

AGRONOMY

Undergraduate Study

The Department of Agronomy offers a degree of Bachelor of Science (B.S.) degree in agronomy. The curriculum is designed to provide a strong foundation in crop science, soil science, agricultural meteorology, and plant breeding.

The curriculum provides both flexibility and direction for students by offering four options: agroecology, crop management and business, plant breeding and biotechnology, and soil science and environmental quality. There are many opportunities for undergraduate students to be involved in research and international agriculture.

Graduates have the theoretical and practical knowledge needed for efficient and sustainable production of food, feed, fuel, and fiber. Graduates are skilled in critical thinking, problem solving, and communicating and working effectively with others. They understand the ethical, cultural, and environmental dimensions of issues facing professionals in agriculture and natural resources.

An agronomy major prepares students for employment in agricultural business and industry, agricultural service organizations, crop production and soil management, environmental and natural resource management, and farm management. Graduates pursue careers in the seed, fertilizer, and agricultural chemical industries as field agronomists, crop and soil management specialists, research technicians, sales and marketing specialists, and production managers. State and federal agencies employ agronomists as extension specialists, county extension directors, environmental and natural resource specialists, research associates, soil surveyors, soil conservationists, regulatory agencies as plant, food, and grain inspectors, science-based professional positions, graduate study, or research careers. Additional areas of work open to agronomists include integrated pest management, land appraisal, agricultural finance, turfgrass management, and the home lawn care industry.

The department offers an international scholar program leading to a credentialed title of "Agronomy International Scholar" for agronomy majors who have distinguished themselves in global understanding and international experience. Contact the department for requirements.

Department of Agronomy website - <http://www.agron.iastate.edu/index.aspx>

Curriculum in Agronomy

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA. A minimum of 15 credits of agronomy courses must be earned at Iowa State and not transferred from other institutions.

International Perspective: 3 cr.

3 cr. <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current>

U.S. Diversity: 3 cr.

3 cr. <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses>

Communication/Library: 13 cr.

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
or AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
LIB 160	Information Literacy	1
One of the following:		3
ENGL 302	Business Communication	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

Humanities and Social Sciences: 6 cr.

3 cr. from approved humanities list <http://www.cals.iastate.edu/student-services/humanities>

ECON 101	Principles of Microeconomics	3
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Ethics/Agricultural Issues: 3 cr.

AGRON 342	World Food Issues: Past and Present	3
or AGRON 450	Issues in Sustainable Agriculture	

Mathematical Sciences: 6-7 cr.

STAT 104	Introduction to Statistics	3
One of the following:		3-4
MATH 140	College Algebra	3
MATH 150	Discrete Mathematics for Business and Social Sciences	3
MATH 160	Survey of Calculus	4
MATH 165	Calculus I	4
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	4

Physical Sciences: 15-17 cr.

CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
PHYS 111	General Physics	4-5
or PHYS 115	Physics for the Life Sciences	
GEOL 100	The Earth	3

One of the following:

AGRON 259	Organic Compounds in Plants and Soils	3
BBMB 221	Structure and Reactions in Biochemical Processes	3
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4

Life and Biological Sciences: 7-8 cr.

BIOL 212 & 212L	Principles of Biology II and Principles of Biology Laboratory II	4
AGRON 320 or BIOL 313 & 313L	Genetics, Agriculture and Biotechnology and Genetics Laboratory	3-4

Agronomy Core: 22.5-24 cr.

AGRON 105	Leadership Experience	R
AGRON 110	Professional Development in Agronomy: Orientation	0.5-1
AGRON 180	Global Agriculture in a Changing World	3
AGRON 181	Introduction to Crop Science	3
AGRON 182	Introduction to Soil Science	3
AGRON 183	Crop and Soil Management Lab	1
AGRON 206	Introduction to Weather and Climate	3
AGRON 210	Professional Development in Agronomy: Career Planning	1
AGRON 310	Professional Development in Agronomy: Work Experience	R
or		
AGRON 311	Professional Internship in Agronomy	1
AGRON 316	Crop Structure-Function Relationships	3
AGRON 354 & 354L	Soils and Plant Growth and Soils and Plant Growth Laboratory	4
AGRON 410	Professional Development in Agronomy: Senior Forum	1

Advising Option Choice

Complete a minimum of 25 cr. including 16 cr. from 300 level courses or above from approved list; no more than 4 cr. of any 490 may count toward graduation.

Electives:

25 credits, student choice

Advising Options**Agroecology**

AGRON 311	Professional Internship in Agronomy	1
AGRON 392	Systems Analysis in Crop and Soil Management	3
AGRON 450	Issues in Sustainable Agriculture	3
AGRON 497	Agroecology Field Course	3

Biological Science Choices: (Choose at least 2) 6 credits

AGRON 217	Weed Identification	1
AGRON 317	Principles of Weed Science	3
AGRON 334	Forage Crop Management	3
AGRON 485	Soil and Environmental Microbiology	3
ENT 376	Fundamentals of Entomology and Pest Management	3
ENT 471	Insect Ecology	3
HORT 424	Sustainable and Environmental Horticulture Systems	3
HORT 484	Organic Agricultural Theory and Practice	3
PL P 408	Principles of Plant Pathology	3

Physical Science Choices: (Choose 2)

AGRON 360	Environmental Soil Science	3
ENSCI 402	Watershed Hydrology	3
AGRON 404	Global Change	3
AGRON 405	Environmental Biophysics	3
AGRON 406	World Climates	3
AGRON 407	Mesoscale Meteorology	3
AGRON 452	GIS for Geoscientists	3

Social Science Choices: (Choose 1)

AGRON 342	World Food Issues: Past and Present	3
ENSCI 484	Ecosystem Ecology	3
SOC 325	Transition in Agriculture	3

Crop Management and Business

AGRON 212	Crop Growth, Productivity and Management	3
AGRON 212L	Field Application and Problem Solving in Crop Production	1
ENT 376	Fundamentals of Entomology and Pest Management	3
PL P 408	Principles of Plant Pathology	3
AGRON 217	Weed Identification	1
AGRON 317	Principles of Weed Science	3

Problem Solving:

AGRON 392	Systems Analysis in Crop and Soil Management	3
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Business Choices: (Choose 3)

ACCT 284	Financial Accounting	3
ECON 102	Principles of Macroeconomics	3
ECON 230	Farm Business Management	3
ECON 235	Introduction to Agricultural Markets	3

Agronomic Choices: (Choose at least 2) 6 credits

AGRON 260	Soils and Environmental Quality	3
AGRON 330	Crop and Seed Identification Laboratory	2
AGRON 334	Forage Crop Management	3
AGRON 338	Seed Science and Technology	3
AGRON 360	Environmental Soil Science	3
AGRON 421	Introduction to Plant Breeding	3
AGRON 463	Soil Formation and Landscape Relationships	4
TSM 333	Precision Farming Systems	3

Plant Breeding and Biotechnology

MATH 165	Calculus I	4
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	

MATH 166	Calculus II	4
or MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
BIOL 314	Principles of Molecular Cell Biology	3
STAT 401	Statistical Methods for Research Workers	4
AGRON 421	Introduction to Plant Breeding	3

Computer Science Choices: (Choose 1)

GEN 444	Bioinformatic Analysis	4
COM S 207	Fundamentals of Computer Programming	3

Problem Solving:

AGRON 392	Systems Analysis in Crop and Soil Management	3
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Agronomic Choices: (Choose 1)

AGRON 212	Crop Growth, Productivity and Management	3
AGRON 338	Seed Science and Technology	3

Interest Choices: (Choose 1)

BBMB 404	Biochemistry I	3
BIOL 315	Biological Evolution	3
GEN 410	Analytical Genetics	3

Soil Science and Environmental Quality

AGRON 260	Soils and Environmental Quality	3
Problem Solving Choices: (Choose 1)		
AGRON 360	Environmental Soil Science	3
AGRON 392	Systems Analysis in Crop and Soil Management	3
GIS Choices: (Choose 1)		
ENSCI 345	Natural Resource Photogrammetry and Geographic Information Systems	3
C R P 451	Introduction to Geographic Information Systems	3
AGRON 452	GIS for Geoscientists	3
Interest Choices: (Choose 3)		
AGRON 459	Environmental Soil and Water Chemistry	4
AGRON 463	Soil Formation and Landscape Relationships	4
AGRON 477	Soil Physics	3
AGRON 485	Soil and Environmental Microbiology	3
Interest Choices: (Choose 2)		
ENSCI 301	Natural Resource Ecology and Soils	4
ENSCI 402	Watershed Hydrology	3
AGRON 404	Global Change	3
AGRON 405	Environmental Biophysics	3
AGRON 406	World Climates	3
AGRON 407	Mesoscale Meteorology	3

Minor - Agronomy

The department offers a minor in Agronomy that may be earned by taking 18 credits in these agronomy courses: AGRON 114, AGRON 154, AGRON 212 & AGRON 354 and 6 credits from approved agronomy courses, with a minimum of 3 of the 6 credits from courses at the 300 level or higher. At least 9 credits must be taken at Iowa State University with 6 credits numbered 300 or above. At least 9 credits must be unique to the requirements for the minor and not used to fulfill specified requirements from the student's major.

Courses Required For a Minor:

AGRON 114	Principles of Agronomy	3
AGRON 154	Fundamentals of Soil Science *	3
AGRON 212	Crop Growth, Productivity and Management	3
AGRON 354	Soils and Plant Growth	3

Approved Elective Courses for Minor Credit (6 credits minimum, 3 credits at 300+ level)

CROP SCIENCE		
AGRON 212L	Field Application and Problem Solving in Crop Production	1
AGRON 217	Weed Identification	1
AGRON 316	Crop Structure-Function Relationships	3
AGRON 317	Principles of Weed Science	3
AGRON 320	Genetics, Agriculture and Biotechnology	3
AGRON 330	Crop and Seed Identification Laboratory	2
AGRON 334	Forage Crop Management	3
AGRON 338	Seed Science and Technology	3
AGRON 351	Turfgrass Establishment and Management	3

AGRON 421	Introduction to Plant Breeding	3
SOIL SCIENCE		
AGRON 260	Soils and Environmental Quality	3
AGRON 360	Environmental Soil Science	3
ENSCI 402	Watershed Hydrology	3
AGRON 452	GIS for Geoscientists	3
AGRON 459	Environmental Soil and Water Chemistry	4
AGRON 463	Soil Formation and Landscape Relationships	4
AGRON 477	Soil Physics	3
AGRON 485	Soil and Environmental Microbiology	3

AGRICULTURAL METEOROLOGY

AGRON 206	Introduction to Weather and Climate	3
AGRON 404	Global Change	3
AGRON 405	Environmental Biophysics	3
AGRON 406	World Climates	3
AGRON 407	Mesoscale Meteorology	3

GENERAL AGRONOMY COURSES

AGRON 342	World Food Issues: Past and Present	3
AGRON 392	Systems Analysis in Crop and Soil Management	3
AGRON 450	Issues in Sustainable Agriculture	3
AGRON 497	Agroecology Field Course	3

Students minoring in agronomy can take the following courses: AGRON 331, AGRON 370, AGRON 490, AGRON 491, and AGRON 496; but only one (1) credit from these courses can be used in the minor program

*Substitution of AGRON 155 may be allowed for students in horticulture.

Agronomy, B.S.

Freshman

Fall	Credits Spring	Credits
AGRON 110	1 AGRON 181	3
AGRON 180	3 AGRON 182	3
AGRON 183	1 BIOL 212	3
CHEM 163 & Lab or CHEM 177 & Lab	5 BIOL 212L	1
ENGL 150	3 ENGL 250	3
LIB 160	1 MATH or ECON 101	3
MATH or ECON 101	3	
	17	16

Sophomore

Fall	Credits Spring	Credits
AGRON 206	3 SP CM 212 or AGEDS 311	3
AGRON 210	1 Organic Chemistry AGRON 259, BBMB 221 or CHEM 231 & L	3-4
STAT 104	3 GEOL 100	3
Humanities Choice	3 Advising Option Choice	3
Elective	3 Elective	3
PHYS 111 or 115	4-5	
	17-18	15-16

Junior		
Fall	Credits Spring	Credits
AGRON 354	3 AGRON 316	3
AGRON 354L	1 AGRON 320 or BIOL 313 & Lab	3-4
Ethics/Ag Issues Choice AGRON 342 or AGRON 450	3 ENGL 302, 309, or 314	3
Advising Option Choice	6 Advising Option Choice	3
Elective	3 International Perspectives Choice	3
	16	15-16
Senior		
Fall	Credits Spring	Credits
Advising Option Choice	6 AGRON 410	1
Elective	6 Advising Option Choice	6
U.S. Diversity Choice	3 Elective	10
	15	17

Total Credits: 128-131

Graduate Study

The department offers programs degrees that lead to master of science (M.S.) and doctor of philosophy (Ph.D.), with majors in agricultural meteorology; crop production and physiology with optional specialization in seed science or weed science; plant breeding; and soil science with specialization in soil chemistry, soil fertility, soil management, soil microbiology and biochemistry, soil morphology and genesis, or soil physics. Minor work is offered for students with majors in other departments. A dissertation is required for the Ph.D., and a thesis is normally required for the M.S. An M.S. nonthesis option is available for students desiring a general degree program, with additional coursework and a written creative component substituting for thesis research.

Graduates have a broad knowledge base germane to their area of study. They are trained to integrate and apply knowledge to different situations. Students develop skills in scientific reasoning, organization, and logical presentation of ideas.

The department offers an M.S. in agronomy that is designed for students who are currently employed full-time. This program is taught at a distance using computer-based instructional media. The M.S. in agronomy is nonthesis only. The M.S. degree in plant breeding is offered both on-campus or at a distance.

The department cooperates in interdepartmental majors in bioinformatics and computational biology; ecology and evolutionary biology; environmental science; genetics; microbiology; molecular, cellular, and developmental biology; plant biology; and sustainable agriculture.

Prerequisite to major work in this department is completion of an undergraduate degree program with emphasis on agronomic, biological, and physical sciences.

Graduate Certificate in Agronomy for distance students

The Graduate Certificate in Agronomy is for distance students and is comprised of the first six courses in the Master of Science in Agronomy Distance Curriculum. All six courses are required for certificate completion.

AGRON 501	Crop Growth and Development	3
AGRON 502	Chemistry, Physics, and Biology of Soils	3
AGRON 503	Climate and Crop Growth	3
AGRON 511	Crop Improvement	3
AGRON 512	Soil-Plant Environment	3
AGRON 514	Integrated Pest Management	3
Total Certificate Credits		18

Courses primarily for undergraduates:

AGRON 105: Leadership Experience

Cr. R. F.S.SS.

A participatory experience in activities or completion of a course that enhances the development of leadership and group-dynamic skills. See adviser for departmental requirements.

AGRON 110: Professional Development in Agronomy: Orientation

Cr. 0.5-1. F.

Orientation to college life, the profession of agronomy, and the agronomy curriculum.

AGRON 114: Principles of Agronomy

(2-3) Cr. 3. F.S.

A foundation course in agronomy applying crop, soil, and environmental sciences in understanding agricultural systems in the world. Includes introductory concepts of plant, soil, tillage, pest, environmental, and sustainable aspects of crop production. Off-campus version offered through internet by interactive computer courseware.

AGRON 120: Introduction to Renewable Resources

(Cross-listed with ENV S, NREM). (3-0) Cr. 3. F.S.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

AGRON 154: Fundamentals of Soil Science

(2-2) Cr. 3. F.S.

Prereq: CHEM 163

Introduction to physical, chemical, and biological properties of soils, their formation, classification, and distribution. Use of soil survey and computer databank information in balancing agronomic, economic, and environmental concerns in soil management. Credit for only one of Agron 154, 155, or 156 may be applied toward graduation.

AGRON 155: Soils for Horticultural Scientists

(2-2) Cr. 3. F.S.

Prereq: CHEM 163, enrollment in horticulture major

Physical, chemical and biological properties of natural and manufactured soils. Use of soil information when producing plants on natural and manufactured soils. Credit for only one of Agron 154, 155, or 156 may be applied toward graduation.

AGRON 160: Water Resources of the World

(Cross-listed with ENV S, GEOL, MTEOR). (3-0) Cr. 3. S.

Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

AGRON 180: Global Agriculture in a Changing World

(3-0) Cr. 3. F.

Understanding climate and its effects in global distribution of food and water resources. The nature of climate and its variability in space and time. Use of satellites and related technology to monitor crop production, water availability and climate. Influence of climate and climate change on drought, famine and other disruptions of essential resources. For students majoring in Agronomy.

AGRON 181: Introduction to Crop Science

(3-0) Cr. 3. S.

Basic structure and function of plants, origin and classification, growth and development. Fundamentals of photosynthesis, plant water use, plant nutrition and genetics that regulate plant growth, development and responses to the environment. For students majoring in Agronomy.

AGRON 182: Introduction to Soil Science

(3-0) Cr. 3. S.

Prereq: Chem 163

Introduction to physical, chemical, and biological properties of soils; soil formation, classification and global distribution; soil health, soils and humanity and sustainable land Management. For students majoring in Agronomy.

AGRON 183: Crop and Soil Management Lab

(0-3) Cr. 1. S.

Problem solving in crop production and soil management. Integration and application of concepts introduced in Agron 181 and 182. For students majoring in Agronomy.

AGRON 206: Introduction to Weather and Climate

(Cross-listed with MTEOR). (3-0) Cr. 3. F.S.

Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

AGRON 210: Professional Development in Agronomy: Career Planning

(1-0) Cr. 1. F.

Prereq: Sophomore classification

Career planning, résumé and cover letter preparation, and interviewing techniques. Career orientation through invited speakers.

AGRON 212: Crop Growth, Productivity and Management

(3-0) Cr. 3. F.S.

Prereq: AGRON 114

Production and management practices for corn, soybean, small grain, and forage crops common to Midwestern U.S. agriculture. Emphasis on growth and development, plant characteristics, management practices, crop use, quality, and problem-solving.

AGRON 212L: Field Application and Problem Solving in Crop Production

(0-2) Cr. 1. F.S.

Prereq: AGRON 154, credit or enrollment in AGRON 212

Problem solving in crop production. Integration and application of concepts introduced in Agron 212. Agronomic field skills such as crop and pest identification, integrated management strategies, staging crop growth, agricultural math and site specific management related to crop production will be emphasized.

AGRON 217: Weed Identification

(0-3) Cr. 1. F.S.

Prereq: BIOL 101 or equivalent

Identification of important weeds of agricultural, horticultural and native ecosystems. Principles of plant taxonomy and classification. Field trips.

AGRON 259: Organic Compounds in Plants and Soils

(3-0) Cr. 3. S.

Prereq: CHEM 163, 167, or 177; BIOL 212; AGRON 154 or AGRON 260; Math 140

Structure, function, and transformations of organic compounds significant in plant and soil environments.

AGRON 260: Soils and Environmental Quality

(Cross-listed with ENV S). (3-0) Cr. 3. F.S.

Role of soils in environmental quality and natural resources management. Emphasis on soil erosion and conservation, water quality, and environmental planning. Saturday field trip.

AGRON 283: Pesticide Application Certification

(Cross-listed with ENT, FOR, HORT). (2-0) Cr. 2. S.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

AGRON 298: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of department cooperative education coordinator, sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGRON 310: Professional Development in Agronomy: Work Experience

Cr. R. F.S.SS.

Professional work experience in agronomy. See adviser for departmental requirements. Offered on a satisfactory-fail basis only.

AGRON 311: Professional Internship in Agronomy

(1-0) Cr. 1. Repeatable. F.S.

Prereq: AGRON 110, agronomy majors only, permission of instructor before internship begins

A supervised learning experience in a professional setting related to crop production, plant breeding, soil science or environmental science.

AGRON 316: Crop Structure-Function Relationships

(3-0) Cr. 3. F.S.

Prereq: BIOL 212 Recommended

Basic principles concerning the growth, development, and production of crop communities in relation to their environment.

AGRON 317: Principles of Weed Science

(2-2) Cr. 3. F.

Biology and ecology of weeds. Interactions between weeds and crops. Principles and practices of integrated weed management systems. Herbicide mechanisms, classification, and fate in plants and soils.

AGRON 320: Genetics, Agriculture and Biotechnology

(Cross-listed with GEN). (3-0) Cr. 3. F.S.

Prereq: BIOL 212

Transmission genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Credit for graduation will not be allowed for more than one of the following: Gen 260, 313, 320 and Biol 313 and 313L.

AGRON 330: Crop and Seed Identification Laboratory

(0-4) Cr. 2. S.

Prereq: AGRON 114

Identification, agronomic and binomial classification of crops, weeds, and diseases. Analysis of crop seed samples for contaminants of weed and other crop seeds.

AGRON 331: Intercollegiate Crops Team

(0-6) Cr. 2. Repeatable. F.S.

Prereq: Permission of instructor

Intensive training in preparation for intercollegiate competition in national crops contests.

AGRON 334: Forage Crop Management

(3-0) Cr. 3. F.S.

Prereq: AGRON 114

Production and management of forage crops; concepts applied to yield, quality, and stand persistence; systems of forage utilization including grazing, hay, and silage. Students enrolling for graduate credit will be expected to complete an additional class project.

AGRON 338: Seed Science and Technology

(Cross-listed with HORT). (2-3) Cr. 3. F.

Prereq: AGRON 114 or HORT 221, BIOL 211

Seed production, maturation, dormancy, vigor, deterioration, and related aspects of enhancement, conditioning, storage, and quality evaluation. Aspects of the seed industry and regulation of seed marketing.

AGRON 342: World Food Issues: Past and Present

(Cross-listed with ENV S, FS HN, T SC). (3-0) Cr. 3. F.S.

Prereq: Junior classification

Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/ undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects. Meets International Perspectives Requirement.

AGRON 342H: World Food Issues: Past and Present, Honors

(Cross-listed with ENV S, T SC). (3-0) Cr. 3. F.S.

Prereq: Junior classification

Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/ undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects. Meets International Perspectives Requirement.

AGRON 351: Turfgrass Establishment and Management

(Cross-listed with HORT). (3-0) Cr. 3. F.

Prereq: HORT 221 or AGRON 114 or BIOL 211

Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests.

AGRON 351L: Turfgrass Establishment and Management Laboratory

(Cross-listed with HORT). (0-3) Cr. 1. F.

Prereq: Credit or enrollment in HORT 351

Those enrolled in the horticulture curriculum are required to take 351L in conjunction with 351 except by permission of the instructor.

AGRON 354: Soils and Plant Growth

(Cross-listed with HORT). (3-0) Cr. 3. F.S.

Prereq: AGRON 154 and BIOL 101 or BIOL 211

Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development.

AGRON 354L: Soils and Plant Growth Laboratory

(Cross-listed with HORT). (0-3) Cr. 1. F.S.

Prereq: Agron or Hort major with credit or enrollment in AGRON 354

Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth.

AGRON 360: Environmental Soil Science

(Cross-listed with ENSCI). (2-3) Cr. 3. S.

Prereq: AGRON 154 or ENSCI 250 or GEOL 201

Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities.

AGRON 370: Field Experience in Soil Description and Interpretation

(0-3) Cr. 1. Repeatable, maximum of 4 times. F.S.

Prereq: AGRON 154 and permission of instructor

Description and interpretation of soils in the field and laboratory, emphasizing hands-on experience. Evaluation of soil information for land use. Students may participate in intercollegiate judging contests.

AGRON 388: Agronomic Sciences in Theory and Practice

(1-0) Cr. 1. F.

Prereq: Junior or senior classification

How science works: Hypotheses, data integrity, classification, interpretations, ethics, and communications.

AGRON 392: Systems Analysis in Crop and Soil Management

(2-3) Cr. 3. F.S.

Prereq: AGRON 316 and AGRON 354

Management strategies at the level of the farm field. Emphasis will be on participatory learning activities.

AGRON 398: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of department cooperative education coordinator; junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGRON 402: Watershed Hydrology and Surficial Processes

(Cross-listed with ENSCI, IA LL). Cr. 4. SS.

Prereq: Four courses in physical or biological sciences or engineering

Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminants) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

AGRON 404: Global Change

(Dual-listed with AGRON 504). (Cross-listed with ENSCI, ENV S, MTEOR). (3-0) Cr. 3. S.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

AGRON 405: Environmental Biophysics

(Dual-listed with AGRON 505). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)

A description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

AGRON 406: World Climates

(Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. S.

Prereq: AGRON 206/MTEOR 206

Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

AGRON 407: Mesoscale Meteorology

(Dual-listed with AGRON 507). (Cross-listed with MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 166 and Mteor 443

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure.

AGRON 410: Professional Development in Agronomy: Senior Forum

(1-0) Cr. 1. F.S.

Prereq: Senior classification

Development of an appropriate content for professionalism. Topics include professional certification, ethics, and maintaining an active network of information sources and professional contacts in support of lifelong learning. Student interpretation, writings, presentations, and discussions.

AGRON 421: Introduction to Plant Breeding

(Cross-listed with HORT). (3-0) Cr. 3. F.

Prereq: GEN 320 or BIOL 313

Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Applications of biotechnology techniques in the development of improved cultivars.

AGRON 446: International Issues and Challenges in Sustainable Development

(Cross-listed with GLOBE, INTST). Cr. 3. F.S.

Prereq: 3-credit biology course, Sophomore or higher classification, permission of Instructor

Interdisciplinary study and analysis of agricultural systems, sustainable management, and impact on plants and animal biodiversity. International field experience in evaluating different agricultural systems and impact on biodiversity may be required. A program fee is charged to students for international study abroad.

Meets International Perspectives Requirement.

AGRON 450: Issues in Sustainable Agriculture

(Cross-listed with ENV S). (3-0) Cr. 3. F.

Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of development of industrial agricultural practices.

AGRON 452: GIS for Geoscientists

(Dual-listed with AGRON 552). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. F.

Prereq: GEOL 100, GEOL 201 or equivalent

Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

AGRON 459: Environmental Soil and Water Chemistry

(Dual-listed with AGRON 559). (Cross-listed with ENSCI). (3-3) Cr. 4. F.

Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 154 or AGRON 360; GEOL 100 and AGRON 354 recommended.

An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

AGRON 463: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 563). (Cross-listed with ENSCI). (2-4) Cr. 4. S.

Prereq: AGRON 154 or AGRON 260

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

AGRON 463I: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 563I). (Cross-listed with ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.

Prereq: AGRON 154 or AGRON 260

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

AGRON 477: Soil Physics

(Dual-listed with AGRON 577). (Cross-listed with ENSCI). (3-0) Cr. 3. S.

Prereq: Recommended: AGRON 154 MATH 166

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 484: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 584). (Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: 9 cr. in biological or physical sciences

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

AGRON 485: Soil and Environmental Microbiology

(Dual-listed with AGRON 585). (Cross-listed with ENSCI, MICRO). (2-3) Cr. 3. F.

Prereq: AGRON 154 or AGRON 402, MICRO 201 (MICRO 201L recommended)

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

AGRON 488: GIS for Geoscientists II

(Dual-listed with AGRON 588). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent

GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

AGRON 490: Independent Study

Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.

Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490E: Entrepreneurship

Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.

Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490G: General

Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.

Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490H: Independent Study, Honors

Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.

Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490Z: Service Learning

Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.

Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 491: Seed Science Internship Experience

(Cross-listed with HORT). Cr. 1-2. Repeatable, maximum of 1 times. F.S.SS.

Prereq: Agron 338, advanced approval and participation of employer and instructor

A professional work experience and creative project for seed science secondary majors. The project requires the prior approval and participation of the employer and instructor. The student must submit a written report.

AGRON 493: Workshop in Agronomy

Cr. arr. Repeatable, maximum of 4 times.

Prereq: Permission of instructor

Workshop experience in crops, soils, or agricultural meteorology.

AGRON 495: Agricultural Travel Course Preparation

Cr. R. Repeatable. F.S.

Prereq: Permission of instructor

Limited enrollment. Students enrolled in this course intend to register for Agron 496 the following term. Topics will include the agricultural industries, climate, crops, culture, economics, geography, history, livestock, marketing, soils, and preparation for travel to locations to be visited.

AGRON 496: Agricultural Travel Course

Cr. arr. Repeatable.

Prereq: Permission of instructor

Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings.

AGRON 496A: International Tour

Cr. arr. Repeatable.

Prereq: Permission of instructor

Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings. Meets International Perspectives Requirement.

AGRON 496B: Domestic Tour

Cr. arr. Repeatable.

Prereq: Permission of instructor

Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings.

AGRON 497: Agroecology Field Course

(3-0) Cr. 3. F.

Prereq: Jr. or Sr. classification with at least 8 credits in Agronomy

A one-week intensive class, offered off-campus. Student will visit farms within the Midwest and analyze the sustainability of each farm.

AGRON 498: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of department cooperative education coordinator; senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:**AGRON 500: Orientation Seminar**

(2-0) Cr. 1. F.

Prereq: International agronomy graduate students only

An introduction to Iowa and U.S. agriculture for international scholars in agronomic majors. Field trips when possible. Departmental role in the functioning of research, teaching, and extension in fulfilling the charge given the land-grant university.

AGRON 501: Crop Growth and Development

(3-0) Cr. 3. F.S.

Prereq: AGRON 114, MATH 140, CHEM 163, BIOL 101

Physiological processes in crop growth, development and yield: photosynthesis, respiration, water relations, mineral nutrition, assimilate partitioning, seedling vigor, light interception and canopy growth, root growth, reproduction and yield. Required course for the Master of Science in Agronomy degree program.

AGRON 502: Chemistry, Physics, and Biology of Soils

(3-0) Cr. 3. F.

Prereq: AGRON 114, AGRON 154, BIOL 101, CHEM 163, and MATH 140

Soil chemical, physical, and biological properties that control processes within the soil, their influence on plant/soil interactions, and soil classification. Basic concepts in soil science and their applications. Required course for the Master of Science in Agronomy degree program.

AGRON 503: Climate and Crop Growth

(3-0) Cr. 3. F.S.SS.

Prereq: AGRON 114 and MATH 140

Applied concepts in climate and agricultural meteorology with emphasis on the climate-agriculture relationship and the microclimate-agriculture interaction. Basic meteorological principles are also presented to support these applied concepts. Required course for the Master of Science in Agronomy degree program.

AGRON 504: Global Change

(Dual-listed with AGRON 404). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. S.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

AGRON 505: Environmental Biophysics

(Dual-listed with AGRON 405). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)

A description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

AGRON 506: Crop Genetics

(Cross-listed with HORT). Cr. 3. F.

Introduction to genetics of reproductive systems, recombination, segregation and linkage analysis, inbreeding, quantitative inheritance, fertility regulation, and polyploidy to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students.

AGRON 507: Mesoscale Meteorology

(Dual-listed with AGRON 407). (Cross-listed with MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 166 and Mteor 443

Gallus. The physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Semester project and in-class presentation required.

AGRON 508: Biophysical Crop Ecology

(3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: AGRON 505

Physical modeling of bio-response and crop adaptation to climate. Principles of resource capture (light and water) applied to growth and development. Ecological implications of radiation, temperature, moisture, and the biological properties of size, shape, resistance to water vapor loss, and absorptivity to solar and thermal radiation. Physiological stress in the soil, plant, atmosphere continuum.

AGRON 509: Agroecosystems Analysis

(Cross-listed with SOC, SUSAG). (3-4) Cr. 4. F.

Prereq: Senior or above classification

Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecological, social, etc), and scales of operation.

AGRON 510: Crop Improvement

(Cross-listed with STB). (3-0) Cr. 3.

Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor

A study of the basic principles and methods in the genetic improvement of crop plants. Methods used in manipulating genomes through the use of biotechnology. Methods of cultivar development. Quantitative procedures for describing response to selection. Analysis of the relationship of reproductive characters and growth characteristics to response to selection.

AGRON 511: Crop Improvement

(3-0) Cr. 3. S.

Prereq: AGRON 114, MATH 140, CHEM 163, BIOL 101

Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. Required course for the Master of Science in Agronomy degree program.

AGRON 512: Soil-Plant Environment

(3-0) Cr. 3. S.

Prereq: AGRON 502. Recommended AGRON 501

Soil properties and their impact on soil/plant relationships. Soil structure, aeration, moisture, and nutrients will be discussed in the context of soil fertility and environmental quality management. Required course for the Master of Science in Agronomy degree program.

AGRON 513: Quantitative Methods for Agronomy

(3-0) Cr. 3. F.S.

Prereq: AGRON 114, MATH 140, STAT 104

Quantitative methods for analyzing and interpreting agronomic information. Principles of experimental design, hypothesis testing, analysis of variance, regression, correlation, and graphical representation of data. Use of SAS and Excel for organization, analyzing, and presenting data. Required course for the Master of Science in Agronomy degree program.

AGRON 514: Integrated Pest Management

(3-0) Cr. 3. SS.

Prereq: AGRON 114, 501, MATH 140, CHEM 163, BIOL 101. Recommended: AGRON 502, AGRON 503

Principles and practices of weed science, entomology, and plant pathology applied to crop production systems. Biology, ecology and principles of integrated crop pest management. Required course for the Master of Science in Agronomy degree program.

AGRON 515: Integrated Crop and Livestock Production Systems

(Cross-listed with A B E, AN S, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: SUSAG 509

Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

AGRON 516: Crop Physiology

(3-0) Cr. 3. S.

Investigation of Molecular, whole plant, and plant community processes essential to biomass production and seed formation, and analysis of molecular approaches to overcome the limitations imposed on these processes by the environment.

AGRON 518: Microwave Remote Sensing

(Cross-listed with E E, MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 265 or equivalent

Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

AGRON 519: Herbicide Physiology and Biochemistry

(2-0) Cr. 2. Alt. S., offered even-numbered years.

Prereq: AGRON 317; BIOL 330

Herbicide mechanisms of action, selectivity, uptake, and translocation. Specific sites of herbicide action as they affect plant physiology. Herbicide resistance in weeds and crops. Implications of herbicides on weed management.

AGRON 520: Plant Breeding Methods

Cr. 3. S.

Prereq: Agron 527 or Agron 506

Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Application of biotechnology techniques in the development of improved cultivars.

AGRON 521: Principles of Cultivar Development

(3-0) Cr. 3. F.

Prereq: AGRON 421; STAT 401

Theoretical and practical analysis of alternative breeding methods to improve crop plants. Strategies to incorporate germplasm resources, develop populations, maximize genetic gain, and use marker-assisted selection. Relationship of breeding methods to commercial seed production.

AGRON 522: Field Methods in Plant Breeding

(0-6) Cr. 1-2. Alt. SS., offered even-numbered years.

Prereq: AGRON 521

Field experience in planning and conducting plant breeding research for germplasm and cultivar development. Offered on a satisfactory-fail basis only.

AGRON 523: Molecular Plant Breeding

(2-2) Cr. 3. S.

Prereq: AGRON 421 or AGRON 521, GDCB 542A

Plant breeding in the era of sequenced genomes and transformation. High throughput genomic technologies will be presented in relation to various applications in plant breeding.

AGRON 524: Applied Plant Molecular Genetics & Biotechnology

Cr. 3. F.

Prereq: Agron 527 or Agron 506

Basic principles and applied techniques used in the genetic improvement of crop plants. Discussion of structure and function of genes that control traits of value. Types of molecular markers, analysis of quantitatively inherited traits, genome mapping, analyses of databases.

AGRON 525: Crop and Soil Modeling

(3-0) Cr. 3. F.

Prereq: Math 181 or 165 or equivalent, Agron 316 or Agron 354 or equivalent.

Understanding basic crop physiology and soil processes through the use of mathematical and statistical approaches. Structure of crop models, dynamics and relationship among components such as leaf-level photosynthesis, canopy architecture, root dynamics and soil carbon and nitrogen pools.

AGRON 526: Field Plot Technique

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: STAT 401

Planning experiments for agricultural research, analysis of data, and concepts in data interpretation.

AGRON 528: Quantitative Genetics for Plant Breeding

(3-0) Cr. 3. S.

Prereq: AGRON 506 or AGRON 513

An introduction to the application of quantitative genetics to plant breeding programs.

AGRON 530: Ecologically Based Pest Management Strategies

(Cross-listed with ENT, PL P, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

AGRON 531: Crop Ecology and Management

(3-0) Cr. 3. F.

Prereq: AGRON 501, AGRON 502, AGRON 503. Recommended: AGRON 512, AGRON 514

Ecological principles underlying crop production systems. Crop production in the context of management approaches, system resources and constraints, and interactions. Emphasis on the ecology of row and forage crops common to the Midwest. Required course for the Master of Science in Agronomy degree program.

AGRON 532: Soil Management

(3-0) Cr. 3. F.

Prereq: AGRON 501, AGRON 503, AGRON 512. Recommended AGRON 513

Evaluates the impact of various soil management practices on soil and water resources. Combines and applies basic information gained in Agron 502 and Agron 512. Emphasizes the agronomic, economic, and environmental effects of soil management strategies. Required course for the Master of Science in Agronomy degree program.

AGRON 533: Crop Protection

(3-0) Cr. 3. F.

Prereq: AGRON 514

Integrated management systems for important crop pests. Cultural, biological and chemical management strategies applicable to major crops grown in the Midwest. Required course for the Master of Science in Agronomy degree program.

AGRON 534: Seed and Variety, Testing and Technology

(Cross-listed with STB). (2-0) Cr. 2.

Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor

The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing.

AGRON 535: Introduction to the Seed Industry

(Cross-listed with STB). Cr. 1.

Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor

An analysis of the defining characteristics of the seed industry and introduction to the Master in Seed Technology and Business curriculum. The tasks of crop improvement and seed production will be analytically related to basic management functions and classifications of management activities that are used in the study of business administration. Management tasks and roles will be analyzed in related to the public policy issues that shape the seed industry, including ethical and economical approaches to biotechnology, intellectual property, and corporate responsibility.

AGRON 536: Quantitative Methods for Seed

(Cross-listed with STB). (1-0) Cr. 1. F.

Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor

Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation and graphical representation of data. Use of spreadsheets for manipulating, analyzing and presenting data.

AGRON 538: Seed Physiology

(2-0) Cr. 2. Alt. F., offered even-numbered years.

Prereq: AGRON 316, CHEM 231 or CHEM 331

Physiological aspects of seed development, maturation, longevity, dormancy, and germination. Emphasis on current literature and advanced methodology.

AGRON 539: Seed Conditioning and Storage

(Cross-listed with STB). (2-0) Cr. 2.

Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor

The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as a focal points within the overall operations of a seed company.

AGRON 541: Applied Agricultural Meteorology

Cr. 2-3. F.S.SS.

Prereq: AGRON 206 or upper division Biological Science

Applied concepts in agricultural meteorology. Basic concepts of weather and of crop/climate relationships influencing production, protection, yield and associated production risk factors. Self study sections are available to resident and to distant education students all semesters. Credit for only one of Agron 503 or 541 may be applied toward graduation.

AGRON 544: Host-Pest Interactions

Cr. 3. F.

Incorporation of the principles of integrated pest management and crop protection. Management systems (biological, cultural, chemical) and strategies which practice principles of weed science, plant pathology, and entomology. Enrollment is restricted to off-campus students in Agronomy MS in Plant Breeding.

AGRON 546: Strategies for Diversified Food and Farming Systems

(Cross-listed with HORT, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: SUSAG 509

Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component.

AGRON 547: Seed Production

(Cross-listed with STB). (2-0) Cr. 2.

Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor

Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Resources and capabilities required. Survey of differences in seed production strategies between crops and impact of differences on management of seed production.

AGRON 551: Growth and Development of Perennial Grasses

(Cross-listed with HORT). (2-0) Cr. 2. Alt. S., offered even-numbered years.

Prereq: Junior or senior or graduate classification or permission of instructor

Selected topics on anatomy, morphology, and physiology relative to growth and development of perennial grasses. Emphasis on growth and development characteristics peculiar to grasses and variations of such characteristics under natural and managed conditions.

AGRON 552: GIS for Geoscientists

(Dual-listed with AGRON 452). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. F.

Prereq: GEOL 100, GEOL 201 or equivalent

Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

AGRON 553: Soil-Plant Relationships

(Cross-listed with ENSCI). (3-0) Cr. 3. F.

Prereq: AGRON 354

Composition and properties of soils in relation to the nutrition and growth of plants.

AGRON 554: Advanced Soil Management

(2-0) Cr. 2. Alt. F., offered odd-numbered years.

Prereq: AGRON 354; MATH 165

Implications of soil management on the soil environment and root activity. Effect of soil physical properties on soil erosion.

AGRON 555: Environmental Soil Mineralogy

(Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: AGRON 473, CHEM 178. Recommend: GEOL 311

Structure and behavior of clay minerals, humic substances and biochar in soil environments, with emphasis on reactions and environmental implications.

AGRON 556: Agroecosystem Nutrient Cycles

(3-0) Cr. 3. F.

Prereq: 3 credits in chemistry, 6 credits in biology. Recommended: ENSCI 382, 553, EEB 484/584 or upper-level coursework in nutrient cycles.

Major, biologically important agroecosystem nutrient cycles as linked to energy (carbon) and water. Effects of agricultural production and management on cycling within systems and transfer among system at local, regional and global scales will be emphasized.

AGRON 558: Laboratory Methods in Soil Chemistry

(Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered even-numbered years.

Prereq: AGRON 354 and CHEM 211

Experimental and descriptive inorganic and organic analyses.

Operational theory and principles of applicable instruments, including spectrophotometry, atomic and molecular absorption and emission spectroscopy, mass spectrometry, X-ray diffraction and fluorescence, gas and ion chromatography, and ion-selective electrodes.

AGRON 559: Environmental Soil and Water Chemistry

(Dual-listed with AGRON 459). (Cross-listed with ENSCI). (3-3) Cr. 4. F.

Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 154 or AGRON 360; GEOL 100 and AGRON 354 recommended.

An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

AGRON 561: Population and Quantitative Genetics for Breeding

(Cross-listed with AN S). (4-0) Cr. 4. F.

Prereq: STAT 401

Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction.

AGRON 563: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 463). (Cross-listed with ENSCI). (2-4) Cr. 4. S.

Prereq: AGRON 154 or AGRON 260

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

AGRON 563I: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 463I). (Cross-listed with ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.

Prereq: AGRON 154 or AGRON 260

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

AGRON 570: Risk Assessment for Food, Agriculture and Veterinary Medicine

(Cross-listed with TOX, VDPAM). (3-0) Cr. 3. F.

Prereq: Statistics 300-level or higher.

Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available only by distance.

AGRON 575: Soil Formation and Transformation

(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: AGRON 463 or equivalent

Advanced study of soil formation, emphasizing relationships among soils, landscapes, environment, humans, and land use.

AGRON 577: Soil Physics

(Dual-listed with AGRON 477). (Cross-listed with ENSCI). (3-0) Cr. 3. S.

Prereq: Recommended: AGRON 154 MATH 166

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 578: Laboratory Methods in Soil Physics

(Cross-listed with ENSCI). (0-3) Cr. 1. S.

Prereq: concurrent enrollment in AGRON 477 or 577

Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases.

AGRON 584: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 484). (Cross-listed with HORT, SUSAG). (3-0) Cr.

3. Alt. S., offered odd-numbered years.

Prereq: 9 cr. in biological or physical sciences

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture.

Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

AGRON 585: Soil and Environmental Microbiology

(Dual-listed with AGRON 485). (Cross-listed with ENSCI, MICRO). (2-3) Cr.

3. F.

Prereq: AGRON 154 or AGRON 402, MICRO 201 (MICRO 201L recommended)

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

AGRON 588: GIS for Geoscientists II

(Dual-listed with AGRON 488). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3.

Alt. S., offered odd-numbered years.

Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent

GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

AGRON 590: Special Topics

Cr. arr. Repeatable.

Prereq: 15 credits in agronomy

Literature reviews and conferences on selected topics in crops, soils, or agricultural meteorology according to needs and interest of student.

AGRON 591: Agronomic Systems Analysis

(3-0) Cr. 3. S.

Prereq: AGRON 511, AGRON 513, AGRON 531, AGRON 532, AGRON 533

Analysis of cropping systems from a problem-solving perspective. Case studies will be used to develop the students' ability to solve agronomic problems. Required course for the Master of Science in Agronomy degree program.

AGRON 592: Current Issues in Agronomy

(3-0) Cr. 3. S.

Prereq: AGRON 501, AGRON 503, AGRON 511, AGRON 512, AGRON 513, AGRON 514

Study and discussion of topics of current interest to the field of agronomy. While Agron 591 deals with agronomics at the farm and landscape level, Agron 592 seeks to address issues on a broader scale including off-farm agricultural impacts. Required course for the Master of Science in Agronomy degree program.

AGRON 593: Workshop in Agronomy

Cr. arr. Repeatable.

Prereq: Graduate classification

AGRON 594: Agronomy MS Practicum

(1-0) Cr. 1. SS.

Prereq: AGRON 501, AGRON 502, AGRON 503, AGRON 514 (or current enrollment. Recommended: AGRON 511, AGRON 512, AGRON 513

Practical field and laboratory experiences integrating coursework in climatology, crops, and soils. Includes lectures, labs and local agri-business tours.

AGRON 595: Seed Quality, Production, and Research Management

(Cross-listed with STB). (3-0) Cr. 3.

Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor

Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

AGRON 599: Creative Component

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599A: Agricultural Meteorology

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599B: Crop Production and Physiology

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599C: Plant Breeding

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599D: Soil Chemistry

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599E: Soil Fertility

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599F: Soil Management

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599G: Soil Microbiology and Biochemistry

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599H: Soil Morphology and Genesis

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599I: Soil Physics

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599K: Seed Science

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599L: Weed Science

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599M: Agronomy

Cr. arr.

Prereq: Nonthesis M.S. option only

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:**AGRON 600: Seminar**

(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.

Reports and discussion of recent literature and research.

AGRON 600A: Seminar: Plant Breeding

(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.

Instruction and practice in giving scientific presentations related to the fields of plant breeding, genetics, or genomics, with an emphasis on effective communication and presentation techniques. An oral seminar and a poster presentation are required, along with analyses of other seminars, and participation in planning and hosting invited speakers.

AGRON 600B: Seminar: Soils

(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.

Reports and discussion of recent literature and research.

AGRON 600C: Seminar: Crop Production and Physiology

(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.

Reports and discussion of recent literature and research.

AGRON 601: Agronomic Science Presentations

(3-0) Cr. 2. S.

Prereq: graduate status in agronomic science, permission of instructor.

Experience in critical communications in exchange of ideas through oral and poster presentations and scientific questioning/evaluation.

AGRON 605: Boundary-Layer Meteorology

(Cross-listed with MTEOR). (3-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: MTEOR 443 or equivalent-level course in engineering fluids

Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy.

AGRON 610: Foundations of Sustainable Agriculture

(Cross-listed with A B E, ANTHR, SOC, SUSAG). (3-0) Cr. 3. F.

Prereq: Graduate classification, permission of instructor

Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

AGRON 621: Advanced Plant Breeding

(3-0) Cr. 3. S.

Prereq: AGRON 521, AGRON 526, AGRON 561; GEN 410

Estimation and interpretation of genetic effects and variances of plant breeding populations, analysis of mating designs, estimation of combining ability and heritability, best linear unbiased prediction, selection indices with and without molecular information, inbreeding and heterosis.

AGRON 625: Genetic Strategies in Plant Breeding

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: AGRON 521, GEN 510

Evaluation of genetic, molecular, and cellular approaches to crop improvement; gene transfer methods. Application and role of basic plant biology in breeding programs and processes; genome structure and function, gene isolation, expression, regulation, and modification. Integration of molecular and cellular methods in breeding strategies; analysis of alternative breeding methods, regulatory and ethical issues.

AGRON 655: Advanced Soil Fertility

(2-0) Cr. 2. Alt. S., offered odd-numbered years.

Prereq: AGRON 553

Evaluation of soil fertility and fertilizers; theory and applications.

AGRON 677: Advanced Soil Physics

(2-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: AGRON 577; MATH 266, MATH 267. *Recommended:* COM S 207

The flow and distribution of water, chemicals, and heat in soils. Physical principles and applications.

AGRON 685: Advanced Soil Biochemistry

(Cross-listed with ENSCI, MICRO). (2-0) Cr. 2. Alt. S., offered even-numbered years.

Prereq: AGRON 585

Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

AGRON 696: Research Seminar

(Cross-listed with BBMB, FOR, GDCB, HORT, PLBIO). Cr. 1. Repeatable. F.S.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

AGRON 698: Agronomy Teaching Practicum

Cr. 1-2. Repeatable. F.S.SS.

Prereq: Graduate classification in agronomy and permission of instructor

Graduate student experience in the agronomy teaching program. Offered on a satisfactory-fail basis only.

AGRON 699: Research

Cr. arr. Repeatable.

AGRON 699A: Agricultural Meteorology

Cr. arr. Repeatable.

AGRON 699B: Crop Production and Physiology

Cr. arr. Repeatable.

AGRON 699C: Plant Breeding

Cr. arr. Repeatable.

AGRON 699D: Soil Chemistry

Cr. arr. Repeatable.

AGRON 699E: Soil Fertility

Cr. arr. Repeatable.

AGRON 699F: Soil Management

Cr. arr. Repeatable.

AGRON 699G: Soil Microbiology and Biochemistry

Cr. arr. Repeatable.

AGRON 699H: Soil Morphology and Genesis

Cr. arr. Repeatable.

AGRON 699I: Soil Physics

Cr. arr. Repeatable.

AGRON 699J: Plant Physiology

Cr. arr. Repeatable.

AGRON 699K: Seed Science

Cr. arr. Repeatable.

AGRON 699L: Weed Science

Cr. arr. Repeatable.