10th International Precision Agriculture Conference
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Precision Agriculture Education Program in Nebraska

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University of Nebraska - Lincoln

Bioresource Engineering
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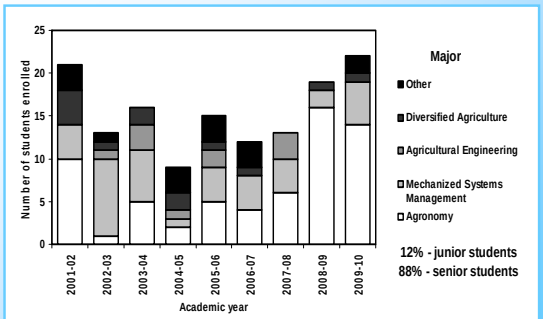
Course Description

- Title: **Site-Specific Crop Management**
- Offering: Fall semester – 3 credit hours (2 hrs lecture and 3 hrs lab) - elective
- Prerequisites: Senior standing with previous introduction to soils and/or general agriculture
- Cross listing: Agronomy, Mechanized Systems Management and Agricultural Engineering majors
- Instruction: Co-taught between Biological Systems Engineering and Agronomy and Horticulture Departments with several guest speakers
- Description: Principles and concepts of site-specific management. Evaluation of geographic information systems for crop production practices. Practical experience with hardware and software necessary for successful application of information affecting crop management.

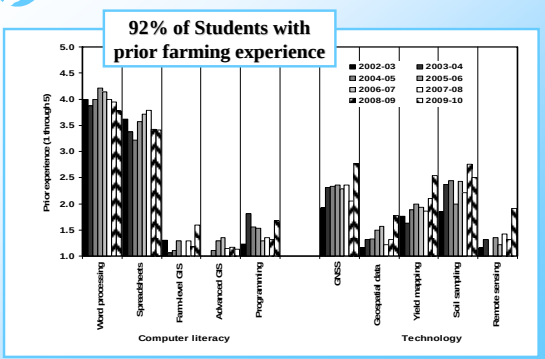
Course Objectives

1. Use global navigation satellite systems (GNSS) receivers and understand the meaning of geo-referenced data.
2. Use geographic information systems (GIS) software to accomplish primary spatial data management tasks.
3. Work with yield monitoring and other relevant data acquisition equipment.
4. Identify major sources of errors and develop proper data-handling strategies.
5. Determine the potential usage of remote sensing and automated on-the-go mapping systems.
6. Understand the principles of variable rate application of seeds, water, fertilizers, lime, and other chemicals.
7. Integrate yield and soil fertility maps with other geo-referenced data to develop an effective site-specific crop management program.
8. Apply a systems approach and common sense to deduct causes of spatial variability and develop corresponding recommendations.
9. Identify potential advantages (both economic and environmental) and current limitations of precision agriculture.

Enrollment



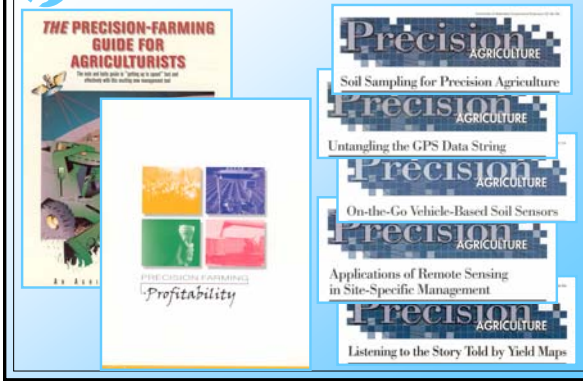
Relevant Background



General Topics

- History and present level of Precision Agriculture
- Principles of yield mapping
- Principles of Global Positioning System (GPS)
- GPS vehicle guidance
- Principles of Geographic Information Systems (GIS)
- Web-based data layers
- Methods for soil sampling and analysis
- On-the-go soil & plant sensors
- Site-specific nutrients and water management
- Introduction to remote sensing
- Interpolation and processing of georeferenced data
- Statistical/geostatistical tools
- System approach to improved management strategies
- Variable rate technology

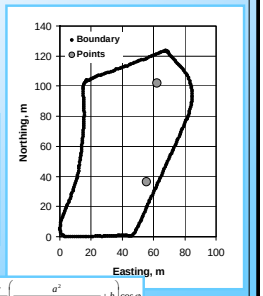
Textbooks



Hand-on Experience

- Field trips
  - GNSS field practice
  - Yield mapping practice
  - Soil pH/EC mapping and sampling practice
  - Husker Harvest Day visit
- Laboratory
  - Yield monitor and lightbar guidance displays
  - GNSS data interpretation (EXCEL)
  - From basic data to prescription maps (Manifold GIS)
  - Profitability of precision agriculture (EXCEL)

GPS Practice



Tracking (boundary)

Measurements (distance)

Navigation (hide and find)

$$F_{lon} = \frac{\pi}{180}\left(\frac{a^2}{\sqrt{a^2\cos^2\varphi + b^2\sin^2\varphi}} + h\right)\cos\varphi$$

$$F_{lat} = \frac{\pi}{180}\left(\frac{a^2 b^2}{\sqrt{\left(a^2\cos^2\varphi + b^2\sin^2\varphi\right)^3}} + h\right)$$

Field Mapping Practice

Yield monitor installation, calibration, and operation

On-the-go mapping of soil pH and electrical conductivity

Soil sampling

Functional Displays

Yield Monitor

Lightbar Guidance

Knowledge Assessment

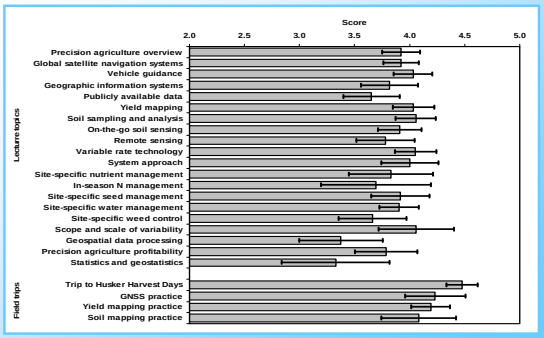
- Assignments
  - Spreadsheet assignments (GNSS data, yield data, profitability)
  - Spatial data importing and display
  - Yield history analysis
  - Development of prescription maps
- Two term projects
  - Technology – recommended line of equipment
  - Applications – case studies
- Two written tests

Case Studies

- Three locations
  - Clay Center, NE (160 acres)
  - Cairo, NE (160 acres)
  - Bellwood, NE (200 acres)
- Principle data
  - Field boundary (.shp)
  - Six-seven years of crop yield (.txt)
  - Field topography (.txt)
  - DOQ image (.jpg)
  - Soil map (.shp)
  - Electrical conductivity measurements (.txt)
  - Soil laboratory analysis – 1 acre sampling (.txt)
  - Soil texture analysis – 3 acre sampling (.txt)

- Center pivot irrigation
- Ridge tillage
- Continuous corn (soybean enclosures)

Topic and Activity Ranking

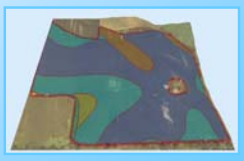


Course Website

http://bse.unl.edu/adamchuk/class_ssm

Software Tutorial

- Lesson 1 - Downloading Publicly Available Data
- Lesson 2 - 3D Display of Integrated Publicly Available Data
- Lesson 3 - Processing a Multi-Year Yield History
- Lesson 4 - Visualization and Analysis of Soil Data
- Lesson 5 - Prescription Map Development



bse.unl.edu/adamchuk/manifold
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