

AGRONOMY (AGRON)

Courses primarily for undergraduates:

AGRON 1050: Leadership Experience

Credits: Required.

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

AGRON 1100: Professional Development in Agronomy: Orientation

Credits: 1. Contact Hours: Lecture 1.

Orientation to college life, the profession of agronomy, and the agronomy curriculum. (Typically Offered: Fall)

AGRON 1200: Introduction to Renewable Resources

(Cross-listed with NREM 1200/ ENVS 1200).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

AGRON 1400: Climate and Society

(Cross-listed with MTEOR 1400/ ENVS 1400/ GEOL 1400).

Credits: 3. Contact Hours: Lecture 3.

The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with focus on changes post industrial revolution. Significant climate events that have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

AGRON 1600: Water Resources of the World

(Cross-listed with MTEOR 1600/ ENVS 1600/ GEOL 1600).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Spring)

AGRON 1800: Global Agriculture in a Changing World

Credits: 3. Contact Hours: Lecture 3.

A scientific investigation of the global distribution of climate, soils and agricultural production and consumption. Physical processes that connect natural resources to agriculture and the environment. How global change drives increasing demand for agricultural production. Meets International Perspectives Requirement. (Typically Offered: Fall)

AGRON 1810: Introduction to Crop Science

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

AGRON 1820: Introduction to Soil Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in CHEM 1630 or CHEM 1670 or CHEM 1770

Introduction to physical, chemical, and biological properties of soils; soil formation, classification and global distribution; soil health, soils and humanity and sustainable land management. (Typically Offered: Fall, Spring)

AGRON 1830: Basic Skills for Agronomists

Credits: 1. Contact Hours: Laboratory 3.

Developing the skills that agronomists employ in their work with crops, soil, and the environment through activities involving tools and methodologies used by agronomists. Enrollment is restricted to first-year students majoring in agronomy. (Typically Offered: Fall)

AGRON 2060: Introduction to Weather and Climate

(Cross-listed with MTEOR 2060).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

AGRON 2100: Professional Development in Agronomy: Career Planning

Credits: Required. Contact Hours: Lecture 1.

Career planning, resume and cover letter preparation. (Typically Offered: Fall, Spring)

AGRON 2170: Weed Identification

Credits: 1.

Prereq: 3 credits in Biological Sciences

Half-semester course. Identification of important weeds of agricultural, horticultural and native habitats. Principles of plant taxonomy and classification. Field trips. (Typically Offered: Fall, Spring)

AGRON 2500: Environmental Geography

(Cross-listed with ENSCI 2500/ ENVS 2500/ NREM 2500).

Credits: 3. Contact Hours: Lecture 3.

The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world. (Typically Offered: Fall)

AGRON 2590: Organic Compounds in Plants and Soils

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AGRON 1820 or GEOL 2100 or ENSCI 2500); BIOL 2120; (CHEM 1630 or CHEM 1770); MATH 1400 or higher

Structure, function, and transformations of organic compounds significant in plant and soil environments. (Typically Offered: Spring)

AGRON 2700: Geospatial Technologies

(Cross-listed with ENSCI 2700).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Concepts and tools for acquiring, managing, analyzing, and displaying geographic information, including GIS, remote sensing, spatial analysis, and cartography. Focus on applications in biological, ecological, environmental, and agricultural sciences. (Typically Offered: Spring)

AGRON 2790: Field Exploration of Agronomy

Credits: 3.

Prereq: AGRON 1810 and AGRON 1820

Field-based investigation of Iowa's agronomic systems. Application of principles learned in introductory soils, crops and agronomy courses. For students majoring in agronomy. (Typically Offered: Fall)

AGRON 2800: Crop Development, Production and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810 and AGRON 1820

Overview of crops and cropping systems in the context of global and US agriculture. Focus on agronomic principles, constraints and opportunities as they apply to various locations in Iowa, the USA and the world. (Typically Offered: Fall, Spring)

AGRON 2810: Crop Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810

Science governing plant growth and development in the context of cropping and genetic improvements. (Typically Offered: Spring)

AGRON 2820: Soil Conservation and Land Use

Credits: 3. Contact Hours: Lecture 3.

Principles of soil conservation and land use with emphasis on best management practices and use of soil maps and databases such as Web Soil Survey. AGRON 1820 recommended. (Typically Offered: Fall, Spring)

AGRON 2830: Pesticide Application Certification

(Cross-listed with ENT 2830/ FOR 2830/ HORT 2830).

Credits: 2. Contact Hours: Lecture 2.

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. (Typically Offered: Spring)

AGRON 2980: Cooperative Education

Credits: Required.

Prereq: Instructor Permission for Course

Students register for this course in order to retain full-time status while on a professional work experience. Students must register for this course prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGRON 3100: Professional Development in Agronomy: Work Experience

Credits: Required.

Professional work experience in agronomy. See advisor for departmental requirements.

AGRON 3110: Professional Internship in Agronomy

Credits: 1. Contact Hours: Lecture 1.

Prereq: Academic Advisor Permission for Course

A supervised learning experience in a professional setting related to crop production, plant breeding, soil science or environmental science. For students majoring in Agronomy or Seed Science. (Typically Offered: Fall)

AGRON 3160: Crop Structure-Function Relationships

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810; 3 credits of BIOL

Basic principles concerning the growth, development, and production of crop communities in relation to their environment. (Typically Offered: Fall, Spring)

AGRON 3170: Principles of Weed Science

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall)

AGRON 3180: Introduction to Ecosystems

(Cross-listed with ENSCI 3180/ BIOL 3180/ NREM 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability.

(Typically Offered: Spring)

AGRON 3200: Genetics, Agriculture and Biotechnology

(Cross-listed with GEN 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Transmission and molecular 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. Graduation Restriction: Credit for graduation will not be allowed for more than one of the following: GEN 2600, 3130, 3200 and BIOL 3130 and 3130L. (Typically Offered: Fall, Spring)

AGRON 3310: Crops Practicum

Credits: 2. Repeatable.

Prereq: Instructor Permission for Course

Identification of crops, weeds and diseases of agronomic importance. Diagnostic skills related to seed purity, grain grading, herbicide injury, nutrient deficiency, insect injury, disease symptoms, and/or abiotic environmental stress. Students may participate in intercollegiate judging contests. (Typically Offered: Fall, Spring)

AGRON 3340: Forage Crop Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810

Production and management of forage crops; concepts applied to yield, quality, and stand persistence; systems of forage utilization including grazing, hay, and silage. (Typically Offered: Spring)

AGRON 3380: Seed Science and Technology

(Cross-listed with HORT 3380).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: (AGRON 1810 or HORT 2210); 3 credits of BIOL

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. (Typically Offered: Fall)

AGRON 3420: World Food Issues: Past and Present

(Cross-listed with ENVS 3420/ FSHN 3420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Issues associated with global agricultural and food systems including ethical, social, economic, environmental, and policy contexts.

Investigation of various causes and consequences of overnutrition/ undernutrition, global health, poverty, hunger, access, and distribution.

Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AGRON 3510: Turfgrass Establishment and Management

(Cross-listed with HORT 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 2210 or AGRON 1810 or BIOL 2110

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. (Typically Offered: Fall)

AGRON 3510L: Turfgrass Establishment and Management Laboratory

(Cross-listed with HORT 3510L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in HORT 3510

Those enrolled in the horticulture curriculum are required to take 3510L in conjunction with 3510 except by permission of the instructor. (Typically Offered: Fall)

AGRON 3540: Soils and Plant Growth

(Cross-listed with HORT 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1820; 3 credits of BIOL

Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development. (Typically Offered: Fall, Spring)

AGRON 3540L: Soils and Plant Growth Laboratory

(Cross-listed with HORT 3540L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: AGRON or HORT major with Credit or concurrent enrollment in AGRON 3540

Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth. (Typically Offered: Fall, Spring)

AGRON 3600: Environmental Soil Science

(Cross-listed with ENSCI 3600).

Credits: 3. Contact Hours: Lecture 3.

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 1820 or ENSCI 2500 or GEOL 1010 recommended. (Typically Offered: Spring)

AGRON 3700: Field Experience in Soil Description and Interpretation

Credits: 1. Repeatable, maximum of 4 times.

Prereq: Credit or concurrent enrollment in AGRON 1820

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. (Typically Offered: Fall, Spring)

AGRON 3920: Systems Analysis in Crop and Soil Management

Credits: 3. Contact Hours: Lecture 2, Studio 3.

Prereq: AGRON 3160 and AGRON 3540

Management strategies at the level of the farm field. Emphasis will be on participatory learning activities. (Typically Offered: Fall, Spring)

AGRON 3980: Cooperative Education

Credits: Required.

Prereq: Permission of Instructor; Junior classification

Student register for this course in order to retain full-time status while on a professional work experience. The student must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

AGRON 4040: Global Change

(Cross-listed with MTEOR 4040/ ENSCI 4040/ ENVS 4040).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

AGRON 4050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 5050/ ENSCI 5050/ MTEOR 5050). (Cross-listed with ENSCI 4050/ MTEOR 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 4060: World Climates

(Cross-listed with ENSCI 4060/ MTEOR 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 2060 or MTEOR 2060

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. (Typically Offered: Spring)

AGRON 4070: Mesoscale Meteorology

(Dual-listed with MTEOR 5070/ AGRON 5070). (Cross-listed with MTEOR 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660; MTEOR 4430

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

AGRON 4100: Professional Development in Agronomy: Senior Forum

Credits: 1. Contact Hours: Lecture 1.

Prereq: AGRON 2100 and 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. (Typically Offered: Fall, Spring)

AGRON 4210: Introduction to Plant Breeding

(Cross-listed with HORT 4210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: GEN 3200 or BIOL 3130

Fundamental principles of plant breeding and cultivar development, breeding methods for self-pollinated, cross-pollinated and clonal crops. (Typically Offered: Fall)

AGRON 4250: Crop and Soil Modeling

(Dual-listed with AGRON 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 3160 or AGRON 3540; MATH 1650

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. (Typically Offered: Fall)

AGRON 4500: Issues in Sustainable Agriculture

(Cross-listed with ENVS 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of agricultural practices from the perspective of ethics and sustainable agriculture. (Typically Offered: Spring)

AGRON 4520: Intro GIS for Geoscientists

(Dual-listed with GEOL 5520/ AGRON 5520/ ENSCI 5520). (Cross-listed with GEOL 4520/ ENSCI 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical use of GIS in industry and academia. Includes a class project for GEOL 5520. Sophomore classification or above recommended. (Typically Offered: Fall, Spring)

AGRON 4590: Environmental Soil and Water Chemistry

(Dual-listed with AGRON 5590/ ENSCI 5590). (Cross-listed with ENSCI 4590).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 6 credit of CHEM; (AGRON 1820 or AGRON 3600); MATH 1400 or higher

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 3540; GEOL 1000 recommended. (Typically Offered: Fall)

AGRON 4630: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 5630/ ENSCI 5630). (Cross-listed with ENSCI 4630).

Credits: 3. Contact Hours: Lecture 3.

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. AGRON 1820 or ENSCI 2500 recommended. Graduation Restriction: Credit for one of AGRON 4630 or AGRON 4630L may be applied for graduation. (Typically Offered: Fall)

AGRON 4770: Soil Physics

(Dual-listed with AGRON 5770/ ENSCI 5770). (Cross-listed with ENSCI 4770).

Credits: 3. Contact Hours: Lecture 3.

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat. AGRON 1820 recommended. (Typically Offered: Spring)

AGRON 4820: Soils of the Tropics

(Cross-listed with GLOBE 4820).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: AGRON 3540 and 9 credits in AGRON, GLOBE, ENSCI, or related discipline

Properties, classification, and geographic distribution of tropical and near-tropical soils and landscapes with emphasis on their suitability for cropping. (Typically Offered: Spring)

AGRON 4840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 5840/ HORT 5840/ SUSAG 5840). (Cross-listed with HORT 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits 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. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 4850: Soil and Environmental Microbiology

(Dual-listed with AGRON 5850/ ENSCI 5850/ MICRO 5850). (Cross-listed with ENSCI 4850/ MICRO 4850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820

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. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

AGRON 4880: Raster GIS for Geoscientists

(Dual-listed with GEOL 5880/ AGRON 5880/ ENSCI 5880). (Cross-listed with GEOL 4880/ ENSCI 4880).

Credits: 3.

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 4900E: Independent Study: Entrepreneurship

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4900G: Independent Study: General

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4900Z: Independent Study: Service Learning

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4910: Seed Science Internship Experience

(Cross-listed with HORT 4910).

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: AGRON 3380; Permission of 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. Advanced approval and participation of employer and instructor required. (Typically Offered: Fall, Spring, Summer)

AGRON 4930: Workshop in Agronomy

Credits: 1-30. Repeatable, maximum of 4 times.

Prereq: Instructor Permission for Course

Workshop experience in crops, soils, or agricultural meteorology.

AGRON 4960A: International Tour

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Instructor Permission for Course

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 4960B: Domestic Tour

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

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 4970: Agroecology Field Course

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior classification; 8 credits in AGRON

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

AGRON 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Senior classification; Permission of Instructor

Students register for this course in order to retain full-time status while on a professional work experience. Students must register for this course prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

AGRON 5000: Orientation Seminar

Credits: 1. Contact Hours: Lecture 2.

Prereq: Agronomy students only

An introduction to Iowa and U.S. agriculture for 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. (Typically Offered: Fall)

AGRON 5010: Crop Growth and Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810 or equivalent, BIOL 1010, CHEM 1630, MATH 1400

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. (Typically Offered: Fall, Spring, Summer)

AGRON 5020: Chemistry, Physics, and Biology of Soils

Credits: 3. Contact Hours: Lecture 3.

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.

Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5030: Climate and Crop Growth

Credits: 3. Contact Hours: Lecture 3.

Prereq: Qualified Undergrads need AGRON 1810, MATH 1400

Applied concepts in climate and agricultural meteorology with emphasis on the climate-agriculture relationship and the microclimate-agriculture interaction and crop risk management. Basic meteorological principles are also presented to support these applied concepts. (Typically Offered: Summer)

AGRON 5040: Global Change

(Cross-listed with MTEOR 5040/ ENSCI 5040).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

AGRON 5050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 4050/ ENSCI 4050/ MTEOR 4050). (Cross-listed with ENSCI 5050/ MTEOR 5050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5060: Crop Genetics

(Cross-listed with HORT 5060).

Credits: 3. Contact Hours: Lecture 3.

Introduction to plant reproductive systems, gene segregation and linkage analysis, molecular nature of genes and how genes confer phenotypes, mutation and biotechnology, quantitative inheritance and population genetics to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students. (Typically Offered: Fall)

AGRON 5070: Mesoscale Meteorology

(Dual-listed with MTEOR 4070/ AGRON 4070). (Cross-listed with MTEOR 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660; MTEOR 4540 OR Graduate Classification

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5080: Biophysical Crop Ecology

Credits: 3. Contact Hours: Lecture 3.

The physics behind how humans use plant photosynthesis to convert energy from the sun into useful products. Techniques for quantifying and predicting ecological interactions in the soil-plant-atmosphere continuum. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5090: Agroecosystems Analysis

(Cross-listed with SUSAG 5090/ SOC 5090).

Credits: 4. Contact Hours: Lecture 3, Laboratory 4.

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

AGRON 5100: Crop Improvement

(Cross-listed with STB 5100).

Credits: 3. Contact Hours: Lecture 3.

A study of agriculture from its origins with the domestication of crop plants through basic genetics, demonstrating the challenges and elements of breeding strategies intended to manage gene x environmental interactions. Elements of biotechnology including use of molecular markers, development of genetically modified cultivars, gene mapping, cloning, and gene editing will be covered. Methods to measure the effectiveness of plant breeding (genetic gain) and the impact of improved agronomic practices contributing to increased agricultural productivity will be covered. Use of intellectual property protection, and the conservation and utilization of exotic genetic resources.

AGRON 5110: Crop Improvement

Credits: 3. Contact Hours: Lecture 3.

Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. (Typically Offered: Fall, Spring)

AGRON 5120: Soil-Plant Environment

Credits: 3. Contact Hours: Lecture 3.

Qualified Undergrad Prereq: AGRON 5020. *Recommended* AGRON 5010 or *graduate standing*

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. (Typically Offered: Spring)

AGRON 5130: Data Science for Agricultural Professionals

(Cross-listed with STB 5130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810 or equivalent, MATH 1400, STAT 1040

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. (Typically Offered: Fall, Spring)

AGRON 5140: Integrated Pest Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810 or equivalent, AGRON 5010,

BIOL 1010, CHEM 1630, MATH 1400; AGRON 5020 and AGRON 5030 recommended

Principles and practices of weed science, entomology, and plant pathology applied to crop production systems. Biology, ecology and principles of integrated crop pest management.

AGRON 5150: Integrated Crop and Livestock Production Systems

(Cross-listed with ABE 5150/ SUSAG 5150/ ANS 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SUSAG 5090 or *Graduate Classification*

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. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5160: Crop Physiology

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Spring)

AGRON 5180: Microwave Remote Sensing

(Cross-listed with EE 5180/ MTEOR 5180).

Credits: 3. Contact Hours: Lecture 3.

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. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5190: Herbicide Physiology and Biochemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: *Qualified Undergrads need* AGRON 3160 and AGRON 3170

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. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5200: Plant Breeding Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5060

Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and clonal crops. (Typically Offered: Fall)

AGRON 5210: Principles of Cultivar Development

Credits: 3. Contact Hours: Lecture 3.

Theoretical and practical exploration of breeding methods to develop clonal, pureline, inbred and hybrid cultivars. Principles and strategies to set breeding objectives, parental selection and germplasm management, population development, generation advancements, multiple trait selection, experimental designs in breeding programs; seed production and certification. Introduce tools available to a breeder. (Typically Offered: Spring)

AGRON 5220: Field Methods in Plant Breeding

Credits: 1-2.

Prereq: AGRON 5210

Field experience in planning and conducting plant breeding research for germplasm and cultivar development. Offered odd-numbered years. (Typically Offered: Summer)

AGRON 5230: Molecular Plant Breeding

Credits: 3.

Prereq: AGRON 4210 or AGRON 5210; GDCB 5420A

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. (Typically Offered: Spring)

AGRON 5240: Applied Plant Molecular Genetics & Biotechnology

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5060

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. (Typically Offered: Fall)

AGRON 5250: Crop and Soil Modeling

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MATH 1650; AGRON 3160 or AGRON 3540) or *graduate classification*

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. (Typically Offered: Fall)

AGRON 5260: Field Plot Technique

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: STAT 4010

Planning experiments for agricultural research, analysis of data, and concepts in data interpretation. (Typically Offered: Spring)

AGRON 5280: Quantitative Genetics for Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5060; AGRON 5370

An introduction to the application of quantitative genetics to plant breeding programs. (Typically Offered: Spring)

AGRON 5300: Ecologically Based Pest Management Strategies

(Cross-listed with SUSAG 5300/ ENT 5300/ PLP 5300).

Credits: 3. Contact Hours: Lecture 3.

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered even-numbered years. (Typically Offered: Fall)

AGRON 5310: Crop Ecology and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5010 or AGRON 5020 or AGRON 5030 or *graduate standing*

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. (Typically Offered: Fall)

AGRON 5320: Soil Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5010; AGRON 5030; AGRON 5120 or *graduate standing*

Evaluates the impact of various soil management practices on soil and water resources. Combines and applies basic information gained in AGRON 5020 and AGRON 5120. Emphasizes the agronomic, economic, and environmental effects of soil management strategies. Required course for the Master of Science in Agronomy degree program. (Typically Offered: Fall)

AGRON 5330: Crop Protection

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5140

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 5340: Seed and Variety, Testing and Technology

(Cross-listed with STB 5340).

Credits: 2. Contact Hours: Lecture 2.

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 5360: Quantitative Methods for Seed

(Cross-listed with STB 5360).

Credits: 2. Contact Hours: Lecture 2.

Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data. (Typically Offered: Fall)

AGRON 5370: Quantitative Analytics for Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Qualified Undergrad Prereq: AGRON 1810; MATH 1400 *or graduate standing*

Methods to quantify consequences of decisions based on analytical methods used in crop genetic improvement and cultivar development. (Typically Offered: Fall, Spring)

AGRON 5380: Seed Physiology and the Environment

(Cross-listed with HORT 5380).

Credits: 2. Contact Hours: Lecture 2.

Prereq: AGRON 3160; CHEM 2310 *or* CHEM 3310 *or graduate standing*

Physiological aspects of seed development, maturation, longevity, dormancy, and germination of agronomic and horticultural crops and their interactions with field and storage environments. Emphasis on current literature and advanced methodology. Offered even-numbered years. (Typically Offered: Fall)

AGRON 5390: Seed Conditioning and Storage

(Cross-listed with STB 5390).

Credits: 2. Contact Hours: Lecture 2.

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 5440: Host-Pest Interactions

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Spring)

AGRON 5460: Strategies for Diversified Food and Farming Systems

(Cross-listed with SUSAG 5460/ HORT 5460).

Credits: 3. Contact Hours: Lecture 3.

Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5470: Seed Production

(Cross-listed with STB 5470).

Credits: 2. Contact Hours: Lecture 2.

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. Survey of the differences in seed production strategies between crops and the impact of these differences on seed production.

AGRON 5510: Growth and Development of Perennial Grasses

(Cross-listed with HORT 5510).

Credits: 2. Contact Hours: Lecture 2.

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. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5520: Intro GIS for Geoscientists

(Dual-listed with GEOL 4520/ AGRON 4520/ ENSCI 4520). (Cross-listed with GEOL 5520/ ENSCI 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical use of GIS in industry and academia. Includes a class project for GEOL 5520. Sophomore classification or above recommended. (Typically Offered: Fall, Spring)

AGRON 5530: Soil-Plant Relationships

(Cross-listed with ENSCI 5530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 3540 *or graduate standing*

Composition and properties of soils in relation to the nutrition and growth of plants. (Typically Offered: Spring)

AGRON 5540: Advanced Soil Management

Credits: 2. Contact Hours: Lecture 2.

Prereq: AGRON 3540; MATH 1650 *or graduate standing*

Implications of soil management on the soil environment and root activity. Effect of soil physical properties on soil erosion. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5550: Environmental Soil Mineralogy

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 4730; CHEM 1780 or graduate standing

Structure and behavior of clay minerals, humic substances and biochar in soil environments, with emphasis on reactions and environmental implications. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5560: Agroecosystem Ecology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Undergraduate coursework in Biology, Physics, and Chemistry

Understanding controls on the transport, transformation, and storage of carbon, nutrients and water. Effects of agricultural production and management on cycling within systems and transfer among systems at local, regional and global scales will be emphasized. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5590: Environmental Soil and Water Chemistry

(Dual-listed with AGRON 4590/ ENSCI 4590). (Cross-listed with ENSCI 5590).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

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 3540; GEOL 1000 recommended. (Typically Offered: Fall)

AGRON 5610: Population and Quantitative Genetics for Breeding

(Cross-listed with ANS 5610).

Credits: 4. Contact Hours: Lecture 4.

Prereq: STAT 5870 or Graduate Classification

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. (Typically Offered: Fall)

AGRON 5630: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 4630/ ENSCI 4630). (Cross-listed with ENSCI 5630).

Credits: 3. Contact Hours: Lecture 3.

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. AGRON 1820 or ENSCI 2500 recommended. Graduation Restriction: Credit for one of AGRON 4630 or AGRON 4630L may be applied for graduation. (Typically Offered: Fall)

AGRON 5700: Risk Assessment for Food, Agriculture and Veterinary Medicine

(Cross-listed with TOX 5700/ VDPAM 5700).

Credits: 3. Contact Hours: Lecture 3.

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. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5750: Soil Formation and Transformation

(Cross-listed with ENSCI 5750).

Credits: 1. Contact Hours: Lecture 1.

A one-week intensive field class examining the pedology of Iowa under natural and transformed con. (Typically Offered: Fall)

AGRON 5770: Soil Physics

(Dual-listed with AGRON 4770/ ENSCI 4770). (Cross-listed with ENSCI 5770).

Credits: 3. Contact Hours: Lecture 3.

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat. AGRON 1820 recommended. (Typically Offered: Spring)

AGRON 5780: Laboratory Methods in Soil Physics

(Cross-listed with ENSCI 5780).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: concurrent enrollment in AGRON 4770 or AGRON 5770

Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases. (Typically Offered: Spring)

AGRON 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with PLP 5810/ ENT 5810/ HORT 5810).

Credits: 1.

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

AGRON 5840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 4840/ HORT 4840/ SUSAG 4840). (Cross-listed with HORT 5840/ SUSAG 5840).

Credits: 3. Contact Hours: Lecture 3.

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. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5850: Soil and Environmental Microbiology

(Dual-listed with AGRON 4850/ ENSCI 4850/ MICRO 4850). (Cross-listed with ENSCI 5850/ MICRO 5850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Qualified Undergrad Prereq: AGRON 1820 or graduate standing

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. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

AGRON 5880: Raster GIS for Geoscientists

(Dual-listed with GEOL 4880/ AGRON 4880/ ENSCI 4880). (Cross-listed with GEOL 5880/ ENSCI 5880).

Credits: 3.

Qualified Undergrad Prereq: GEOL 4520; CRP 4510; CRP 4520; NREM 3450; NREM 4460; AE 4080 or graduate standing

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: 15 credits in AGRON or graduate standing; *Permission of Instructor for Course*

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

AGRON 5910: Agronomic Systems Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5110, AGRON 5130, AGRON 5310, AGRON 5320, AGRON 5330

Analysis of cropping systems from a problem-solving perspective. Case studies will be used to develop the students' ability to solve agronomic problems. (Typically Offered: Spring)

AGRON 5920: Current Issues in Agronomy

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5010, AGRON 5030, AGRON 5110, AGRON 5120, AGRON 5130, AGRON 51

Critical analysis and discussion of agricultural practices, programs, and policies of current interest to the field of agronomy. Leadership skill development through consideration of technical, social, and ethical components underlying controversial topics. Enhancement of communication proficiency through debate and writing in order to define problems, articulate possible solutions, and propose appropriate courses of action. Required course for the Master of Science in agronomy degree program. (Typically Offered: Fall, Spring)

AGRON 5930: Workshop in Agronomy

Credits: 1-30. Repeatable.

AGRON 5940: Agronomy MS Practicum

Credits: 1.

Practical field and laboratory experiences integrating coursework in climatology, crops, and soils. Includes lectures, labs and field tours. (Typically Offered: Summer)

AGRON 5950: Seed Quality, Production, and Research Management

(Cross-listed with STB 5950).

Credits: 2. Contact Hours: Lecture 2.

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 5990A: Agricultural Meteorology

Credits: 1-30. Repeatable.

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. (Typically Offered: Fall, Spring, Summer)

AGRON 5990B: Crop Production and Physiology

Credits: 1-30. Repeatable.

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 5990C: Plant Breeding

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

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 5990D: Soil Chemistry

Credits: 1-30. Repeatable.

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 5990E: Soil Fertility

Credits: 1-30. Repeatable.

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 5990F: Soil Management

Credits: 1-30. Repeatable.

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 5990G: Soil Microbiology and Biochemistry

Credits: 1-30. Repeatable.

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 5990H: Soil Morphology and Genesis

Credits: 1-30. Repeatable.

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 5990I: Soil Physics

Credits: 1-30. Repeatable.

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 5990K: Seed Science

Credits: 1-30. Repeatable.

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 5990L: Weed Science

Credits: 1-30. Repeatable.

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 5990M: Agronomy

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

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. Offered on a satisfactory-fail basis only.

Courses for graduate students:**AGRON 6000A: Seminar: Plant Breeding**

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 times.

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. (Typically Offered: Spring)

AGRON 6000B: Seminar: Soils

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 times.

Reports and discussion of recent literature and research. (Typically Offered: Spring)

AGRON 6000C: Seminar: Crop Production and Physiology

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 times.

Reports and discussion of recent literature and research. (Typically Offered: Fall, Spring)

AGRON 6010: Agronomic Science Presentations

Credits: 2. Contact Hours: Lecture 2.

Prereq: AGRON students only

Experience in critical communications in exchange of ideas through oral and poster presentations and scientific questioning/evaluation. (Typically Offered: Spring)

AGRON 6050: Boundary-Layer Meteorology

(Cross-listed with MTEOR 6050).

Credits: 3. Contact Hours: Lecture 3.

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. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 6100: Foundations of Sustainable Agriculture

(Cross-listed with ABE 6100/ SUSAG 6100/ ANTHR 6100/ SOC 6100).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall)

AGRON 6210: Advanced Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5210; AGRON 5260; AGRON 5610; or Graduate Classification

Genetics of breeding populations, means of genotypes and breeding populations, mapping quantitative trait loci, variation in breeding populations, genetic design, genotype by environment interaction, selection in breeding populations, recurrent selection, marker-assisted selection, best linear unbiased prediction, genome-wide association studies, genomic selection, heterosis and hybrid prediction, and multiple traits. (Typically Offered: Spring)

AGRON 6250: Genetic Strategies in Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5210; GDCB 5100; or Graduate Classification

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. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 6770: Advanced Soil Physics

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5770 or Graduate Classification

The flow and distribution of water, chemicals, and heat in soils. Physical principles and applications. Offered even-numbered years. (Typically Offered: Fall)

AGRON 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with EE 6930/ BCB 6930/ ENGR 6930/ GENET 6930/ ME 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AGRON 6960: Research Seminar

(Cross-listed with PLBIO 6960/ BBMB 6960/ FOR 6960/ GDCB 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AGRON 6980: Agronomy Teaching Practicum

Credits: 1-2. Repeatable.

Prereq: Graduate classification; M.S. or Graduate Certificate in Agronomy; Permission of Instructor

Graduate student experience in the agronomy teaching program. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGRON 6990A: Agricultural Meteorology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990B: Crop Production and Physiology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990C: Plant Breeding

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990D: Soil Chemistry

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990E: Soil Fertility

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990F: Soil Management

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990G: Soil Microbiology and Biochemistry

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990H: Soil Morphology and Genesis

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990I: Soil Physics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990J: Plant Physiology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990K: Seed Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

AGRON 6990L: Weed Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course