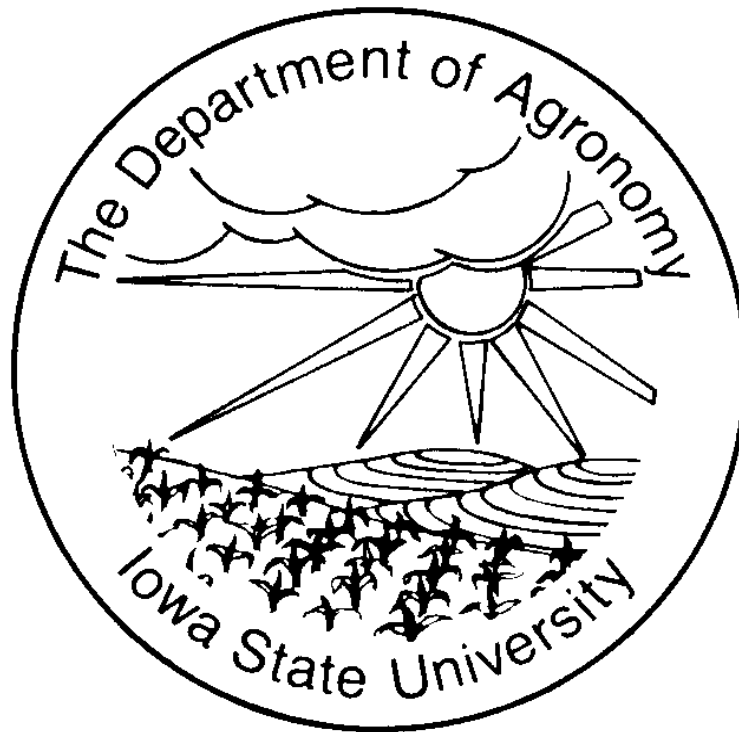


# Crop Production and Physiology



A Guide to Graduate Study  
in the Agronomy Department  
at Iowa State University

revised August 2007

## CROP PRODUCTION AND PHYSIOLOGY PROGRAM

The Iowa State Agronomy Department offers MS and PhD degrees in Crop Production and Physiology (CP&P). The program goals are to provide every graduate with the theoretical concepts and practical experience needed to function effectively as an independent scientist in the public or private sector. The learning experience in the Crop Production and Physiology Program has three major components: academic courses, thesis or dissertation research, and informal interaction among faculty and students. We believe that a collegial environment is essential for personal intellectual growth.

Graduate students can select from a wide range of advanced courses in agronomy, biochemistry, genetics, horticulture, meteorology, molecular biology, plant physiology, seed and weed science, and sustainable agriculture. Depending upon research interest and career focus, the student, in consultation with his/her advisory committee, will design a program of study (POS) from courses taught in several departments. The CP&P Program has no foreign language requirement.

### GUIDELINES FOR GRADUATE COURSE REQUIREMENTS

#### Guidelines for Entrance

Entering students are expected to have a basic competence in physical science, mathematics, and plant science. Minor deficiencies in these areas usually can be addressed during graduate study. Minimum competency is defined by undergraduate credit in the following subject areas (ISU course equivalent in parentheses).

All Candidates

Course area (Iowa State Catalogue designation)

Crop Physiology (Agron 230)  
 Soil Fertility (Agron 354)  
 Genetics (Agron 320)  
 Plant Physiology (Biol 330)  
 Organic Chemistry I (Chem 331)  
 Analytical Geometry (Math 142)

PhD Candidates

Courses listed for "All Candidates" plus:

Plant Anatomy (Biol 454)  
 Organic Chemistry II (Chem 332)  
 Calculus (Math 181)  
 Physics (Phys 111 and 112)

These are minimum expectations; additional requirements for specific areas of study may be required.

### PROGRAM OF STUDY GUIDELINES

All MS and PhD candidates are to establish their program of studies through discussion with their major professor and their POS Committee. It is recommended that students take at least one course from each of the following CORE AREAS.

CORE AREA 1 MOLECULAR BIOLOGY / BIOCHEMISTRY		
Catalog No.	Course Title	Credits
Agron 616	Advanced Topics in Crop Physiology & Biochemistry	4
BBMB 404	Biochemistry I	3
BBMB 405	Biochemistry II	3
BBMB 501	Comprehensive Biochemistry I	4
BBMB 502	Comprehensive Biochemistry II	4
BBMB 542	Introduction to Molecular Biology Techniques	1-5
BBMB 607	Plant Lipid Biochemistry	2
P Phy 545	Plant Molecular Biology	3

CORE AREA 2 GROWTH and DEVELOPMENT		
Catalog No.	Course Title	Credits
Biol 454	Plant Anatomy	3
Biol 428	Cell Biology	2
GDCB 528	Cellular Growth and Regulation	3
GDCB 529	Plant Cell Biology	3
Hort 551	Growth and Development of Perennial Grasses	2
P Phy 512	Plant Growth & Development	3

<b>CORE AREA 3 PLANT PHYSIOLOGY and METABOLISM</b>		
<b>Catalog No.</b>	<b>Course Title</b>	<b>Credits</b>
Agron 516	Crop Physiology	3
Agron 508	Biophysical Crop Ecology	3
Agron 519	Herbicide Physiology and Biochemistry	2
Agron 538	Seed Physiology	2
Agron 553	Soil-Plant Relationships	3
Agron 616	Advanced Topics in Plant Physiology and Biochemistry	4
BBMB 645	Molecular Signaling	2
Hort 537	Plant Stress Biology	3
P Phy 513	Metabolism	2

<b>CORE AREA 4 CROP ECOLOGY AND MANAGEMENT</b>		
<b>Catalog No.</b>	<b>Course Title</b>	<b>Credits</b>
Agron 509	Agroecosystem Analysis	3
Agron 515	Integrated Crop and Livestock Production Systems	3
Agron 517	Weed Biology and Ecology	3
Agron 530	Ecologically Based Pest Management Strategies	3
Agron 553	Soil-Plant Relationships	3
Biol 474	Plant Ecology	3
EEOB 570	Landscape Ecology	3
EEOB 582	Functional Ecology	3
EEOB 584	Ecosystem Ecology	3
Biol 472	Community Ecology	3
EEOB 588	Population Ecology	3
Hort 524	Sustainable and Environmental Horticulture Systems	2
PL P 577	Bacterial-Plant Interactions	3
PL P 594	Seed Pathology	3

<b>CORE AREA 5 STATISTICS/QUANTITATIVE METHODS</b>		
<b>Catalog No.</b>	<b>Course Title</b>	<b>Credits</b>
Agron 526	Field Plot Technique	3
Stat 401	Statistical Methods for Research Workers	4
Stat 402	Statistical Design & the Analysis of Experiments	3
Stat 407	Methods of Multivariate Analysis	3
Stat 505	Environmental Statistics	3
Stat 512	Design of Experiments	3
BCB 596	Computational Molecular Biology	3
CRP 551	Introduction to Geographic Information Systems	3
NREM 546	Integrating GPS AMD GIS for Natural Resource Management	3

### **OTHER REQUIREMENTS**

All students are expected to register and attend the Crop Physiology and Production Seminar, Agron 600C, each term; they are expected to make one presentation for the MS and three for the PhD (two beyond the MS).

For Research, Agron 699B, students are expected to register for a minimum of 7 credits for the MS (thesis) and 24 credits for the PhD.

### **DESIGNATED "MINOR ONLY" COURSES**

CP&P graduate students may take 400-level Agronomy courses outside the major, and not required for the BS in Agronomy, for credit toward their MS or PhD degree. The candidate is limited by the department to no more than three such courses. The POS Committee may choose, however, not to accept any such credits to fulfill the degree requirements.

Additionally, courses specifically designated for the Master of Science in Agronomy and Master of Professional Agriculture degrees may be accepted for graduate credit toward the MS or PhD, but they are restricted to the "minor only" category. These courses may not be used to substitute for any POS-required course.

### **GRADUATE STUDENT POLICIES – ANNUAL REVIEW**

The department will evaluate graduate student progress annually. Graduate students will be asked to submit an Annual Report Form by 1 February. Reports are to be signed by the major professor and submitted to the Graduate Student Coordinator (1126 Agron Hall) by the date indicated.

## TEACHING ASSISTANTS (TAs)

The teaching activities for TAs average 15 hours per week for both fall and spring terms and 5 hours per week in the summer semester (actual hours per term may vary). The nature of the teaching responsibilities shall be arranged in consultation with the graduate student and major professor. Teaching assistants will be involved primarily in the undergraduate teaching program and receive two credits in Agron 698 for each term of involvement.

## AGRONOMY 698 TEACHING PRACTICUM

The Department of Agronomy at Iowa State recognizes the importance of teaching and extension experiences in the professional development of MS and PhD candidates. Students have the opportunity to receive credit for teaching/extension experiences, Agron 698, Teaching Practicum. Students earn one credit in Agron 698 for each 5 hours of effort. The course is offered on a satisfactory-fail basis only and the grade will be awarded by the staff member supervising the teaching/extension experience. Graduate students are encouraged to visit with teaching or extension faculty in the department in order to select the most appropriate experience.

## WRITTEN PRELIMINARY EXAMINATION—CROP PRODUCTION AND PHYSIOLOGY

### Policy

All PhD students majoring in Crop Production and Physiology at Iowa State are required to take a written preliminary examination. If a student fails the examination, the respective POS Committee may require the student to retake the examination, to answer additional written questions, or proceed with the oral examination. Passage of the written examination is required for a student to move to an oral examination by her/his POS Committee. The final decision regarding the student's suitability as a doctoral candidate resides with the student's POS Committee.

### Procedure

The written examination is administered by the student's POS Committee, the second week of October and the second week of February each academic year. A student wishing to take the written examination is required to develop a written agreement with her/his POS Committee to establish the date of examination.

The examination consists of two daily sessions, each starting at 8 a.m. and ending at 1 p.m. Students are required to answer up to four questions each day. This is a closed book examination.

The PhD student's POS Committee is responsible for writing and grading the examination. Questions may be drawn from the bank of prior exam questions available to all CP&P students and faculty. New questions also may be included in an examination, at the discretion of the POS Committee. Subject areas from which questions are developed include but not limited to: plant physiology and metabolism, plant anatomy, plant growth and development, crop ecology and management, weed science, and statistics.

Prior to administering a written examination, each POS Committee sends the assembled set of examination questions to the three-member CP&P written examination committee for review. The review is intended to promote consistency with regard to rigor, breadth, and depth of the exam questions. Suggestions for changes in content are returned to the POS Committee in a timely manner. Differences of opinion concerning examination content are resolved in consultation with the chair of the Plant and Climate panel.

POS Committee members grade the student's answers to the examination questions on a scale of 1-5 scale (1=unsatisfactory, 2=poor, 3=pass, 4=good, 5=excellent). An average score of at least 3.0 with no more than two answers being scored less than 3.0 is required to pass the written preliminary examination.

## GRADUATE FACULTY IN CROP PRODUCTION AND PHYSIOLOGY

**Stephen K. Barnhart.** Professor. Management practices of harvested and grazed forages in forage-livestock systems. ([sbarnhar@iastate.edu](mailto:sbarnhar@iastate.edu))

**Jack Dekker.** Associate Professor. Biology of weeds. Seed dormancy and germinability-dormancy states in soil seed banks. Biology of adaptive traits of weeds in agroecosystems. ([jdekker@iastate.edu](mailto:jdekker@iastate.edu))

**Kathleen Delate.** Associate Professor. Organic agriculture/horticulture. Improving organic production through soil amendments, crop rotation, varietal selection, and biologically-based pest management; agroecology of sustainable cropping systems. ([kdelate@iastate.edu](mailto:kdelate@iastate.edu))

**Roger Elmore.** Professor and Extension Corn Specialist. Extension and research on corn production management. ([relmore@iastate.edu](mailto:relmore@iastate.edu))

**Steve Fales.** Professor. Forage production, management, and quality. Biomass energy crops and cropping systems. ([slf@iastate.edu](mailto:slf@iastate.edu))

**Lance Gibson.** Associate Professor. Crop production and management with an emphasis on winter and spring crops. (*lgibson@iastate.edu*)

**Susana Goggi.** Assistant Professor. Influence of genotype and environment on seed development, maturation and quality. Physiology of seed deterioration. Development and standardization of seed quality tests. (*susana@iastate.edu*)

**Robert Hartzler.** Professor. Influence of cultural practices on weed management systems. Weed population dynamics as affected by management practices. (*hartzler@iastate.edu*)

**Jerry Hatfield.** Professor. (USDA-ARS National Soil Tilth Lab). Production efficiency and environmental quality of farming systems, sustainable agriculture and microclimate of farming systems. (*jerry.hatfield@ars.usda.gov*)

**Douglas L. Karlen.** Professor. (USDA-ARS National Soil Tilth Lab). Tillage systems, compaction, and residue management as they affect crop growth, development and yield (*doug.karlen@ars.usda.gov*)

**Tom Kaspar.** Professor. (USDA-ARS National Soil Tilth Lab). Tillage systems, cover crops, and soil spatial variability as they affect soil and water quality, crop growth, development and yield. (*tom.kaspar@ars.usda.gov*)

**Allen D. Knapp.** Associate Professor. Environmental stress influence on germination, emergence and early autotrophic seedling growth of maize and soybean. Stress adaptations of diverse maize germplasm. (*adknapp@iastate.edu*)

**Matt Liebman.** Professor. Crop, weed, and soil responses to crop rotation, intercropping, and cover cropping practices. Impacts of crop residues, manures, and composts on crop and weed performance. (*mliebman@iastate.edu*)

**Kenneth J. Moore.** Professor. Forage quality and utilization. Identification and characterization of factors that limit the nutritive value of forages. Grazing systems. (*kjmoore@iastate.edu*)

**Russell E. Mullen.** Professor. Stress mediated changes in whole-plant and seed physiology; seed quality and chemical composition of crop seeds. (*remullen@iastate.edu*)

**Micheal D.K. Owen.** Professor. Tillage and management systems on weed population dynamics and weed seed biology. Environmental stress on weed development. Herbicides and herbicide resistant weeds. (*mdowen@iastate.edu*)

**Palle Pedersen.** Assistant Professor. Soybean production management. Soybean response to management systems and new technologies, crop rotation effects and influence of agronomic practices on soybean pathogens and pests. (*palle@iastate.edu*)

**Jeremy Singer.** Assistant Professor. (USDA-ARS National Soil Tilth Lab). Development of sustainable and integrated crop and livestock systems. Resource use efficiency. (*jeremy.singer@ars.usda.gov*)

**Mark E. Westgate.** Professor. Reproductive physiology of corn and soybeans. Environmental effects on seed formation and seed development. Physiological and environmental control of seed composition. (*westgate@iastate.edu*)

**Mary Wiedenhoef.** Associate Professor. Production and management of forage crops, alternative cropping systems, sustainable agriculture and grazing management. (*mwiedenh@iastate.edu*)

## FACILITIES

The Agronomy Department occupies a state-of-the-art facility with over 10,000 square feet of laboratory space for Crop Production and Physiology research. A greenhouse facility and phytotron facility with 30 growth chambers are available for controlled environment studies. And field studies can be conducted at 14 ISU research and demonstration farms across the state. The main 700-acre field research station is within 7 miles of campus. Seed Science Laboratories and the National Soil Tilth Laboratory also provide modern research facilities adjacent to Agronomy Hall.