

# AGRONOMY (AGRONOMY)

## AGRONOMY 100 – PRINCIPLES AND PRACTICES IN CROP PRODUCTION

4 credits.

Plant science applied to the growth, production, management, distribution and utilization of field crops.

**Requisites:** None

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Elementary

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

## AGRONOMY/AGROECOL/C&E SOC/ENTOM/ENVIR ST 103 – AGROECOLOGY: AN INTRODUCTION TO THE ECOLOGY OF FOOD AND AGRICULTURE

3 credits.

Agroecology has blossomed across the world in recent decades as not only a science, but also a practice, and a movement. Employ the multiple disciplines and perspectives that Agroecology affords to analyze our agricultural and food systems within a broader context of dynamic social and ecological relationships.

**Requisites:** None

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Elementary

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Explain and analyze basic biophysical processes of agricultural ecosystems and the challenges and benefits of various management systems

Audience: Undergraduate

2. Interrogate social, economic, and political structures underlying agriculture at local, regional, national, and global scales

Audience: Undergraduate

3. Describe how they personally connect to local to global agricultural landscape as humans, ecological actors, food and fuel consumers, and thoughtful citizens

Audience: Undergraduate

## AGRONOMY 289 – HONORS INDEPENDENT STUDY

1-2 credits.

Research work under direct guidance of an Agronomy faculty or instructional academic staff member. Students are responsible for arranging the work and credits with the supervising instructor. Intended for students in the CALS Honors Program.

**Requisites:** Consent of instructor

**Course Designation:** Honors - Honors Only Courses (H)

**Repeatable for Credit:** Yes, unlimited number of completions

**Learning Outcomes:** 1. Develop critical, analytical and independent thinking skills through a scientific research project.

Audience: Undergraduate

2. Apply the scientific method and engage in constructive problem solving in a scientific research project.

Audience: Undergraduate

3. Demonstrate application of research skills and methodologies through a research project.

Audience: Undergraduate

4. Effectively communicate scientific findings in an oral and/or written format.

Audience: Undergraduate

## AGRONOMY 299 – INDEPENDENT STUDY

1-3 credits.

Research work under direct guidance of a faculty or instructional academic staff member. Students are responsible for arranging the work and credits with the supervising instructor.

**Requisites:** Consent of instructor

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Develop critical, analytical and independent thinking skills through a scientific research project.

Audience: Undergraduate

2. Apply the scientific method and engage in constructive problem solving in a scientific research project.

Audience: Undergraduate

3. Demonstrate application of research skills and methodologies through a research project.

Audience: Undergraduate

4. Effectively communicate scientific findings in an oral and/or written format.

Audience: Undergraduate

### **AGRONOMY 300 – CROPPING SYSTEMS**

3 credits.

Agronomic cropping systems of the Midwest: environmental impacts, productivity, and profitability. Cropping system diversification and sustainable agriculture. An agroecological approach, the application of ecological concepts and principles for the improvement of cropping systems is emphasized.

**Requisites:** AGRONOMY 100 or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Describe the dynamic history and unique characteristics of agriculture

Audience: Both Grad & Undergrad

2. Identify factors that drive change and those that constrain change in cropping systems

Audience: Both Grad & Undergrad

3. Use an agroecological approach to better understand and improve cropping systems

Audience: Both Grad & Undergrad

4. Explain key components of cropping systems and their impact on agroecosystem services and sustainability

Audience: Both Grad & Undergrad

5. Evaluate new and emerging approaches to crop management in the context of sustainability and potential tradeoffs

Audience: Both Grad & Undergrad

6. Develop a comprehensive grant research proposal that effectively addresses a topic pertinent to sustainability of cropping systems

Audience: Graduate

### **AGRONOMY 302 – FORAGE MANAGEMENT AND UTILIZATION**

3 credits.

Establishment, management, harvesting and utilization of forage crops for use as hay, pasture and silage. Emphasis on cool season perennial grasses and legumes.

**Requisites:** Junior standing and (DY SCI/AN SCI 101, ZOOLOGY/ BIOLOGY 101, ZOOLOGY/BIOLOGY/BOTANY 151, AGRONOMY 100, or BIOCORE 381) or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Explain the importance of forages in Wisconsin, USA, and the world

Audience: Both Grad & Undergrad

2. Identify forage species commonly grown and know the environmental conditions to which each is best adapted

Audience: Both Grad & Undergrad

3. Identify an alfalfa variety or corn silage hybrid best suited for a specific environment

Audience: Both Grad & Undergrad

4. Describe how legumes and grasses grow, and regrow, after harvest or grazing

Audience: Both Grad & Undergrad

5. Recommend practices to optimize establishment, growth, persistence, and nutritive value of forages

Audience: Both Grad & Undergrad

6. Evaluate how the environment impacts forage persistence, production, and quality

Audience: Both Grad & Undergrad

7. Develop optimal harvest strategies based on farming operation goals

Audience: Both Grad & Undergrad

8. Explain the principles of preserving forage crops (hay or silage) and direct grazing

Audience: Both Grad & Undergrad

9. Recognize major pests (diseases, insects, and weeds) that affect alfalfa production and best management practices for control

Audience: Both Grad & Undergrad

10. Communicate effectively ideas in written reports and oral presentations

Audience: Both Grad & Undergrad

11. Understand and summarize current topics in forages research

Audience: Graduate

**AGRONOMY/HORT/SOIL SCI 326 – PLANT NUTRITION MANAGEMENT**

3 credits.

Functions, requirements and uptake of essential plant nutrients; chemical and microbial processes affecting nutrient availability; diagnosis of plant and soil nutrient status; fertilizers and efficient fertilizer use in different tillage systems.

**Requisites:** (CHEM 103, 109, or 115 and SOIL SCI/ENVIR ST/GEOG 230) or SOIL SCI 301, or graduate/professional standing

**Course Designation:** Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Identify the essential plant nutrients and their biological functions

Audience: Both Grad & Undergrad

2. Explain sampling and analytical methods used to determine macronutrients sufficiency for healthy plant growth

Audience: Both Grad & Undergrad

3. Discuss the primary fertilizer materials used in agriculture, their sources and limitations

Audience: Both Grad & Undergrad

4. Analyze and interpret experimental data collected in the laboratory about plant growth and nutrient use efficiency

Audience: Both Grad & Undergrad

5. Describe the environmental impact of fertilizer manufacture, the impacts of nutrient loss by leaching and runoff, and best-known practices for improved fertilizer efficiency and mitigation of nutrient loss to the environment

Audience: Both Grad & Undergrad

6. Synthesize soil, cropping systems, and other critical on-farm details needed to develop a comprehensive nutrient management plan

Audience: Graduate

**AGRONOMY/HORT 338 – PLANT BREEDING AND BIOTECHNOLOGY**

3 credits.

Principles of transferring plant genes by sexual, somatic, and molecular methods and the application of gene transfer in plant breeding and genetic engineering to improve crop plants.

**Requisites:** (BOTANY/BIOLOGY 130, GENETICS 466, 467, or BIOCORE 381) or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Explain the basic principles of plant breeding

Audience: Both Grad & Undergrad

2. Describe and analyze different plant breeding systems and methods

Audience: Both Grad & Undergrad

3. Identify, formulate, and solve breeding problems using appropriate information and approaches

Audience: Both Grad & Undergrad

4. Discuss the professional and ethical responsibility of plant breeding activities

Audience: Both Grad & Undergrad

5. Synthesize knowledge to propose improvements to breeding systems and write clear and concise technical reports and research articles

Audience: Both Grad & Undergrad

6. Discuss the significance of current research in the field of plant breeding

Audience: Both Grad & Undergrad

7. Critically assess and compare various breeding strategies

Audience: Both Grad & Undergrad

8. Evaluate advanced breeding strategies and technologies as presented in scientific literature (e.g. use of genomic tools in breeding, CRISPR, speed breeding strategies, and use of AI in breeding among others)

Audience: Graduate

**AGRONOMY/BOTANY/HORT 340 – PLANT CELL CULTURE AND GENETIC ENGINEERING**

3 credits.

Presents an overview of the techniques, biology and underlying theory of plant tissue culture, genetic engineering and genome editing. Overviews of research and commercial applications, and issues/challenges in the area of plant biotechnology are also covered.

**Requisites:** (BOTANY/BIOLOGY 130, ZOOLOGY/BIOLOGY/BOTANY 152, ZOOLOGY/BIOLOGY 102, or BIOCORE 381) and (CHEM 104, 109, or 116), or graduate/professional standing

**Course Designation:** Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Recall and summarize the general principles, practices and application of plant cell and tissue culture, and genetic engineering and gene editing in science, agriculture and industry.

Audience: Both Grad & Undergrad

2. Apply experimental design and analysis of plant biotechnology experiments.

Audience: Both Grad & Undergrad

3. Illustrate representative plant cell culture and bioengineering techniques.

Audience: Both Grad & Undergrad

4. Recall biosafety and regulatory requirements for conducting research involving cell culture, microbes and recombinant DNA.

Audience: Both Grad & Undergrad

5. Understand issues and challenges encountered in the areas of in vitro culture and plant biotechnology

Audience: Both Grad & Undergrad

6. Demonstrate understanding, application and synthesis of concepts learned in the course through completion of a review paper on approved topics relating to plant biotechnology

Audience: Graduate

**AGRONOMY/A A E/NUTR SCI 350 – WORLD HUNGER AND MALNUTRITION**

3 credits.

Hunger and poverty in developing countries and the United States. Topics include: nutrition and health, population, food production and availability, and income distribution and employment.

**Requisites:** None

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Demonstrate a basic understanding of the complex links between nutrition and malnutrition.

Audience: Undergraduate

2. Learn and apply the economic tools of supply and demand to solving/analyzing issues including income and population growth, income and population policies, and agricultural supply topics.

Audience: Undergraduate

3. Synthesize knowledge about the economics and nutritional aspects of world hunger to better understand solutions.

Audience: Undergraduate

4. Communicate effectively through written reports and online discussions.

Audience: Undergraduate

5. Apply sustainability principles and/or frameworks to addressing the challenge of addressing issues of population growth, hunger and poverty.

Audience: Undergraduate

6. Describe the social, economic, and environmental dimensions of food, hunger and malnutrition. Identify potential tradeoffs and interrelationships among these dimensions at a level appropriate to the course.

Audience: Undergraduate

**AGRONOMY/HORT 360 – GENETICALLY MODIFIED CROPS: SCIENCE, REGULATION & CONTROVERSY**

2 credits.

Explores how and why genetically modified (GM) crops are created and their regulation at the federal and state level. Through case studies, students will learn about the impacts of GM crops and critically evaluate arguments both for and against their use. Readings and discussion introduce students to the complex economic, cultural, and political issues surrounding GM crops.

**Requisites:** ZOOLOGY/BIOLOGY 101, BOTANY/BIOLOGY 130, ZOOLOGY/BIOLOGY/BOTANY 151, BIOCORE 381, GENETICS 466, or GENETICS 467

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Explain how genetically modified crops are made and compare genetic engineering with other plant breeding methods.

Audience: Undergraduate

2. Describe the US coordinated framework for the regulation of biotechnology and labeling laws.

Audience: Undergraduate

3. Discuss the potential risks and benefits of genetically modified crops for agriculture, the environment, and human health.

Audience: Undergraduate

4. Analyze different perspectives on controversial topics related to genetically modified organisms.

Audience: Undergraduate

**AGRONOMY/A A E/HORT/PL PATH 367 – INTRODUCTION TO ORGANIC AGRICULTURE: PRODUCTION, MARKETS, AND POLICY**

3 credits.

Provides an in-depth understanding of the history of organic agriculture, its production, processing, marketing, and social dimensions, and its impact on environmental, community, and human health.

**Requisites:** ENVIR ST/AGROECOL/AGRONOMY/C&E SOC/ ENTOM 103, AGRONOMY 100, HORT 120, BOTANY/PL PATH 123, SOC/ C&E SOC 222, or graduate/professional standing

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level - Elementary

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Describe the history of current organic systems and how it influences the way that organic farms and industries work.

Audience: Both Grad & Undergrad

2. Explore the biological, ecological, and agricultural underpinnings of organic production systems.

Audience: Both Grad & Undergrad

3. Examine how organic systems, social initiatives, and regulations are developed and how they shape business activities, community development efforts, and human and environmental health outcomes.

Audience: Both Grad & Undergrad

4. Evaluate the benefits and limitations of organic systems, social initiatives, and regulations from environmental, social, economic, and racial justice perspectives.

Audience: Both Grad & Undergrad

5. Analyze sustainability issues and/or practices using a systems-based approach.

Audience: Both Grad & Undergrad

6. Describe the social, economic, and environmental dimensions of organic farming and identify potential tradeoffs and interrelationships among these dimensions at a level appropriate to the course.

Audience: Both Grad & Undergrad

7. Develop the capacity to evaluate sustainability and resilience outcomes of organic and other agricultural production and processing systems using interdisciplinary methods.

Audience: Graduate

**AGRONOMY/BOTANY/SOIL SCI 370 – GRASSLAND ECOLOGY**

3 credits.

Understand factors driving global, continental, regional, and local distribution of grasslands. Discuss how management affects provision of grassland ecosystem goods and services. Compare and contrast plant community and ecosystem dynamics in native prairie and intensively managed pastures.

**Requisites:** PL PATH/BOTANY 123, BOTANY/BIOLOGY 130, SOIL SCI/ ENVIR ST 101, SOIL SCI/ATM OCN 132, ZOOLOGY/BIOLOGY/ BOTANY 151, BIOCORE 381, BOTANY 100, or AGRONOMY 100, or graduate/professional standing

**Course Designation:** Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Explain the social, economic, and environmental dimensions of the sustainability challenges of grasslands

Audience: Undergraduate

2. Describe the social, economic, and environmental dimensions of grasslands and identify potential trade-offs and interrelationships among these dimensions

Audience: Both Grad & Undergrad

3. Predict the distribution, structure, function, and services of grasslands from global to local levels of resolution

Audience: Graduate

**AGRONOMY 375 – SPECIAL TOPICS**

1-4 credits.

Special topics on issues relevant to Agronomy.

**Requisites:** None

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Explain concepts relating to a special topic outlined in the title

Audience: Undergraduate

**AGRONOMY/HORT 376 – TROPICAL HORTICULTURAL SYSTEMS**

2 credits.

Highlights the connections between tropical plants and society. Topics include multidisciplinary reflections on the biology of tropical plants, as well as an overview of different production systems and some of the social and environmental problems associated with the utilization of tropical plants in the context of local and global markets. Provides the opportunity to demonstrate comparative skills with respect to local and international challenges posed by the topics we address in class. Illustrates connections between horticulture and conservation, food security, nutrition, and global health.

**Requisites:** Junior standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Demonstrate interdisciplinary skills, intercultural knowledge, and global competencies through the understanding of the relationships between tropical plants and different cultures.

Audience: Undergraduate

2. Recognize social, economic, and environmental issues related to sustainable food production in tropical ecosystems and find suitable methods to address them

Audience: Undergraduate

3. Discuss the unique challenges to food security and sustainability in tropical ecosystems under the pressure of climate change

Audience: Undergraduate

4. Develop a critical perspective and creative thinking regarding the production and consumption of tropical horticultural products, and how they relate to nutrition, food security, health and wellbeing, sustainable cropping practices and community development

Audience: Undergraduate

5. Recognize the importance of green spaces, conservation of biodiversity, traditional knowledge, intellectual property rights, and equitable sharing of benefits derived from the use of tropical plants

Audience: Undergraduate

6. Apply written and public speaking skills through critical explorations of tropical food systems

Audience: Undergraduate

**AGRONOMY 377 – GLOBAL FOOD PRODUCTION AND HEALTH**

3 credits.

Crops, food, and cropping systems from different parts of the world and their impact on global sustainability and health. Introduction to crop biology, environmental requirements, and agronomic production practices of major food crops. Environmental, socioeconomic, and health impacts of farming systems and how to assess their sustainability. For those with broad interests in global issues, agroecology, food, environment, health, and agriculture.

**Requisites:** BOTANY/BIOLOGY/ZOOLOGY 151, BIOLOGY/ZOOLOGY 101, BIOLOGY/BOTANY 130, BIOCORE 381, HORT 120, AGRONOMY 100, ENVIR ST/AGROECOL/AGRONOMY/C&E SOC/ENTOM 103, or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. describe, analyze, and understand cropping systems of different parts of the world

Audience: Both Grad & Undergrad

2. describe the social, economic, and environmental dimensions of cropping systems and identify potential trade-offs and interrelationships among these dimensions at a level appropriate to the course

Audience: Both Grad & Undergrad

3. analyze sustainability issues and/or practices using a systems-based approach within the Agroecology framework.

Audience: Both Grad & Undergrad

4. consider thoughtfully engaging in international sustainable agriculture and health issues.

Audience: Both Grad & Undergrad

5. communicate effectively ideas in written reports and oral presentations.

Audience: Both Grad & Undergrad

6. use sustainability principles for developing personal goals and professional values

Audience: Both Grad & Undergrad

7. explain the social, economic, and/or environmental dimensions of the sustainability challenges of global food production systems and health

Audience: Graduate

**AGRONOMY 399 – COORDINATIVE INTERNSHIP/COOPERATIVE EDUCATION**

1-8 credits.

An internship under guidance of a faculty or instructional academic staff member in Agronomy and internship site supervisor. Students are responsible for arranging the work and credits with the faculty or instructional academic staff member and the internship site supervisor.

**Requisites:** Consent of instructor

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Workplace - Workplace Experience Course

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Apply concepts learned in coursework to authentic professional situations

Audience: Undergraduate

2. Demonstrate professional skills appropriate for the industry

Audience: Undergraduate

3. Identify and reflect on how concepts learned in coursework apply to specific work settings and situations

Audience: Undergraduate

**AGRONOMY 400 – STUDY ABROAD IN AGRONOMY**

1-6 credits.

Provides an area equivalency for courses taken on Madison Study Abroad Programs that do not equate to existing UW courses. Current enrollment in a UW-Madison study abroad program

**Requisites:** None

**Repeatable for Credit:** Yes, unlimited number of completions

**Learning Outcomes:** 1. Demonstrate understanding of concepts described in course syllabus

Audience: Undergraduate

**AGRONOMY/DY SCI 471 – FOOD PRODUCTION SYSTEMS AND SUSTAINABILITY**

3 credits.

Delves into aspects of natural sciences (biology and agricultural sciences) and social sciences underpinning the assessment of food production systems as related to a variety of outcomes including but not restricted to human and environmental health, air and water quality, greenhouse gases emission, land use, economic opportunity, social justice, as well as mitigation and adaptation to climate change, locally, regionally, domestically, across continents, and globally.

**Requisites:** (Graduate/professional standing) or junior standing and satisfied Quantitative Reasoning (QR) B requirement

**Course Designation:** Breadth - Either Biological Science or Social Science

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Explain the social, economic, and/or environmental dimension of sustainability challenges associated with food production systems.

Audience: Both Grad & Undergrad

2. Evaluate food production systems for their contribution to, mitigation potential of, and adaptation to climate change.

Audience: Both Grad & Undergrad

3. Identify ways in which social structures profoundly affect not only people, but also biology, ecology, and our very climate. And the complement: how people's race/class/gender/occupation/nation status within the global social structure, as well as the nature of the global social structure itself, profoundly impacts their ability to cope with changing climate.

Audience: Both Grad & Undergrad

4. Critically evaluate the scientific literature and other sources of information related to the sustainability of food systems.

Audience: Both Grad & Undergrad

5. Analyze the causes of and solutions for the sustainability of food production, distribution, marketing, consumption, and waste disposal.

Audience: Both Grad & Undergrad

6. Develop analytical and problem-solving skills individually and in teams of classmates with diverse worldviews.

Audience: Both Grad & Undergrad

7. Communicate effectively information to multiple audiences through multiple medias

Audience: Both Grad & Undergrad

8. Develop an aptitude for working with mixed teams including undergraduate students

Audience: Graduate

9. Demonstrate research and writing skills to produce academically rigorous literature reviews

Audience: Graduate

**AGRONOMY 500 – SENIOR CAPSTONE EXPERIENCE**

2 credits.

A stepping stone between the classroom and society. Emphasizes discussion and activities for enhancing integration of diverse bodies of knowledge, critical thinking, and effective written and oral communication.

**Requisites:** Senior standing only

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Integrate existing knowledge of plant science and technology with current research to evaluate key contemporary issues in the field of plant and agroecosystem sciences.

Audience: Undergraduate

2. Synthesize plant science information, predictions, insights, and hypotheses into effective forms of written and oral communication.

Audience: Undergraduate

3. Evaluate plant sciences information from a broad range of sources.

Audience: Undergraduate

4. Discuss societal, economic, ethical, scientific, and social issues relevant to plant scientists

Audience: Undergraduate



**AGRONOMY/HORT 501 – PRINCIPLES OF PLANT BREEDING**

3 credits.

Principles involved in breeding and maintaining economic crops; factors affecting the choice of breeding methods; alternative approaches through hybridization and selection.

**Requisites:** (GENETICS 466 or 467) and (BOTANY/BIOLOGY 130, ZOOLOGY/BIOLOGY/BOTANY 151, or BIOCORE 381) or graduate/professional standing

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**Learning Outcomes:** 1. Identify key biological and quantitative principles behind the science of plant breeding.

Audience: Both Grad & Undergrad

2. Recognize how genetic variation is generated and how other sources of variation can affect phenotypes.

Audience: Both Grad & Undergrad

3. Describe how crops were domesticated, and how germplasm can be deployed by plant breeders to improve crops.

Audience: Both Grad & Undergrad

4. Apply scientific theories, concepts, reasoning, and quantitative and qualitative approaches to understand and solve problems in plant breeding and plant genetics.

Audience: Both Grad & Undergrad

5. Use terminology accurately and effectively in describing plant breeding phenomena and processes.

Audience: Both Grad & Undergrad

6. Evaluate and discuss relevant scientific concepts.

Audience: Both Grad & Undergrad

7. Relate scientific information found in primary scientific literature to key issues and concepts in plant breeding.

Audience: Graduate

**AGRONOMY/HORT 502 – TECHNIQUES OF PLANT BREEDING**

1 credit.

Lab and field techniques used in breeding and maintaining economic crops.

**Requisites:** (GENETICS 466 or 467) and (BOTANY/BIOLOGY 130, ZOOLOGY/BIOLOGY/BOTANY 151, or BIOCORE 381) or graduate/professional standing

**Course Designation:** Breadth – Biological Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2019

**Learning Outcomes:** 1. Define different approaches, techniques, and ideas in plant breeding from a practical and theoretical point of view by interacting with plant breeders who breed a wide range of crops.

Audience: Both Grad & Undergrad

2. Identify why certain techniques are used in certain situations, and what options might exist for plant breeders to pursue particular breeding objectives.

Audience: Both Grad & Undergrad

3. Describe why a particular crop is bred in a certain way, and be able to articulate why the crop's biology or key traits are best served by these approaches.

Audience: Both Grad & Undergrad

4. Explain how improved germplasm and cultivars are developed and released by plant breeders.

Audience: Both Grad & Undergrad

5. Use terminology accurately and effectively in describing plant breeding problems and solutions.

Audience: Both Grad & Undergrad

6. Read, evaluate, and discuss scientific concepts.

Audience: Both Grad & Undergrad

7. Relate scientific information found in primary scientific literature to key issues and concepts in plant breeding.

Audience: Graduate

**AGRONOMY/ATM OCN/SOIL SCI 532 – ENVIRONMENTAL BIOPHYSICS**

3 credits.

Plant-environment interactions with particular reference to energy exchanges and water relations. Models are used to provide a quantitative synthesis of information from plant physiology, soil physics, and micrometeorology with some consideration of plant-pest interactions.

**Requisites:** BIOLOGY/BOTANY 130 and (MATH 211, 217, or 221) and (PHYSICS 103, 201, 207, or 247), or graduate/professional standing

**Course Designation:** Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**AGRONOMY/C&E SOC/MED HIST/PHILOS 565 – THE ETHICS OF MODERN BIOTECHNOLOGY**

3 credits.

An in-depth study of a selection of ethical issues arising from the application of modern biotechnology to microorganisms, plants, non-human animals, and human beings. We will aim at a discussion that is informed by empirical research and by work done in ethical theory, political philosophy, and other relevant disciplines, and whose character is rigorous, clear, nuanced, and unbiased.

**Requisites:** Junior standing

**Course Designation:** Breadth - Humanities

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2021

**Learning Outcomes:** 1. Think critically about arguments.

Audience: Both Grad & Undergrad

2. Communicate precisely and concisely in both writing and speech.

Audience: Both Grad & Undergrad

3. Exchange reasons about controversial matters respectfully and with the aim of uncovering the truth.

Audience: Both Grad & Undergrad

4. Practice interpretive charity and intellectual honesty, which includes appropriate attribute to others of their ideas, and recognition and frankness about the limitations of one's own ideas.

Audience: Both Grad & Undergrad

5. Independently locate and engage with the latest relevant empirical and philosophical research.

Audience: Graduate

6. Exhibit substantial synthetic and analytic abilities by considering how an application of modern biotechnology ethically compares to the status quo and to other possible alternatives.

Audience: Graduate

**AGRONOMY/AN SCI/GENETICS/HORT 615 – GENETIC MAPPING**

3 credits.

Computing-intensive course to prepare students for genetic mapping research; linkage analysis and QTL mapping in designed crosses; linkage disequilibrium and association analysis (GWAS). Recommended preparation is undergraduate courses in genetics and statistics and prior experience writing R scripts (such as module 1 of STAT 327).

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Write scripts to curate marker data and analyze population structure

Audience: Graduate

2. Explain the distinction between linkage and association mapping

Audience: Graduate

3. Describe how population and model parameters affect statistical power

Audience: Graduate

4. Construct genetic linkage maps and discover QTL in biparental populations

Audience: Graduate

5. Perform a genome-wide association analysis and interpret the results

Audience: Graduate

**AGRONOMY 681 – SENIOR HONORS THESIS**

2-4 credits.

Individual study for majors completing theses for Agronomy Honors degrees.

**Requisites:** Consent of instructor

**Course Designation:** Honors - Honors Only Courses (H)

**Repeatable for Credit:** No

**Last Taught:** Fall 2018

**Learning Outcomes:** 1. Investigate a topic in conjunction with other investigators to develop a deep understanding of a research problem.

Audience: Undergraduate

2. Identify a research problem and develop a set of testable hypotheses.

Audience: Undergraduate

3. Carry out analysis of data related to the testable hypotheses.

Audience: Undergraduate

4. Communicate the results of investigations via written and/or oral means to an appropriate audience.

Audience: Undergraduate

5. Write an honors thesis that contains an abstract, background, a demonstration of research skills, analysis of the research question, and a summary of the impact of the work.

Audience: Undergraduate

**AGRONOMY 682 – SENIOR HONORS THESIS**

2-4 credits.

Individual study for majors completing theses for Honors degrees as arranged with a faculty member. Requires consent of supervising instructor. Continuation of AGRONOMY 681. Enrolled in CALS Honors Program.

**Requisites:** Consent of instructor

**Course Designation:** Honors - Honors Only Courses (H)

**Repeatable for Credit:** No

**Last Taught:** Spring 2009

**Learning Outcomes:** 1. Investigate a topic in conjunction with other investigators to develop a deep understanding of a research problem.

Audience: Undergraduate

2. Identify a research problem and develop a set of testable hypotheses.

Audience: Undergraduate

3. Carry out analysis of data related to the testable hypotheses.

Audience: Undergraduate

4. Communicate the results of investigations via written and/or oral means to an appropriate audience.

Audience: Undergraduate

5. Write an honors thesis that contains an abstract, background, a demonstration of research skills, analysis of the research question, and a summary of the impact of the work.

Audience: Undergraduate

**AGRONOMY 699 – SPECIAL PROBLEMS**

1-4 credits.

Independent research guided by an Agronomy faculty or instructional academic staff member. Students are responsible for arranging the work and credits with the supervising instructor.

**Requisites:** Consent of instructor

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Articulate a clear research question or problem and formulate a hypothesis.

Audience: Undergraduate

2. Identify appropriate research methodologies and collect sound scientific data.

Audience: Undergraduate

3. Apply critical thinking skills to interpret laboratory data and apply problem solving skills to constructively address research setbacks.

Audience: Undergraduate

4. Practice research ethics and responsible conduct in research.

Audience: Undergraduate

5. Communicate scientific ideas and results verbally and in written form effectively.

Audience: Undergraduate

**AGRONOMY/AGROECOL/ENVIR ST 724 – AGROECOSYSTEMS AND GLOBAL CHANGE**

3 credits.

Impacts of global change drivers (climate change, atmospheric chemistry, bioenergy, urbanization, policy) on agroecosystems and their associated goods and services; environmental impacts of agricultural land use and feedbacks to climate; modeling approaches; critical review of current scientific literature.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Explain key physical, biological, and social drivers of change to agroecosystems on planet Earth

Audience: Graduate

2. Apply important biophysical and biological concepts to describe how a changing climate and changes in atmospheric composition impact agricultural systems

Audience: Graduate

3. Describe how agricultural land management impacts the Earth's climate system through changing biogeochemical cycling

Audience: Graduate

4. Discuss how agricultural land management impacts Earth's climate system through biogeophysical processes that effect energy and water balance in the soil-plant-atmosphere system

Audience: Graduate

5. Identify and summarize ecosystem services that are impacted by agroecosystems and land management decision-making, and how this effects global environmental sustainability

Audience: Graduate

**AGRONOMY 771 – EXPERIMENTAL DESIGNS**

1 credit.

Review of methods for controlling error in research experiments; review and in-depth development of factorial treatment designs; theory, analysis, and examples of advanced experimental designs for plant and animal research. Knowledge of statistics such as STAT/F&W ECOL 571 is strongly encouraged.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Describe the importance of experimental design in research.

Audience: Graduate

2. Plan and execute a proper basic experimental design, critically evaluate personal limitations, and actively seek assistance when necessary.

Audience: Graduate

3. Use proper experimental design and analysis tools for most agricultural situations.

Audience: Graduate

4. Explain experimental design in the context of agricultural experimentation.

Audience: Graduate

**AGRONOMY 772 – APPLICATIONS IN ANOVA**

1 credit.

Development of models, programs, inferences, and interpretations of analysis of variance in biological research; mixed vs. random effects models and their development; choosing the correct inference range; variance and covariance analyses; repeated measures; dealing with missing data; SAS programming. Knowledge of statistics such as STAT/F&W ECOL 571 is strongly encouraged.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Describe the importance of experimental design in research.

Audience: Graduate

2. Plan and execute a proper advanced experimental design.

Audience: Graduate

3. Use proper experimental design and analysis tools for most advanced agricultural experiments.

Audience: Graduate

4. Explain the theory and concepts of mixed models as well as applications of mixed models in biological research settings.

Audience: Graduate

**AGRONOMY 799 – PRACTICUM IN AGRONOMY TEACHING**

1-3 credits.

Instructional orientation to teaching at the higher education level in the agricultural and life sciences, direct teaching experience under faculty supervision, experience in testing and evaluation of students, and the analysis of teaching performance.

**Requisites:** Consent of instructor

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Articulate learning goals for the practicum in cooperation with supervising instructor

Audience: Graduate

2. Prepare and/or implement lesson plans for a class period, week, or module of the class

Audience: Graduate

3. Deliver course content and/or facilitate discussion

Audience: Graduate

4. Identify pedagogical strengths and opportunities for growth based on classroom assessment and/or feedback

Audience: Graduate

**AGRONOMY/HORT 811 – BIOMETRICAL PROCEDURES IN PLANT BREEDING**

3 credits.

Use of statistical methods to facilitate improvements in quantitative traits of cultivated plants.

**Requisites:** Graduate/professional standing and STAT/F&W ECOL 572

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2023

**Learning Outcomes:** 1. Describe quantitative genetics principles, including heritability, repeatability, and resemblance between relatives, and the application of these concepts to assess genetic variation and trait inheritance in plant populations.

Audience: Graduate

2. Analyze phenotypic datasets and interpreting results, particularly in relation to variance partitioning and resource allocation in plant breeding.

Audience: Graduate

3. Identify the impact of genotype-by-environment ( $G \times E$ ) interactions and environmental stability on breeding outcomes, and the application of this knowledge to optimize breeding strategies.

Audience: Graduate

4. Analyze and interpret genotype-phenotype association tools to identify the genetic basis of traits and refine breeding approaches across plant populations.

Audience: Graduate

5. Communicate complex biometrical and genetic concepts, through effective scientific writing and presentations, clearly conveying research findings and upholding principles of scientific integrity.

Audience: Graduate

**AGRONOMY/HORT 812 – SELECTION THEORY FOR QUANTITATIVE TRAITS IN PLANTS**

2 credits.

Discuss advanced topics in selection theory and the utilization of molecular markers in selection.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2024

**Learning Outcomes:** 1. Apply the breeder's equation to design and evaluate selection schemes

Audience: Graduate

2. Explain Best Linear Unbiased Prediction (BLUP) and its application to selection

Audience: Graduate

3. Analyze multi-environment trial data to make genomic predictions

Audience: Graduate

4. Identify resource allocation tradeoffs and strategies for long-term genetic gain

Audience: Graduate

**AGRONOMY 875 – SPECIAL TOPICS**

1-4 credits.

Special topics on issues relevant to Agronomy.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Explain concepts relating to a special topic outlined in the title

Audience: Graduate

**AGRONOMY 920 – SEMINAR**

1 credit.

Weekly seminar topics in agronomy and horticulture.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Communicate effectively through oral presentations, discussion and writing

Audience: Graduate

2. Translate scientific information into outreach materials for agricultural stakeholder audiences

Audience: Graduate

3. Evaluate the effectiveness of oral and written scientific communication

Audience: Graduate

**AGRONOMY/ATM OCN/BOTANY/ENTOM/ENVIR ST/F&W ECOL/  
GEOG/ZOOLOGY 953 – INTRODUCTION TO ECOLOGY  
RESEARCH AT UW-MADISON**

1-2 credits.

Introduces new graduate students to the diversity of ecologists across the UW-Madison campus. Includes discussions of key topics in professional development, research presentations by faculty members, and discussions of assigned papers with senior graduate students.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2024

**AGRONOMY/GENETICS/HORT 957 – SEMINAR-PLANT  
BREEDING**

1 credit.

Graduate seminar in Plant Breeding Plant Genetics (PBPG) that requires students to give oral scientific presentations on topics chosen by the instructors and/or the student's thesis research. This seminar is coordinated by PBPG faculty on a rotating basis.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Present current research in plant breeding and genetics clearly and effectively, including appropriate visuals and following the structure of a scientific seminar

Audience: Graduate

2. Deliver constructive feedback on peers' research and presentations, fostering a collaborative and supportive academic environment

Audience: Graduate

3. Discuss current research in plant breeding and genetics, identifying strengths, weaknesses, and areas for further research

Audience: Graduate

**AGRONOMY 990 – RESEARCH**

1-9 credits.

Independent writing and research to complete thesis or dissertation requirements.

**Requisites:** Consent of instructor

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2025

**Learning Outcomes:** 1. Demonstrate graduate-level research skills and techniques

Audience: Graduate

2. Address research challenges using a broad range of theories, research methods, and approaches to scientific inquiry

Audience: Graduate

3. Formulate and design new approaches that extend plant science and technology research beyond its current boundaries

Audience: Graduate