

# Plant, Insect and Microbial Sciences

Division of Plant Sciences  
College of Agriculture, Food and Natural Resources  
52 Agriculture Laboratory  
(573) 882-3001  
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Division Director: Heike Bücking

The Division of Plant Sciences is a consolidation of the disciplines of Agronomy, Entomology, Horticulture, Plant Microbiology and Pathology. Containing both a vibrant and diversified undergraduate and graduate education program, students completing B.S., M.S. or Ph.D. programs are highly competitive for the strong job market in basic or applied careers. In addition to education, the Division of Plant Sciences also provides leadership for plant, insect and microbe-based research, education and Extension programs in the college.

The division is the sole academic program in the state to address issues related to plant production, plant protection and plant biology from the laboratory to the field. We intend to be at the national and international forefront of disciplinary and interdisciplinary research, Extension and education in applied and basic aspects of plant sciences.

Division faculty contribute to advances in conventional, sustainable and alternative production systems, plant biology, genetics and breeding, plant protection and pest management, plant-insect/pathogen interactions, and plant-soil relationships.

## Faculty

**Professors** B. A. Barrett\*\*, K. W. Bradley\*\*, D. Finke\*\*, F. B. Fritschl\*\*, W. Gassmann\*\*, R. L. Kallenbach\*\*, B. Meyers\*, R. Mittler\*, K. A. Nelson\*\*, C. Roberts\*\*, C. P. Scharf\*, J. E. Schoelz\*\*, R. E. Sharp\*\*, R. W. Sites\*\*, R. J. Smeda\*\*, Q. Song\*\*, M. R. Warmund\*\*, B. Yang  
**Curators' Professors** H. T. Nguyen\*\*, G. Stacey\*\*

**Endowed Professors** P. Chen\*\*

**Associate Professors** C. Elsik\*\*, D. Mendoza-Cozatl\*\*, G. L. Miller\*\*, X. Xiong\*\*

**Assistant Professors** S. Park, K. Rice\*, A. Scaboo\*\*

**Distinguished Research Professor** J. Boyer\*

**Assistant Research Professors** M. Stacey\*, A. Thomas\*

**Associate Extension Professors** J. A. Lory\*, M. Nathan\*

**Assistant Extension Professors** K. Bissonnette\*, D. Volenberg

**Associate Teaching Professor** H. Naumann\*

**Assistant Teaching Professor** M. A. Gowdy\*, C. Spinka

**Adjunct Professors** S. H. Anderson\*, P. R. Arelli, B. Beerntsen\*, P. Beuselinc, K. D. Bilyeu\*\*, S. Flint-Garcia\*\*, J. P. Gustafson\*, B. E. Hibbard\*\*, J. C. Hong, C. F. Hwang\*\*, L. G. Kovacs\*\*, R. J. Kremer\*, H. B. Krishnan\*, M. D. McMullen\*\*, P. Motavalli\*, M. J. Oliver\*\*, W. Qiu\*\*, D. Schachtman, D. Stanley\*, J. Weirich

**Adjunct Associate Professors** D. M. Burner\*, T. A. Coudron\*\*, M. Gehan, J. Gillman\*, N. R. Kitchen\*\*, A. H. McIntosh\*, R. L. Myers, D. H. Trinklein\*, O. Yu, R. Zhang

**Adjunct Assistant Professors** I. Baxter, J. Benne, K. S. Shelby\*, T. L. Slewinski, C. Topp, P. L. Vincent\*, J. D. Washburn

**Adjunct Associate Professor Emeritus** M. A. Schaeffer

**Research Associate Professor Emeritus** J. Bruhn

**Professor Emeritus** S. C. Anand, D. G. Blevins\*, G. M. Chippendale, E. H. Coe\*, M. Collins\*, J. T. English\*\*, R. D. Hall\*, A. Keaster, M. J. Linit\*, J. D. Mihail\*\*, G. Neuffer, T. L. Payne\*, J. C. Schultz\*\*, D. A. Sleper\*, W. J. Wiebold\*\*, J. A. Wrather\*

**Associate Professor Emeritus** W. C. Bailey\*\*, A. L. McKendry\*\*, C. Starbuck\*

**Assistant Professor Emeritus** B. Puttler

**Curators' Professor Emeritus** C. J. Nelson\*

**Endowed Professor Emeritus** J. G. Shannon\*\*

\* Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.

\*\* Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

## Undergraduate

While the College of Agriculture, Food and Natural Resources does not offer an undergraduate degree specifically in Plant, Insect and Microbial Sciences, there are many options available for undergraduate studies in Plant Sciences (<http://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantsciences/>). The catalog provides a complete list of degree program options (<http://catalog.missouri.edu/degreesanddegreeprograms/>).

## Graduate

- MS in Plant, Insect and Microbial Sciences (<http://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantinsectmicrobialsciences/ms-plant-insect-microbial-sciences/>)
- PhD in Plant, Insect and Microbial Sciences (<http://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantinsectmicrobialsciences/phd-plant-insect-microbial-sciences/>)

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<https://pst.missouri.edu/graduate/>

**Director of Graduate Studies:** David Mendoza Cozatl

The Division of Plant Sciences offers graduate programs leading to master of science and doctor of philosophy degrees in Plant, Insect and Microbial Sciences. A student can select training from a wide range of courses and research programs to prepare for a career in research, teaching, industry and extension work.

The Division of Plant Sciences maintains excellent graduate programs with classroom instruction and research supervision provided by leading scientists in the field. A student can select training in one of several Graduate Program Areas. Students can follow a traditional curriculum or take advantage of the cross-disciplinary expertise that exists within the Division.

## Programmatic Interactions

Students also benefit from interaction with closely allied academic units on and off campus. Students work with scientists in two campus-based USDA research units associated with the division: the Plant Genetics Unit and the Biological Control of Insects Research Laboratory. Additional opportunities exist for interaction with scientists at the Donald Danforth Plant Science Center in St. Louis. Numerous USDA and Danforth Center

scientists hold adjunct appointments in the DPS. Students in the DPS are encouraged to interact with interdisciplinary programs on campus such as the Interdisciplinary Plant Group, the Molecular Biology Program, the Genetics Area Program, the Center for Agroforestry and the Missouri Precision Agriculture Center.

## Areas of Study

A student can select training from a wide range of courses and research programs to prepare for a career in research, teaching, industry and extension work. Students may complete their graduate degrees through any of the Graduate Program Areas:

- Crop, Soil and Pest Management
- Entomology
- Horticulture
- Plant Breeding, Genetics and Genomics
- Plant Stress Biology

### **PLNT\_SCI 1002: Topics In Plant Science - Biological**

Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

**Credit Hour:** 1-4

### **PLNT\_SCI 1120: Career Development**

Introductory course for students planning a career in plant sciences. Includes an overview of each emphasis area, as well as development of professional skills required for a successful career. Graded on A-F basis only.

**Credit Hour:** 1

**Prerequisites:** Plant Science majors only

### **PLNT\_SCI 2002: Topics in Plant Science - Biological**

Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

**Credit Hour:** 1-4

### **PLNT\_SCI 2075: Environmental Horticulture**

Investigate interrelationships between plants and the environment. Special emphasis placed on improving homeowners' environmental stewardship and their knowledge of sustainable practices. Graded on A-F basis only.

**Credit Hours:** 3

### **PLNT\_SCI 2110: Plants and their Cultivation**

Principles of plant growth with emphasis on anatomy, physiology, and response to environmental factors. Production and protection of economically important crop and horticulture species.

**Credit Hours:** 3

### **PLNT\_SCI 2125: Plant Structure and Function**

Introduction to plant anatomy; physiology; how plant structures and processes are involved in growth/development. Labs explore photosynthesis, mineral nutrition, water relations, growth, and hormonal regulation.

**Credit Hours:** 3

**Prerequisites:** BIO\_SC 1200 and CHEM 1100 or CHEM 1320

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### **PLNT\_SCI 2155: Interior Plants**

Identification, cultural requirements and use of plants adaptable or capable of becoming acclimated to interior environments. Graded on A-F basis only.

**Credit Hour:** 1

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### **PLNT\_SCI 2195: Grapes and Wines of the World**

(same as F\_S 2195). Explores the world of wine through study of viticultural principles and practices, wine styles, classifying wine, the winemaking process and New World and Old World wine regions. Learn wine tasting skills and experience wines from around the world. World wine consumption, social and physical health benefits of moderate wine consumption.

**Credit Hours:** 3

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### **PLNT\_SCI 2210: Ornamental Landscape Plants I**

Identification and evaluation of woody and herbaceous stemmed ornamental landscape plants.

**Credit Hours:** 3

**Prerequisites:** BIO\_SC 1200 or instructor's consent

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### **PLNT\_SCI 2215: Ornamental Landscape Plants II**

Annuals, biennials, perennials, ground covers, and bulbs; their identification, nomenclature classification, culture and use.

**Credit Hours:** 3

**Prerequisites:** BIO\_SC 1010 or BIO\_SC 1500 or BIO\_SC 1200

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### **PLNT\_SCI 2220: Introduction to Floral Design**

Introduction to the basics of floral design with special emphasis on design mechanics, flower processing, care and handling. Graded on A-F basis only.

**Credit Hours:** 2

**Prerequisites:** Some sections of this course may be restricted to Plant Science Majors Only and/or students with 75 credit hours or less

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### **PLNT\_SCI 2221: Everyday Floral Design**

Intermediate floral design course expanding skills from introductory floral design with emphasis on the elements and principles of design. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2220

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### **PLNT\_SCI 2240: Landscape Graphic Communication**

Landscape design is a blend of art and science. This course is designed to help students expand their artistic skills, including graphic communications. Topics included to achieve this goal are drawing mediums and techniques, coloring mediums and techniques, symbol usage, and elevation drawings. Graded on A-F basis only.

**Credit Hours:** 2

**Recommended:** ARTDR\_VS 1050

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**PLNT\_SCI 2250: Landscape Site Analysis**

In order to effectively design what a site can become a landscape designer must first be able to accurately see what it is. This course presents a detailed look at obtaining, calculating, and manipulating a site's topography and features while offering a glimpse into the methods and means required for implementation of the final landscape design. Graded on A-F basis only.

**Credit Hours:** 2

**Recommended:** MATH 1100 or equivalent

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**PLNT\_SCI 2254: Landscape Design**

An introduction into the processes, principles, and practices of landscape design, this course begins with site analysis and moves through the drawing and presentation of your landscape concepts.

**Credit Hours:** 3

**Prerequisites:** Completion of 30 hours

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**PLNT\_SCI 3002: Topics in Plant Science - Biological**

Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

**Credit Hour:** 1-4

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**PLNT\_SCI 3110: Horticultural Drainage and Irrigation Systems**

This course is designed to provide practical knowledge of drainage and irrigation systems for golf courses, sports fields, lawns, landscapes, greenhouses, nurseries and vineyards. Graded on A-F basis only.

**Credit Hours:** 2

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**PLNT\_SCI 3130: Undergraduate Seminar in Plant Science**

Discussion of assigned or selected topics in Plant Science, including participation in a panel debate and individual seminar oral presentations.

**Credit Hour:** 1

**Prerequisites:** Completion of 60 credit hours

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**PLNT\_SCI 3210: Principles of Weed Science**

Introduction to principles of weed growth, reproduction, and impact on human activities. Discussion of weed control techniques and technology, weed identification, and developing weed management strategies.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 2110 or BIO\_SC 1200

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**PLNT\_SCI 3210W: Principles of Weed Science - Writing Intensive**

Introduction to principles of weed growth, reproduction, and impact on human activities. Discussion of weed control techniques and technology, weed identification, and developing weed management strategies.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 2110 or BIO\_SC 1200

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**PLNT\_SCI 3213: Genetics of Agricultural Plants and Animals**

(same as AN\_SCI 3213). Concepts of molecular, transmission, and population and quantitative genetics. Emphasis given to breeding and biotechnological applications in plant and animal agriculture. Prerequisites: MATH 1100 or higher and one of the following: BIO\_SC 1100 or BIO\_SC 1200 or BIO\_SC 1500 or F\_W 1100.

**Credit Hours:** 3

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**PLNT\_SCI 3220: Special Occasion Floral Design**

Advanced floral design course with emphasis in silk décor, sympathy design and public ceremony design. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2220 and PLNT\_SCI 2221 with grade of B or above in both

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**PLNT\_SCI 3221: Wedding Floral Design**

Advanced floral design course with emphasis in wedding floral design and personal pieces design. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2220 and PLNT\_SCI 2221 with grade of B or above in both

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**PLNT\_SCI 3222: Retail Floral Management**

Course focusing on all areas of retail floral management: business finance, marketing, products and services, employee management, and customer service. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2220 and PLNT\_SCI 2221

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**PLNT\_SCI 3222W: Retail Floral Management - Writing Intensive**

Course focusing on all areas of retail floral management: business finance, marketing, products and services, employee management, and customer service. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2220 and PLNT\_SCI 2221

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**PLNT\_SCI 3225: Plant Breeding and Genetics**

Mendelian genetic principles and related genetic developments applicable in plant breeding. Discussion of established and new plant breeding procedures applicable to cultivar development.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2110 or PLNT\_SCI 2125

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**PLNT\_SCI 3230: Plant Propagation**

Principles and practices of propagation of horticultural plants. Prerequisites: One of the following: PLNT\_SCI 2075, BIO\_SC 1200, or BIO\_SC 1500 or Instructor's consent.

**Credit Hours:** 3

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**PLNT\_SCI 3230W: Plant Propagation - Writing Intensive**

Principles and practices of propagation of horticultural plants. Prerequisites: One of the following: PLNT\_SCI 2075, BIO\_SC 1200, or BIO\_SC 1500 or Instructor's consent.

**Credit Hours:** 3

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**PLNT\_SCI 3240: Principles of Viticulture I**

(same as F\_S 3240). Grapevine growth, development, selection, propagation, training systems, pruning, and harvesting; vineyard site selection, design, and development. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites:** F\_S 1010 and F\_S 2195 or PLNT\_SCI 2195; or PLNT\_SCI 2100; or PLNT\_SCI 2110; or PLNT\_SCI 2125

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**PLNT\_SCI 3250: Green Industry Bidding**

Principles of interpreting drawings, estimating labor, equipment, materials and other costs and recordkeeping for preparation of competitive green industry bids. Graded on A-F basis only.

**Credit Hours:** 2

**Prerequisites:** Plant Science major and completion of 30 credit hours

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**PLNT\_SCI 3252: Arboriculture and Pruning**

Concepts for establishment and management of urban trees. Emphasis on planting, fertilization, pruning, disease, hazard assessment and components of a municipal trees ordinance.

**Credit Hour:** 1

**Prerequisites:** PLNT\_SCI 2210 or instructor's consent

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**PLNT\_SCI 3254: Digital Landscape Graphics**

This course will help students explore the latest design software available to transform their design concepts into a digital format and investigate the benefits of utilizing technology as a design tool. Technology can help designers elevate their skills to the highest level of professionalism while bringing excitement and clarity to the presentation of their concepts. Programs utilized will include, but not be limited to AutoCAD; Adobe Photoshop; Google Sketchup; and Lumion. Graded on A-F basis only.

**Credit Hours:** 3

**Recommended:** PLNT\_S 2250 and PLNT\_S 2254

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**PLNT\_SCI 3260: Greenhouse Management**

Greenhouse design, environmental control and equipment. Practices associated with plant nutrition management, greenhouse pest control, postproduction handling and marketing of greenhouse crops, and greenhouse management are also covered.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 2075 or instructor's consent

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**PLNT\_SCI 3270: Forage Crops**

An introduction to principle forage crops, including identification, anatomy, physiology, and growth characteristics. Pasture production and management, grazing systems, and forage preservation and utilization will also be covered.

**Credit Hours:** 3

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**PLNT\_SCI 3275: Grain Crops**

Lecture and discussion covering production and utilization, plus growth and development of a wide range of grain crops, including Missouri crops. Problem solving tasks include agronomics, economics and environmental factors.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2110 or PLNT\_SCI 2125

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**PLNT\_SCI 3355: Introductory Turfgrass Management**

Characteristics of turf materials, principles of establishment and maintenance.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2100 or instructor's consent

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**PLNT\_SCI 3385: Problems in Plant Science**

Not accepted as a substitute for any regularly scheduled course. Problems arranged with individual faculty member in specific matter area.

**Credit Hour:** 1-4

**Prerequisites:** consent required

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**PLNT\_SCI 3510: Biology of Fungi**

(same as BIO\_SC 3510). The diverse roles of fungi in the biosphere will be explored by considering fungi we eat, fungi which destroy our food, fungi in folklore and fungi as global nutrient recyclers.

**Credit Hours:** 3

**Prerequisites:** BIO\_SC 1200 or BIO\_SC 1500 or equivalent

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**PLNT\_SCI 3710: Introductory Entomology**

(same as BIO\_SC 3710). Emphasizes the role insects play in the scheme of life. Topics include insect structure, development, diversity, ecology, communication and behavior, and management. Prerequisites: Completion of 60 credit hours and one of the following: BIO\_SC 1100 (or F\_W 1100) or BIO\_SC 1200, or BIO\_SC 1500.

**Credit Hours:** 3

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**PLNT\_SCI 3715: Insect Diversity**

(same as BIO\_SC 3715). Laboratory exercises emphasizing external insect anatomy, classification, and identification (to family level). Preparation of an insect collection is required.

**Credit Hours:** 2

**Prerequisites or Corequisites:** PLNT\_SCI 3710 (or BIO\_SC 3710)

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**PLNT\_SCI 4002: Topics in Plant Science - Biological**

Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

**Credit Hour:** 1-4

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**PLNT\_SCI 4003: Topics in Plant Science - Biological- Lab**

Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

**Credit Hour:** 1-4

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**PLNT\_SCI 4225: Principles of Plant Breeding**

(cross-leveled with PLNT\_SCI 7225). This is an introductory course exploring the principles of plant breeding where we examine the application of genetics and the plant sciences to the breeding and improvement of field crops, focusing on conventional plant breeding principles. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2110 or PLNT\_SCI 2125 or BIO\_SC 1200

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**PLNT\_SCI 4270: Laboratory Techniques in Forage Analysis**

(cross-leveled with PLNT\_SCI 7270). This course explores the analysis of forages for yield and nutritive value. Students will learn how to properly collect forage samples in the field, followed by proper preservation

and processing techniques. Students will perform all of the laboratory analyses necessary to determine the full nutritive value of their sampled forages (dry matter yield, crude protein, fiber and digestibility), learning the what, how and why behind each analysis performed along the way. Lastly, students will learn how to compare different forage samples and draw conclusions based on their results. Students will be prepared for employment in the feed and forage analysis industry following completion of this course. Graded on A-F basis only.

**Credit Hours:** 2

**Prerequisites or Corequisites:** PLNT\_SCI 3270

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**PLNT\_SCI 4313: Soil Fertility and Plant Nutrition**

(same as SOIL 4313; cross-leveled with PLNT\_SCI 7313, SOIL 7313). Explanation of principles of delivery of plant nutrients to plants, discussion of the role of each essential nutrient in crop plants and introduction to the management of soil amendments.

**Credit Hours:** 3

**Prerequisites:** SOIL 2100 or instructor's consent

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**PLNT\_SCI 4315: Crop Physiology**

(cross-leveled with PLNT\_SCI 7315). Basic course on crop growth and development. Emphasis is on physiological processes and morphology of crop plants, and their application to crop breeding and management decisions.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2125 or equivalent

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**PLNT\_SCI 4320: Molecular Plant Physiology**

(same as BIO\_SC 4320; cross-leveled with BIO\_SC 7320, PLNT\_SCI 7320). Modern physiology of higher plants using common cultivated plants as examples. Prerequisites: CHEM 1320 or CHEM 1330 and one of the following: BIO\_SC 1500 or BIO\_SC 1200.

**Credit Hours:** 3

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**PLNT\_SCI 4325: Advanced Plant Breeding**

(cross-leveled with PLNT\_SCI 7325). Will introduce students to the application of genetics and the plant sciences to the breeding and improvement of self-pollinated field crops. Classical, current and innovative plant breeding techniques will be addressed.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2110 or PLNT\_SCI 2125, and PLNT\_SCI 3213 (or equivalent), and PLNT\_SCI 3225 (or equivalent)

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**PLNT\_SCI 4340: Principles of Viticulture II**

(same as F\_S 4340). Environmental and biological factors influencing vine physiology and winegrape quality. Irrigation, canopy management, pest and disease control, budgets and current trends in viticulture. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites:** F\_S 3240 or PLNT\_SCI 3240

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**PLNT\_SCI 4345: Principles of Viticulture and Winemaking**

(same as F\_S 4345; cross-leveled with PLNT\_SCI 7345, F\_S 7345). This course will cover the basics needed by viticulturists and winemakers to understand grape vine growth and vineyard considerations along

with winemaking principles. Viticultural topics will include grapevine growth and development, vineyard design and development, cultivar selection, grapevine propagation, training systems, and harvest and pruning. Winemaking topics will include sensory analysis of grapes, chemical, microbiological and technological aspects of winemaking, and the analytical methods used for juice and wine analysis. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** BIO\_SC 1010 or BIO\_SC 1020 or BIO\_SC 1030

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**PLNT\_SCI 4355: Advanced Turfgrass Management**

(cross-leveled with PLNT\_SCI 7355). Provides turfgrass majors a more informative and applicable look at mathematics of turfgrass management, application techniques, cultural practices, and soil/water relationships applicable to careers in golf course and sports turf management, lawn care, and professional grounds maintenance.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3355 or instructor's consent

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**PLNT\_SCI 4360: Precision Agriculture Science and Technology**

(same as AG\_S\_TCH 4360, SOIL 4360; cross-leveled with PLNT\_SCI 7360, AG\_S\_TCH 7360, SOIL 7360). Precision agriculture is an information-based approach to farming whereby variability is managed to optimize crop production and reduce environmental pollution. This course provides an overview of precision agriculture technologies (like GIS, GPS, remote sensing), mapping methods, and case studies illustrating decisions and management.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2100 or SOIL 2100, or PLNT\_SCI 2110; MATH 1100; AG\_S\_TCH 1040

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**PLNT\_SCI 4365: Greenhouse Crops Production**

(cross-leveled with PLNT\_SCI 7365). Production management decision and commercial culture of the major floriculture crops.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 3260 or instructor's consent

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**PLNT\_SCI 4385: Problems in Plant Science**

Special problem in plant pathology designed for the minor program in Plant Pathology. Problems arranged on an individual student basis.

**Credit Hours:** 3

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**PLNT\_SCI 4400: Plant Anatomy**

(same as BIO\_SC 4400; cross-leveled with PLNT\_SCI 7400, BIO\_SC 7400). Comparative structure, growth of meristems; development, structure of important cell types, tissues systems; comparative anatomy of stem, root, leaf. Emphasizes anatomy of gymnosperms, angiosperms. Includes lab. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites:** BIO\_SC 1200 or equivalent

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**PLNT\_SCI 4500: Biology and Pathogenesis of Plant-Associated Microbes**

(cross-leveled with PLNT\_SCI 7500). Diagnosis of diseases of plants caused by fungi, nematodes, viruses and bacteria Environmental and

genetic factors leading to disease development and strategies for disease management, including biotechnology. Prerequisites: 5 hours from the following courses: BIO\_SC 1010, BIO\_SC 1020, BIO\_SC 1030, BIO\_SC 1100, BIO\_SC 1200 or BIO\_SC 1500; and completion of 60 credit hours.

**Credit Hours:** 4

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**PLNT\_SCI 4520: Environmental Microbiology**

Fundamental knowledge of selected microbial processes that are important in agriculture, environmental detoxification, and microbial biotechnology. Emphasis is on molecular, genetic and physiological aspects of nitrogen metabolism, bioconversions, antibiotics and biocontrol.

**Credit Hours:** 3

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**PLNT\_SCI 4550: Plant Biotechnology**

(cross-leveled with PLNT\_SCI 7550). Principles of gene expression, metabolic pathway analysis and data mining, plant tissue culture and transformation, transgene integration and expression analysis, plant epigenome, emerging transgenic technologies, etc. Prerequisites: PLNT\_SCI 2125 and one of the following: PLNT\_SCI 3213, or BIO\_SC 2200 or BIO\_SC 2300.

**Credit Hours:** 4

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**PLNT\_SCI 4720: Aquatic Entomology**

(cross-leveled with PLNT\_SCI 7720). Identification, life histories, ecology of aquatic insects. Grading is based on lecture, lab, and a collection. For students of wildlife, fisheries management, aquatic biology, advanced entomology.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3710 or PLNT\_SCI 3715 or equivalent, or instructor's consent

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**PLNT\_SCI 4730: Insect Pest Management for Plant Protection**

(cross-leveled with PLNT\_SCI 7730). History and concepts of Integrated Pest Management of insect pests, emphasizing complementary use of biological control, plant resistance, environmental manipulations, genetic manipulations, and selective use of insecticides.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3710 or instructor's consent

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**PLNT\_SCI 4940: Internship in Plant Science**

Combines study, observation, and employment with an industry or government agency in area of agronomy or horticulture. Written and oral reports and faculty evaluation.

**Credit Hours:** 3

**Prerequisites:** Completion of 75 hours including two courses in department and instructor's consent

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**PLNT\_SCI 4945: Experiential Learning in Industry Internship in Plant Science**

Learning experience combining observation, application, and reflection in a discipline-based industry internship. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only.

**Credit Hours:** 0

**Prerequisites:** instructor's consent

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**PLNT\_SCI 4950: Undergraduate Research in Plant Science**

Capstone experience consisting of investigations in Plant Science in support of an undergraduate thesis or special project portfolio.

**Credit Hour:** 1-3

**Prerequisites:** Completion of 75 credit hours and Plant Science Majors only

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**PLNT\_SCI 4955: Experiential Learning in Research in Plant Science**

A supervised learning experience contributing to faculty research. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only. Requires instructor's consent.

**Credit Hours:** 0

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**PLNT\_SCI 4965: Special Readings in Plant Pathology**

Independent readings and discussions of topics in entomology selected in consultation with supervising faculty member. Paper required.

**Credit Hour:** 1-99

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**PLNT\_SCI 4970: Readings in Plant-Insect Interactions**

(cross-leveled with PLNT\_SCI 7970). This course is designed to provide graduate and advanced undergraduate students with skills to critically read and evaluate the primary scientific literature using the current primary literature in the field of plant-herbivore interactions. The rich history of chemical, physiological, population, and multi-trophic ecology studies on plant-insect interactions has produced an exciting, fast-paced interdisciplinary field at the forefront of ecology. This course is an ideal way to help students working in this field, or other areas of plant stress, to understand what is currently known, to experience the breadth of questions asked, and to think critically about what's published. Learning to evaluate the literature and prepare well-written critiques will help students to participate effectively in the important peer-review process of science. Graded on S/U basis only.

**Credit Hour:** 1

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**PLNT\_SCI 4975: Advanced Landscape Design**

(cross-leveled with PLNT\_SCI 7975). Development of project presentation techniques by analysis of the social, cultural, historical and ecological aspects of landscape design.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 2254 or instructor's consent

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**PLNT\_SCI 7001: Topics**

Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

**Credit Hour:** 1-4

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**PLNT\_SCI 7002: Topics- Lab**

Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

**Credit Hour:** 1-4

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**PLNT\_SCI 7085: Problems**

Advanced studies not expected to terminate in thesis. Problems arranged with individual faculty member in specific matter area.

**Credit Hour:** 1-3

**Prerequisites:** instructor's consent

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**PLNT\_SCI 7087: Seminar**

In-depth development of advanced aspects of plant, insect, or microbial sciences through reviews of results of research in progress and current scientific publications. Graded on S/U basis only.

**Credit Hour:** 1

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**PLNT\_SCI 7225: Principles of Plant Breeding**

(cross-leveled with PLNT\_SCI 4225). This is an introductory course exploring the principles of plant breeding where we examine the application of genetics and the plant sciences to the breeding and improvement of field crops, focusing on conventional plant breeding principles. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2110 or PLNT\_SCI 2125 or BIO\_SC 1200

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**PLNT\_SCI 7270: Laboratory Techniques in Forage Analysis**

(cross-leveled with PLNT\_SCI 4270). This course explores the analysis of forages for yield and nutritive value. Students will learn how to properly collect forage samples in the field, followed by proper preservation and processing techniques. Students will perform all of the laboratory analyses necessary to determine the full nutritive value of their sampled forages (dry matter yield, crude protein, fiber and digestibility), learning the what, how and why behind each analysis performed along the way. Lastly, students will learn how to compare different forage samples and draw conclusions based on their results. Students will be prepared for employment in the feed and forage analysis industry following completion of this course. Graded on A-F basis only.

**Credit Hours:** 2

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**PLNT\_SCI 7313: Soil Fertility and Plant Nutrition**

(same as SOIL 7313; cross-leveled with PLNT\_SCI 4313, SOIL 4313). Explanation of principles of delivery of plant nutrients to plants, discussion of the role of each essential nutrient in crop plants and introduction to the management of soil amendments.

**Credit Hours:** 3

**Prerequisites:** SOIL 2110 or instructor's consent

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**PLNT\_SCI 7315: Crop Physiology**

(cross-leveled with PLNT\_SCI 4315). Basic course on crop growth and development. Emphasis is on physiological processes and morphology of crop plants, and their application to crop breeding and management decisions.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2125 or equivalent

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**PLNT\_SCI 7320: Molecular Plant Physiology**

(same as BIO\_SC 7320; cross-leveled with PLNT\_SCI 4320, BIO\_SC 4320). Modern physiology of higher plants using common cultivated plants as examples. May be taken with or without laboratory.

**Credit Hours:** 3

**Prerequisites:** BIO\_SC 1500 or BIO\_SC 1200 and five hours of chemistry

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**PLNT\_SCI 7325: Advanced Plant Breeding**

(cross-leveled with PLNT\_SCI 4325). Will introduce students to the application of genetics and the plant sciences to the breeding and improvement of self-pollinated field crops. Classical, current and innovative plant breeding techniques will be addressed.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2110 or PLNT\_SCI 2125, and PLNT\_SCI 3213 (or equivalent), and PLNT\_SCI 3225 (or equivalent)

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**PLNT\_SCI 7345: Principles of Viticulture and Winemaking**

(same as F\_S 7345; cross-leveled with PLNT\_SCI 4345, F\_S 4345). This course will cover the basics needed by viticulturists and winemakers to understand grape vine growth and vineyard considerations along with winemaking principles. Viticultural topics will include grapevine growth and development, vineyard design and development, cultivar selection, grapevine propagation, training systems, and harvest and pruning. Winemaking topics will include sensory analysis of grapes, chemical, microbiological and technological aspects of winemaking, and the analytical methods used for juice and wine analysis. Graded on A-F basis only.

**Credit Hours:** 3

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**PLNT\_SCI 7355: Advanced Turfgrass Management**

(cross-leveled with PLNT\_SCI 4355). Provides turfgrass majors a more informative and applicable look at mathematics of turfgrass management, application techniques, cultural practices, and soil/water relationships applicable to careers in golf course and sports turf management, lawn care, and professional grounds maintenance. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3355 or instructor's consent

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**PLNT\_SCI 7360: Precision Agriculture Science and Technology**

(same as AG\_S\_TCH 7360 and SOIL 7360; cross-leveled with PLNT\_SCI 4360, AG\_S\_TCH 4360, SOIL 7360). Precision agriculture is an information-based approach to farming whereby variability is managed to optimize crop production and reduce environmental pollution. This course provides an overview of precision agriculture technologies (like GIS, GPS, remote sensing), mapping methods, and case studies illustrating decisions and management.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2100 or SOIL 2100, or PLNT\_SCI 2110; MATH 1100; AG\_S\_TCH 1040

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**PLNT\_SCI 7365: Greenhouse Crops Production**

(cross-leveled with PLNT\_SCI 4365). Production management decision and commercial culture of the major floriculture crops.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 3260 or instructor's consent

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**PLNT\_SCI 7370: Small Fruit and Vegetable Production**

Emphasizes production, management and marketing practices for small fruit and vegetable crops.

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**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 2100, PLNT\_SCI 3230, and PLNT\_SCI 3235

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**PLNT\_SCI 7400: Plant Anatomy**

(same as BIO\_SC 7400; cross-leveled with PLNT\_SCI 4400, BIO\_SC 4400). Comparative structure, growth of meristems; development, structure of important cell types, tissue systems; comparative anatomy of stem, root, leaf. Emphasized anatomy of gymnosperms, angiosperms. Includes lab. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites:** BIO\_SC 1200 or equivalent

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**PLNT\_SCI 7500: Biology and Pathogenesis of Plant-Associated Microbes**

(cross-leveled with PLNT\_SCI 4500). Diagnosis of disease of plants caused by fungi, nematodes, viruses and bacteria. Environmental and genetic factors leading to disease development and strategies for disease management, including biotechnology.

**Credit Hours:** 4

**Prerequisites:** 5 hours BIO\_SC

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**PLNT\_SCI 7550: Plant Biotechnology**

(cross-leveled with PLNT\_SCI 4550). Principles of gene expression, metabolic pathway analysis and data mining, plant tissue culture and transformation, transgene integration and expression analysis, plant epigenome, emerging transgenic technologies, etc.

**Credit Hours:** 4

**Prerequisites:** BIO\_SC 2960 or equivalent; BIO\_SC 2200 or equivalent; BIO\_SC 2300 or equivalent; PLNT\_SCI 2125

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**PLNT\_SCI 7710: Systematic Entomology**

(cross-leveled with PLNT\_SCI 4710). Taxonomy of insects: emphasizes biology and classification of orders and suborders in lecture, and major families in lab. Insect collection required.

**Credit Hours:** 5

**Prerequisites:** PLNT\_SCI 3710 and PLNT\_SCI 3715 or 10 hours Biological Sciences

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**PLNT\_SCI 7720: Aquatic Entomology**

(cross-leveled with PLNT\_SCI 4720). Identification, life histories, ecology of aquatic insects. Grading is based on lecture, lab, and a collection. For students of wildlife, fisheries management, aquatic biology, advanced entomology.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3710, PLNT\_SCI 3715 or equivalent or instructor's consent

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**PLNT\_SCI 7730: Insect Pest Management for Plant Protection**

(cross-leveled with PLNT\_SCI 4730). History and concepts of Integrated Pest Management for insects pests, emphasizing complementary use of biological control, plant resistance, environmental manipulations, genetic manipulations, and selective use of insecticides.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3710 or instructor's consent

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**PLNT\_SCI 7820: Principles of Insect Physiology**

Major concepts of insect physiology emphasizing functions of organ-systems sensory physiology hormones in development, nutrition.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 3710, PLNT\_SCI 3715 and PLNT\_SCI 7810 or equivalent

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**PLNT\_SCI 7965: Readings in Plant Stress Biology**

Independent readings and discussion of recent research publications. Topics selected in consultation with supervisory faculty member.

**Credit Hour:** 1-9

**Prerequisites:** instructor's consent

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**PLNT\_SCI 7970: Readings in Plant-Insect Interactions**

(cross-leveled with PLNT\_SCI 4970). This course is designed to provide graduate and advanced undergraduate students with skills to critically read and evaluate the primary scientific literature using the current primary literature in the field of plant-herbivore interactions. The rich history of chemical, physiological, population, and multi-trophic ecology studies on plant-insect interactions has produced an exciting, fast-paced interdisciplinary field at the forefront of ecology. This course is an ideal way to help students working in this field, or other areas of plant stress, to understand what is currently known, to experience the breadth of questions asked, and to think critically about what's published. Learning to evaluate the literature and prepare well-written critiques will help students to participate effectively in the important peer-review process of science. Graded on S/U basis only.

**Credit Hour:** 1

**Prerequisites:** Instructor's consent

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**PLNT\_SCI 7975: Advanced Landscape Design**

(cross-leveled with PLNT\_SCI 4975). Development of project presentation techniques by analysis of the social, cultural, historical and ecological aspects of landscape design.

**Credit Hours:** 4

**Prerequisites:** PLNT\_SCI 2254, instructor's consent

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**PLNT\_SCI 8001: Topics**

Instruction in specific subject matter areas in plant, insect or microbial sciences.

**Credit Hour:** 1-4

**Prerequisites:** instructor's consent

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**PLNT\_SCI 8010: Professionalism and Ethics**

Ethical issues in the conduct of scientific research including data integrity, plagiarism, and intellectual property. Scientific writing, lab management, peer review and other professional skills for the life sciences. Graded on A-F basis only.

**Credit Hours:** 2

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**PLNT\_SCI 8090: Thesis Research**

Original investigations in plant, insect or microbial science in support of thesis for master's candidates. Graded on S/U basis only.



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**Credit Hour:** 1-10

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**PLNT\_SCI 8330: Molecular Breeding and Genomic Technology**

Development of molecular plant breeding, including genome sequencing, molecular markers, genotyping methods, and genome editing. The course provides the principles and application of marker-assisted trait introgression, genomics-assisted selection, and fundamental and methodology of genome editing for crop improvement. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 4325 or equivalent

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**PLNT\_SCI 8362: Introduction to Plant Metabolism**

(same as BIO\_SC 8362 and BIOCHM 8362). This course is part of a series that aims to provide a solid conceptual foundation in interdisciplinary plant biology for graduate students with a research emphasis in plant biology. This course examines the basic concepts and techniques used to understand plant metabolism. Graded on A-F basis only.

**Credit Hours:** 2

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**PLNT\_SCI 8365: Introduction to Molecular Cell Biology**

(same as BIOCHM 8365 and BIO\_SC 8365). This course is part of a series that aims to provide a solid conceptual foundation in interdisciplinary plant biology for graduate students with a research emphasis on plant biology. This course examines the basic concepts and techniques used to understand molecular cell biology. Graded on A-F basis only.

**Credit Hours:** 2

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**PLNT\_SCI 8410: Advanced Weed Science**

Discussion of herbicide physiology and fate in the environment, current development in weed science theory and methodology, and application of analytical procedures in weed research.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3210

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**PLNT\_SCI 8420: Herbicide Mode of Action and Symptomology**

Designed for graduate students to gain an understanding of the in-depth processes by which herbicides interrupt normal plant growth and development at a tissue, cellular, and enzymatic level while learning to diagnose visual symptoms associated with herbicide injury. Course may be repeated for credit. Graded on A-F basis.

**Credit Hours:** 2

**Prerequisites:** PLNT\_SCI 3210; instructor's consent

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**PLNT\_SCI 8430: Introduction to Bioinformatics Programming**

(same as AN\_SCI 8430). This course provides the basics of programming and database development to students in the life sciences who have little prior programming experience. It covers Unix/Linux, Perl, MySQL, the relational database design process, and common data formats used in genome informatics. Students will learn how programming skills can enhance their ability to analyze large biological datasets, and will gain hands on experience with examples focused on genomics and bioinformatics. Graded on A-F basis only.

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**Credit Hours:** 4

**Prerequisites:** Instructor's consent

**Recommended:** Undergraduate or graduate course in Genetics

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**PLNT\_SCI 8441: Statistical Applications in Agriculture**

(same as AN\_SCI 8441). Techniques of experimentation, with application to livestock production and management. Exercises in methods of planning, conducting, analyzing, evaluating and reporting research.

**Credit Hours:** 3

**Prerequisites:** STAT 4530/STAT 7530 or equivalent or instructor's consent

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**PLNT\_SCI 8505: Plant Stress Biology**

(same as BIO\_SC 8505). This course will introduce the basic concepts of abiotic and biotic plant stress agents and discuss how to conduct research with plant stress agents alone or in combination. Graded on A-F basis only.

**Credit Hours:** 3

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**PLNT\_SCI 8530: Research with Plant Stress Agents**

Students will learn key research strategies for abiotic and biotic plant stress agents. Students will complete two focused hands-on projects. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 7500 and PLNT\_SCI 7510 or PLNT\_SCI 7315, or PLNT\_SCI 7320, or equivalent

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**PLNT\_SCI 8720: Insect Behavior**

An examination of the breadth of behaviors found in insects, such as orientation mechanisms, communication, dispersal and migration, defensive mechanisms, lost location, feeding strategies, pollination, courtship and reproduction, and social behavior.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3710 and PLNT\_SCI 3715 or 10 hours of Biological Sciences

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**PLNT\_SCI 9001: Topics**

Instruction in specific subject matter areas in plant, insect or microbial sciences.

**Credit Hour:** 1-4

**Prerequisites:** instructor's consent

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**PLNT\_SCI 9087: Seminar in Plant Science**

In-depth development of advanced aspects of plant, insect and microbial sciences through reviews of results of research in progress and current scientific publications. Graded on A-F or S/U basis dependent on section.

**Credit Hour:** 1

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**PLNT\_SCI 9090: Dissertation Research**

Original investigations in plant, insect or microbial science in support of dissertation for doctoral candidates. Graded on a S/U basis only.

**Credit Hour:** 1-10

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**PLNT\_SCI 9310: Ecology of Grazing Lands Systems**

Students travel to grazing lands ecosystems to learn: the components and function of grazing lands; research techniques in soil-plant-animal research; forage-livestock ecology; and the role of forages in conservation practices, wildlife habitat, and sustainable agriculture.

**Credit Hours:** 3

**Prerequisites:** instructor's consent

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**PLNT\_SCI 9415: Advanced Plant Physiology**

Advanced course in the physiology of plant growth and development. Discussion of current and classical studies in plant physiology with emphasis on responses to environmental variation.

**Credit Hour:** 1-3

**Prerequisites:** PLNT\_S 4315 or PLNT\_S 4320 or equivalent. Instructor's consent required

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**PLNT\_SCI 9440: Applied Quantitative and Statistical Genetics**

Estimation of genetic effects using means and variances, diallel analysis, environmental stability responses, index selection, and gain from selection.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 4330, STAT 4510, STAT 4530, AN\_SCI 9423, or equivalent

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**PLNT\_SCI 9540: Genetics of Plant-Microorganism Interaction**

Molecular and general genetics of the interactions between plants and pathogenic or symbiotic microorganisms.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 7500 and PLNT\_SCI 7510, one course each in Biochemistry and Genetics

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**PLNT\_SCI 9810: Insect Ecology**

Ecological aspects of insect populations and communities including population dynamics, predator-prey interactions, competition, diversity and stability. Quantitative methods are emphasized.

**Credit Hours:** 3

**Prerequisites:** PLNT\_SCI 3710 and PLNT\_SCI 3715, STAT 1400 and BIO\_SC 3650 or instructor's consent

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