

Department of Plant Pathology
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The mission of the Plant Pathology Department is to educate students and the public about plant diseases and to conduct basic and problem-solving research that results in new knowledge to minimize crop losses, ensure sustainable agricultural productivity and enhance the stewardship of our natural resources and environment.

Program Goals

- Discipline Expertise and Critical Thinking.
 - Graduates will have and be able to apply a broad-based knowledge of entomological science in appropriate-level private, government, or academic positions.
- Problem Solving and Technical Skills.
 - Graduates will be able to design original research and interpret research results through statistical inference appropriate for post-graduate continuation of education or professional endeavors.
- Communication Skills.
 - Graduates will be able to communicate effectively through multiple channels of communication to both scientific and lay audiences.
- Independent Science.
 - Doctoral Graduates will contribute to the advancement of science through creation of original and independent ideas and research.
- Leadership and Teamwork.
 - Graduates will demonstrate leadership and teamwork through service to the Department, outreach to the public, or service in professional societies.

Learning Outcomes

- Students will demonstrate the ability to critically evaluate situations or scenarios to arrive at well thought out and supported decisions and outcomes. Students will demonstrate the ability to work through and solve complex, multidisciplinary problems.
- Students will demonstrate the appropriate depth and breadth of discipline specific knowledge required to function as expert entomology professionals.
 - Students will demonstrate the skills required to effectively communicate technical/scientific information in oral platforms to general and professional audiences.
 - Students will demonstrate the ability to integrate, organize, and effectively present written reports of technical/scientific information to general and professional audiences.
- Students will contribute to the advancement of science by acquiring skills (e.g. conceptual, statistics, laboratory or field skills, etc.) to fulfill project requirements to generate original and independent research data.
- Students will demonstrate leadership and teamwork abilities presentations and outreach activities presented in professional and public venues.

Student Learning Outcome 1: Students will demonstrate the ability to critically evaluate situations or scenarios to arrive at well thought out and supported decisions and outcomes. Students will demonstrate the ability to work through and solve complex, multidisciplinary problems.

Assessment Measure 1:

- **Course Performance**
- Students were assessed by an aggregate of the following assessment tools: quizzes, midterm and final exams, written assignments, discussions and presentations.
- Direct assessment measure
- Six graduate-level courses were taught to students in 2018-19 (our graduate courses are taught every other year).
- The courses and instructor(s) of record:
 - PLPA 5223 John Rupe
 - PLPA 5333 Ken Korth
 - PLPA 6203 Ioannis Tzanetakis
 - PLPA 504V/BIOL 580V Clemencia Rojas
 - PLPA 504V Travis Faske
 - PLPA 5303 Martin Egan and Ken Korth

B. Acceptable and Ideal Targets (not required for indirect measures).

- Acceptable: 50% of students will complete their graduate coursework with a composite GPA of 3.50 or higher
- Ideal: 75% of students will complete their graduate coursework with a composite GPA of 3.75 or higher

C. Summary of Findings.

Course performance is evaluated in the aggregate. The average grade for plant pathology graduate students in plant pathology courses is an "A". This performance is consistent historically indicating that students continue to master the subject material.

All graduate students are required to maintain a minimum cumulative grade-point average and all students met this criterion. The average G.P.A. is 3.73.

D. Recommendations (not required for indirect measures)

- The Department is in the process of merging with Entomology and with that transition comes the opportunity to better align the graduate program curriculum with the needs of students and their prospective futures either in academia or industry. While students continue to demonstrate strong learning in the offered courses it is recognized that existing course topics and new courses to be introduced can and should be better aligned with contemporary plant pathology science needs. The existing outcome measures for courses and seminars are well-balanced but additional methods of effective measurement will not be overlooked. For example, there is potential for increased use of formative assessment measures.

Learning Outcome 2: Students will demonstrate the appropriate depth and breadth of discipline specific knowledge required to function as expert entomology professionals.

- a. Students will demonstrate the skills required to effectively communicate technical/scientific information in oral platforms to general and professional audiences.
- b. Students will demonstrate the ability to integrate, organize, and effectively present written reports of technical/scientific information to general and professional audiences.

Assessment Measure 2:

- **Entrance seminar (M.S. and Ph.D.), candidacy exam (Ph.D.), exit seminar and defense of thesis or dissertation**
 - Each student's committee is responsible for providing feedback and the pass/fail grade for these assessment activities.
 - Direct measure of assessment
 - A set of three rubrics adapted from designs from the American Association of Colleges and Universities (AACU) are the assigned measurement tools for these activities (see Addendum.) For the candidacy exam, and the defense of the thesis or dissertation, the depth and breadth of discipline specific knowledge learned will be assessed through oral questions posed by the student's committee. The number and type of questions will be subject to the committee's discretion based on the student's background and research focus and responses to questions.
- B. Acceptable and Ideal Targets** (not required for indirect measures).
- Acceptable: At the relevant events as listed above, 70% of students will have an average of greater than or equal to 3.0 on the attached rubrics.
 - Ideal: At the relevant events as listed above, 90% of students will have an average of greater than or equal to 3.0 on the attached rubrics.
- C. Summary of Findings.**
- In the 2018-19 academic year, 4 M.S. degrees and 2 Ph.D. degrees were granted. Four students successfully presented an entrance seminar and 1 student passed their candidacy exam. 100% of students who participated in these measures passed.
 - Graduate students in the plant pathology program continue to be successful in the graduated assessment of their depth and breadth of discipline specific knowledge.
- D. Recommendations** (not required for indirect measures)
- The use of the graduate assessment rubric has to be fully implemented in the process of completing dissertation defenses so that completing the rubric is a routine practice for advisory committee members.
 - Students will be made aware of the content of the rubrics upon their orientation as they enter the program.

Learning Outcome 3: Students will contribute to the advancement of science by acquiring skills (e.g. conceptual, statistics, laboratory or field skills, etc.) to fulfill project requirements to generate original and independent research data.

Assessment Measure 3:

- **Publications**

- Students will publish the results of their thesis/dissertation research in peer-reviewed scientific journals.
- Direct measure of assessment

B. Acceptable and Ideal Targets (not required for indirect measures).

- Acceptable: 75% of graduating students will publish their research findings as lead author in at least one peer-reviewed paper.
- Ideal: 50% of graduating students will publish their research findings as lead author in at least three peer-reviewed papers.

C. Summary of Findings.

Due to self-reporting and a lack of a 100% response rate the numbers provided may not reflect the total publications.

- Students in the PLPA program were listed as co-authors on 11 peer-reviewed publications in 2018 (21 students).

D. Recommendations (not required for indirect measures)

- Curricular efforts and professional-development training opportunities will continue to improve student communication and critical thinking skills.
- Presentation of student research plans will continue and aid students in adapting their research skills and success.

Learning Outcome 4: Students will demonstrate leadership and teamwork abilities presentations and outreach activities presented in professional and public venues.

Assessment Measure 4:

- **Presentations and outreach activities in professional and public venues**
- Indirect measure of assessment

B. N/A

C. Summary of Findings.

Due to self-reporting and the lack of a 100% response rate the numbers provided may not reflect the total activities executed.

- Students reported giving 8 presentations.
- Students participated in or led 6 outreach activities.

D. N/A

Learning Outcome 5: Students will demonstrate growth of professional skills over time and an understanding of effective work environment interactions with colleagues.

Assessment Measure 5:

- **Annual committee meetings, annual performance reviews, and exit interviews.**
- Annual committee meetings take place with the student and the student's committee.
- The student will meet one-on-one with their faculty advisor and then with the Department Head to discuss their progress in the graduate program to be recorded on the Annual Academic Review form required by the Graduate School.
- Indirect measure of assessment

B. N/A

C. Summary of Findings.

- Nearly all students were recorded as making sufficient progress toward a degree. One student left the program for personal reasons, and one student not making sufficient progress developed a plan to improve performance.

D. N/A

Overall Recommendations

The assessment results suggest we are preparing students well. However, there is always room for improvement and changes are planned to further enhance the degree programs offered to students to best prepare them for careers.

In 2019, the Ph.D. in Plant Sciences – Plant Pathology will end and a new AFLS Ph.D. with a Plant Pathology concentration will be offered. This consolidation of programs under a single umbrella Ph.D. better positions the AFLS College to continue to offer exceptional graduate programs. Great care was taken to identify and build a plant pathology concentration for this new Ph.D. to meet modern need.

Furthermore, changes will be made to the M.S. degree plan to clearly identify required coursework for the degree and remove credits that have proven unnecessary in the pursuit of a well-rounded education.

Action Plan

- Integrating graduate students from the ENTO and PLPA programs into joint activities (seminar, outreach efforts, new courses, social events) will improve and expand the experiences of each group.
- Our faculty curriculum committee will make a concerted effort in the coming year to optimize available courses and adapt requirement to best fit the needs of our students.

Supporting Attachments
Rubrics for Assessment Measure 2

Rubric 1: Oral Communication VALUE
 Adapted from AACU rubric for oral communication

Evaluators are encouraged to assign a one to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	Capstone 4	Milestones 3	Benchmark 2
Organization Scientific presentations should include all of the following sections: introduction with hypotheses and objectives, methods, results and conclusion.	The presentation includes all the sections and the contents of each section are seamlessly integrated. Each section is clear and concise. The final conclusions are fully supported. Overall, the presentation is memorable.	The presentation includes all the sections and the contents of each section are consistently integrated. Most of the final conclusions are supported. The presentation is very informative.	The presentation includes all the sections and the integration of all the sections is apparent. Some sections are not thoroughly explained. Some conclusions are supported. The presentation is understandable.
Language and use of technical vocabulary	Uses appropriate and precise professional language and, language that is appropriate to the audience.	Mostly uses appropriate and precise professional language and, language that is appropriate to the audience.	Generally uses appropriate and precise professional language, but may not always be appropriate to audience.
Delivery Clearly points to pertinent aspects	Demonstrates confidence and knowledge. Engages the audience by skillfully keeping eye contact with the audience while making use of the supporting material and appropriate use of technology. Body language appropriately used to enhance value of presentation.	Appears comfortable with the topic and, consistently engages the audience. Makes appropriate use of the supporting material. Body language tentative.	Does not always appear comfortable with the topic or able to engage the audience. Uses supporting materials inconsistently... Limited eye contact with audience. Some distracting mannerisms.
Supporting Material Presented and shows clear understanding	Supporting materials are attractive, carefully designed and with clear purpose that elegantly supports the message. They do not repeat the oral content. Proper credit to references given.	Supporting materials are well designed and properly used to convey message. Proper credit to references given.	Supporting materials are adequately prepared and help conveying the message. Proper credit to references given in most cases.
Central Message effort	Central message is strongly supported by all the sections of the presentation. The audience fully understands the relevance and implications of the research.	Central message is clear. The audience understand the basic aspects of the research.	Central message is clear. The audience can deduce the importance of the research.

Rubric 2: Written Communication Value

Adapted from the written communication rubric from AACU

Evaluators are encouraged to assign a 1 to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	Capstone 4	Milestones 3	Benchmark 2
Purpose for Writing	Demonstrates a thorough understanding of audience, intent of writing is clear and focuses all elements of the work.	Demonstrates adequate consideration of audience, intent of writing is clear and and focuses most elements of the work.	Demonstrates awareness of audience, intent of writing can be inferred by the audience and focuses some elements of the work.
Content	Contains the necessary amount of information carefully summarized to convey a clear and informative message to the audience	Contains the necessary information conveying a general message to the audience.	Contains relevant information but not well- focused to accurately convey the message to the audience.
Genre and Disciplinary Conventions	Understands scientific conventions of writing and, skillfully uses appropriate scientific terms. Demonstrates excellent understanding of technical language.	Understands scientific conventions of writing and consistently uses relevant scientific language.	Uses some scientific conventions and is aware of relevant scientific language.
Sources: include published literature	Comprehensively uses published references that are critically analyzed and presented in the appropriate context. Background information is clear and carefully summarized given proper credit to authors in publications. Meticulously uses own words and style avoiding any possible plagiarism.	Comprehensibly uses publishes references that are assumed to be of high quality. Background information is well summarized given proper credit to authors in publications. Uses own words frequently.	Uses most references that provide relevant information. Avoids plagiarism.
Results: includes data from research and in the form of figures, tables, images.	Logically presents high quality data that is comprehensive, informative, cohesive and skillfully integrated. Appropriate data is properly analyzed and adheres to scientific standards.	Presents high quality data that is well integrated. Data is well presented and properly analyzed.	Presents sufficient data and properly analyzed. Presentation is adequate.
Discussion	Demonstrates comprehensive knowledge of the topic by carefully integrating published information with results from own research. Conveys a strong message that is fully supported by results.	Demonstrates broad knowledge and is capable of integrating published information with results from own research. Conveys a general message about research	Demonstrates relevant knowledge and relevance of the research is apparent. Integration of literature and own work adequate. General message lacks depth.

Rubric 3: Problem Solving and Critical Thinking

adapted from AACU rubrics on Problem Solving, Inquiry and Analysis and Creative Thinking

Evaluators are encouraged to assign a 1 to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	Capstone 4	Milestones 3	Benchmark 2
Define Problem Reflects an understanding of the context in terms of current knowledge	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant literature and observations.	Demonstrates the ability to construct a clear problem statement with evidence of most relevant literature and observations.	Demonstrate adequate ability to construct a problem statement with evidence of most relevant literature and observations, but problem statement is superficial.
Hypotheses	Proposes one or more hypotheses that indicates a deep comprehension of the problem. Hypotheses address all of the relevant relevant literature and observations, and relations between hypotheses are strong.	Proposes one or more hypotheses that indicates comprehension of the problem. Hypotheses address most of the relevant relevant literature and observations, but relations between hypotheses are weak	Proposes one hypothesis that is superficial rather than designed to address the relevant literature and observations of the problem.
Experimental Approach	Clear objectives are proposed for each hypothesis. Appropriate methodology are adopted from across disciplines. All necessary treatments and controls are included. Analysis is appropriate and well thought out. All experiments are feasible in terms of time, effort, facilities and cost. Schedule of experiments well developed. Likely problems with experiments anticipated and contingencies outlined.	Objectives proposed for each hypothesis mostly clear. Methodology is appropriately developed, however, more subtle aspects are ignored. Most necessary treatments and controls are included. Analysis is appropriate, but needs more detail. Most experiments are feasible in terms of time, effort, facilities and cost. Schedule of experiments mostly developed. Some problems with experiments anticipated.	Objectives proposed for hypothesis mostly clear. Elements of the methodology are poorly developed, or unfocused. Most necessary treatments and controls are included. Analysis vague. Problems with experiments not anticipated.
Interpretation of Results, Limitations, and Implications	Clear understanding of how results relate to the hypothesis, the other hypotheses and to the stated problem. Insightfully discusses in detail relevant and supported limitations and implications of the research. Demonstrates a clear understanding of future research direction.	Has an understanding of how results relate to individual hypothesis and to the stated problem, but not necessarily to the other hypotheses. Discusses relevant and supported limitations and implications of the research. Demonstrates some understanding of future research direction.	Has a superficial understanding of how results relate to individual hypotheses and to the stated problem. Presents relevant and supported limitations and implications. Can suggest possible future research direction.

RUBRIC 4: Plant Pathology Knowledge-base

Evaluators are encouraged to assign a one to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	Capstone 4	Milestones 3	Benchmark 2
Causal agents	Knowledge of abiotic and biotic agents causing disease. Extensive knowledge of the types of organisms causing plant diseases and their biology. Can integrate this knowledge into how disease cycles and control strategies differ among causal agents.	Knowledge of abiotic and biotic agents causing disease. Clear understanding of the different types of organisms causing plant diseases and their biology. Able to express how pathogen biology impacts disease cycle and control.	Knowledge of abiotic and biotic agents causing disease. Knowledge of types of organisms causing plant disease and understanding of their biology.
Koch's postulates	Demonstrates in-depth understanding of Koch's postulates. Able to develop methods that clearly demonstrate the role of causal agents in disease and understands appropriate limitations of the protocols used.	Clear understanding of the use of Koch's postulates and how it is used in determining causal agents of disease.	Able to define Koch's postulates and knows why they are important in plant pathology.
Plant Disease Control Principles	Understands the principles of exclusion, eradication, protection, avoidance, therapy, and resistance and can apply disease control principles to diseases caused by fungi, oomycetes, bacteria, viruses, and nematodes. Able to synthesize these principles into an integrated disease management approach.	Understands the principles of exclusion, eradication, protection, avoidance, therapy, and resistance and can apply disease control principles to diseases caused by fungi, oomycetes, bacteria, viruses, and nematodes.	Has a general knowledge of the principles of exclusion, eradication, protection, avoidance, therapy, and resistance and can illustrate each with simple disease examples.
Disease Triangle	Can state the three components of the disease triangle and how they determine the outcome of plant diseases. Can describe the interactions between these components and how they relate to disease development, and illustrate the interactions of these components as they relate to plant disease epidemiology and control.	Can state the three components of the disease triangle and how they determine the outcome of plant diseases. Can also describe the interactions between these components and how they relate to disease development.	Can state the three components of the disease triangle and how they determine the outcome of plant diseases.
Plant responses to pathogens	Comprehensively understands genetic components of non-host resistance and host-specific resistance. Shows in-depth understanding of molecular and cellular events associated with PAMP-trigger immunity (PTI) and effector-triggered immunity (ETI). Has general knowledge about genes and molecules important in defense responses. Familiar with tools and technologies to investigate plant defense responses.	Differentiates between non-host resistance and host-specific resistance. Understands differences between gene-for-gene hypothesis and guard hypothesis. Is able to differentiate between PAMP-triggered immunity (PTI) and effector-triggered immunity (ETI).	Understands the concept of host specificity between plants and pathogens. Shows general knowledge on constitutive and inducible mechanisms of plant resistance.
Pathogen's virulence mechanisms	Thoroughly understands pathogen's virulence mechanisms and how they target plant specific functions. Knows that pathogen's virulence determinants can be recognized by the plant.	Understands the main mechanisms that different pathogens use to cause disease. Shows basic knowledge on molecular and cellular events pathogens use to cause disease.	Understands that pathogens have virulence factors that enable them to cause disease. Is able to differentiate between categories of pathogens, for example fungi, oomycetes, bacteria, viruses, and nematodes.

