, but also the load of P and reduction targets) would produce a more costeffective approach.

Energy Dissipation by Single Emerged Riparian Vegetation within an Open Channel Flow

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In this experimental study, measurements were conducted to explore the impact which different forms of individual natural vegetative elements within the flow domain have on velocity - and the resulting turbulence characteristics. All experiments were performed in a flume measuring 18m in length, 0,5m in width and 0,5m in depth, and real tree saplings were utilized to represent the vegetation element. In order to examine vegetation characteristics a parameter was introduced using a height/volume relationship. During the experiments an acoustic Doppler velocimeter was used for point velocity measurements. Time-averaged velocities, turbulent kinetic energies, normalized turbulent kinetic energies and mean kinetic energies were examined and brought into relation. It has been found that - despite their porous structure - the presence of vegetation considerably disturbs the flow field and dissipates a remarkable amount of energy through turbulence.

Crating the Sows for 4 Days After Farrowing Reduces Piglet Motality

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Keywords: Farrowing environment, Piglet mortality, Welfare

Crating the sows during the lactation period disturbs he normal behavior of sows and reduces their welfare, but keeping farrowing sows in pens may increase piglet mortality. The aim of this experiment was to investigate how the use of a crate, in the first few days after farrowing, would affect the piglet mortality including stillborns. A specially designed combination farrowing pen was used, where the sows could be kept loose or in a crate. Registrations were conducted from introduction to the farrowing pen until 10 days after farrowing. 216 sows were divided into 4 groups, with an even distribution of parity number between the groups, and every group was represented equally in every farrowing batch. Group 1: The sows were loose during the entire experimental period. Group 2: The sows were crated from day 0 to day 4 after farrowing. Group 3: The sows were crated from day 0 to day 7 after farrowing. Group 4 (control): The sows were crated from the introduction to the farrowing pen until 7 days after farrowing. There was no effect of sows being loose before and during farrowing on the number of stillborn piglets ($P>0,05$). Sows that were crated after farrowing had fewer dead piglets ($P<0,001$) than loose sows, probably because more piglets were crushed in the first few days after farrowing when the sow was kept loose. There was no difference in the number of dead piglets when the sow was crated for 4 or 7 days after farrowing, so it was concluded that crating the sow for 4 days after farrowing would be enough to reduce the piglet mortality. The welfare of the sows and piglets was enhanced in the combination farrowing pen, when the crate was used for only 4 days after farrowing, compared to the traditional farrowing crate.

AUTHOR INDEX