Syllabus - AGRY 59800/AGRY 48500 Precision Crop Management – Fall 2019

**Course Description:** Credit Hours: 3. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital geo-referenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. Typically offered Fall.

**Learning Outcomes:**

At the end of this course students will be able to:

1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from DuPont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input levels.
2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions.
3. Utilize data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific basis.
4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management.
5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates.
6. Utilize geo-referenced field scouting data and crop models to prescribe effective pest management strategies.
7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources.
8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies.
9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors.
10. Evaluate potential crop response to varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions).
11. Describe and explain the impact of productivity-influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management).
12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies.

13. Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management.

This course helps satisfy the following embedded outcomes:

1. Critical Thinking
2. Quantitative Reasoning
3. Verbal Communication

Topics planned include but are not limited to GPS, GIS, RTK, auto steer basics, GIS data collection, crop management software and the use of integrated spatial data in zone management decision-making. Includes harvest operations and accurate yield mapping, soil sampling, precision zone P, K and pH management, N management, remotely-sensed data interpretation, variable rate and variable genetic planting, planting systems, spray systems, tile drainage design and installation, field operation logistics, crop residue management, cover crops, soil compaction, irrigation management and crop diagnostics. Consent of instructor required.

Taught by Dr. Lee Schweitzer with support from industry professionals and additional Purdue Agronomy faculty and staff including Drs. Eileen Kladivko, Jim Camberato, Keith Johnson, Bob Nielsen and Jason Ackerson.

1. Course Resource Website
https://ag.purdue.edu/agry/courses/Pages/agry598.aspx

2. Class Meetings
Attendance is required. The class meets each Tuesday 1:30 to 5:20 p.m. (includes travel time for off-campus field demonstrations when scheduled). Please see the class schedule for meeting locations. The first class meeting is in 2-425 Lilly Hall. Subsequent classes are location-specific by date. For field trips meet the bus on Russell Street south of State Street and west of Lilly Hall. Crop management are held in B-286 Beering Computing Lab. Students’ practice runs and final presentations are held in 2-425 Lilly Hall. Please follow the published schedule carefully to note the location for each class meeting and be on time.

3. Field Trips
On days scheduled for field trips (see the class schedule) please board the bus at the curb of Russell Street west of Lilly Hall. The bus will leave promptly at 1:30 p.m. so please plan to arrive on time. If an emergency arises and you are delayed or cannot attend class please notify Dr. Schweitzer prior to class if possible (cell phone / text 765 413 5994 ; email lschweit@purdue.edu).

4. Grading Policy and Performance Evaluation
This class is structured to provide students with opportunities to gain practical insight and experience with a wide array of emerging crop management technologies and strategies. It my goal to work with each student to maintain a high level of learning and performance.
Feedback on your course notes plus feedback on the practice run of your team presentation will help you to know if you need to work a little harder in some aspect to achieve excellence in the course. Each student’s course grade is based upon their work throughout the semester in three areas listed below.

a) **Attendance:** Attendance is required. Each unexcused absence will result in a reduction of 1 letter grade for the course so please see Dr. Schweitzer (in advance if you know you will need to miss class or as soon as possible after an unavoidable absence) to request an excused absence and to make up missed work.

b) **Participation and Class Notes:** As a senior capstone course, active participation by all students is expected in each class meeting. Please ask questions which exercise critical and analytical thinking and communicate as a professional in interactions with faculty, guest speakers and fellow students.

Each student is expected to highlight in their daily class notes the key concepts emphasized. Your daily class notes will provide input for your participation grade and serve as a valuable reference for your use in preparing your team presentation. Your notes will also serve as a valuable future professional resource. A bound composition book is recommended as a way to organize your notes by speaker and date but all options are welcome. Students who are attentive in class, take excellent notes and actively participate in discussions will earn an “A” for their participation. Lesser engagement in class and/or notes that do not document the key points presented and analyze their practicality and profitability through the course of the semester will result in a lesser participation grade.

*Students notes from the semester’s class presentation will be collected in class on November 19 and returned to students on December 3.* Please organize your notes in a composition book, binder or folder. Thank you.

c) **Team Presentation:**

Each student will be a part of a team (generally 3 students) to research, compose, practice and present a precision crop management topic selected from a list provided and targeted as an industry or extension presentation to a group of well-informed, experienced crop producers.

Each team will include a captain responsible for organization, on-schedule progress, practice and communications among and preparation by team members.

**PowerPoint presentations (required format** so no internet issues will arise from on-line applications – no exceptions) are to be 15 to 20 minutes in length plus 5 minutes for questions and answers, professional grade and supported by valid data, photos, graphics and video clips as appropriate. Each presentation is to be informative, tightly-organized, practiced and structured in such a way that an industry or extension farmer audience member will be convinced to take home your key points and translate them to action in their farming operation.

Team presentations may be added to each students’ academic portfolio for future job or graduate study interviews and will boost students’ professional prospects as evidence of professional presentation capability and experience.
Students who contribute at a level of excellence in all phases of the development and delivery of their team’s presentation will earn a presentation grade of “A“. Poor levels of contribution and presentation performance will earn a lesser presentation grade.

Each presentation should document how and why the crop management concept(s) presented is relevant to the crop producers in their audience. Presentations should also demonstrate if possible how the concepts presented benefit the crop producers in their audience by accomplishing one or more of the following outcomes.

1. Positive economic return on the investment to implement the concept.
2. Protection and enhancement of the long-term productive potential of a crop producer’s land resources and their farm business.

Please begin preparation of your presentation early in the semester and take full advantage of university faculty, industry representative, farmer, library database (e.g. Agricola), Google Scholar, university (e.g. Dr. Nielsen’s “Chat and Chew” land-grant university extension publication web source https://www.agry.purdue.edu/ext/corn/cafe/) and industry web-based resources. Sources quoted for your presentation must be properly cited as to author and place of publication.

There are no restrictions on the range of resources you can utilize so please think broadly and be imaginative! Please complete as much of your literature review as possible prior to the October 15 class meeting so you will be well prepared to present general outline of topic coverage on that day.

1) The key to a successful presentation is to start early with your preparation.

2) Organize and meet with your team and utilize on-line, industry and university faculty resources and resource people early and often during the first half of the semester so most of your information gathering is done by October 15 and you can refine the delivery of your presentation during the back half of the semester.

3) Conduct a thorough literature review using the Purdue Library databases (such as Agricola) on-line extension resources (such as Dr. Robert Nielsen’s “Chat ‘N Chew Cafe” web site http://www.kingcorn.org/cafe), Google Scholar https://scholar.google.com/ and industry resources.

Each team is encouraged to schedule an appointment with and meet with the Purdue Agriculture Sciences Information Specialist Danielle N. Walker walke524@purdue.edu in WALC between well-prior to your team’s presentation of your outline in class on October 15 so she can help you with your search of the literature relating to your presentation topic.

Purdue Library Resources (Books & Media, Articles, Website, Databases, Online Journals) https://www.lib.purdue.edu such as the database “Agricola” https://agricola.nal.usda.gov/
4) Network with university and industry professionals to gain valuable direction and insight and adhere to a timeline that allows sufficient time for preparation and multiple cycles to practice and upgrade. Gaps in coverage and support show up best through formal practice.

Please take full advantage of university faculty, industry representative, farmer, library database and university and industry web-based resources. All sources must be properly cited.

There are no restrictions on the range of resources you can utilize so please think broadly and be imaginative.

A well-developed draft outline of each team’s presentation content is due in class on October 15.

This outline should include a minimum of three appropriate references you will cite (could be personal communication with a faculty or professional individual), plus the name of at least one faculty member or industry representative with whom you’ve discussed your topic and from whom you’ve gotten presentation content and/or ideas. Each team will present their outline to the class on whiteboards in a workshop in class on that day so teams can share ideas and resources, narrow the focus of their presentation and avoid overlap.

Each team will make a formal practice-run presentation (slides finalized as nearly as possible and presentation practiced more than once) in class in 2-425 Lilly Hall on either November 5 or November 12 depending on your team assignment. Practice runs are to provide opportunity for constructive peer and faculty review and critique. For the practice runs as with the final presentations each team will have 15 to 20 minutes to present with 5 minutes for questions.

Final presentations are scheduled for November 19 and December 3 in 2-425 Lilly Hall depending on the schedule for each team.

Presentation Topics - Students Will Sign Up For Topic Preferences On August 20. Team Assignments Will Be Announced In Class On August 27.

Topic Areas Are A General Guideline – Student teams may narrow (but not broaden) the scope of their presentation. Draft outlines will be shared in class on October 15) to assist teams in narrowing their focus on their topic and avoiding overlap. You are welcome to pull out specific pieces of a topic as your preferred point of emphasis and clearly indicate that in your notes with your ranking. You are also welcome to suggest another topic not listed and that topic will be taken into consideration as well.

1. Agronomics of variable seeding rate and genetics by zones within fields (corn hybrids and/or soybean varieties). Include data supporting or refuting variable population and genetics.

2. Technology, Design and Key Operational Features of Contemporary Corn Planting Systems – Monitors and sensors, active / passive downpressure control and margin management on seed slot openers and seed slot closure, seed singulation and spacing (include precision planting yield
3. Variable Rate Soil Fertility Management. Use of spatially-referenced soil sampling, yield maps and other spatial (GIS) data layers – to determine zone boundary definition and most-profitable variable rate P, K and Ag Lime application by zones within fields.

4. Nitrogen Prescriptions For Corn Production – Variable rate zone boundary definition and N rate, timing, form and additive (e.g. nitrogen stabilizer) prescriptions. Include hybrid genetic profile, soil characteristics (e.g. soil type, drainage and drainage improvement, leaf reflectance and soil sensor input, weather and climate information (temperature and rainfall) integrated software model information (e.g. Granular Agronomy Nitrogen Service and Climate Corp FieldView Nitrogen Management), Land Grant University N Rate Calculator For Eastern Corn Belt States, and other N management considerations. Exclude management of N contributions from cover crops which will be included in a separate topic.

5. Economic, labor, pesticide and fuel savings, equipment efficiencies, land and environmental stewardship, farm business and owner/operator family time and stress management benefits of precision crop management technologies. Technology examples include RTK GPS, auto steer, swath control, boom control, section control, direct injection pesticide spray systems, machine synchronization, variable rate fertilizer and lime application (exclude variable N rate, seeding rate and genetics). **Exclude the mechanics of how these technologies work and focus on the benefits as listed above.**

6. Combine set up and yield monitor calibration for accurate yield mapping. Yield map data cleaning / smoothing and interpretation / analysis of yield maps as input for agronomic decision-making.

7. Demonstrating The Value Of Integrative Precision Crop Management Software – Compare commercial integrated software alternatives available and discuss their value for zone management and agronomic decision making. What level of software fits best with producer goals? Include To- Apply Maps, As-Applied Maps, Economic Summaries (Profit Or Loss $/Acre, $/Bushel).

Data integrated may include yield, soil fertility P, K, pH, SURGO, topography, tile, field boundaries, soil productivity indices and other similar resources

8. Cover Crop Management To Improve Profitability, Soil Health and Productive Potential. Include Agronomics, Interactions and Yield Response Data. Also include the management of N contributions from cover crops to cash crops following in rotation or in relay.

9. Use of artificial intelligence (e.g. Farmer’s Edge) in spatial data layer analysis, interpretation and agronomic decision making.
10. Precision weed control strategies in contemporary cropping systems in the U.S. Corn Belt. Include sensor technology, variable product and rate, robotics and spatial data layer use in crop management decision making.

11. Management and marketing of specialty corn and soybean cropping systems (e.g. Waxy Maize, High Oleic Soybeans, non-GMO, certified organic corn and soybeans). Include all aspects unique to these premium-market systems.

12. Seed Treatments, Biostimulants and Inoculants for Corn and Soybean production systems. Include data supporting or refuting their value.

13. Making great late plant, replant and overplant decisions for corn and soybean cropping systems.

14. Design, implementation and interpretation of crop producer farm field experiments using yield maps and other data layers (e.g. SURGO, UAV imaging SmartFirmer soil O.M. and other) to evaluate spatially-referenced main effect and interaction responses (e.g. N rate and timing, plant population, P and K soil test goals by soil type, Sulfur response, etc.) in corn and soybean cropping systems.

15. Use of robotics (autonomous platforms) as agronomic tools (e.g. for disease and insect scouting, stand counts, weed identification and stand density determinations, crop leaf canopy closure, leaf reflectance for N status, P, K and pH soil sampling, soil mapping (e.g. O.M., moisture, bulk density), tissue testing and other assessments.

16. Surface and subsurface drainage management. Determining field zone-specific levels of limitation to corn and soybean production profitability and evaluating the potential for long-term economic and environmental gain from designed drainage improvement. Integration of reduced tillage, conservation tillage and cover crop strategies to enhance soil drainage.

17. Acquisition, interpretation, analysis and use of UAV-derived data in crop scouting and crop management decision-making. Include use of other data layers (e.g. historical yield maps, soils maps, ground observation maps), artificial intelligence (e.g. FarmersEdge), and other data management tools.

18. Soil compaction – impact on corn and soybean yield. Sources of compaction, prevention and correction.


20. Irrigation management of corn and soybean production systems. New technologies for sensing, monitoring, modeling, measuring and mapping soil and crop water status as well as for variable rate prescription irrigation technologies. Include surface and sub-surface irrigation systems.
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Please ask questions and let Dr. Schweitzer or other participating faculty know if we may be of assistance.  

HAVE A GREAT SEMESTER!

Purdue University Academic Honesty Statement. Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.”

Purdue Honor Pledge  
“As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.”

Diversity  
All students are valued in the Purdue University community.

EMERGENCY PREPARENESS PROCEDURES:  
Preparedness will be critical IF an unexpected event occurs! Emergency preparedness is your personal responsibility. Purdue University is actively preparing for natural disasters or human-caused incidents with the ultimate goal of maintaining a safe and secure campus. Let’s review the following procedures:

• To report an emergency, call 911.  
• To obtain updates regarding an ongoing emergency, and to sign up for Purdue Alert text messages, view www.purdue.edu/ea  
• If we hear a fire alarm, we will immediately suspend class, evacuate the building, and proceed outdoors, and away from the building. Do not use the elevator.  
• If we are notified of a Shelter in Place requirement for a tornado warning, we will suspend class and shelter in the lowest level of this building away from windows and doors.  
• If we are notified of a Shelter in Place requirement for a hazardous materials release, or a civil disturbance, including a shooting or other use of weapons, we will suspend class and shelter in our classroom, shutting any open doors or windows, locking or securing the door, and turning off the lights.

EMERGENCY PREPARENESS WEBSITE:  
http://www.purdue.edu/ehps/emergency_preparedness/index.html