

FUNDAMENTALS OF PEST MANAGEMENT

IPM 3022

Professor: Dr. Ronald D. Cave
Indian River REC
772-468-3922 ext. 145
rdcave@ufl.edu

Credits: 3
Interactive videoconferences:
Thursday 5:30 – 8:30pm

Description and Objectives: This course will examine the concepts, philosophies, strategies, and tactics used to manage pest populations. Terms, history, and an overview of pest groups will be presented. Ecological principles, disease vector ecology, and comparisons of natural ecosystems and agroecosystems will be examined. Sampling procedures, decision-making criteria, management tactics, and area-wide pest management will be discussed. Specific cases of pest management in plant production systems will be studied. Readings will form the basis of interactive discussions. Assignments will mainly review information available on the Internet, and a project paper describing the IPM program for a selected pest will be prepared by the student.

In this course the student will learn:

1. What is IPM, what it does and who it benefits
2. Internet resources on IPM
3. Differences between an agroecosystem and a natural ecosystem
4. Ecological principles related to IPM
5. Disease vector ecology
6. Objectives of scouting and sampling tactics
7. Modeling in pest management
8. Economic injury level concept and how its quantified
9. Management tactics in IPM and their pros and cons
10. Fate of agrochemicals in the environment and the consequences
11. Area-wide pest management
12. Examples of successful implementation of IPM

OPTIONAL TEXTBOOK: Norris, R.F., E.P. Caswell-Chen & M. Kogan. 2003. Concepts in Integrated Pest Management. Prentice Hall, Upper Saddle River, New Jersey. ISBN 0-13-087016-1

READINGS should be read during the week following the date they are assigned. PDFs will be provided in a timely matter. The purpose of these readings is to provide further information on topics discussed in class and fodder for questions and discussion in class.

ASSESSMENT:

Three exams (80 points each)	240 pts
Four assignments (40 pts each)	160 pts
Project paper	100 pts
TOTAL	500 pts

EXAMS are all take-home, open-book exams, so you may use your class notes, books and Internet. However, all responses must be in your own words. You must return your responses to me via email no later than five days after the exam is delivered.

ASSIGNMENTS are to be done individually, not as a group. Reports are to be a maximum of 2 pages in length, single spaced, font size 12. Please provide the citations of all literature and the URL for all websites cited (**see the Readings list for proper format of citations**). All assignments must be delivered to the professor by electronic delivery or on paper no more than 1 week after they are assigned.

PROJECT PAPER, also an individual effort, is a synopsis of an IPM program for a selected pest. The paper should include the following:

- overview of the biology of the pest (including development, distribution, injury it causes, hosts)
- monitoring and sampling techniques
- EIL and ET (if used, what are they; if not, why not?)
- management strategies and tactics
 - biological control (natural enemies; stages of pest they attack; if commercially available, release rates and timing)
 - chemical control (products registered for use; rates of application; application methods),
- adoption by growers (if information available)
- measurable impact of IPM on pest populations and the crop production system
- need for research

The report should be **4-6 pages** in length and single-spaced, use font size 12, and delivered electronically to the professor. Provide the complete reference of all literature and the URL for all websites cited (**see the Readings list for proper format of citations**). Tables and images may be employed. An outline (1 page without reference citations) of your project paper is due to the professor on **TBA**. Final paper is due no later than **TBA**.

****THOROUGHNESS AND GOOD WRITING SKILLS ARE RECOMMENDED****

Grading scale:

A = 90-100%
B+ = 85-89%
B = 80-84%
C+ = 75-79%
C = 70-74%
D+ = 65-69%
D = 60-64%
F = 0-59%

ATTENDANCE at all class periods is required. The professor will not provide notes or synopses of sessions missed by the student. Interactive discussion is a critical component of this class, so students should come prepared by having read the assigned reading material and be willing to share opinions, perceptions and experiences in class.

Academic Honesty:

As a result of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University".

We, the members of the University of Florida, pledge to hold ourselves and peers to the highest standards of honesty and integrity.

Software Use:

All faculty, staff and students of the University of Florida are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damage and/or criminal penalties for the individual violator. Because such violations are against University policies and rules, disciplinary action will be taken, as appropriate.

Course Outline and Schedule

Week 1

- overview of course, readings, schedule, exams, assignments, and project paper
- What is a pest?
- pest groups and how pests cause problems
- strategies in pest management
- historical moments in pest management
- definitions and concept of pest management
- where might pest management be used
- Internet resources

READING: Royer et al.

Week 2

- ecological principles
- comparison of natural ecosystems and agroecosystems and the implications of the differences on pest management
- types of agroecosystems (annuals, perennials, forestry)
- food webs and trophic interactions
- population dynamics and natural control
- value of biodiversity: resource concentration hypothesis and natural enemies hypothesis
- disease vector ecology

READING: pp. 150-179, 182-185 in IPM in Practice

Week 3

- monitoring and sampling
- importance and methods of correct diagnosis
- pest classification according to type of damage caused
- sampling strategies and tactics
- sampling methods
- modeling

ASSIGNMENT 1: monitoring program for a specific crop or system

Week 4

- decision-making (who makes the decisions?)
- economic injury level
- economic damage
- economic threshold
- inaction level
- where are these concepts applicable?, where are they not applicable?

Week 5

- invasive species
- regulatory control
- Federal laws and agencies; FL regulations
- risk assessments
- pest-free areas

DELIVERY OF 1st EXAMWeek 6

- cultural control
- soil preparation and organic content
- clean equipment
- sanitation and pruning
- crop rotation
- planting time
- irrigation methods
- crop spacing
- intercropping or companion planting
- cover crops
- trap crops

ASSIGNMENT 2: descriptions of cultural controls for 4 pestsWeek 7

- biological control: definition and principles
- natural enemies
- classical biological control

READING: Hoffman *et al.* 1990Week 8

- augmentative biological control
- conservation biological control
- biological control in decision-making

ASSIGNMENT 3: comparison of commercialization of 4 natural enemiesWeek 9

- mechanical/physical control
- pesticides (history and development)
- biopesticides
- regulations

Week 10

- fate of pesticides in the environment

DELIVERY OF 2nd EXAM

Week 11

- genetic control
- sterile insect technique
- inherited (F1) sterility
- host plant resistance
- resistance management
- genetically-modified crops

READING: Shelton *et al.* 2002; Hoy 2000

**ASSIGNMENT 4: position paper on personal opinion with genetically altered crops
OR review the host plant resistance of a selected crop**

Week 12

- discussion of genetically-modified organisms

Week 13

- area-wide pest management
- examples of IPM programs

Week 14

- examples of IPM programs
- future of pest management

DELIVERY OF 3rd EXAM

READINGS

Flint, M.L. & Gouveia, P. 2001. IPM in Practice: Principles and Methods of Integrated Pest Management. University of California, Statewide Integrated Pest Management Project, Agriculture and Natural Resources. Publication 3418.

Hoffman, M.P., L.T. Wilson, F.G. Zalom & R.J. Hilton. 1990. Parasitism of *Heliothis zea* (Lepidoptera: Noctuidae) eggs: effect on pest management decision rules for processing tomatoes in the Sacramento Valley of California. *Environmental Entomology* 19(3): 753-763.

Hoy, M.A. 2000. Transgenic arthropods for pest management programs: risks and realities. *Experimental and Applied Acarology* 24: 463-495.

Royer, T. A., P. G. Mulder & G. W. Cuperus. Renaming (redefining) integrated pest management: fumble, pass, or play? http://www.pmac.net/fumble_pass.html. Accessed January 2008.

Shelton, A.M., J.-Z. Zhao & R.T. Roush. 2002. Economic, ecological, food safety, and social consequences of the deployment of Bt transgenic plants. *Annual Review of Entomology* 47: 845-881.

ASSIGNMENTS

A1: description of the monitoring/scouting methodology for a specific crop or system

Research and write a summary of the monitoring and sampling scheme for pests of a single crop. Address the following topics:

- What are the major pests (e.g. arthropods, diseases, nematodes, and weeds) [The list does not need to be exhaustive.] and what are the resources (on-line, diagnostic labs) for identifying them?
- Briefly describe the sampling tactics used in the system
- Is absolute density or relative abundance being measured?
- What other information besides pest population should be monitored (rainfall, plant stage for example)

Graphs, tables, and figures are allowed as appendices (not part of the 2-page limit).

A2: descriptions of cultural control for 4 pests

Research and describe 4 different, target-specific cultural control methods, either 4 methods used in 1 crop or in 2-4 different crops. Give the objective of each method. Describe the method and how it is implemented. Mention the pest(s) each method controls. Most importantly, explain the **biological basis of the control method**, *i.e.* how does it interfere biologically in the pest's survivorship, dispersal, establishment, and/or reproduction?

A3: comparative analysis of the commercialization of 4 natural enemies

For each of the 4 natural enemies listed below, locate 3 companies on-line that sell them (the 3 companies need not be the same for all 4 natural enemies). For each natural enemy compare the commercialization of it between the 3 companies. Compare pricing, quantities available, packaging and availability of supporting information (*e.g.* release recommendation, biology, anything else). The 4 natural enemies are:

Trichogramma (there are several species but all attack insect eggs)

Chrysopa/Chrysoperla (predators commonly called aphid lions and green lacewings)

Hippodamia convergens (convergent ladybird beetle)

predatory mites (many different species available)

A4: position paper on personal opinion concerning genetically altered crops OR review the host plant resistance of a selected crop

Take a stand for **OR** against genetically-modified crops and present your case of pro or con. Explain your position using appropriate information from references cited.

OR

Write a description of the past and current activities in breeding and research for the development of pest resistant varieties of a particular agricultural commodity.

Assignments are not to exceed 2 written pages (not including appendices). Use font size 12, single spaced. They should provide a detailed yet concise discussion of the topic, written with correct spelling and grammar. The product should indicate that you have adequately researched the topic, thought about it, and can clearly express the information learned or your opinion. Please include the URL for all websites and complete citations for all literature referenced (see the Readings list for proper format of citations). All assignments may be delivered to the professor by electronic delivery or on paper no later than 1 week after they are assigned.

Information Retrieval and Referral Systems

- Database of IPM Resources (DIR)
<http://www.IPMnet.org/DIR/>
- Acarology WWW Home Page
http://www.nhm.ac.uk/hosted_sites/acarology/
- AgNIC- a guide to online agricultural information
<http://www.agnic.org/>
- Agricultural Genome Information Server
<http://ars-genome.cornell.edu/>
- All the Virology on the WWW
<http://www.tulane.edu/~dmsander/garryfavweb.html>
- Arachnology Page (Spiders and their relatives)
<http://www.ufsia.ac.be/Arachnology/Arachnology.html>
- Compendium of IPM Definitions (CID)
<http://www.ippc.orst.edu/IPMdefinitions/home.html>
- Entomology Index of Internet Resources
<http://www.ent.iastate.edu/list/>
- Internet Resources on Weeds & Their Control
<http://www.ippc.orst.edu/cicp/gateway/weed.htm>
- Internet Resources on Vertebrate Pests
<http://www.ippc.orst.edu/cicp/pests/vertpest.htm>
- IPMnet NEWS
http://ipmwww.ncsu.edu/cicp/IPMnet_NEWS/archives.html
- Nematology Sites on the Web
<http://nematode.unl.edu/wormsite.htm>
- Pesticide & Agrichemical Industry Information
<http://www.bmckay.com/>
- Pesticide Information Profiles (PIPs)
<http://ace.ace.orst.edu/info/extoxnet/pips/pips.html>
- Plant Pathology Internet Guide Book
<http://www.ifgb.uni-hannover.de/extern/ppigb/ppigb.htm>
- US National Pesticide Information Retrieval System
<http://www.ceris.purdue.edu/npirs/npirs.html>
- Biocontrol Network
<http://www.biconet.com/>

Biointegral Resource Center
<http://www.birc.org/>
 NSF Center for Integrated Pest Management
<http://cipm.ncsu.edu/>
 National Sustainable Agriculture Information
 Service, Pest Management Section
<http://www.attra.org/pest.html>
 Biological Control Virtual Information Center
<http://cipm.ncsu.edu/ent/biocontrol/>

Phenology, models, and pest forecasting and alert systems (dynamic and integrated tools)

Blue Mold Forecast Website (USA)
<http://www.ces.ncsu.edu/depts/pp/bluemold/>
 Disease Model Database (USA)
<http://www.ipm.ucdavis.edu/DISEASE/DATABASE/>
 Models of Plants, Pests, and Beneficials Using Degree-Days (USA)
<http://www.ipm.ucdavis.edu/PHENOLOGY/models.html>
 Near Real-time Pest Alert Systems
<http://ippc.orst.edu/pestalet/>
 Online Weather Data and Degree-Days (USA)
<http://www.orst.edu/Dept/IPPC/wea/>

North America

Biocontrol of Plant Diseases
<http://www.barc.usda.gov/psi/bpdl/bpdl.html>
 BT (*Bacillus thuringiensis*) Toxin Resources
<http://www.nalusda.gov/bic/BTTOX/bttox.htm>
 Cornell University's Guide to Natural Enemies in North America
<http://www.nysaes.cornell.edu/ent/biocontrol/>
 Clemson Entomology - Insect Information
<http://entweb.clemson.edu/cuentres/>
 Crop Protection Guide (Insects, Disease, & Weeds)
<http://www.agr.gov.sk.ca/Docs/crops/cropguide00.asp>
 Diagnostic Key to Major Tree Fruit Diseases in the Mid-Atlantic Region
<http://www.caf.wvu.edu/kearneysville/wvufarm6.html>
 Electronic Resources on Lepidoptera
<http://www.chebucto.ns.ca/Environment/NHR/lepidoptera.html>
 University of Florida IPM Program
<http://ipm.ifas.ufl.edu/>
 Fungal Databases
<http://nt.ars-grin.gov/fungalatabases/databaseframe.cfm>
 Northwest Berry & Grape InfoNet
<http://www.orst.edu/dept/infonet/>
 Overview of Organic Fruit Production
<http://www.attra.org/attra-pub/fruitover.html>

Pest/Biocontrol Information

<http://www.ceris.purdue.edu/napis/pests/index.html>

Pesticide Handling and Storage Tutorial

<http://danpatch.ecn.purdue.edu/~epados/farmstead/pest/src/main.htm>

Photo Gallery of Insects and Mites

http://ipmwww.ncsu.edu/current_ipm/otimages.html

Plant and Insect Parasitic Nematodes Homepage

<http://nematode.unl.edu/wormhome.htm>

University of California Pest Management Guidelines

<http://www.ipm.ucdavis.edu/>

Urban Integrated Pest Management

<http://hammock.ifas.ufl.edu/en/en.html>

Weed Images and Descriptions

<http://www.rce.rutgers.edu/weeddocuments/index.htm>

IPM of North America, Inc.

<http://www.ipminstitutue.org/>

US Department of Agriculture Cooperative State Research, Education & Extension Service (USDA,/CSREES)

<http://www.reeusda.gov/>

Alternative Methods of Mole Cricket Control

<http://molecrickets.ifas.ufl.edu/>

Cultural Control in Landscapes

http://www.uky.edu/Ag/Horticulture/landipm/ipm/cultural_control.htm

Cultural Control for Management of Vegetable Pests in Florida

<http://www.imok.ufl.edu/liv/groups/cultural/pests/insects.htm>

Alabama Pecan Management Checklist

<http://www.aces.edu/department/ipm/pmc.htm>

EPA IPM

<http://www.epa.gov/pesticides/food/ipm.htm>

University of California Statewide IPM Project

<http://www.ipm.ucdavis.edu/>

National Foundation for IPM Education

<http://www.ipm-education.org/>

Australasia

Insect and Allied Pests of Extensive Farming in Western Australia

<http://www.agric.wa.gov.au/ento/allied1.htm>

Plant Viruses Online

<http://biology.anu.edu.au/Groups/MES/vide/refs.htm>

Asia

Japan.s Pesticide Database

<http://chrom.tutms.tut.ac.jp/JINNO/PESDATA/00database.html>

Malaysia.s Crop Technology

<http://agrolink.moa.my/doa/english/croptech/crop.html>

Africa

Biological control of Cereal Stemborers in East and Southern Africa
<http://nbo.icipe.org/agriculture/stemborers/default.html>

South America

Brazilian National Fungal Catalogue
<http://www.bdt.org.br>

Europe

A Guide to the use of Terms in Plant Pathology
<http://www.bspp.org.uk/fbpb.htm>

Cereal Pathology at Scottish Crop Research Institute (SCRI), UK
<http://www.scri.sari.ac.uk/mbn/cerpath/cerpath.htm>

Chemical Ecology (Sweden)
<http://www.vsv.slu.se/cec/h.htm>

ExPASy - Molecular Biology Server (Switzerland)
<http://www.expasy.ch/>

IPM Europe (UK)
<http://www.nri.org/IPMEurope/homepage.htm>

The Pherolist (Sweden)
<http://www-pherolist.slu.se/>

International

FAO: Pesticide Management
<http://www.fao.org/waicent/FaoInfo/Agricult/AGP/AGPP/Pesticid/>

Global Plant Protection Information System
<http://pppis.fao.org/>

IMPnet
<http://www.IPMnet.org/>

International Survey of Herbicide-Resistant Weeds
<http://www.weedscience.com/>

The Universal Virus Database
<http://life.anu.edu.au/viruses/canintro1.htm>

Industry

American Crop Protection Association.s IPM: The Quiet Evolution
<http://www.acpa.org/public/pubs/quiteevol.html>

Cyanamid.s Weed Identification Guide
<http://www.cyanamid.com/tools/weedguide/index.shtml>

Integrated Pest Management (IPM) from Asia-PacificCrop Protection Association
<http://www.apcpa.org/ipm.htm>

Growers

Grape Grower's Notebook

<http://users.erols.com/gmead/>
North American Fruit Explorers Website
<http://www.nafex.org/>

Books/Literature

AGRICOLA- The bibliographic database
<http://www.nal.usda.gov/ag98/>

Florida Entomologist (Online Journal, USA)
<http://www.fcla.edu/FlaEnt/>

Quantitative Population Ecology (A. Sharov, Dept. of Entomology, Virginia Tech, USA.)
<http://www.gypsymoth.ento.vt.edu/~sharov/PopEcol/popecol.html>

Radcliffe's IPM World Textbook
<http://ipmworld.umn.edu/>

Texas Plant Disease Handbook (USA)
<http://cygnus.tamu.edu/Textlab/tpdh.html>