

AGRICULTURAL AND ENVIRONMENTAL PLANT SCIENCE

Graduate Program Head	Erin Connolly
Program Code	AEPS
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-title Ph.D. and M.S. in Agricultural and Environmental Plant Science and International Agriculture and Development
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AEPS)

The graduate program in Agricultural and Environmental Plant Science emphasizes research that increases the efficiency of production of agronomic and horticultural crops, improves the quality of food, feed, and fiber available for humans and animals, develops an understanding of the basic soil-plant-animal climate complex of which humans are a part, and improves the overall quality of the human environment. Within this framework, students may specialize in various disciplinary foci related to horticultural or agronomic crops including turfgrass. Specialties include plant breeding, genetics, and genomics, agricultural ecology, ecophysiology, management of cropping systems, plant nutrition, root/soil interactions including microbiomes, plant physiology, international agriculture, abiotic stress biology, climate resilience, plant molecular biology and biotechnology, horticultural crop marketing, pomology, viticulture, vegetable production, and weed science.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants should have a B.S., B.A. or comparable degree in agricultural or biological sciences with strong academic performance. Students from other majors will be considered provided they have academic background that includes biological sciences, chemistry, and mathematics. Expected course background varies with the intended area of concentration, but botany or plant science courses, statistics, soils, and chemistry are recommended. Students who lack some of the prerequisite courses may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-303-provisional-admission/>) but may be required to take these courses without degree credit. Ph.D. applicants should have a M.S. degree in a related field or significant research experience.

Scores from the Graduate Record Examination (GRE) general tests are not required for admission.

A minimum junior/senior grade-point average 3.00 (on a 4.00 scale) is required in all courses in the biological and physical sciences.

Exceptions to these requirements may be made for students with special backgrounds, abilities, and interests.

Applicants must submit a statement of interests and goals and three letters of reference.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. Students are required to complete a thesis and at least 6 credits in thesis research (AEPS 600 or AEPS 610) must be included in the program.

Code	Title	Credits
Required Courses		
AEPS 502	Current Issues in Agricultural Innovation	2
AEPS 515	Professional Development for the Plant Sciences	3
AEPS 555	Effective Scientific Communications	3
AEPS 602	Supervised Experience in College Teaching (Any time) ¹	1
AEPS 590	Colloquium	1
Electives		
	Choose appropriate course in statistical methods course at 400-800 level. (By the end of the third semester)	3
	Choose from 400-800 level courses in AGRO, AEPS, BIOL, ENT, FOR, HORT, INTAD, PLBIO, PPATH, PPEM, SOILS, STAT or related areas with approval of advisory committee. (All semesters)	13
Other Requirements		
	Proposal meeting - Proposal presentation to committee, competency evaluation, and approval of course work plan. (By the end of the second semester)	
SARI Training		
	2-hour workshop	
	1 hour completed in AEPS 502	
	3 hours completed in AEPS 515	
Culminating Experience		
AEPS 600	Thesis Research (Any time)	6
	Final oral exam - Administered by committee. (Final semester)	
Total Credits		31

¹ Even though one credit of AEPS 602 is required, it cannot be counted towards fulfilling the credit requirement for the degree.

M.S. Student Advisory Committee

The M.S. student advisory committee must consist of three members of the Graduate Faculty, one of whom must be outside the major program.

Proposal presentation

A written research outline (including hypothesis, objectives, and methods) should be delivered to each member of the committee at least one week before the proposal meeting. The student will present the research plan at the meeting for discussion and recommendations by members of the advisory committee. Changes agreed upon by the committee members, adviser, and student will be incorporated in a

revised research plan. If a new draft is required, it will be completed within one month of the meeting. Subsequent revisions of the plan may be accomplished by consulting committee members individually. Copies of each revision will be distributed to committee members for their concurrence.

Competency evaluation

A competency evaluation will be held as part of the proposal meeting. The advisory committee will determine the student's strengths and weaknesses in subject areas relevant to the proposed research and the professional goals of the candidate. Committee members will ask specific questions related to the proposed research and evaluate the competency of the student to pursue the M.S. degree. Students may (1) pass with or without additional recommended course work; (2) have an opportunity for a second evaluation; (3) be asked to leave the program.

Approval of course work plan

The advisory committee will consider the course work plan in the context of the student's prior preparation, performance on the competency evaluation, and professional goals. The committee may approve the plan as presented or require additional courses.

Teaching experience

A teaching experience is required of all M.S. students in the Department of Plant Science. This experience shall consist of one semester of assistance with one section of a course documented by at least one credit of AEPS 602. (*NOTE: Even though one credit of AEPS 602 is required, it cannot be counted towards fulfilling the credit requirement for the degree.*) Equivalent teaching experience completed outside of the Department may be substituted for this requirement. Students may waive this requirement only by written concurrence of the Thesis Adviser, Graduate Program Director, and Department Head.

Final oral exam

The final oral exam will be based on the student's written thesis, which should be distributed to the advisory committee at least one week before the final exam. The student should be able to marshal satisfactory defense of the methods, findings, and conclusions of the thesis, be able to relate the findings to pertinent literature, and demonstrate acceptable knowledge in the major and minor fields.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Code	Title	Credits
Required Courses		
AEPS 502	Current Issues in Agricultural Innovation	2
AEPS 515	Professional Development for the Plant Sciences	3
AEPS 555	Effective Scientific Communications	3
AEPS 602	Supervised Experience in College Teaching (Any time)	2
AEPS 590	Colloquium (Final semester)	1
Electives		
Choose appropriate course in statistical methods at 400-800 level. (1st-3rd semester)		6
Choose from 400-800 level courses in AGRO, AEPS, BIOL, ENT, FORT, HORT, INTAD, PLBIO, PPATH, PPEM, SOILS, STAT or related areas with approval of advisory committee. (Complete most course work before the comprehensive exam)		

Other Requirements

Qualifying exam - Oral exam, includes evaluation of English competency, conducted by intended committee members. (Within 3 semesters of enrolling)

Proposal meeting - Proposal presentation to dissertation committee and approval of course work plan. (1st-3rd semester, after passing qualifying exam)

SARI training

2-hour workshop

1 hour completed in AEPS 502

3 hours completed in AEPS 515

Comprehensive exam - written and oral exams. (After most course work is complete but more than 3 months before intended graduation)

Culminating Experience

AEPS 600	Thesis Research (Any time)	Variable
or AEPS 601	Ph.D. Dissertation Full-Time	

Dissertation defense (Final semester)

Total Credits

17

Qualifying exam

The purpose of the qualifying examination is to assess whether the student is capable of conducting doctoral research based on critical thinking, basic intellect, attitude, and previous training. The oral examination will be administered by the prospective Ph.D. committee. At the beginning of the exam, the candidate will make a 15-minute oral presentation summarizing a journal article. Each member of the committee will ask questions of the candidate and rate the candidate's performance.

English Competency Evaluation

English competency will be evaluated as part of the qualifying exam. The prospective candidate will write a summary and critique of a journal article provided by the adviser, which will be submitted to the full committee one week before the oral qualifying exam. At the oral qualifying exam, the student will present the summary and critique to the committee and answer questions from committee members about the written and oral critique and other subjects relevant to the student's intended course of study. Committee members will then determine whether the student should take additional courses or actions to improve English competency.

The Ph.D. committee

The Ph.D. committee must meet all Graduate Council requirements; refer to GCAC-602 Ph.D. Committee Formation, Composition, and Review – Research Doctorate (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>).

Teaching experience

A teaching experience is required of all Ph.D. students in the Department, accompanied by registration for AEPS 602 (1 credit). This requirement is independent of the requirement at the master's level. Equivalent teaching experience completed outside of the Department may be substituted for this requirement. Students may waive this requirement only by written concurrence of the dissertation adviser, Graduate Program Director, and the Department Head.

Proposal meeting

The student will prepare a written research outline (including hypothesis, objectives, and methods) for presentation to and approval by the Ph.D. committee. A copy of the proposal should be delivered to each member

of the committee at least one week before the scheduled meeting. The Ph.D. committee will suggest changes to be considered by the student and the dissertation adviser. At the conclusion of the Dissertation Research Proposal Presentation and Approval meeting, each committee member must rate the student's dissertation proposal. If a new draft of the research proposal is required, it must be completed within one month of the proposal meeting. Copies of the revision should be distributed to committee members for their concurrence.

Comprehensive exam

The objective of the comprehensive exam is to determine if the student has attained a level of training in the major and minor fields with sufficient depth and breadth to be worthy of the Ph.D. degree upon submitting an acceptable dissertation.

The comprehensive will be given when, in the student's and the dissertation adviser's opinion, the student is ready for the examination and when the communications and English competency requirements and essentially all of the coursework (including at least 12 credits of AEPS 600/AEPS 610) have been completed. The examination will include written and oral segments.

Each Ph.D. committee member will prepare a written set of questions to be completed by the student. Not more than three hours will be allowed for each member's questions and not more than two sets may be completed per day. Each committee member shall review the student's answers and provide an evaluation to the student and the Ph.D. committee within one week after the examination. The written examination and evaluation shall be completed at least one week but not more than four weeks prior to the date of the oral examination. All committee members who are members of the Graduate Faculty in AEPS must give both written and oral examinations. Those who are not members of the Graduate Faculty in AEPS may at their discretion omit the written examination and defer all questions to the oral examination.

The oral examination shall be administered by the entire Ph.D. Committee. Each committee member will have approximately 30 minutes to question the student. At the end of the examination each committee member will be asked to rate the candidate's performance on both the written and oral portions of the exam.

A favorable vote of at least two-thirds of the members of the committee is required for passing a comprehensive or final oral examination. If a student fails an examination, the Ph.D. committee will determine whether the student will be granted a second opportunity to take the examination.

Final oral examination

The final oral examination will be a defense of the dissertation before the full Ph.D. committee. The Ph.D. committee will be provided with a copy of the dissertation at least two weeks before the final oral examination. During the final exam, the student will make a public presentation summarizing the dissertation, followed by a period of questions from the committee relating primarily to the dissertation. The committee members will evaluate the student's performance during the exam and the quality of the dissertation and determine whether the student passes the final exam. A favorable vote by two-thirds of the committee members is required for passing. In the event of failure, the committee may determine whether another examination may be taken. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-title M.S. and Ph.D. in Agricultural and Environmental Plant Science and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international agriculture may apply to the dual-title degree program in Agricultural and Environmental Plant Sciences and International Agriculture and Development. The goal of the dual-title degree is to enable graduate students from Agricultural and Environmental Plant Sciences to acquire the knowledge and skills of their primary area of specialization, while at the same time gaining the perspective and methods needed for work in the international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, engineering, outreach, and project management anywhere in the world. Students acquire a broad perspective on how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can effectively engage in agricultural development activities within various countries and regions.

Admission Requirements

Students must apply and be admitted to the graduate program in AEPS and the Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements tab on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.S.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.S. degree in AEPS, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD (<http://bulletins.psu.edu/graduate/programs/W/GRAD%20WMNST/>) Bulletin page. (<http://bulletins.psu.edu/graduate/programs/W/GRAD%20WMNST/>) Up to 6 credits of INTAD approved courses can be applied to fulfilling AEPS program requirements. Final course selection must be approved by the student's advisory committee.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title Ph.D. in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Up to 6 credits of INTAD approved courses can be applied to fulfilling AEPS program requirements. Final course selection must be approved by the student's advisory committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from AEPS and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in

a combined role. There will be a single qualifying examination, containing elements of both AEPS and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an AEPS and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may service in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in AEPS and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Agricultural and Environmental Plant Science (AEPS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aeps/>)

Agronomy (AGRO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/agro/>)

Horticulture (HORT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hort/>)

Learning Outcomes

M.S. and Ph.D. students in Agricultural and Environmental Plant Science will demonstrate competency and breadth of knowledge in their chosen specialization within plant science-related disciplines (Penn State goal #1). They will create new knowledge by conducting and reporting relevant research within their sub-disciplines (Penn State goal #2). Students will be able to communicate with diverse audiences regarding issues related to crops and their social and environmental impacts (Penn State goal #3). They will develop analytical and critical thinking skills so that they can apply their knowledge to agriculturally and environmentally relevant problems (Penn State goal #4). They will become practiced in applying the principles of academic integrity and proper research methodology and reporting (Penn State goal #5).

Contact

Campus	University Park
Graduate Program Head	Erin L Connolly
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Surinder Chopra
Program Contact	Stephanie L Hill slf5335@psu.edu (814) 863-7724