

**Graduate Program in  
Plant Breeding and Plant Genetics**

PhD Degree

Program Handbook

June 2013

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## **1. PROGRAM AUTHORITY**

### **1.1 Graduate School**

The doctor of philosophy is the highest degree conferred at UW-Madison. It is never conferred solely as a result of any prescribed period of study, no matter how faithfully pursued. Rather, a PhD is a research degree and is granted on evidence of distinctive attainment in a specific field and on ability for independent investigation as demonstrated by a dissertation presenting original research or creative scholarship with a high degree of literary skill.

The UW-Madison Graduate School is the ultimate authority for granting PhD degrees at the University. Plant Breeding and Plant Genetics (PBPG) administers a Graduate Degree Program under the authority of the Graduate School. If completed successfully, the Program's minimum requirements meet all Graduate School requirements for conferring a PhD degree.

### **1.2 Departments**

Program authority to set degree requirements beyond the minimum required by the Graduate School lies with the PBPG faculty. The policies described in this handbook have been approved by the program faculty as a whole, and are subject to periodic review and update. Administration of the PBPG program is overseen by the Executive Committee, whose membership is determined by the Chairs of member departments.

## **2. ADMISSION TO THE PROGRAM**

Student admission into the Graduate Program in PBPG is contingent on meeting requirements set forth by the Graduate School and by the Program.

### **2.1 Graduate School Admission Requirements**

The Graduate School web site (<http://www.wisc.edu/grad/>) details minimum University admission standards, including expected degree achievement from an accredited institution, grade-point average (GPA), and English language proficiency.

### **2.2 PhD Program Admission Requirements**

- 2.2.1 For admission to the PhD Program in PBPG, a student must have completed a bachelor's degree or equivalent at a recognized, accredited college or university prior to enrollment in the PhD Program.
- 2.2.2 Students must meet the general requirements of the UW-Madison Graduate School. Course deficiencies should be made up during the first two years of the student's graduate studies.
- 2.2.3 Students are expected to have completed coursework in supporting fields (mathematics, physics, biology, genetics, and chemistry), ideally obtained by advanced courses taken during the undergraduate years. Specific requirements are listed in the PBPG Certification Form.
- 2.2.4 Undergraduate research experience is recommended, but not required.

### **2.3 Admission Timeline**

The Program application deadlines for each semester can be found on the Graduate School website:

<http://www.grad.wisc.edu/education/academicprograms/mas/794.html>

### **2.4 Selecting a Major Professor**

Admission into the PhD Program in PBPG is contingent on the applicant identifying a member of the PBPG Faculty who is willing to serve as the student's Major Professor. The Major Professor serves as the student's faculty mentor and supervises the student's thesis research. In order to gain admission into the program it is therefore beneficial for an applicant to directly contact potential Major Professors to discuss the possibility of studying under their guidance.

## **3. REQUIREMENTS FOR A PHD IN PBPG**

### **3.1 Program Course Requirements**

- 3.1.1 Rectifying Admission Deficiencies. Any deficiencies identified by the student's PhD Committee in the background course work should be made up during the first 2 years of graduate study.

3.1.2 General Course Requirements. All PhD students in PBPG must satisfy the following general course requirements. These requirements can be satisfied by coursework completed while the student was an undergraduate or enrolled in another graduate program.

- Physical Sciences. One course in each of the following

- 1) Physics, including electricity, heat, and light
- 2) Calculus (differential and integral)
- 3) Two semesters of general chemistry with lab
- 4) Organic chemistry lecture with lab
- 5) One course in statistics

- Biological Sciences. Four courses distributed among three of the following areas:

- 1) Biochemistry
- 2) Genetics
- 3) Structure and/or function of organisms
- 4) Population or ethology of organisms

3.1.3 Program Requirement. PhD students in PBPG must complete 17 credits of graduate level coursework (numbered 300 and above) plus three credits of seminar while enrolled as a graduate student at UW-Madison. Research (990) credits do not count towards this total. Coursework for the PhD degree must be graded (no pass-fail or satisfactory-unsatisfactory). A cumulative GPA of 3.00 or greater is required for all coursework.

3.1.4 Specific course requirements. PhD students in PBPG are required to complete coursework in specific areas as shown in the course table at <http://plantbreeding.wisc.edu/wp-content/uploads/2007/10/pbpgcoursetable.gif> . At least two credits are required from each of sections A (plant breeding), B (genetics and molecular biology), and C (quantitative genetics and biometry). At least 11 credits must be taken from the course table (sections A, B, C, and D). Additional graduate-level credits (course numbers 300 and above) totaling 17 or more can be taken to best meet the individual student's needs and interests. Final determination of a student's required coursework is made by the student's PhD Committee as part of the certification process (see 3.8).

## **3.2 Graduate School Minor Requirements**

The Graduate School specifies that a PhD Program must be rationally unified, with courses that contribute to an organized plan of study and

research. Most courses are selected from a single group embracing a principal subject of concentration, called the "major" (in this case, PBPG) and additional courses are selected from one or more related fields, called the "minor", to provide educational breadth. The Graduate School minor course requirements may be satisfied by Minor Option A or Minor Option B. A cumulative grade-point average GPA of 3.00 or better is required for all minor coursework.

3.2.1 Minor Option A (focused): requires a minimum of 9 credits in a single department or field of study. With the advice of a "minor professor", the student chooses courses from the offerings of a particular UW department or program of study (e.g., Agronomy, Plant Pathology, Genetics, Statistics, etc.). The specific requirements, course work and grades to be met are prescribed by the chosen department or program.

3.2.2 Minor Option B (distributed): requires a minimum of 9 credits forming a coherent topic of study in one or more departments or programs. This can include course work in the major department.

As a matter of course, most PBPG students select Minor Option B to fulfill the Graduate School minor requirements because the Program allows (nearly) all course work credits taken for the major to count towards the Option B minor in addition to counting towards the major requirements.

3.2.3 UW Course Work not applicable to the Minor. The Graduate School stipulates that the 9 credits required to satisfy the minor requirement can only be fulfilled by advanced courses (300 level or above). Seminar courses, research study credits, audits, and courses taken pass/fail are not applicable toward minor requirements. Coursework taken more than ten years ago may not be used. No more than 5 credits worth of courses taken more than 5 years prior to admission may be used to satisfy minor requirements.

### **3.3 Seminar Requirements**

3.3.1 Required Seminar Presentations. During their graduate careers, students are required to present a minimum of 3 seminars in advanced seminar courses and receive a passing grade in each seminar. Advanced seminar courses offered by departments or programs other than PBPG may be used to satisfy this requirement.

### 3.4 Course Load

- 3.4.1 Graduate School Minimum Credit Requirement. For a PhD, the Graduate School requires completion of at least 32 graduate-level credits taken at UW-Madison. Transfer credits from another institution do not count toward this requirement. Acceptable work includes all Program course work, research credits (990), seminar credits, and course work for the minor.
- 3.4.2 Course Load for Non-Dissertators. PBPG recommends students register continuously for 12 credits (full load) of graduate-level courses each semester and 2 credits in the 8-week summer session until all major and minor course credit requirements are met. [Note, however, that students who are Trainees or Fellows may need to register for more than 2 credits in the summer session, depending on the terms of their traineeship or fellowship.] All credits must be in science courses (with a possible exception for international students who require English courses) and may include any courses related to PBPG, as well as 990 (research), seminars, and courses taken for the minor.
- 3.4.3 Dissertator Status should be achieved before the beginning of the student's third year of study provided that:
- The student has completed all required course work including the minor.
  - The student has successfully passed the Preliminary Examination.
- 3.4.4 Course Load for Dissertators. Students who have passed the Preliminary Examination, completed all course work for the major and minor, met the Graduate School minimum credit requirement, and filed a signed preliminary warrant with the Graduate School, are eligible for "dissertator status," which allows them to register for a reduced number of credits (3 each semester/summer) until completion of the degree. Dissertators should register for 3 credits of research (990) each session (fall, spring, and summer). Dissertators exceeding 3 credits per session will lose dissertator status, and they will be assessed segregated fees at the non-dissertator rate.
- 3.4.5 Continuous Registration. Graduate School policy requires dissertators to register continuously each semester and summer until the thesis is filed with the Graduate School. Once you have filed your preliminary warrant, you must be continuously registered as a

dissertator through the day that you file your PhD thesis with the Graduate School. For this purpose, registration in a given academic term extends up to the first day of classes of the following term. If you delay filing your thesis until the first day of classes (or after) of a given academic term, you must register for that term. Those who fail to maintain continuous registration are subject to a penalty of 12 times the current per credit fee (dissertator rate), and are personally responsible for payment of this penalty.

### **3.5 Grades**

- 3.5.1 Cumulative GPA. The Graduate School requires all PhD students to achieve a cumulative grade point average (GPA) of 3.0 or better in all lecture and laboratory courses taken at the UW-Madison while enrolled in the graduate program. If a course is repeated because of an unsatisfactory grade, both grades are included in the cumulative GPA. Grades in research and advanced seminars are not included in this average.
- 3.5.2 Satisfactory Progress. Success in the PhD program is determined by adequate progress in both coursework and research. Your coursework is determined by the PBPG program requirements as well as by your PhD Committee. Satisfactory progress in the lab is determined by your major professor. If a student is not making satisfactory progress, the advisor will consult with the student's PhD Committee and the student may be dismissed from the program.

### **3.6 Major Professor and PhD Committee**

- 3.6.1 Major Professor: Every graduate student must have one faculty advisor (Major Professor) who is a member of the PBPG faculty. The Major Professor advises the student about course work and supervises the student's research.
- 3.6.2 PhD Committee. A PhD Committee is composed of at least 5 members, the major professor and four more who must be UW–Madison graduate faculty or former UW–Madison graduate faculty up to one year after resignation or retirement. The committee is



empowered by the Program to advise and evaluate the student with regards to certification, administer the preliminary examination, oversee progress meetings, approve thesis composition, and conduct the final PhD examination.

The student, in consultation with their Major Professor(s), should select four additional members of the UW-Madison faculty to serve on their PhD Committee prior to the end of the second semester of graduate study in order to convene a meeting to discuss the student's coursework and plan for Certification. Certification is the process by which the PhD Committee certifies that the student has completed the formal coursework requirements of the PhD. This coursework plan must be approved by the student's PhD Committee, and for this reason it is important for the student to convene a meeting of their PhD committee prior to the end of their second semester so that additional courses suggested by the committee may be taken during the student's second year of graduate study.

The Graduate School requires at least one member of the PhD Committee to be from outside the academic department of the major professor. Students choosing Minor Option A typically include their minor professor as a member of their PhD Committee. It is the student's responsibility to seek and obtain (verbal) approval from the faculty members selected to serve on this committee.

### **3.7 Certification**

- 3.7.1 Certification. The student's PhD Committee should be convened prior to the end of the student's second semester of study in order to establish the student's program of required coursework and discuss their research project. The major professor and at least 2 of the 4 other committee members must be present. In the event that a faculty member should miss this meeting, the student must contact that faculty member within one week for an individual reprise of the meeting's content and to obtain the requisite signatures.

The completed Certification Form should be distributed to the PhD Committee *at least one week prior to* this committee meeting. The Certification Form is a written document that details the student's progress towards completing the coursework requirements for their degree. This document should list the classes that have already been completed by the student as well as those that still need to be completed. If the committee is satisfied that the student's planned program of coursework meets all university and departmental

requirements for the PhD degree, then the committee will sign the student's Certification Form. A student cannot take their preliminary examination until they have a completed Certification Form that has been signed by all the members of their PhD committee and filed with Program staff.

### 3.8 Research Proposal

- 3.8.1 Research Proposal. The student must prepare a written document describing the research that they propose to perform for their PhD thesis and present it to their PhD Committee for approval. The format for this document is described below (see 3.8.4).
- 3.8.2 Presentation of the Research Proposal. The student should convene a meeting of their PhD Committee to discuss the research proposal. At this meeting the student will give an oral presentation describing their proposed research project. This presentation should last no more than thirty minutes, and it will be followed by a period of oral questioning by the PhD committee. The objective of this discussion is to provide the student with constructive feedback on their proposed research plan, not to test the student's breadth of knowledge in the field of PBPG. The completed written proposal must be distributed to the PhD Committee *at least one week prior to* this committee meeting.
- 3.8.3 Timing. The student should complete their Research Proposal prior to the end of their second year of graduate study.
- 3.8.4 Recommended Format for Research Proposal. The suggested length of the proposal is 10-20 pages of double-spaced text (12 pt. font), excluding title page, figures, and references; however this can vary according to the discretion of the major professor.

The research proposal should include the following sections:

**Title:** Should be short and informative.

**Summary:** In one page, define the problem and state the objectives of the proposed research. Include a brief description of the experimental approaches to be used and indicate why the expected results should represent a significant advance in the field.

**Background:** Review current knowledge in the field that is relevant to the proposed research plan. The student should convey how the research proposal represents a logical and important

extension of current knowledge. This section should demonstrate familiarity with, and critical analysis of, the literature in the area. Confine this section to 2-4 pages. The “Proposed Research” section should flow naturally from the final paragraph of this section.

**Proposed Research:** One might begin this section by stating the specific aims of the project and how they relate to the broader questions that the proposal addresses. Subsequently, describe how you propose to approach each specific aim. Explain the objectives and rationale of the designed experiments, the results you expect from the experiments, and how the results will be interpreted. Include here (or in a separate section before the Proposed Research) any preliminary data. Be as specific as possible about how you will do an experiment, but realize that details can be elaborated upon orally during the committee meeting. Discuss the problems inherent to the experimental approach, and alternate approaches you might try if one approach fails. From the results you anticipate, what new experiments will follow? Indicate what specific aims are dependent upon successful resolution of earlier objectives, and which are independent. Indicate the priority you think should be devoted to each objective. This should be the major section of the proposal, perhaps 6-8 pages.

**Possible Extensions and Importance (Optional):** In one or two paragraphs, you may wish to indicate new approaches or important extensions that might stem from the proposed research. You might, for example, discuss the more speculative ramifications of the research or suggest experiments that may be too broad in scope for one person to accomplish.

**Priorities / Timeline:** You should define the order in which you plan to pursue the proposed experiments and how long you expect each stage of the research to take.

### 3.9 Preliminary Examination

3.9.1 Exam Content. Preliminary Examinations are a standard feature of PhD Programs. The exam serves to evaluate whether a student meets the expected professional standards for educational acumen, scientific background, aptitude for research, and literary competency. In addition to subject areas related to the student’s proposed thesis research, the exam will also cover topics from the breadth of the plant sciences.

3.9.2 Exam Timing. PBPG students are expected to complete the Preliminary Exam by the end of their 3rd year in residence.

3.9.3 Exam Format. The student will schedule a meeting of their PhD Committee for the purpose of administering the Preliminary Examination.

The Preliminary Examination may begin with the candidate giving a 10 minute oral presentation summarizing their proposed research. The purpose of this *brief* presentation is to provide the committee members with a broad overview of the student's research project in order to stimulate the initial round of questioning. ***This oral presentation should not last longer than 10 minutes.***

The remainder of the Preliminary Examination involves the student responding to oral questions posed by the members of the PhD Committee. These questions may be drawn from the breadth of knowledge in the field of PBPG. The major professor may not help to answer questions or direct the questioning of other committee members.

After the exam is completed, the candidate is excused from the room. The committee discusses the candidate's performance during the exam and recommends one of the following:

- 1) Pass
- 2) Conditional Pass
- 3) Fail

Candidates who receive a 'Conditional Pass' will be given specific goals and a timeline by which those goals must be met. Failure to meet these goals in the specified time will result in the student failing the prelim. At any time, failure to achieve satisfactory progress may lead to dismissal from the program.

If the committee recommends failure or a conditional pass, the committee must summarize the reasons for this recommendation.

Candidates who fail their exam have nine months to repeat the exam. If a candidate fails the Preliminary Examination twice, they cannot continue in the PBPG PhD Program.

3.9.4 Preliminary Warrant. As part of the preliminary exam procedure, the student must contact Program staff at least three (3) weeks before the preliminary exam to ask the Graduate School to issue a "preliminary warrant." After a successful Preliminary Examination, a student's PhD Committee will sign this warrant, and the student or a member of the committee must return the warrant to the Program

office where it is kept until the student has completed all required course work, including the Graduate School minimum credit requirement. In lieu of a minor professor, the Department Chair of the student's Major Professor signs the warrant for a distributed minor. Only after the warrant is completed and filed with the Graduate School, is a student "certified for the PhD" and eligible for registration as a dissertator.

### 3.10 Annual Review

3.10.1 Annual Review. Students must convene a meeting of their PhD Committee at least once each academic year that they are enrolled in the PhD program. Committee meetings that are convened to address Certification, the Research Proposal, and the Preliminary Exam satisfy this requirement for the academic year during which they are held.

### 3.11 Thesis

3.11.1 Thesis. Students are expected to carry out significant, original research during the entire period of their PhD training and to write a thesis based on this research. The thesis must be formatted according to the guidelines of the Graduate School, present evidence of a substantial experimental effort by the student, and reflect a strong intellectual contribution that meets all standards set by the student's PhD Committee. If the work is the result of collaborative enterprises, the writing must clearly define those portions representing the student's own contribution. The thesis must also include a substantive review of the literature relevant to the project. It should be written with a high level of literary skill, such as would be found in leading journals in that research area.

The Graduate School website hosts *A Guide to Preparing Your Doctoral Dissertation* which will help to prepare the final thesis:

<http://www.grad.wisc.edu/education/completedegree/pguide.html>

The thesis must be completed and distributed to the members of a student's PhD Committee *at least two weeks before* the date of the Final Oral Examination.

After successful completion of the Final Oral Exam, an unbound, fully corrected, and complete copy of the thesis must be deposited with the Graduate School. Students are responsible for all costs associated with depositing their theses. They are also responsible for knowing and meeting all thesis filing deadlines for degree completion. The Graduate School web site provides clear instructions for these procedures in *The Three D's: Deadlines, Defending, & Depositing Your Ph.D. Dissertation*. This document can be found at the following web site:

<http://www.grad.wisc.edu/education/completedegree/ddd.html>

- 3.11.2 PhD Warrant. One month prior to an anticipated Final Oral Exam date, the student must contact the Program office and file a "Request for PhD Examination Form." This process initiates Graduate School and Program activities that result in the issue of a formal "PhD Warrant" to be signed upon successful conclusion of the Final Oral Exam. The student is responsible for organizing the defense date and reserving appropriate rooms. Program staff are available to assist students with these organizational matters. Program staff will also help distribute announcements about the oral presentation. Students who do not initiate warrant requests one month ahead of time may face postponement of their anticipated defense.
- 3.11.3 Final Oral Exam. The final oral examination deals primarily with the thesis content. A student takes the final exam only after all other degree requirements have been satisfied.

PhD students must present a final oral seminar on their PhD thesis research. Within PBPG, students traditionally begin their oral exam with a public seminar summarizing their research accomplishments. The seminar should consist of a 40 minute lecture and a 10 minute public question/answer period. The seminar is not graded. Afterwards, the student meets with their PhD Committee and responds to oral questions. The Major Professor can take part in the questioning, but should not actively steer the discussion or defend the research. The oral examination usually lasts at least 2 hours, or until the committee is satisfied with their individual evaluations. The student is then excused, and after deliberation, the committee members decide whether or not to endorse the degree completion by signing the PhD Warrant.

To pass the final examination, a student must receive no more than one dissenting vote from their PhD Committee. A missing signature on the Warrant is considered a dissent. At the discretion of the

student's PhD Committee, a student may repeat a failed final exam once. Failure of the final examination two times will result in the student being dropped from the Program.

### **3.12 Progress Towards Degree**

3.12.1 Graduate School Five Year Rule. Students have five years from the date of passing their Preliminary Examination to successfully complete a Final Oral Examination and deposit their thesis with the Graduate School. Students who fail to meet this deadline are required by the Graduate School to take another Preliminary Exam and be admitted to candidacy for a second time.

## **4. GUIDELINES FOR NEW PHD STUDENTS**

### **4.1 Program Milestones**

- 4.1.1 Certification. Students should convene the first meeting of their PhD Committee prior to the end of their first year of graduate study and submit a copy of their signed Certification Form to the Program Office.
- 4.1.2 Research Proposal. Students should complete their Research Proposal prior to the end of their second year of graduate study.
- 4.1.3 Preliminary Examination. Students should complete their Preliminary Examination by the end of their third year of graduate study. The student may choose to complete their Preliminary Examination before or after they complete their Research Proposal.
- 4.1.4 Advanced Seminar Requirement. Students must present a seminar in an Advanced Seminar class during three of the semesters that they are enrolled in graduate school and earn a passing grade for each of those three semesters.
- 4.1.5 Annual Review Meetings. Students should convene a meeting of their PhD Committee at least once each academic year that they are enrolled in the PhD program.
- 4.1.6 Thesis Defense
  - At least one month prior to the anticipated defense, the student should schedule the Final Oral Exam with their PhD Committee by arranging a specific date, time, and venue. The student should notify Program staff of their intentions by submitting a "Request

for PhD Examination Form". If all other degree requirements have been met, Program staff will request a PhD Warrant.

- Students should consult the Graduate School website for specific thesis format requirements and follow those guidelines. (<http://info.gradsch.wisc.edu/education/completedegree/pguide.html> )
- Students should visit the Ph.D. Coordinator in Room 217 of Bascom Hall for a thesis format review, or to clarify any questions about the approved use of tables, graphs, charts, etc.
- Immediately after a defense, the student should contact the Graduate School (262-2433) to arrange an appointment for the final thesis review and deposition of the Warrant. Please remember that Graduate School appointment times fill rapidly near the end of each semester. All thesis corrections and revisions must be final before this review. No changes can be accepted on the copy that is submitted to the Graduate School after the final review.

## **5. APPENDIX (List of Contents)**

- 5.A Certification Form
- 5.B PBPG Course Table



**APPENDIX 5.A Certification Form**

**PLANT BREEDING AND PLANT GENETICS  
Certification for Ph.D. Degree**

**ACADEMIC HISTORY OF CANDIDATE**

Name: \_\_\_\_\_ Date of Certification: \_\_\_\_\_

Undergraduate Work:

Institution(s): \_\_\_\_\_ Dates Attended: \_\_\_\_\_

Major Subjects: \_\_\_\_\_ Degree (with date): \_\_\_\_\_

Previous Graduate Work:

Institution(s): \_\_\_\_\_ Dates Attended: \_\_\_\_\_

Major Subjects: \_\_\_\_\_ Degree (with date): \_\_\_\_\_

**GENERAL REQUIREMENTS**

List course numbers, titles, credits, and institution for the courses offered in fulfillment of requirements. If any requirements are not yet absolved, enter to be taken.

Biology - Four courses distributed among at least three of the following areas:

1. Biochemistry:
2. Genetics:
3. Structure and/or function of organisms:
4. Population or ethology of organisms:

Chemistry:

1. Two semesters of general chemistry including laboratory:

2. One semester of organic chemistry including laboratory:

Physics - A course in physics to include electricity and light:

Mathematics:

1. Calculus, differential and integral:
2. A one-semester course in statistics:
3. A course in computer programming is recommended.

## MAJOR REQUIREMENTS

For a Ph.D. major, at least 17 credits are required with at least 11 credits from the Core Curriculum; including at least 2 credits each in Sections A, B, and C. An additional three credits of seminar and one exit seminar are also required. In each course area indicate (A) courses taken elsewhere, (B) courses taken at Wisconsin and (C) courses to be taken at Wisconsin.

A. Plant Breeding:

A.

C.

B.

B. Genetics and Molecular Biology:

A.

C.

B.

C. Quantitative Genetics and Biometry:

A.

C.

B.

D. Additional Core Courses:

A.

C.

B.

Seminar (3 credits):

Additional courses advised but not required:

Foreign Language Proficiency (optional):

Joint Major or Minor:

Minor Professor:

1. Courses completed elsewhere:
2. Courses completed at Wisconsin:
3. Courses to be completed:

Approved by Certification Committee

\_\_\_\_\_  
\_\_\_\_\_  
Major Professor \_\_\_\_\_ Student

\_\_\_\_\_  
\_\_\_\_\_  
Member \_\_\_\_\_ Member

\_\_\_\_\_  
\_\_\_\_\_  
Member \_\_\_\_\_ Member

**Copy Distribution:**

One copy for candidate

Two copies for major professor

One copy for chair of PBPG program

## APPENDIX 5.B PBPG Course Table

Course Number	Credits	Course Title	Category
Hort/Agron 501	3	Principles of Plant Breeding	A
Hort/Agron 502	1	Techniques of Plant Breeding	A
Hort/Agron 850	3	Advanced Plant Breeding	A
Hort 550	3	Molecular Approaches for Potential Crop Improvement	B
Hort/Agron 561	2-3	Introductory Cytogenetics	B
Genetics 631	3	Plant Genetics	B
Genetics 701	3	Advanced Genetics	B
Genetics 703	2	Topics in Eukaryotic Regulation	B
Botany 840	3	Regulatory Mechanisms in Plant Development	B
Stat 572	4	Statistical Methods for Bioscience II	C
Genetics 629	3	Evolutionary Genetics	C
Agron 771	1	Experimental Design	C
Agron 772	1	Applications in ANOVA	C
Agron/Hort 811	3	Biometrical Procedures in Plant Breeding	C
Plant Path 505	3	Plant-Microbe Interactions: Molecular and Ecological Aspects	D
Plant Path 517	3	Plant Disease Resistance	D
Botany 563	3	Phylogenetics Analysis of Molecular Data	D
Biochem 621	3	Plant Biochemistry	D
Hort/Agron/Bot 555	2-3	Plant Functional Genomics and Bioinformatics	D
Agron/Hort 957	1	Plant Breeding Seminar	D
Category Key: <b>A</b> = Plant Breeding <b>B</b> = Genetics and Molecular Biology <b>C</b> = Quantitative Genetics and Biometry <b>D</b> = Additional Core Courses			