# IPM 5305
# PRINCIPLES OF PESTICIDES
# Spring 2017

Three (3) credit hours – Spring semesters

**Instructor**: Dr. Fred Fishel
Professor, Dept. of Agronomy
Pesticide Information Office, Bldg. 164, Box 110710
Gainesville, FL 32611
Phone: (352) 392-4721
Email: weeddr@ufl.edu

**OFFICE HOURS:** I am in my office most days. While I do not set aside dedicated office hours, I am readily available to make appointments. To arrange an appointment, email or call me on the telephone as listed above. Should you send email to me, please do so only within the Canvas course management system. Please do not text me. I do not communicate by texting, and will not respond to you.

**COURSE MEETINGS:** Asynchronous – UF Elearning (Distance).

## COURSE DESCRIPTION

Principles of Pesticides will provide opportunities for students to gain a basic knowledge of pesticides and their use. The course is not designed for students to memorize chemical structures, but to gain a practical working knowledge of all types of pesticides used primarily in agricultural and horticultural settings. Emphasis will be placed upon major classes of agricultural pesticides used on commodities grown in Florida. Students are expected to be able to associate common names of pesticide active ingredients with chemical families, modes of action, and use patterns.

## COURSE OBJECTIVES

- To have a thorough knowledge of the history of pest management, particularly the specific role pesticides have served in the development of management strategies.
- To have a knowledge of pesticide families and be able to differentiate among families based on their specific modes of activity.
- To evaluate specific pest scenarios caused by arthropods, nematodes, pathogens and weeds in order to develop appropriate pesticide management strategies.
- To be knowledgeable of the laws and regulations governing the proper use of pesticides.
- To obtain a working knowledge of the equipment used to apply pesticides and to understand the factors involved in calibrating application equipment for pesticide applications and be able to make accurate calculations for these purposes.
- To understand the potential hazards to humans, wildlife, and the environment by the use of pesticides.

**COURSE PREREQUISITES:** Graduate standing or approval by the instructor.

**REQUIRED TEXTBOOKS**: None

**SUGGESTED TEXTBOOKS (not required):**

Fishel, F.M. 2014. Applying Pesticides Correctly. University of Florida IFAS Bookstore. 1-800-226-1764 or www.ifasbooks.com.

Ware, G.W. and D.M. Whitacre. 2004. The Pesticide Book – 6th edition. Thompson Publications, Fresno, CA.

**RECOMMENDED GENERAL REFERENCES**
Students are advised to review assigned reading materials (see listings of lectures and required readings). Material from assigned readings and class lectures is considered fair game for exams. A list of helpful references is provided for your own information. Some of my lecture material is taken from these references.

**GRADING CRITERIA**
The course grade will be determined from:

- 3 semester exams
- A final comprehensive exam
- 4 written assignments
- A project PowerPoint presentation

The following is a breakdown of how the final course grade is calculated by total available points:

| Activity | Points |
|---|---|
| Exam 1 (Module 01) | 150 |
| Exam 2 (Module 02) | 150 |
| Exam 3 (Module 03) | 150 |
| Final Exam (Comprehensive) | 150 |
| Written Assignments | 200 |
| Project Presentation | 200 |
| **Total** | **1000** |

**Written Assignments:** under the "Assignments" tab in the Canvas course management system, students will find instructions and due dates, as well as below, for completing these written assignments of relevant topics.

Assignment 1: (introductory bio) **Due: 11:59 p.m. Friday, January 13, 2017**
Assignment 2: (justifying the use of pesticides in the U.S.) **Due: 11:59 p.m. Friday, January 27, 2017**
Assignment 3: (the biotech dilemma) **Due: 11:59 p.m. Friday, March 3, 2017**
Assignment 4: (calculation problems) **Due: 11:59 p.m. Monday, April 10, 2017**

**Project Presentation:** the presentation will be a comprehensive pest management plan for an agricultural commodity. Instructions and the due date will be posted in the course management system under the "Assignments" tab. **Due: 11:59 p.m. Friday, April 14 2017.**

**Learning Activities:** some weeks I will post a learning activity. Although not required, your learning of relevant material will be enhanced with your participation and interaction with your classmates. My hope is that these activities will foster an interactive environment and be driven by you, the students. Typically in the past, those students who actively participate do well in IPM 5305.

**Due Dates:** all exam, assignment, and project presentation due dates and times are strictly adhered. The course management system will not allow submissions after the due time and date. If you anticipate a problem, contact me ahead of time. **Late submissions are allowable only at the discretion of the instructor.**

**Grading (% of total points):** 93 to 100 A; 90 to 92 A-; 87 to 89 B+; 83 to 86 B; 80 to 82 B-; 77 to 79 C+; 73 to 76 C; 70 to 72 C-; 67 to 69 D+; 63 to 66 D; 60 to 62 D-; <60 E.

**ACADEMIC HONESTY, SOFTWARE USE, SERVICES FOR STUDENTS WITH DISABILITIES, UF COUNSELING SERVICES**

The University of Florida Honor Code may be found in the Regulations of the University of Florida under section 6C1-4.041.

Preamble: In adopting this Honor Code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the University community. Students who enroll at the University commit to holding themselves and their peers to the high standard of honor required by the Honor Code. Any individual who becomes aware of a violation of the Honor Code is bound by honor to take corrective action. Student and faculty support are crucial to the success of the Honor Code. The quality of a University of Florida education is dependent upon the community acceptance and enforcement of the Honor Code.

The University of Florida requires all members of its community to be honest in all endeavors. Cheating, plagiarism, and other acts diminish the process of learning. When students enroll at UF they commit themselves to honesty and integrity. Your instructor fully expects you to adhere to the academic honesty guidelines you signed when you were admitted to UF.

As a result of completing the registration form at the University of Florida, every student has signed the following statement:

**The Honor Pledge:**

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Honor Code.

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied:

"On my honor, I have neither given nor received unauthorized aid in doing this assignment."

Reminder: you have 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."*

It is to be assumed all work will be completed independently unless the assignment is defined as group project, in writing by the professor.

This policy will be vigorously upheld at all times in this course.

**Plagiarism**

You will not receive credit for the assignment. The Office of the Dean for Students will be notified and you will deal with them. IPM 5305 is a graduate-level course and I believe graduate students should have high standards which includes doing one's own work.

**Software Use**

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

**Campus Resources**

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center:

http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

*Sexual Assault Recovery Services (SARS)*
Student Health Care Center, 392-1161.

*University Police Department,* 392-1111 (or 9-1-1 for emergencies).
http://www.police.ufl.edu/

Academic Resources

*E-learning technical support*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

*Career Resource Center*, Reitz Union, 392-1601. Career assistance and counseling.
http://www.crc.ufl.edu/

*Library Support*, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

*Teaching Center*, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. http://teachingcenter.ufl.edu/

*Writing Studio, 302 Tigert Hall,* 846-1138. Help brainstorming, formatting, and writing papers. http://writing.ufl.edu/writing-studio/

*On-Line Students Complaints:* http://www.distance.ufl.edu/student-complaint-process

**Students with Disabilities**
The Dean of Students Office coordinates the needed accommodations of students with disabilities. This includes the registration of disabilities, academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services, and mediating faulty-student disability related issues.

001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

# ***The Canvas Course Management System***

We will be utilizing the Canvas distance course management system (http://lss.at.ufl.edu) to communicate relevant course-related material, due dates, etc. You will login with your GatorLink username and password. Students must have an active GatorLink ID to access E-Learning. Should you encounter problems or you cannot remember your GatorLink login information, visit the GatorLink website (http://gatorlink.ufl.edu) or the UF Computing Help Desk: (352) 392-HELP for assistance.

# ***Online Course Evaluation Process***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

# ***Listings of lectures and required readings***

Readings are also found in the "Modules" tab of the Canvas course management system. Upon entering, select "Readings" for each week. I suggest that you print and read these.

**Module 01 (The Foundation of Principles of Pesticides): opens Wednesday, January 4.**

**01.01.01_Introduction to IPM 5305** (Review course syllabus)
**01.01.02_What is a Pesticide and Why Use Pesticides?**

**Weekly readings:**
1. How Are Pesticides Classified? http://edis.ifas.ufl.edu/pdffiles/PI/PI08300.pdf
2. What is and isn't a Pesticide? http://edis.ifas.ufl.edu/pdffiles/PI/PI13300.pdf
3. Pest Control Devices http://www.epa.gov/pesticides/factsheets/devices.htm
4. Why Do We Use Pesticides? http://edis.ifas.ufl.edu/pdffiles/PI/PI14000.pdf

**01.02.01_History of Pest Management and Pesticides**
**01.02.02_The Law and Pesticide Application**
**01.02.03_Principles of Pesticides and Pest Control**

**Weekly readings:**
1. Pest Management and Pesticides: A Historical Perspective http://edis.ifas.ufl.edu/pdffiles/PI/PI21900.pdf
2. Agricultural and Related Pest Control Applicator License Classifications under the Florida Department of Agriculture and Consumer Services http://edis.ifas.ufl.edu/pdffiles/PI/PI09500.pdf
3. Federal Regulations Affecting Use of Pesticides http://edis.ifas.ufl.edu/pdffiles/PI/PI16800.pdf

**01.03.01_Understanding Pesticide Labeling**
**01.03.02_Pesticide Formulations**

**Weekly readings:**
1. Interpreting Pesticide Label Wording http://edis.ifas.ufl.edu/pdffiles/PI/PI07100.pdf

2. Understanding Safety Data Sheet Language
   http://edis.ifas.ufl.edu/pdffiles/PI/PI07200.pdf
3. Pesticide Formulations http://edis.ifas.ufl.edu/pdffiles/PI/PI23100.pdf
4. Formulations to Make Insecticide Treatments Last Longer
   http://pested.ifas.ufl.edu/pdfs/Insecticide_Treatments.pdf

**01.04.01_Pesticides and the Environment**
**01.04.02_Harmful Effects and Emergency Response**
**01.04.03_Personal Protective Equipment**

**Weekly readings:**
1. Pesticide-Organism Interactions http://edis.ifas.ufl.edu/pdffiles/PI/PI08000.pdf
2. Pesticide Effects on Nontarget Organisms
   http://edis.ifas.ufl.edu/pdffiles/PI/PI12200.pdf
3. Protecting Water Resources from Agricultural Pesticides
   http://edis.ifas.ufl.edu/pdffiles/PI/PI00100.pdf
4. Pesticide Residues http://edis.ifas.ufl.edu/pdffiles/PI/PI10600.pdf
5. Personal Protective Equipment for Handling Pesticides
   http://edis.ifas.ufl.edu/pdffiles/PI/PI06100.pdf
6. Glyphosate Biomonitoring for Farmers and Their Families: Results from the Farm Family Exposure Study
   http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241861/pdf/ehp0112-000321.pdf

**01.05.01_Transportation, Storage and Security, and Disposal of Pesticide Wastes**
**01.05.02_Pesticide Drift**
**01.05.03_Pesticide Resistance**

**Weekly readings:**
1. Proper Disposal of Pesticide Waste https://edis.ifas.ufl.edu/pdffiles/PI/PI01000.pdf
2. Secure Pesticide Storage: General Features
   https://edis.ifas.ufl.edu/pdffiles/PI/PI06800.pdf
3. Secure Pesticide Storage: Security Against Terrorist Threats
   https://edis.ifas.ufl.edu/pdffiles/PI/PI07900.pdf
4. Managing Pesticide Drift http://edis.ifas.ufl.edu/pdffiles/PI/PI23200.pdf
5. Florida's Organo-Auxin Herbicide Rule - 2015
   http://edis.ifas.ufl.edu/pdffiles/WG/WG05100.pdf
6. Pest Resistance to Pesticides http://ipm.ncsu.edu/safety/factsheets/resistan.pdf

**End of material for Exam I**

**Exam I opens 8:00 a.m. Monday, February 6 and must be completed by 11:59 p.m. Wednesday, February 8, 2017.**

**<u>Module 02</u> (Fungicides and Insecticides): opens Monday, February 6.**

**02.01.01_Introduction to Fungicides I**
**02.01.02_Introduction to Fungicides II**

**02.01.03_Introduction to Fungicides III**

**Weekly readings:**

1. Fungicide Resistance Action Committee's (FRAC) Classification Scheme of Fungicides According to Mode of Action http://edis.ifas.ufl.edu/pdffiles/PI/PI13100.pdf
2. Rethinking Copper http://pested.ifas.ufl.edu/pdfs/Rethinking_Copper.pdf
3. Control of Bacterial Spot of Pepper Initiated by Strains of *Xanthomonas campestris* pv. *vesicatoria* That Differ in Sensitivity to Copper http://pested.ifas.ufl.edu/pdfs/Bacterial_Spot_Control.pdf

**02.02.01_Introduction to Fungicides IV**
**02.02.02_Introduction to Fungicides V**
**02.02.03_Introduction to Fungicides VI**

**Weekly readings:**

1. Fungicide Resistance Action Committee's (FRAC) Classification Scheme of Fungicides According to Mode of Action http://edis.ifas.ufl.edu/pdffiles/PI/PI13100.pdf
2. Management of Early Leaf Spot of Peanut with Pyraclostrobin as Affected by Rate and Spray Interval http://www.plantmanagementnetwork.org/pub/php/research/pyraclostrobin/
3. Evaluating Fungicide Recommendations for Vegetable Crops in the United States: Should More Be Done to Limit the Risks of Fungicide Resistance Development? http://www.joe.org/joe/2011june/a8.php
4. Managing Bacterial Speck and Spot of Tomato with Acibenzolar-S-Methyl in Virginia. http://www.plantmanagementnetwork.org/pub/php/research/speckspot/

**02.03.01_Introduction to Insecticides I**
**02.03.02_Introduction to Insecticides II**
**02.03.03_Introduction to Insecticides III**

**Weekly readings:**

1. IRAC's Insecticide Mode of Action Classification (Students should focus on this document for all insecticide lectures) http://edis.ifas.ufl.edu/pdffiles/PI/PI12100.pdf
2. History of the Pyrethroids http://pested.ifas.ufl.edu/pdfs/History_of_the_Pyrethroids.pdf
3. Spinosad: An Exciting New Product for Larval Control http://pested.ifas.ufl.edu/pdfs/spinosad_history.pdf
4. History of Bt http://pested.ifas.ufl.edu/pdfs/History_of_Bt.pdf

**02.04.01_Introduction to Insecticides IV**
**02.04.02_Introduction to Insecticides V**
**02.04.03_Introduction to Insecticides VI**

**Weekly readings:**

1. IRAC's Insecticide Mode of Action Classification (Students should focus on this document for all insecticide lectures) http://edis.ifas.ufl.edu/pdffiles/PI/PI12100.pdf
2. Genetically Modified Food http://edis.ifas.ufl.edu/pdffiles/FS/FS08400.pdf
3. Water pH and the Effectiveness of Pesticides http://edis.ifas.ufl.edu/pdffiles/PI/PI19300.pdf
4. Natural Products for Managing Landscape and Garden Pests in Florida http://edis.ifas.ufl.edu/pdffiles/IN/IN19700.pdf

**End of material for Exam II**

**Exam II opens 8:00 a.m. Monday, March 13 and must be completed by 11:59 p.m. Wednesday, March 15, 2017.**

**Module 03 (Herbicides and Miscellaneous Pesticides): opens Monday, March 13.**

**03.01.01_Introduction to Herbicides I**
**03.01.02_Introduction to Herbicides II**
**03.01.03_Introduction to Herbicides III**

**Weekly readings:**
1. Classification of Herbicides According to Site of Action (all lectures for the herbicide section) http://www.hracglobal.com/pages/classificationofherbicidesiteofaction.aspx
2. ACCase Inhibitors http://pested.ifas.ufl.edu/pdfs/ACCase_Inhibitors.pdf
3. ALS Inhibitors http://pested.ifas.ufl.edu/pdfs/ALS_Inhibitors.pdf

**03.02.01_Introduction to Herbicides IV**
**03.02.02_Introduction to Herbicide V**
**03.02.03_Introduction to Herbicides VI**

**Weekly readings:**
1. Classification of Herbicides According to Site of Action (all lectures for the herbicide section) http://www.hracglobal.com/pages/classificationofherbicidesiteofaction.aspx
2. Specifically Regulated Pesticides in Florida – Bromacil https://edis.ifas.ufl.edu/pdffiles/PI/PI11200.pdf
3. Photosystem Inhibitors http://pested.ifas.ufl.edu/pdfs/Photosystem_Inhibitors.pdf
4. Protox Inhibitors http://pested.ifas.ufl.edu/pdfs/scans/ppoinhibitor.pdf
5. Pesticide Storage: Keep It in the Container https://edis.ifas.ufl.edu/pdffiles/PI/PI25500.pdf
6. Bleaching Herbicides http://pested.ifas.ufl.edu/pdfs/scans/bleachers.pdf
7. Glyphosate http://pested.ifas.ufl.edu/pdfs/scans/glyphosate.pdf
8. Glufosinate http://pested.ifas.ufl.edu/pdfs/scans/glufosinate.pdf
9. Mitosis Inhibitors http://pested.ifas.ufl.edu/pdfs/scans/trifluralin.pdf
10. S-Metolachlor http://pested.ifas.ufl.edu/pdfs/scans/metolachlor.pdf
11. Cellulose Inhibitors http://pested.ifas.ufl.edu/pdfs/scans/celluloseinhibitors.pdf
12. Non-ACCase Inhibitors http://pested.ifas.ufl.edu/pdfs/scans/eptc.pdf

**03.03.01_Introduction to Herbicides VII**
**03.03.02_Plant Growth Regulators, Acaricides, and Molluscicides**
**03.03.03_Soil Fumigants and Nematicides**

**Weekly readings:**
1. Classification of Herbicides According to Site of Action (all lectures for the herbicide section) http://www.hracglobal.com/pages/classificationofherbicidesiteofaction.aspx
2. Synthetic Auxins http://pested.ifas.ufl.edu/pdfs/scans/24d.pdf
3. MSMA http://pested.ifas.ufl.edu/pdfs/scans/msma.pdf
4. Plant Growth Regulators http://edis.ifas.ufl.edu/pdffiles/PI/PI13900.pdf
5. Movement and Toxicity of Nematicides in the Root Zone http://edis.ifas.ufl.edu/pdffiles/NG/NG00200.pdf
6. Florida's Organo-Auxin Herbicide Rule - 2015 http://edis.ifas.ufl.edu/pdffiles/WG/WG05100.pdf
7. Fumigants and Nematicides http://pested.ifas.ufl.edu\pdfs\Fumigants_and_Nematicides.pdf

**End of material for Exam III**

**Exam III opens 8:00 a.m. Monday, April 3 and must be completed by 11:59 p.m. Wednesday, April 5, 2017.**

**Module 4 (Application of Pesticides): opens Monday, April 3.**

**04.01.01_Application Equipment and Methods**
**04.01.02_Calibration and Calculations**
**04.01.03_Adjuvants for Pesticide Applications**

**Weekly readings:**
1. Boom Sprayer Nozzle Performance Test http://edis.ifas.ufl.edu/pdffiles/PI/PI01500.pdf
2. Calibration of Herbicide Applicators http://edis.ifas.ufl.edu/pdffiles/WG/WG01300.pdf
3. Spray Adjuvants http://extension.psu.edu/pests/pesticide-education/applicators/fact-sheets/pesticide-safety/spray-adjuvants/extension_publication_file

**04.02.01_Pesticide Interactions**
**04.02.02_Misuse of Pesticides**

**Weekly readings:**
1. Pesticide Interactions http://edis.ifas.ufl.edu/pdffiles/PI/PI18200.pdf
2. Precision Laboratories Tank-Mix Site http://www.mixtankapp.com/index.html

**End of class material (Last day of class: April 19)**
**Final exam opens 8:00 a.m. Monday, April 24 and must be completed by 11:59 p.m. Wednesday, April 26, 2017.**

**List of helpful references (Note: not required reading)**

Crop Data Management Systems. (Pesticide product labels) http://www.cdms.net/LabelsMsds/LMDefault.aspx?t=

Crop Protection Handbook. (Technical information for 1,000s of pesticide active ingredients) Meister Media Worldwide. http://www.meistermedia.com/

EXTOXNET (Extension Toxicology Network provides detailed toxicology data for many pesticide active ingredients) http://extoxnet.orst.edu/

Florida Department of Agriculture and Consumer Services. Division of Agricultural Environmental Services. (Licensing and regulatory information) http://www.flaes.org/

Herbicide Handbook, 10th ed. 2014. Weed Science Society of America. (Very detailed technical information for herbicide active ingredients) http://www.wssa.net/

Insecticide Basics for the Pest Management Professional. 2008. Suiter, D.R. and M.E. Scharf. Available from the UF/IFAS Extension Bookstore (SP-458) https://ifasbooks.ifas.ufl.edu/

TeeJet Technologies. (Sprayer equipment manufacturer and retailer) http://www.teejet.com/english/home.aspx

Use and Management of Insecticides, Acaricides, and Transgenic Crops. 2006. Entomological Society of America. (Good reference for insecticides) http://entsoc.org

Weed Science: Principles, 2nd ed. 1983. West Publishing Co., 50 W. Kellogg Blvd., P.O. Box 3526, St. Paul, MN 55165. (A fundamental text for man