CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

CUPAGIS

Kick-Off Meeting

Tallinn
18-19 February 2019

New Curricula in Precision Agriculture Using GIS Technologies and Sensing Data

CZECH UNIVERSITY OF LIFE SCIENCES PRAHUE,
FACULTY OF ENGINEERING

Co-funded by the Erasmus+ Programme of the European Union

Joint Project: Capacity Building in the Field of Higher Education ERASMUS+ 2018

DR JAN CHYBA

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Basic information about CULS





- The CULS history proper begins with the establishment of the department of agriculture at the Czech Technical University by the Decree of Emperor Franz Josef I of October 26, 1906.
- In 1952 an independent University of Agriculture was founded by a government decree on the basis of the School of Agriculture of the Czech Technical University.
- By 1959, new faculties were established at the CUA with the idea of serving the new concept of agriculture.
- On January 1st 1995 the Czech Agricultural University was transformed.
- In 2007 the English name of the university was changed to Czech University of Life Sciences Prague

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Number of students: 25 000

Teachers: 498

Other staff: 695

Total area of University Campus: 46 ha

DRC
Danube Rectors' Conference

UI GreenMetric

Euroleague
FOR LIFE SCIENCES

CULS STRUCTURE

- Faculty of Agrobiology, Food and Natural Resources

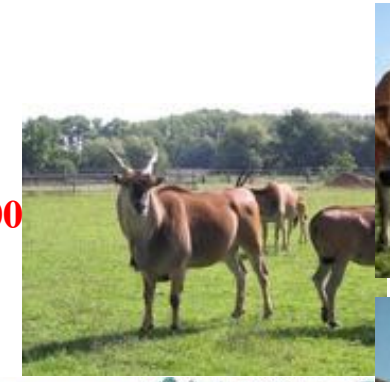
- Faculty of Economics and Management

- Faculty of Forestry and Wood Sciences
- Faculty of Environmental Sciences
- Faculty of Engineering
- Faculty of Tropical AgriSciences
- Institute of Education and Communication

CULS

Farm Estate Lány

- Lány Agricultural Production Centre (3000 ha)
- Mělník Chloumek Fruit and Viticultural Centre (12 ha, wine prod.: 30 000 lt/year)
- Farm Animals Breeding (cattle: 520, milk. prod.: 4 000 000 lt/year)



Forest Establishment in Kostelec nad Černými lesy (7000 ha)

- Sawmill with the Wood Handling Department
- Nursery of Forest and Ornamental Trees
- Pond management (74 ha)

CULS Castle

- Kostelec's castle was built in the 14th century and it is a protected historic building. Castle in Kostelec nad Černými Lesy is one of the most historic buildings in central Bohemia (Chapel of saint Vojtech, Knight Hall, gardens etc.)

establishments

Almost 200 study programmes in Czech and English at Bachelor, Master and PhD. level

BACHELOR STUDY PROGRAMMES IN ENGLISH	FACULTY
Economics and Management	FEM
Business Administration	FEM
Informatics	FEM
Sustainable Use of Natural Resources	FAFNR
Agriculture and Food	FAFNR
Game Management	FFWS
Forestry	FFWS
Cynology	FAFNR
International Cooperation in Agriculture and Rural Development	FTAS

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

MASTER STUDY PROGRAMMES IN ENGLISH	FACULTY
Economics and Management	FEM
Informatics	FEM
European Agrarian Diplomacy	FEM
Natural Resources and Environment	FAFNR
Natural Resources Management and Ecological Engineering	FAFNR
Sustainable Agriculture and Food Security	FAFNR
Technology and Environmental Engineering	FE
Forestry, Water and Landscape Management	FFWS
Forest Engineering	FFWS
Tropical Forestry and Agroforestry	FFWS+FTAS
Nature Conservation	FES
Environmental Modeling	FES

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

MASTER STUDY PROGRAMMES IN ENGLISH (CONT.)	FACULTY
Landscape Planning	FES
International Economic Development	FTAS
Tropical Crop Management and Ecology	FTAS
Animal and Food Sciences in Tropics and Subtropics	FTAS
Sustainable Rural Development in the Tropics and Subtropics	FTAS
Wildlife Management in the Tropics and Subtropics	FTAS
Business Administration	FEM
Environmental Geosciences	FES
Wood Engineering	FFWS

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

More than 80 large international research projects from 2000 (over 1 mil EUR)

In 2017: 4,422 international students (from 112 countries)

- 2015 - 2018 - Brachiopods as sensitive tracers of global marine environment: insights from alkaline, alkaline Earth metal, and metalloid trace element ratios and isotope systems
- 2015 - 2017 - Towards a long-term Africa-EU partnership to raise sustainable food and nutrition security in Africa
- 2013 - 2013 - Agricultural Drought Monitoring and Assessment driven by Satellites
- 2013 - 2013 - Testing of using lichenicolous fungi as indicators of long term ecological continuity in arctic-alpine ecosystems
- 2012 - 2016 - FORest Management Strategies To Enhance The MITigation Potential Of European Forests
- 2012 - 2015 - BIOFECTOR - Resource Preservation by Application of BIOeffECTORs in European Crop Production
- 2012 - 2016 - COMPETE - International comparisons of product supply chains in the agro-food sectors: determinants of their competitiveness and performance on EU and international markets
- 2012 - 2015 - Forest management strategies to enhance the mitigation potential of European forests
- 2012 - 2014 - International comparisons of product supply chains in the agro-food sectors: determinants of their competitiveness and performance on EU and international markets
- 2012 - 2015 - PRICE - PRactical implementation of Coexistence in Europe
- 2012 - 2017 - Resource preservation by application of bioeffectors in European crop production
- 2011 - 2013 - FARMPATH - Farming Transitions: Pathways Towards Regional Sustainability of Agriculture in Europe
- 2011 - 2014 - RESTEP - Regional Sustainable Energy Policy based on the Interactive Map of Sources
- 2010 - 2013 - VOAJR - virtual Open Access Agriculture & Aquaculture Repository: Sharing Scientific and Scholarly Research related to Agriculture, Food and Environment
- 2008 - 2011 - CERTCOST - Economic Analysis of Certification Systems for Organic Food and Farming
- 2008 - 2012 - e-SOTER - Regional pilot platform as EU contribution to a Global Soil Observing System
- 2008 - 2011 - iSOIL - Interactions between soil related sciences - Linking geophysics, soil science and digital soil mapping
- 2008 - 2010 - RES COMPASS
- 2008 - 2010 - Transfer of Innovative Learning Techniques over Forestry Education
- 2007 - 2009 - TRAME - Transnational Mobility of Cyber people Working in Teamwork

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

- **Development projects in foreign countries**
- **Summer schools (more than 630 international students in 2017 for summer schools at CULS and almost 220 CULS students abroad for summer schools)**

CULS – FACULTY OF ENGINEERING

Faculty of Engineering (formerly Technical Faculty) was established as a part of the University of Agriculture in 1952

Students: 2200 **Teachers:** 88 **Other staff:** 34

Objective:

- to educate graduates for the whole of agri-food sector
- for road automobile transport
- for waste management technologies
- for trade and business involving machinery
- for the field of technological equipment of building sites

Departments

1. Department of Mathematics
2. Department of Physics
3. Department of Mechanical Engineering
4. Department of Electrical Engineering and Automation
5. Department of Material Science and Manufacturing Technology

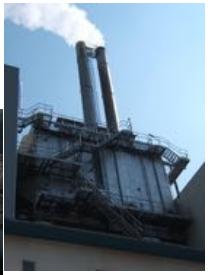
Programmes of FE

BSc – Agricultural Engineering

The first two years of study demonstrates theoretical basis in agricultural technology which enables students to undertake further study in technical and biological sciences. The last year of study is focused on the practical application of the theoretical k

Programmes of FE

MSc - Technology and Environmental Engineering



Subjects include agricultural engineering, road and urban transport, technology and equipment for waste management, technology and equipment for building constructions, trade and business in mac and control technology in agrifood

Programmes of FE

PhD - Engineering of Agricultural Technological Systems

EATS is a three year doctoral study programme taught in English.

The field of study includes all scientific and technical problems associated with the construction, operation and application of technical elements in the agricultural and food technology systems.

The graduates have in-depth knowledge in general theory of machinery and


Soil & Tillage Research 105 (2009) 171–175

Contents lists available at ScienceDirect

Soil & Tillage Research

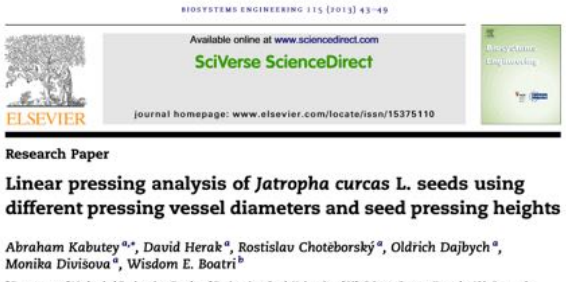
journal homepage: www.elsevier.com/locate/still

Short communication

The evaluation of agricultural machines field trafficking intensity for different soil tillage technologies

Milan Kroulík *, František Kumhála, Josef Hůla, Ivo Honzík

Czech University of Life Sciences Prague, Faculty of Engineering, Department of Agricultural Machines, Kamýcká 129, 165 21, Prague 6 Suchdol, Czech Republic


BIOSYSTEMS ENGINEERING 115 (2013) 43–49

Available online at www.sciencedirect.com

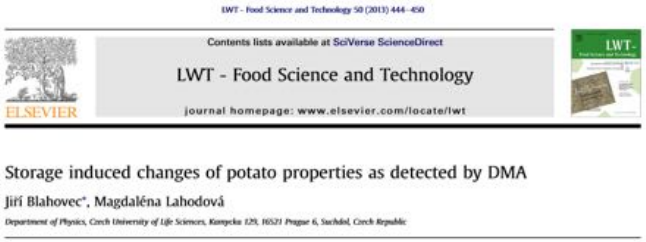
SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/issn/15375110

Research Paper

Linear pressing analysis of *Jatropha curcas* L. seeds using different pressing vessel diameters and seed pressing heights

Abraham Kabutey [a,*], David Herak [a], Rostislav Chotěborský [a], Oldrich Dajbych [a], Monika Divišova [a], Wisdom E. Boatri [b]


LWT - Food Science and Technology 50 (2013) 444–450

Contents lists available at SciVerse ScienceDirect

LWT - Food Science and Technology

journal homepage: www.elsevier.com/locate/lwt

Storage induced changes of potato properties as detected by DMA

Jiří Blahovec*, Magdaléna Lahodová

Department of Physics, Czech University of Life Sciences, Kamycka 129, 16521 Prague 6, Suchdol, Czech Republic

DEVELOPMENT PROJECTS

- Indonesia
- Ethiopia
- Ghana
- Cambodia
- India
- Malaysia
- Ukraine
- Myanmar
- Philipinas

CULS – FACULTY OF ENGINEERING

KZS
DEPARTMENT OF AGRICULTURAL MACHINES

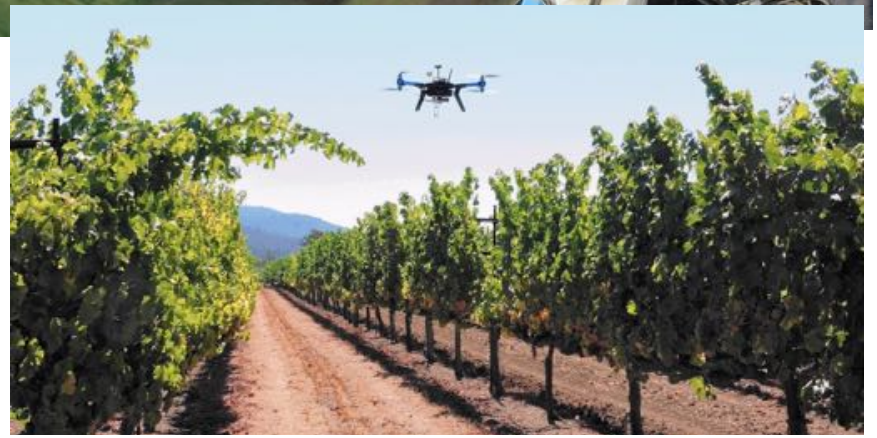
Research activities are oriented to following main topics:

1) Soil tillage technologies and machinery

2) Precision Agriculture

3) Hop growing and harvesting technologies

4) Field robots



CULS – FACULTY OF ENGINEERING

Currently solved Projects:

DEPARTMENT OF AGRICULTURAL MACHINES

- ***Research of the systems for increasing soil tillage energy efficiency (2018-2019)***
- ***Autonomous navigation of seeders and automatic detection of over-compacted subsoil (2018-2021).***
- ***Platform for the Identification and Interpretation of Stress Factors in Plant Production (2016-2018).***
- ***Data acquisition platform based on spectral imaging (2017-2019)***
- ***Implementation of principles of variable fertilization and application of pesticides (2017-2019).***
- ***The gentle method of conservation thermally labile substances of hops (2015-2018).***

CULS – FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MACHINES

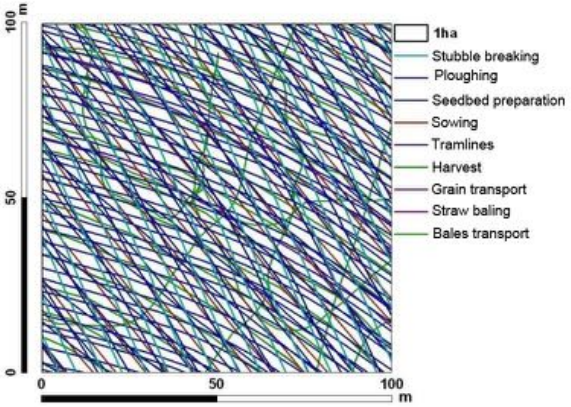
Other activities: Field robotics

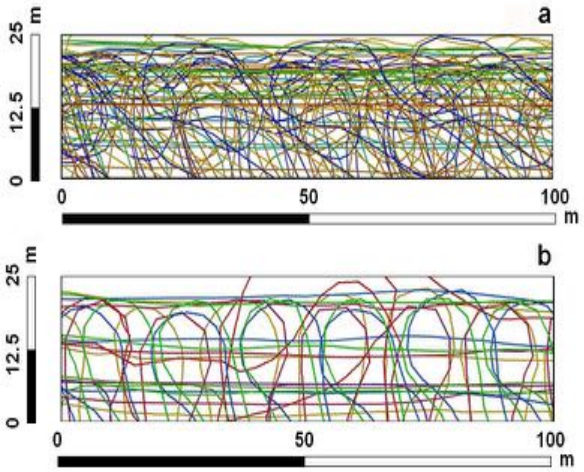
CULS – FACULTY OF ENGINEERING

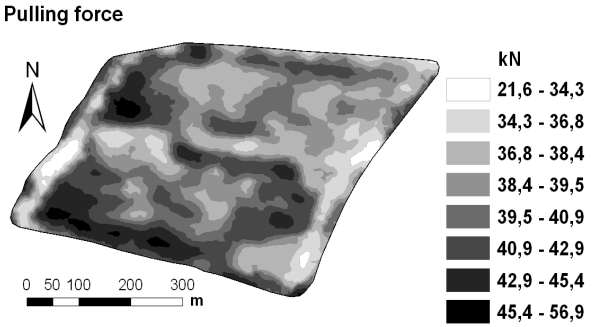
Other activities: Precision Agriculture Technologies

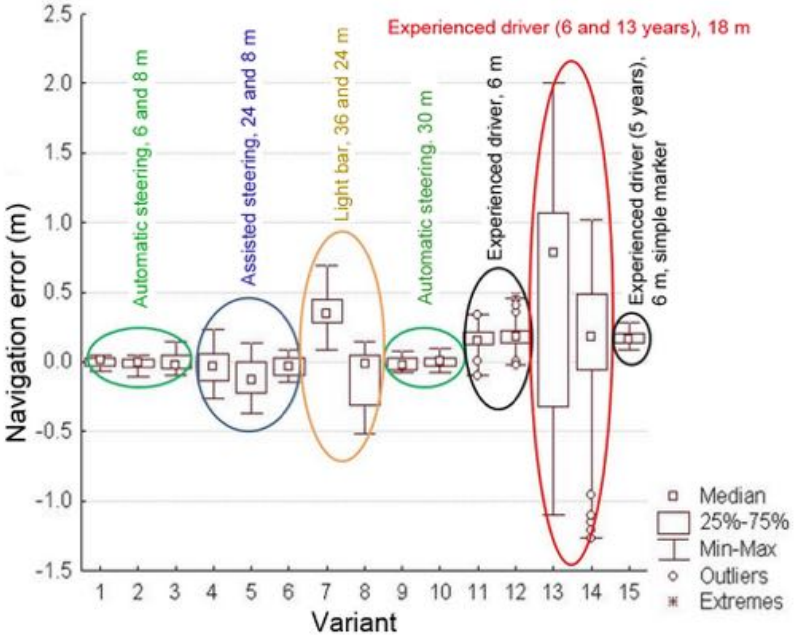
DEPARTMENT OF AGRICULTURAL MACHINES

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE







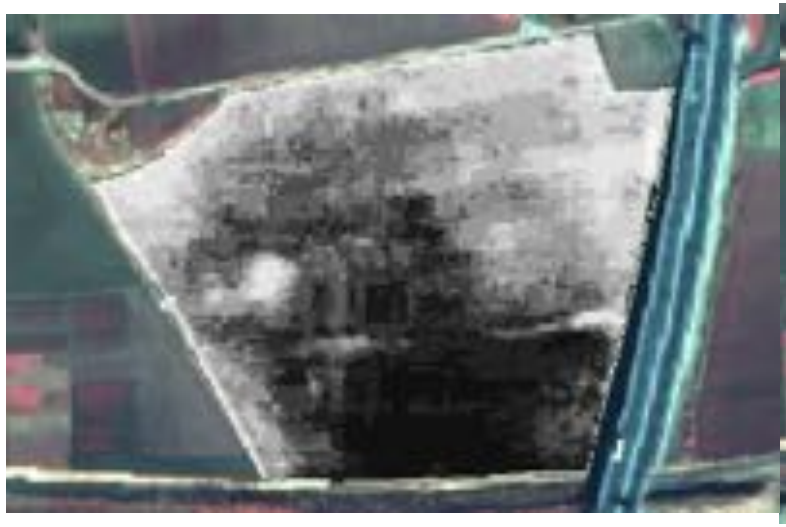


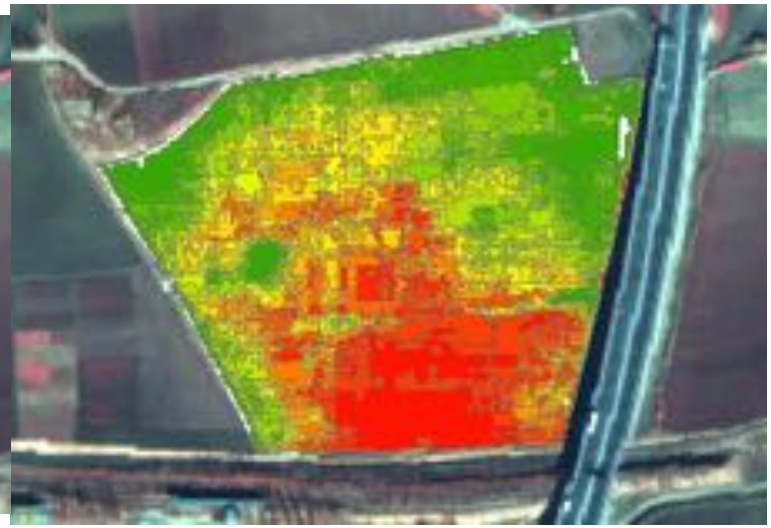
CULS – FACULTY OF ENGINEERING

Other activities: Precision Agriculture Technologies

DEPARTMENT OF AGRICULTURAL MACHINES

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE





Curricula CUPAGIS

- Advanced geoinformatics for Engineering
- Geoinformatics for Engineering
- Precision Agriculture
- Smart Control Elements in Agricultural Machinery
- Trends in Agricultural Engineering

Advanced geoinformatics for Engineering

Teacher:	**Associate professor Jitka Kumhálová**
Study cycle:	**BA/MA/PhD**
ECTS:	**--**
Hours:	**48**
Total hours:	**125**
Mode of comletition:	**Exam**

Advanced geoinformatics for Engineering

The participant acquires theoretical and practical knowledge of geoinformatics methods for technical applications especially in the fields of agricultural production. Teaching areas include orientation in data sources, availability and data quality, including the level of processing. Advanced processing vector data formats derived from both machines, as well as from public archives. Advanced processing of raster data formats obtained both from unmanned vehicles and from satellite imagery archives. Combination of vector and raster data to obtain the necessary information in the context of production planning or spatial planning. The knowledge of the subject is necessary not only for planning of production or spatial development, but also for monitoring the current state of the land and its betterment. The course creates conditions for mastering the advanced tools of geographic information systems (GIS) and remote sensing (RS) and their application in practice.

Advanced geoinformatics for Engineering

Lecture	
1	Introduction, usage, history.
2	Data formats– raster and vector data format, properties, data storage, transformation and editing, resolution, conversion.
3	Vector analysis, overlay algebra – practical usage.
4	Data from agricultural machines, import, conversion, processing – theory, practical usage, PLM Viewer, SMS Basic.
5	Spatial interpolation, practical usage.
6	Raster modelling (coordinate system, advanced tools) – theory, practical usage.
7	Raster modelling – land management – digital elevation/surface model, micro-topography, slope calculation, flow accumulation calculation – theory, practical usage.
8	Advanced analysis of image data I (radiometric and atmospheric correction, cloud mask) – theory, practical usage.
9	Advanced analysis of image data II (image enhancements – point, spatial – filtering, spectral – colour synthesis, spectral indices, PCA, Tasseled Cap transformation) – theory, practical usage.
10	Advanced analysis of image data III (resizing, mosaicking, image registration) – theory, practical usage.

CULS – Curricula CUPAGIS

Geoinformatics for Engineering

Teacher:	**Associate professor Jitka Kumhálová**
Study cycle:	**BA/MA/PhD**
ECTS:	**5**
Hours:	**48**
Total hours:	**125**
Mode of comletition:	**Exam**

Geoinformatics for Engineering

Students are given an introduction of basic principles of geoinformatics in engineering. Students obtain the overview about Geographic Information Systems (GIS) and Remote Sensing (RS) tools utilization. Beside the overview of data use potential, possibilities of its application and theoretical background, students are required to manage fundamental exercises of image visualization and interpretation, and know how to use basic analaytics GIS and RS tools.

Geoinformatics for Engineering

Lecture	
1	Introduction, history, usage.
2	Data sources. Coordinate systems.
3	Data and their characteristics. Interpolations.
4	Map composition.
5	Physical aspects.
6	Spectral responses.
7	Aerial photography and interpretation.
8	Concepts of digital remote sensing.
9	Optical and hyperspectral remote sensing.
10	Thermal remote sensing.
11	Microwave remote sensing.

Geoinformatics for Engineering

Seminar	
1	Introduction to SW.
2	Basic data processing -- data preparation.
3	Devices.
4	Basic works with image - introduction (vector, raster).
5	Interpolations, introduction to map creation.
6	Basic work with image.
7	Spectral indices.
8	Task processing I.
9	Task processing II.
10	Task processing III.
11	Task processing IV.

Geoinformatics for Engineering

Recommended literature:

JONES, H.G. & VAUGHAN, R.A. (2010). Remote Sensing of Vegetation: Principles, techniques and applications. Oxford University Press, Oxford, 353 pp.

LILLESAND, T.M., KIEFER, R.W. (2000). Remote Sensing and Image Interpretation. John Wiley & Sons, New York, 724 s.

TUPIN, F. INGLADA, J. NIKOLAS, J.-M. (2014). Remote Sensing Imagery. John Wiley and Sons, Inc. 367 s.

ZHANG, Q. (2015). Precision Agriculture Technology for Crop Farming. CRC Press, 360 pp.

Precision Agriculture

Teacher:	**Associate professor Milan Kroulík**
Study cycle:	**BA/MA**
ECTS:	**5**
Hours:	**30**
Total hours:	**125**
Mode of comletition:	**Exam**

Precision Agriculture

The subject is comprehensive and includes the field of soil management, information and navigation technologies, soil and plant characteristics mapping and their analysis, precise application procedures and contexts related to the conservation of natural resources and ecological functions of the landscape. During the course, the participants are gradually acquainted with the technical possibilities of data collection, editing and interpretation. Participants also have the opportunity to become familiar with the device in real-world demonstrations and exercises. The aim is to obtain information about the basic sense of precision farming, which is the increase in effectiveness of inputs through optimized and localized interventions.

Precision Agriculture

Lecture	
1.	Precision Agriculture, Introduction, Assumptions, Technical Possibilities
2.	Satellite Guidance, Use of Navigation Devices, Other Navigation Options
3.	Methodological Aspects of Soil Sampling. Spatial Variability of Soil Properties
4.	Spatial Variability of Soil Agrochemical Properties and Their Analysis
5.	Technique for Measuring and Mapping Yields of Field Crops.
6.	Sensors, Measurement Principles, Geophysical Instruments
7.	Remote Sensing, Data Processing and Interpretation
8.	Telematics, Data Acquisition, Machine Monitoring
9.	Geographic Information System and Data Management, Economic Aspects of PA
10.	Robotics and Autonomous Systems in Agriculture, Smart Farming

Precision Agriculture

Seminar
1. Reports Topics Assignment, News From the PA. How and Where to Search Information.
2. Using Location Knowledge for PA, Working with GPS on Site
3. Demonstration of Soil Sampling
4. Technical Realization of Soil Characteristics
5. Sensory Analysis of Plants
6. Remote Sensing Using UAV
7. Working with GIS, Data Preparation. Application Maps and Their Processing.
8. Field Robots Presentation
9. Presentation of Current Research Activities, New Possibilities of Data Collection
10. Presentation of Student Projects, Credit

Precision Agriculture

Literature:

Basic:

HŮLA, J.; PROCHÁZKOVÁ, B. a kol. Minimalizace zpracování půdy. Praha Profi Press, s.r.o., 2008. 248 s. ISBN 978-80-86726-28-1.

JECH, J. a kol. Stroje pre rastlinnú výrobu 3 - Stroje a zariadenia na pozberovú úpravu rastlinných materiálov a na ich skladovanie. Nitra SR Profi Press, s.r.o., 2011. 368 s. ISBN 978-80-86726-41-0.

KUMHÁLA, F. a kol. Zemědělská technika - Stroje a technologie pro rostlinnou výrobu. Praha ČZU v Praze, 2007. 438 s. ISBN 978-80-213-1701-7.

NEUBAUER, K. a kol. Stroje pro rostlinnou výrobu. Praha SZN, 1989. 720 s. ISBN 80-209-0075-6.

RYBKA, A.; ŠŤASTNÝ, M. Precizní zemědělství. Praha ÚZPI, 1998. 52 s. ISBN 80-7271-038-9.

Recommended:

JOHNSON,R.C. Target Farming. Saskatoon Canada 1996. 138 p.

LUDOWICY,CH. et al. Precision Farming. Frankfurt am Main Germany DLG Verlag, 2002. 168 p. ISBN 3-7690-0600-3.

STOUT,B.A. et al. CIGR Handbook of Agricultural Engineering. Vol. III. St.Joseph USA ASAE. 1999. 632 p. ISBN 1-892769-02-6.

Smart Control Elements in Agricultural Machinery

Teacher:	**professor František Kumhála**
Study cycle:	**BA/MA**
ECTS:	**6**
Hours:	**48**
Total hours:	**--**
Mode of comletition:	**Exam**

Smart Control Elements in Agricultural Machinery

The aim of the subject is to acquaint participants with the most advanced intelligent control elements used in agricultural technology. Participants gain theoretical knowledge of intelligent control systems used for the management of agricultural technology and communications between the energy source and the implement. They also get information about equipment and SW for data transfer and documentation, from various manufacturers of agricultural machinery. Emphasis is placed on data exchange for machines from different manufacturers.

Smart Control Elements in Agricultural Machinery

Lecture	
1.	Introductory lecture, general overview
2.	Overview of navigation systems, benefits and potential of navigation utilization
3.	ISOBUS communication interface between tractor and implement
4.	ISOMatch simulator
5.	Server MyJohnDeere.com
6.	Data transfer between the server and the machine
7.	Transfer data from machine to server
8.	AEF Database - Compatibility between machines of different manufacturers
9.	Applications in agriculture
10.	Modeling yields
11.	SMS software for data transfer between machines of different manufacturers

Smart Control Elements in Agricultural Machinery

Literature:

11783 Tractors and machinery for agriculture and forestry—Serial control and communications data network (ISOBUS).

Land.Technik – Agricultural Engineering.. VDI Verlag Düsseldorf, Německo.

Jahrbuch Agrartechnik (Agricultural Engineering). Institut für mobile Maschinen und Nutzfahrzeuge, Braunschweig.

Elsevier: Biosystems Engineering, Computers and Electronics in Agrciculture, Soil and Tillage Research.

Springer: Precision Agriculture

Agco, Claas, CNH, John Deere, Kverneland a dalších.

Web:

https://www.aef-isobus-database.org/isobusdb/login.jsf


THANK YOU FOR YOUR
ATTENTION