Course guide
390425 - GIPMM - Integrated Management of Pests, Diseases and Weeds

Last modified: 19/01/2026

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit:
Degree: BACHELOR'S DEGREE IN AGRONOMIC SCIENCE ENGINEERING (Syllabus 2018). (Optional subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JORDI IZQUIERDO FIGAROLA

Others: Ariadna Giné Blasco
Jordi Izquierdo Figarola

REQUIREMENTS

For optimal progress in this course, it is highly recommended that students have previously acquired the following competencies or knowledge:
Botany and Plant Physiology: Understanding of plant growth and environmental responses.
General Entomology and Phytopathology: Basic knowledge of the biology of the main groups of insects, mites, fungi, and bacteria affecting crops.
Basic Statistics: Mastery of fundamental concepts (mean, variance, probability distributions) essential for sampling and population estimation.
Fundamentals of Agricultural Economics: Basic notions of production costs and yield analysis to understand economic threshold calculations.

TEACHING METHODOLOGY

The course is structured around active learning, placing the student at the center of the process. The main objective is for students to acquire the necessary competencies to design and implement Integrated Pest Management (IPM) programs.
To achieve this, the following organizational modalities will be used:
1. Theory Classes and Active Participation
Participatory lectures will be held in both theory sessions (large groups) and practical sessions (small groups). These will include the presentation of core content and the study of practical cases. Sessions will be supported by visual presentations, board work, and the use of IT tools in specific sessions.
2. Practical Sessions (Laboratory and Classroom)
Practical sessions aim to complement, consolidate, and apply the concepts discussed in theory. This will be achieved through the preparation and monitoring of laboratory experiments or through problem-solving exercises in the classroom.
3. Project-Based Learning (PBL): The Management Plan
As a core pillar of the course, students will work in groups to design an Integrated Management Program for a real crop in the region. This project will include:
a. Crop monitoring.
b. Diagnosis and identification of phytosanitary problems: recognition of symptoms and signs of pathogens, identification of insect pests and beneficial fauna (natural enemies), and classification of weeds in their early stages.
c. Risk analysis and decision-making.
d. Proposal of interventions, prioritizing non-chemical methods.
e. Economic and environmental assessment of the strategy.
Proposals must be justified considering the biology and ecology of the harmful agents, biotic and abiotic factors, and the specific production system. A selection of these proposals may be presented and debated in class.
4. Learning Resources and Support
Students will have access to support material published on the ATENEA digital platform related to the topics covered in face-to-face sessions. This includes links to recognized agricultural institutions and entities, as well as audiovisual materials and complementary articles.

LEARNING OBJECTIVES OF THE SUBJECT

The course lies at the core of modern crop protection. In a global context where sustainability and efficiency are imperative, agricultural production can no longer be seen as a simple exercise in applying treatments, but rather as a complex process of data-driven decision-making.
This course is designed to provide students with the analytical tools necessary to transition from conventional chemical control to Integrated Pest Management (IPM). Throughout the subject, we will explore how population biology, climate modeling, and economic analysis converge to optimize crop health.
Core Pillars of Learning:
1. Quantitative Rigor: Students will learn to estimate population parameters and use statistically valid sampling methods to understand field realities.
2. Economic Perspective: Not every presence of a harmful organism justifies intervention. We will delve into the concept of the Economic Injury Level (EIL) to ensure that control actions are both cost-effective and necessary.
3. Strategy and Sustainability: We will analyze the combined use of biotechnological methods, biological control, and plant resistance, viewing chemical control as a last-resort tool fully integrated into a global program.

STUDY LOAD

Type	Hours	Percentage
Laboratory classes	20,0	13.33
Self study	90,0	60.00
Practical classes	40,0	26.67

Total learning time: 150 h

CONTENTS

Syllabus

Description:
1. Quantitative and Economic Bases of Integrated Management
Lesson 1. Introduction. Evolution of control systems in Crop Protection: from chemical control to integrated control, and from integrated control to integrated production. Quantitative and economic bases of integrated control.
Lesson 2. Estimation of population parameters. Population dispersal: types of spatial distribution. Measuring population aggregation.
Lesson 3. Evaluation of organism densities or disease. Sampling: absolute sampling techniques, relative sampling techniques. Sampling unit and size. Sequential sampling.
Lesson 4. Primary agent density/yield relationships. Crop loss assessment.
Lesson 5. Attack prediction systems. Prediction through environmental observations. Phenological models. Thermal integral (Degree-days) in crop protection. Insect models. Prediction by climatic charts. Prediction by empirical observations. Agricultural warning stations. Pathogen models.
Lesson 6. Decision-making in Integrated Control. Risk. Use and limitations of economic thresholds.
2. Control Methods and Management Strategies
Lesson 7. Plant resistance. Types of resistance. Resistance mechanisms. Genetics of resistance. Environmental factors affecting the expression of resistance. Breeding of resistant cultivars. Influence of resistance on the population dynamics of pests and diseases. Strategies for the use of resistance.
Lesson 8. Biotechnological methods: Pheromones: types and use of pheromones. Monitoring, mass trapping, and mating disruption. Other technologies. Perspectives and challenges.
Lesson 9. Biological pest control. Prey-predator relationship. Prey localization. Generalist and specialist predators. Main groups of predators and parasitoids. Methods for the use of beneficial fauna. Entomopathogens: characteristics of entomopathogenic viruses, bacteria, fungi, and nematodes. Microbiological insecticides.
Lesson 10. Biological disease control: antagonists, types of antagonistic relationships. Strategies for biological control of pathogens.
Lesson 11. Chemical control. Effect of pesticides on auxiliary (beneficial) organisms. Integration of pesticides in integrated control programs.
Lesson 12. Pesticide resistance. Issues in the use of insecticides/acaricides. Resistance mechanisms. Factors affecting the rate of development. Resistance management in insecticides/acaricides. Fungicide resistance, resistance mechanisms, resistance management. Use of fungicides and nematicides in integrated control programs.
3. Integrated crop management: current state.

Specific objectives:
To understand and apply the quantitative and economic foundations necessary for the design and implementation of effective control systems, considering the three types of harmful organisms.
To identify the available control methods and learn how to use them in a combined and strategic manner to achieve optimal and sustainable effectiveness.
To comprehend, develop, and evaluate integrated management strategies specific to different cropping conditions.
To become familiar with sampling methods, risk assessment, and decision-making based on the economic injury level.

Related activities:
Activity 1: Lectures.
Activity 2: Individual written assessment test.
Activity 3: Laboratory practices.

Full-or-part-time: 120h
Theory classes: 40h
Laboratory classes: 20h
Self study : 60h

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Description:
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GRADING SYSTEM

EXAMINATION RULES.

Attendance and participation in the proposed activities (practicals) is mandatory, and if they are not completed, they will be graded with a 0.
The activities's report must be submitted or handled at the established time.

BIBLIOGRAPHY

Basic:
- Coscollá, Ramon. Introducción a la protección integrada . Valencia : M. V. Phytoma-España, DL 2004. ISBN 84-932056-5-6.
- A. Ciancio, K.G. Mukerji. Integrated Management of Diseases Caused by Fungi, Phytoplasma and Bacteria. 1st. Springer Nature, 2010. ISBN 978-90-481-7914-5.
- Richard A. Sikora, Johan Desaeger, Leendert Molendijk. Integrated nematode management: state-of-the-art and visions for the future . 1st. Wallingford (UK): CABI, 2022. ISBN 978-1-78924-754-1.
- Naylor, Robert E. L. Weed management handbook . 9th ed. Oxford ; Malden, MA : British Crop Protection Council, cop. 2002. ISBN 0-632-05732-7.

Complementary:
- ALBAJES GARCIA, R. y CENTRE INTERNATIONAL DE HAUTES ÉTUDES AGRONOMIQUES MÉDITERRANÉENNES. Integrated pest and disease management in greenhouse crops. 1st. Kluwer Academic Publishers, 1999. ISBN 9781786761644.

RESOURCES

Hyperlink:
- Intranet docent ATENEA. Resource