PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Higher School of Saharan Agriculture

El Oued

HIGHER SCHOOL OF SAHARAN AGRICULTURE - ELOUED

المدرسة العليا للفلاحة الصحراوية - الوادي

Academic Program

2nd Cycle

Plant Protection

3rd Year

5th Semester

Teaching Unit: Fundamental
Subject: Integrated agricultural pest management
VHS: 67h30min (C/T)
Credits: 6
Coefficient: 3
Evaluation method: Continuous assessment: 40% Exam: 60 %.

Learning Objectives

The main objective of this module is to detail all potential methods that can be utilized to manage phytoparasitic nematodes (cultural control, resistance, chemical control, biological control, and integrated management).

Course Content

- History, overview, and principles of ecological pest management.
- Integrated Pest Management (IPM) for sustainable agriculture.
- Pest monitoring and forecasting.
- Augmentation and conservation of natural enemies.
- Biotechnological and molecular approaches in pest and plant disease management in cultivated crops.
- Role of integrated pest management in food and nutritional security.
- Role of information and communication technologies (ICT) in integrated pest management.

TUTORIALS (TD):

- Economic decision rules for Integrated Pest Management (IPM).
- Decision-making and economic risk in IPM.
- Integrated management as applied ecology: biological principles.
- Population dynamics and species interactions.
- Sampling for detection, estimation, and decision-making in IPM.
- Resistant varieties (Meloidogyne, Heterodera).
- Use of nematophagous fungi.

Teaching Unit: Fundamental
Subject: Ecotoxicology
VHS: 67h30min (C/T)
Credits: 6
Coefficient: 3
Evaluation method: Continuous assessment: 40% Exam: 60 %.

Learning Objectives

The discharge of various substances into the biosphere (soil, air, and water) causes severe ecological disruptions. Polluting substances originate from natural, industrial, and agricultural sources. Plant protection students must acquire essential concepts regarding the impacts of heavy metals (lead and mercury), synthetic pesticides, and mineral fertilizers on animals, plants, and the atmosphere.

Course Content

CHAPTER I: Pollution of Agroecosystems by Plant Protection Products

- 1. Biogeochemical cycles
- 2. Air pollution
- 3. Soil pollution
- 4. Water pollution

CHAPTER II: Effects of Plant Protection Products

- 1. Effects of plant protection products on plants
- 2. Effects of plant protection products on animals
- 3. Biological indicators

CHAPTER III: PESTICIDE DOSAGE AND QUANTIFICATION TECHNIQUES

- 1. Sampling methods
- 2. Extraction methods
- 3. Quantification/Assay methods
- 4. Determination methods

TUTORIALS (TD):

- Determination of organophosphorus residues.
- Determination of deltamethrin residues (fruits and vegetables, soil, water).

Teaching Unit: Fundamental
Subject: Plant protection application equipment
VHS: 67h30min (C/PW)
Credits: 6
Coefficient: 3
Evaluation method: Continuous assessment: 40% Exam: 60 %.

Learning Objectives

This course constitutes a specialized domain within agricultural machinery engineering and oversight. Treatments are varied and require the application of specific active ingredients utilized in distinct manners with specialized equipment.

Course Content

CHAPTER I: HISTORICAL OVERVIEW OF PLANT PROTECTION EQUIPMENT FROM ITS ORIGINS

CHAPTER II: COMPLETE PANORAMA OF APPLICATION EQUIPMENT

1. Description and Operating Principles

- 1.1. Operating principles
  - 1.1.1. Liquid sprayers: Pressure sprayers, Projected jet sprayers, Air-assisted/Carried jet sprayers, Pneumatic sprayers, Centrifugal sprayers, Thermal sprayers.
  - 1.1.2. Dusters: Full-field dusters, Seed coating dusters, Baiting dusters.
  - 1.1.3. Soil injectors.

2. Adapting Treatment Equipment to Crops

- 2.1. Selection of equipment and accessories
- 2.2. Calibration according to standards
- 2.3. Monitoring during application
- 2.4. Capacity, efficiency, advantages, and limitations

Conclusion: Conclusion

PRACTICAL WORK (PW):

- **TP 1: Comparative study of different sprayer types —** Analyze operating principles, advantages, and limitations of pressure, pneumatic, centrifugal, and thermal sprayers.
- **TP 2: Calibration and adaptation of treatment equipment to crops —** Learn to select and configure a sprayer based on crop type and application standards.
- **TP 3: Control and evaluation of duster efficiency —** Test and compare the performance of field dusters, coating dusters, and baiting dusters.

- **TP 4: Measurement of application capacity and analysis of treatment parameters —** Evaluate efficiency, coverage, and operational costs of different equipment under real field conditions.

Teaching Unit: Methodology
Subject: Methodology in plant protection
VHS: 45h (C/T/PW)
Credits: 3
Coefficient: 2
Evaluation method: Continuous assessment: 40% Exam: 60 %.

Learning Objectives

Equip students with theoretical knowledge and practical competencies for sampling, extraction, identification, and ecological study of plant-parasitic nematodes, insects, and vertebrate populations, enabling them to apply integrated methods for biological research and agricultural pest management in natural and cultivated environments.

Course Content

METHODOLOGY APPLIED TO NEMATOLOGY

- Sampling methods for plant-parasitic nematodes: (a) In open fields and greenhouses; (b) From plant tissues.
- Extraction techniques for plant-parasitic nematodes: (a) Ectoparasitic nematodes; (b) Semi-endoparasitic nematodes; (c) Endoparasitic nematodes; (d) Grain and seed nematodes.
- Slide mounting and staining techniques.

METHODOLOGY APPLIED TO ENTOMOLOGY

- Methods for studying Orthoptera.
- Sampling in a block system (Coccids, Whiteflies, etc.): Case of a citrus orchard; Case of a date palm grove.
- Methods for studying aquatic insects.
- Methods for studying forest insects.

METHODOLOGY APPLIED TO VERTEBRATE POPULATIONS

- Relative counts: Point Abundance Index (PAI / IPA) method; Progressive Frequency Sampling (PFS / EFP).
- Absolute counts: Censuses; Grid mapping method.

PRACTICAL WORK (PW):

- **TP 1: Sampling and extraction techniques for plant-parasitic nematodes —** Master sampling and extraction methods for nematodes from soil, roots, and plant tissues based on their parasitism mode.

- **TP 2: Microscope slide mounting and identification of nematodes —** Learn staining and slide mounting techniques for microscopic observation and classification of nematodes.
- **TP 3: Sampling methods for insect pests in agricultural environments —** Compare trapping and counting techniques for Coccids, Whiteflies, and other insects in citrus orchards and palm groves.
- **TP 4: Vertebrate counting and inventory method applications (IPA, EFP, quadrats) —** Evaluate animal populations in natural environments using quantitative and comparative methods.

TUTORIALS (TD):

- **TD 1: Application of the quadrat method and Line Abundance Indices (LAI / ILA) —** Put into practice ecological sampling techniques to estimate animal and plant population densities.
- **TD 2: Study of aquatic and forest insects —** Analyze sampling protocols adapted to aquatic and wooded ecosystems.
- **TD 3: Dissection and morphological analysis of insects (Orthoptera, Coleoptera, etc.) —** Identify key anatomical structures for classification and pest insect study.
- **TD 4: Practical case studies in integrated pest management —** Study real-world infestation scenarios and propose management strategies combining biological, cultural, and chemical methods.

Teaching Unit: Methodology
Subject: Biodiversity and conservation strategies
VHS: 37h30min (C/PW)
Credits: 3
Coefficient: 2
Evaluation method: Continuous assessment: 40% Exam: 60 %.

Learning Objectives

- Understand biodiversity at genetic, species, and ecosystem levels.
- Recognize major threats to global and local biodiversity.
- Apply ecological and genetic principles to conservation.
- Evaluate conservation policies and management strategies.
- Design and evaluate conservation plans for threatened species and ecosystems.

Course Content

- **Introduction to Conservation Biology** — History, scope, ethical foundations, and conservation as a crisis discipline.
- **Biodiversity (Definition and Levels)** — Genetic, species, and ecosystem diversity; importance of biodiversity.
- **Patterns of Biodiversity** — Global distribution, biogeography, biodiversity hotspots, endemism.
- **Extinction and Threatened Species** — Causes of extinction, IUCN categories, island biogeography theory.
- **Habitat Destruction and Fragmentation** — Deforestation, agriculture, urbanization, edge effects, corridors.
- **Climate Change and Biodiversity** — Impacts of climate change, species range shifts, adaptation strategies.
- **Invasive Species and Pollution** — Ecological impacts, case examples, control and management approaches.
- **Conservation Genetics** — Genetic drift, inbreeding, gene flow, population viability analysis.
- **Design of Protected Areas and Reserves** — Design principles, SLOSS debate, connectivity, management categories.
- **Ecosystem Restoration and Rewilding** — Principles of restoration ecology, passive and active rewilding strategies.
- **Ex Situ Conservation** — Zoos, seed banks, botanical gardens, gene banks, captive breeding.
- **Community-Based Conservation** — Role of local communities, indigenous knowledge, participatory conservation.
- **Conservation Policy and Legislation** — CBD, CITES, Ramsar Convention, national and international legal frameworks.
- **Conservation Planning and Prioritization** — Systematic conservation planning, gap analysis, conservation tools (e.g., Marxan).

PRACTICAL WORK (PW):

- GIS mapping of protected areas.
- Red List species assessment.
- Conservation genetics simulations.
- Stakeholder role-play on conservation conflicts.
- Field visit to a protected area or botanical garden.
- Group project: Conservation plan for a local species/habitat.

Teaching Unit: Methodology
Subject: New technologies for integrated pest management
VHS: 22h30min (C)
Credits: 3
Coefficient: 1
Evaluation method: Continuous assessment: 100%

Learning Objectives

The module aims to provide learners with an in-depth, multi-scale operational mastery of modern and emerging technologies for pest population monitoring and plant health management.

Course Content

Chapter 1: Modern Tools for Pest Population Monitoring

- Applications of geospatial technologies in plant health management.
- Application of Unmanned Aerial Vehicles (UAVs) for pest surveillance, tracking, and management.
- Unmanned Aerial System (UAS) technologies for pesticide spraying.
- Detection, migration, and tracking of pest insects using radar and LiDAR systems.
- Use of mobile applications and software for collecting and disseminating information on pest and disease management.
- Light trap: a dynamic tool for data analysis, documentation, and monitoring of insect populations and diversity.

Chapter 2: Emerging Fields in Pest Management

- Applications of nanotechnology in pest management.
- Integrated and ecological pest management.
- Integrated pest management and remote sensing.

Teaching Unit: Discovery
Subject: Plant protection legislation
VHS: 22h30min (C)
Credits: 1
Coefficient: 1
Evaluation method: Continuous assessment: 40% Exam: 60%

Learning Objectives

Pesticides are frequently utilized inappropriately without respecting proper dosages or basic safety precautions, alongside the problematic use of expired products. This course provides necessary legal and regulatory foundations.

Course Content

CHAPTER I: GENERAL OVERVIEW

- 1. Importance of plant protection products globally and in Algeria
- 2. Consequences of pesticide usage
- 3. Classification of pesticide categories

CHAPTER II: DEFINITION AND OBJECTIVES OF LEGISLATION

- 1. Definition of legislation
- 2. History of legislation
- 3. Main objectives of legislation

CHAPTER III: FOUNDATIONS OF LEGISLATION

- 1. Provisions related to manufacturing: Production, Synthesis, Formulation
- 2. Provisions related to registration/approval: Overall framework, Composition of the registration commission, Functioning of the registration commission, Registration authorization
- 3. Provisions related to marketing and commercialization
- 4. Provisions related to application and usage

CHAPTER IV: LEGISLATIVE AND REGULATORY PHYTOSANITARY TEXTS ADOPTED IN ALGERIA

- 1. Legislative texts
- 2. Border control and quarantine inspection
- 3. Practical aspects of law enforcement

CHAPTER V: LEGISLATIVE AND REGULATORY TEXTS WITHIN THE EUROPEAN FRAMEWORK

Conclusion: Conclusion

Teaching Unit: Discovery
Subject: introduction to bibliographic research
VHS: 22h30min (C)
Credits: 1
Coefficient: 1
Evaluation method: Continuous assessment: 100%

Learning Objectives

This module aims to develop in learners the essential competencies required for collecting, analyzing, and rigorously structuring scientific information through the preparation of bibliographic index cards and mastery of document retrieval tools.

Course Content

CHAPTER I: THE BIBLIOGRAPHIC INDEX CARD

- 1. Document identification on the index card
- 2. Preparation of an index card from an offprint / reprint
- 3. Preparation of an index card from a book or reference work

CHAPTER II: EXPLOITATION OF A TEXT

- 1. Categorization based on key ideas / main concepts (Headings and subheadings; Passages to summarize or transcribe)
- 2. Organization of bibliographic cards in a systematic filing index

CHAPTER III: SPECIALIZED DOCUMENT RETRIEVAL PROCESS

- 1. On-site document retrieval (direct search of available offprints, journals, bulletins, annals) with text analysis or photocopying
- 2. Use of indexing bulletins, abstracts, and Current Contents (requesting offprints)
- 3. Retrieval of historical / archival documents

CHAPTER IV: PREPARATION OF THE BIBLIOGRAPHY PAGE

- 1. Alphabetical and chronological ordering
- 2. Placement of single-author references versus co-authored team references
- 3. Case of edited works composed of multiple contributions from different collaborators

Teaching Unit: Transversal
Subject: Application of artificial intelligence in plant protection
VHS: 22h30min (C)
Credits: 1
Coefficient: 1
Evaluation method: Continuous assessment: 40% Exam: 60%

Learning Objectives

The module proposes to develop a practical operational vision of artificial intelligence applied to crop protection among learners.

Course Content

- Chapter 1: Introduction
- Chapter 2: AI-Based Flowchart for Plant Protection (Image pre-processing, Feature Extraction, Classification)
- Chapter 3: Different Techniques for Plant Protection Image Processing (Machine Learning - ML, Artificial Neural Networks - ANN, Support Vector Machines - SVM, Deep Learning - DL)
- Chapter 4: Case Studies on the Use of AI in Plant Protection and Weed Management