

**AGRN 377**  
**Field Crops of the Midwest**  
**Spring 2017**

**I. General Information**

AGRN 377 (Field Crops of the Midwest) is a 4 credit hour course that explores the science behind many of the decisions a producer or agronomist must consider in managing forage and field crops.

*Prerequisite:* AGRN 176 – Principles of Crop Science.

*Desired:* AGRN 278 – Introduction to Soil Science

Lecture: MTuWTh 11:00-11:50 a.m., Knoblauch 152

Instructor: Dr. Mark Bernards  
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Office Hours: M 12:00-12:50 p.m.; T 10:00-10:50 a.m., W 10:00-10:50 a.m., Th 12:00-12:50 a.m. or by appointment.

**Required Texts:**

Nafziger, E. (Editor). 2009. Illinois Agronomy Handbook, 24<sup>th</sup> edition. University of Illinois Extension C1394. Available for download at <http://extension.cropsci.illinois.edu/handbook>

Abendroth, L.J., R.W. Elmore, M.J. Boyer and S.K. Marlay. 2011. Corn Growth and Development. Iowa State University Extension PMR 1009.

Pedersen, P. 2009. Soybean Growth and Development. Iowa State University Extension PM 1945.

Undersander, D., et al. 2011. Alfalfa Management Guide. American Society of Agronomy-Crop Science Society of America-Soil Science Society of America, Madison, WI. Available for download at <https://www.crops.org/files/publications/alfalfa-management-guide.pdf>

Other readings will be made available through Western Online or the Internet.

Other texts that will be used in the development of lectures and which may be good references for you:

Barnes, R.F., C.J. Nelson, M.Collins and K.J. Moore. 2003. Forages, Volume 1: An Introduction to Grassland Agriculture. Iowa State Press, Ames, Iowa.

Connor, D.J., R.S. Loomis, K.G. Cassman. 2011. Crop Ecology: Productivity and Management in Agricultural Systems, 2<sup>nd</sup> edition. Cambridge University Press, Cambridge, England.

Martin, J.H., R.P. Waldren, D.L. Stamp. 2006. Principles of Field Crop Production. Pearson, Upper Saddle River, New Jersey.

Stoller, P. 2012. Growth Stages of Agronomic Crops. University of Illinois X905.

**II. University Policies and Expectations**

**Student rights and responsibilities:** A complete description is available at [www.wiu.edu/provost/students](http://www.wiu.edu/provost/students).

**Disruptive Student Policy:** Students who interfere with normal class function or the ability of other students to learn may be asked to leave the class for the day. For repeated offenses, a student may be removed from the course. Details may be found at: <http://www.wiu.edu/vpas/policies/disrupst.php>

*Two dismissals due to disruptive or unprofessional behavior will result in a permanent disbarment from the course and a final grade of "F" will be assigned.*

**Academic Integrity:** <http://www.wiu.edu/policies/acintegrity.php> Western Illinois University, like all communities, functions best when its members treat one another with honesty, fairness, respect, and trust. . . It is the student's responsibility to be informed and to abide by all University regulations and policies on Academic Integrity. Plagiarism, cheating, and other forms of academic dishonesty constitute a serious violation of University conduct regulations. Students who engage in dishonesty in any form shall be charged with academic dishonesty. . . Any student, faculty member, or staff person who has witnessed an apparent act of student academic dishonesty, or has information that reasonably leads to the conclusion that such an act has occurred or has been attempted, has an ethical responsibility for reporting said act(s).

*The policy for AGRN 377: Any confirmed act of academic dishonesty (especially plagiarism or cheating) will result in the loss of all points associated with that assignment, and may result in an "F" for the course.*

**Equal Opportunity:** <http://www.wiu.edu/policies/affirmact.php> Western Illinois University complies fully with all applicable federal and state nondiscrimination laws, orders, and regulations. The University is committed to providing equal opportunity and an educational and work environment for its students, faculty, and staff that is free from discrimination based on sex, race, color, sexual orientation, gender identity and gender expression, religion, age, marital status, national origin, disability, or veteran status.

**Sex-Discrimination and Misconduct:** University values, Title IX, and other federal and state laws prohibit sex discrimination, including sexual assault/misconduct, dating/domestic violence, and stalking. If you, or someone you know, has been the victim of any of these offenses, we encourage you to report this to the Title IX Coordinator at 309-298-1977 or anonymously online at: [http://www.wiu.edu/equal\\_opportunity\\_and\\_access/request\\_form/index.php](http://www.wiu.edu/equal_opportunity_and_access/request_form/index.php). If you disclose an incident to a faculty member, the faculty member must notify the Title IX Coordinator. The complete Title IX policy is available at: <http://www.wiu.edu/vpas/policies/titleIX.php>

**Disabilities:** Students with disabilities: In accordance with University values and disability law, students with disabilities may request academic accommodations where there are aspects of a course that result in barriers to inclusion or accurate assessment of achievement. To file an official request for disability-related accommodations, please contact the Disability Resource Center at 309-298-2512, [disability@wiu.edu](mailto:disability@wiu.edu) or in 143 Memorial Hall. Please notify the instructor as soon as possible to ensure that this course is accessible to you in a timely manner.

**Education Majors:** The state teaching license requires all education majors to receive a grade of a "C" or better in this course in order to meet its requirements. With the university +/- grading system, receiving a "C-" or below will require you to retake this course or find a substitute course to meet School of Agriculture graduation requirements.

### III. Course Expectations and Policies

1. Live the Golden Rule. Treat others with respect and courtesy in your conversation and actions. Turn off and put away electronic devices (phones, tablet computers, laptop computers, etc.) during the class period unless directed to use them for class activities. Inappropriate use of an electronic device will result in loss of participation points for that day.
2. Show up. Attendance and punctuality is expected. Notify the instructor in advance if you have any reason to miss a class period through the O.A.R.S system (<http://wiu.edu/oars>). A minimum of 24 h notice (email or phone) is required if there is any cause to miss a quiz or exam. If you do miss a class, do not ask the instructor "Did I miss anything important?" It is your responsibility to make arrangements to get the information you missed and to make up any missed assignments.
3. Participate. Be prepared for class discussions by completing readings, answering questions, taking notes, asking questions, and working effectively with other students on lecture and laboratory activities.
4. Study. You should plan to spend a minimum of 5 hours outside of class each week to master the material. Reading assignments relating to each lecture/lab will be particularly beneficial.

5. Complete assignments. Assignments not turned in on the assigned date may have 10% of the total potential points deducted for each day after the due date. The instructor will generally return exams and assignments within 1 week.
6. The use of tobacco is prohibited in Knoblauch Hall, nor is it allowed during sessions at the AFL.

#### IV. Grading

<u>Component</u>	<u>Portion*</u>
Attendance	10%
Participation	10%
Assignments	20%
Quizzes & Final Exam	60%

*\*These percentages are subject to modification. However, any changes will be discussed during class lecture prior to being implemented.*

#### Grading Scale

<u>Percentage</u>	<u>Grade</u>	<u>Percentage</u>	<u>Grade</u>
93.0-100	A	73.0-76.9	C
90.0-92.9	A-	70.0-72.9	C-
87.0-89.9	B+	67.0-69.9	D+
83.0-86.9	B	63.0-66.9	D
80.0-82.9	B-	60.0-62.9	D-
77.0-79.9	C+	<59.9	F

#### V. Learning Assessments

**Attendance:** Attending class is required and will improve your ability to learn the material and to contribute to the classroom community. 10% of the final grade will be earned through attendance. Each student will be allowed 3 “vacation” days (for funerals, job interviews, oversleeping, etc). More than 3 “vacation” absences will result in the loss of attendance percentage points (2 points per absence). Absence for WIU-sanctioned activities (i.e., team travel, presenting at conferences, etc.) will not count against “vacation” days. Absence due to illness will be evaluated on a case-by-case basis and will not count against the vacation days. Students who accumulate 10 or more “vacation days” will NOT receive a passing grade.

**Participation:** Each student will receive points based on their preparedness for class lectures and discussions. Readings/exercises will be assigned prior to many lectures. The expectation is that you will have completed those activities so you are prepared to participate in class discussion and application of the material. Preparedness may be evaluated through Western Online reading quizzes, pop-quizzes and contributions to discussions or in-class activities. This means you will be expected to make comments.

**Assignments:** There will be assignments associated with lecture topics that will be designed to help you better understand the material and benefit from resources you can use after you graduate from WIU. Assignments will be graded on completeness and/or accuracy.

**Quizzes:** A 20-30 question quiz will be given during part of a class period approximately once every two weeks. It may include multiple choice, fill in the blank, true-false, matching and short essay questions.

**Final Exam:** The final exam will be comprehensive, and will include multiple choice, matching, fill in the blank, true-false and short essay questions.

#### VI. Course Objectives

This course will prepare you to make many of the decisions necessary for growing crops in the Midwest,

either as a producer or as a crop advisor. At the end of the class it is expected that you will be able to answer most of the questions in the “Crop Management Performance Objectives” for the International Certified Crop Advisor Exam” <https://www.certifiedcropadviser.org/files/certifiedcropadviser/international-performance-objectives.pdf>. These questions are listed below.

### Competency Area 1. Cropping Systems

1. List advantages and limitations of monoculture and crop rotation systems.
2. Describe the role of the following in a cropping system:
  - a. fallow.
  - b. green manure crops.
  - c. cover crops.
3. Describe how cropping sequence in a rotation influences
  - a. tillage options.
  - b. residue management.
  - c. moisture availability.
  - d. pest management.
  - e. yield potential.
  - f. herbicide choice.
4. Compare clean-till and high surface residue management systems for the following:
  - a. crop rooting patterns.
  - b. seed placement.
  - c. pest management.
  - d. stand establishment.
  - e. fertilizer placement.
5. Describe how the following affect the conversion of non-cropland to cropland:
  - a. existing vegetation.
  - b. pest management.
  - c. nutrient availability.
  - d. yield potential.
  - e. erosion potential.
  - f. soil limiting factors.
  - g. water management.
  - h. first cropping choice.
  - i. other environmental impacts.
6. Define allelopathy.

### Competency Area 2. Hybrid and Variety Selection

1. Define cultivar or variety, and hybrid.
2. Differentiate hybrid and open-pollinated varieties.
3. Describe how the following influence hybrid or variety selection:
  - a. maturity.
  - b. yield potential.
  - c. adaptation to soil and climatic conditions.
  - d. yield stability among years and locations.

- e. pest resistance and tolerance.
  - f. herbicide sensitivity.
  - g. harvestability.
  - h. end use.
  - i. value added trait.
4. Define transgenic crop.
  5. Describe how growing transgenic crops can affect marketing.
  6. Explain why randomization and replication are important in field trials.
  7. Use least significant difference (LSD) values to interpret differences among varieties or hybrids.
  8. Describe how plant variety protection laws affect the use of seed.

### Competency Area 3. Crop Establishment

1. Use seed tag information to determine seed quality.
2. Describe how pre-harvest and harvest conditions influence seed quality.
3. Describe how storage time, handling, and storage conditions affect seed quality.
4. Describe advantages and limitations of using seed treatments to
  - a. facilitate pest control.
  - b. facilitate seed handling and planting.
  - c. enhance nutrient uptake and use.
  - d. facilitate stand establishment.
5. Describe advantages and limitations of bacterial inoculants.
6. Describe how seed treatments, storage time, handling, and storage conditions affect quality and use of bacterial inoculants.
7. Describe uses and limitations of the standard germination test.
8. List benefits of using certified seed.
9. Use purity, germination, and seed size information to calculate a seeding rate.
10. Define seed lot.
11. Describe how the following factors affect seed germination:
  - a. soil temperature.
  - b. soil moisture.
  - c. seed/soil contact.
12. Describe how depth of planting affects crop emergence.
13. List conditions that alter recommended planting depth.
14. Identify factors that influence planting date.

15. Identify consequences of seeding earlier or later than optimum.
16. Describe how the following factors affect seeding rates:
  - a. planting practices.
  - b. soil tillth.
  - c. soil salinity.
  - d. environmental conditions.
  - e. crop residue.
  - f. seed size.
  - g. seed quality.
17. Describe advantages and limitations of applying fertilizer at seeding.
18. Calculate plant population in a field.
19. Differentiate seeding rate, plant population, and harvest population.

#### **Competency Area 4. Crop Growth, Development, and Diagnostics**

1. Describe characteristics of the following growth stages:
  - a. germination and emergence.
  - b. vegetative.
  - c. flowering.
  - d. seed development.
  - e. physiological maturity.
2. Describe how temperature and moisture extremes affect crops at the growth stages listed.
3. Define growing degree unit.
4. Use growing degree units to determine rate of crop development.
5. Describe how daylength affects flowering in short day, long day, and day neutral crops.
6. Locate the growing points in grasses and broadleaf plants.
7. Describe how the following factors affect crop canopy closure:
  - a. row spacing.
  - b. plant population.
  - c. plant growth habit.
8. Differentiate the following:
  - a. summer annual.
  - b. winter annual.
  - c. biennial.
  - d. perennial.
9. Describe how the following soil factors affect crop root growth:
  - a. pH.
  - b. moisture and temperature.
  - c. texture and structure.
  - d. nutrient status.
  - e. fertilizer placement.
  - f. soil borne pests.
  - g. compaction.

- h. salinity.
10. Describe the effect of tap and fibrous root systems on
  - a. nutrient uptake.
  - b. water uptake.
  - c. erosion control.
  - d. soil structure.
  - e. ability to penetrate compacted layers.
11. Describe how the following affect the economics of replanting:
  - a. expected date of replanting.
  - b. population of surviving plants.
  - c. pesticides applied.
  - d. stand uniformity.
  - e. pest pressure.
  - f. nutrients applied.
  - g. crop insurance.
  - h. seed company replant policy.
12. Use information about the following to diagnose a cropping problem:
  - a. pattern of problem in the field.
  - b. cropping history.
  - c. field preparation.
  - d. weather information.
  - e. management practices.
  - f. equipment function.
  - g. traits and seed treatments.
  - h. pesticide history.
  - i. soil characteristics.

#### **Competency Area 5. Applied Information Technologies**

1. Differentiate precision and accuracy.
2. Define global positioning system (GPS).
3. Describe how the following precision agriculture tools are used in crop management:
  - a. guidance systems.
  - b. remote sensing.
  - c. geographic information systems (GIS).
  - d. crop management zone.
  - e. variable rate technology (VRT).
4. Differentiate management zone, grid, and field composite approaches to precision farming.
5. Describe how the following factors affect yield variability in a field:
  - a. soil texture.
  - b. soil organic matter.
  - c. soil moisture.
  - d. topography.
  - e. pest distribution.
  - f. previous management.

- g. salinity.
  - h. nutrient status and pH.
  - i. drainage.
6. Use a map legend to identify information on a GIS field map.
  7. Use latitude and longitude coordinates to locate a point in a field.

7. Describe how the following affect food safety:
  - a. worker/equipment sanitation.
  - b. water sources/irrigation testing.
  - c. buffer zones.
  - d. pesticide use.
  - e. record keeping.

**Competency Area 6. Harvest and Storage**

1. Describe how the following factors influence when to harvest:
  - a. crop moisture percentage.
  - b. hybrid or variety characteristics.
  - c. end use.
  - d. weather.
  - e. pest damage.
2. Describe how the following factors influence crop quality in storage:
  - a. temperature.
  - b. moisture.
  - c. aeration.
  - d. stored product pests.
  - e. crop condition and moisture at harvest.
  - f. post-harvest handling.
  - g. length of storage.
  - h. amount of foreign material.
  - i. sanitation of storage facilities
3. Describe consequences of biomass harvest in crops.
4. List the consequences of not maintaining the purity of an identity-preserved (IP) crop.
5. Describe how to maintain purity of an identity-preserved (IP) crop at planting, harvest, storage, and delivery.
6. Recognize excessive crop loss or low quality factors in harvested product caused by improper harvesting procedures.

**Competency Area 7. Crop Production Economics**

1. Describe how to use the following to manage production risk:
  - a. crop selection.
  - b. hybrid or variety selection.
  - c. planting and harvest date.
  - d. crop rotation.
  - e. pest and nutrient management.
  - f. record keeping.
2. Describe how the following affect crop management decisions:
  - a. crop prices.
  - b. input costs.
  - c. availability and skill of labor.
  - d. equipment.
  - e. weather.
  - f. cash flow.
  - g. crop insurance.
  - h. farm programs.
  - i. field proximity to sensitive areas.
  - j. time constraints.
  - k. pest threat.
3. Differentiate commodity crops from specialty crops.
4. Describe how the following factors influence crop prices:
  - a. basis.
  - b. supply and demand.

**VIII. Probable Course Calendar**

Date	Lecture Topics	Reading Assignment
Jan 17	Introduction. What is the difference between climate and weather?	IAH, pp 10-12; Syllabus
Jan 18	How does temperature affect plant growth and development?	IAH, pp 1-5
Jan 19	How does precipitation and evapotranspiration impact plant productivity?	IAH, pp 5-9
Jan 23	How does solar (and thermal) radiation affect plant productivity and development?	IAH, pp 9-10; Posted material
Jan 24	The climate is always changing. How is it different this time? And if climate prediction models are correct, what challenges will plants face in the future?	Posted material
Jan 25	Quiz 1. What services does society expect from crop farming (besides food)?	IAH, pp 49-50, 61-63

Jan 26	<i>Review Quiz 1. To till or not to till?</i>	IAH, pp 133-137
Jan 30	What are the short and long-term effects of tillage on soils and crops?	IAH, pp 137-142,
Jan 31	Roots need oxygen – Excess water and drainage	IAH, pp 143-148;
Feb 1	Roots need water – Using irrigation intelligently	IAH, pp 148-152
Feb 2	Crop rotation and yield	IAH, pp 50-54, 58-61,
Feb 6	Beyond Corn & Soybean (online)	IAH, pp 37-38, 54-61
Feb 7	Beyond Alfalfa, Smooth Brome & Tall Fescue (online)	IAH, pp 74-81
Feb 8	<i>Quiz 2.</i>	
Feb 9	How to view the numbers (and where to get them? (Online)	Posted articles
Feb 13 (Lincoln B-Day)	No class. Lincoln's Birthday (Feb 12)	
Feb 14	<i>Review Quiz 2. What do the numbers say? Understanding the USDA's World Agricultural Supply and Demand Report</i>	
Feb 15	Based on the numbers, what would you choose to grow?	Posted material
Feb 16	What is and is not a genetically modified crop (GMO)?	Posted material
Feb 20	What traits have been commercialized and adopted in GMO crops?	Posted material
Feb 21	CRISPR/Cas9 and RNAi – new technologies for genetic manipulation	Posted material
Feb 22	Is society's response to GMOs rational?	Posted material
Feb 23	<i>Quiz 3. Special Use Corn</i>	IAH pp 25-26,
Feb 27	<i>Review Quiz 3. Special Use Soybean</i>	IAH pp 35-36,
Feb 28	Wheat & Cereal Grains	IAH pp 37-38, 43-47
<b>March</b>	TBA	
<b>April</b>	TBA	
<b>May</b>	TBA	
<b>May 10</b>	<b><i>Final Exam, 10 a.m.</i></b>	