ENTOM 7006: Advanced Insect Pest Management
3 credit hours

Fall 2016 (draft)

Schedule: TBA (Monday, Wednesday, & Friday)
Class room: A561 Life Sciences Building

Instructors: F. Huang (coordinator), J. Beuzelin, M. Stout, J. Ottea, D. Ring, R. Leonard, L. Foil, K. Healy.

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Textbook: There are no required textbooks for the course. However, there will be assigned readings.

Course Overview and Organization

I. Course Overview:

Insect pest management is a pest management system that integrates multiple, complementary control tactics such as biological control, cultural control, genetic control, host plant resistance, and chemical control to manage insect pests in a profitable yet environmentally sound manner. The theory and practice of insect pest management are continuously being improved as our knowledge increases. During the last decade, there have been numerous scientific and technological advances in insect pest management, such as use of the internet systems, global positioning systems (GPS) and geographical information systems (GIS), modeling, biotechnology, host plant resistance, biological control, as well as many discoveries of environmentally benign novel pesticide chemistries.

ENTOM 7006 will provide students with cutting edge information and knowledge related to the development and implementation of modern insect pest management tactics and strategies. The course will begin with an overview of pest management history and the ecological basis of insect pest management. Subsequent lectures will emphasize advances in major insect pest management tactics including cultural control, biological control, host plant resistance, and chemical control. Several key components of insect pest management, such as insect sampling, commonly used experimental designs in agricultural research, economic injury level (EIL), economic threshold (ET), and an introduction of system analysis and its applications in insect pest management will then be presented to underscore the quantitative aspects of insect pest management programs. Several lectures at the end of the course will focus on two novel technologies (biotechnology and GPS/GIS) and their applications in insect pest management.

II. **Course Organization**:

1. Lectures

Total 41 hours (Lectures: 36 hours; Exams: 3 hours; In-class discussion: 2 hour). Most of the lectures will be given using PowerPoint presentations. Handouts of PowerPoint outlines in each lecture along with copies of references will be available to students prior to the start of the lecture.

2. Grant Proposal

Writing a good research proposal for competitive grants is difficult and is often a big challenge. To complete this course, each student is required to write a 6- to 12-page (single- or double-line spaced) competitive grant proposal using the format of USDA AFRI (see the handout: Guidelines for the Grant Proposal). We will give a presentation about how to write grant proposals for the class. The main objectives of this assignment are to give students the opportunities to become familiar with the key components of a competitive grant proposal and to learn some basic skills and techniques in writing a competitive grant proposal. Students may choose any research topic related to pest management. **However, the proposals should not be the same as your M.S. or Ph. D. research project.**

3. Two assignments

Two to five questions in each assignment will be given to students. Assignments will be due about 10 days after questions are assigned.

III. ***Examination components***

Course components	Proportion of course grade
1) Three examinations	300 points = 60%
2) One grant proposal	150 points = 30%
3) Two assignments	2 x 25 points = 10%

The three in-class examinations will contain two types of questions:

1) short answer questions (5 points/question);
2) discussion questions (10 points/question).

***IV. Grading Scale* (*)**

Letter Grade	Percent
A+	≥ 96%
A	≥93%, <96%
A-	≥90%, <93%
B+	≥86%, <90%
B	≥83%, <86%
B-	≥80%, <83%

C+	≥76%, <80%
C	≥73%, <76%
C-	≥70%, <73%
D+	≥66%, <70%
D	≥63%, <66%
D-	≥60%, <63%
F	<60%

Detailed Course Schedule

Topic	Lecture	Date	Instructor (hr)	Points
Chapter 1. Overview of pest management history and the ecological basis of insect pest management Course introduction Concepts of IPM	1	TBA	Huang (1)	10
1.1. Overview of pest management history 1.2. Ecological basis of insect pest management	2	TBA	Beuzelin (1)	20
Chapter 2. Cultural control	3	TBA	Beuzelin (1)	
Chapter 3. Advances in biological control 3.1. Evaluating indirect ecological effects of biological control 3.2. Measuring success in biological control 3.3. Transgenic beneficial insects for pest management programs 3.4. Future of biological control *In class work on research proposals (potential titles)*	4-5	TBA	Huang (2)	15
Chapter 4. Novel chemistries in insect pest management 4.1. Overview of insecticides in insect pest management 4.2. New chemistries Juvenoids, diacylhydrazides, benzoylphenylurea (hexaflumuron, lufenuron), diofenolan, spinosad (Naturalyte®), avermectins (emamectin benzoate), ecdysone agonists, fipronil, neo-nicotinoid (thiamethoxam,	6-7	TBA	Ottea (2)	15

imidacloprid), deltamethrin, chlorfenapyr, fenazquin, pyridaben, pymetrozine, indoxacarb, phenylpyrazole, etc. 4.3. Insecticide resistance management 4.4. Challenges and prospects				
How to write grant proposals ***Submit grant proposal titles for approval***	8	TBA	Huang (1)	
Chapter 5. Advances in host plant resistance 5.1. Overview: the use of plant resistance in insect pest management 5.2. Molecular breeding 5.3. Novel approaches to HPR (e.g., elicitors, induced resistance, and dissection of signaling pathways in plants, "indirect defense")	9-10	TBA	Stout (2)	20
Chapter 6. Genetic control and area-wide pest management 6.1. Overview of genetic control in insect pest management 6.2. Sterile insect technique 6.3. Area wide pest management 6.4. Termite/structural pest IPM	11-14	TBA	Foil (1), Healy (1), Huang (1), and Brown (1)	30
Exam 1 (110 points + 10 bonus)	**15**	TBA	**Huang (1)**	
Chapter 7. Commonly used experimental designs in agricultural research 7.1. Linear regression 7.2. Completely randomized designs 7.3. Randomized block design 7.4. Split-plot design	16	TBA	Huang	10
Chapter 8. Insect sampling 8.1. Common distributions of insect populations in the field (Random, uniform, and aggregated distributions) 8.2. Sample mean, variance, and error; random vs non-random sampling; precision vs accuracy. 8.3. Sampling techniques (In situ, knockdown, netting, trapping, extraction; absolute and relative; direct vs indirect)	17-20	TBA	Huang (4)	40

8.4. Sampling program (Sampling size determination) 8.5. Binomial sampling 8.6. Sequential sampling				
		TBA		
Assignment 1: Distribution and sampling.	20	TBA	Ring and Huang	5%
Chapter 9. Economic considerations in insect pest management 9.1. Commonly used experimental designs in agricultural research 9.2. Estimation of crop yield losses economic losses 9.3. EIL and ET 9.3.1. Single species 9.3.2. Multiple pests	21-23	TBA	Huang (1) and Ring (2)	30
Chapter 10. System analysis and insect pest management 10.1. System analysis 10.2. Modeling of insect growth and development 10.2.1. Curves of insect growth and development 10.2.2. Relationship between temperature and insect growth and development 10.2.3. Simulation models of insect development rates 10.3. Modeling of insect population dynamics 10.3.1. Concept of population growth 10.3.2. Models of single-species population growth 10.3.3. Degree-day models 10.4. Applications of system analysis in pest management	24-27	TBA	Beuzelin(2) and Ring (2)	30
Exam 2 (110 points + 10 bonus)	**28**	TBA	**Huang (1)**	
Assignment 2. Pest management models. Assignment will be given on Nov 3 and due on Nov21	29	TBA	Ring and Huang	5%
Submit first version of the grant proposal for comments		*TBA*	Huang	

Chapter 11. Genetic Engineering for insect management 11.1. General concepts, status, and potential of transgenic organisms in insect pest management 11.2. Bt cotton 11.3. Bt corn 11.4. Other non-commercial Bt plants 11.5. Bt resistance 11.5.1. Bt resistance monitoring 11.5.2. Resistance management strategy for Bt crops: High dose/refuge strategy 11.5.3. Other resistance management strategies 11.6. Impact of Bt plants on non-target organisms 11.7. Other potential transgenic insecticidal proteins 11.8. Transgenic pests in insect pest management 11.9. Challenges and Prospects	30-35	TBA	Huang (6)	60
Chapter 12. Applications of global positioning systems (GPS) and geographical information systems (GIS) in pest management 12.1. General knowledge of GIS and GPS 12.2. GIS and GPS in agriculture 12.3. GIS and GPS in pest management	36-37	TBA	Leonard & invited guests (2)	20
Grant proposal: in class discussion and submission of final grant proposal	38-40	TBA	Huang (3)	30%
Final Exam (Exam 3) (80 points + 10 bonus)	**41**	TBA	Huang (1)	