Precision Integrated Pest Management (IPM) for Fruit and Vegetable Crops

Course Coordinator: Anna Maria D'Onghia

- **Aims**

The Programme has been designed to train graduate students (disciplines: plant health, crop production and protection, biology, biotechnology, agricultural engineering, horticultural sciences, farm management, natural sciences, environmental sciences) in the smart and sustainable integrated management of economically important pests affecting main Mediterranean fruit and vegetable crops in pre and post-harvest.

The Programme is structured in 2 parts: the first part, the Master Programme, is based on an intensive learning course and on the elaboration of an IPM project; the second part, the Master of Science Programme (MSc), is dedicated to the acquisition of research methodologies and to the development of a scientific applied research work.

- **Objectives**

The main objective of the Master Programme is to train experts able to apply and transfer an innovative IPM approach with the support of smart technologies for site-specific applications in a management system; this approach will lead to an effective and environmentally-friendly crop protection with great advantages for the farm economy and food safety. The MSc programme will also provide basic and technical knowledge on bibliographic research, field and laboratory methodologies to support a research work on phytosanitary topics of great interest for a sustainable agriculture.

Students learn professional priorities, apply smart solutions and change their way of thinking about crop protection.

In the Master programme students build knowledge and develop skills in:

- ✓ basic IPM principles and methodologies;
- ✓ proactive measures: plant quarantine, pest risk analysis, certified propagating material, resistant/tolerant cultivars or graft combinations, biodiversity maintenance;
- ✓ sustainable use of pesticides and relative regulations; applications of alternative non-chemical pest management methods;
- ✓ food quality and safety;
- ✓ smart-decisions support systems

- ✓ sound management of biotic and abiotic disorders in pre and post-harvest.
- ✓ communication and entrepreneurship

In the Master of Science programme (MSc) students build capacity and develop skills in:

- ✓ innovative field and/or laboratory techniques and methodologies relating to the research topic
- ✓ in-depth and critical analysis of research data
- ✓ autonomy in work
- ✓ teamwork
- ✓ bibliographic research on English scientific material
- ✓ preparation and presentation of a scientific paper

Part 1 - The Master Programme

The programme is organized in **9 Units (72 ECTS)**
Duration: **9months, from September 2019 to June 2020**

30 September – 11 October 2019

UNIT 1- INTRODUCTORY COURSES (4 ECTS)

Content:

- ✓ Introduction to the general principles of thematic areas of great interest for agriculture that can be shared between the three programmes of the Master: biodiversity, climate change and high technology for agriculture.
- ✓ Information and Communication Technologies (ICTs). Criteria for bibliographic research
- ✓ English language

Learning outcomes:
To provide students with in-depth information on relevant issues and topics that have a great impact on agriculture.
Harmonization of students linguistic and technical background on general topics to support lectures understanding and scientific papers research.

Evaluation procedure: written examination

14October –21 November 2019

UNIT 2 - INTRODUCTION TO IPM (11 ECTS)

Content:

- ✓ Basic knowledge of plant pests, pathogens, nematodes, physiological disorders and weeds
- ✓ Disease diagnosis, pest and weed identification, pathogen detection using classical and advanced diagnostic methods
- ✓ IPM concepts

Learning outcomes:

Harmonization of students background on biotic and abiotic disorders and their control based on a modern and sustainable IPM approach.

Evaluation procedure: written examination

22 November 2019– 30 January2020

UNIT 3 - PEST/PATHOGEN CONTROL (16 ECTS)

Content:

- ✓ Basic genetic in plants
- ✓ Breeding and biotech resistance
- ✓ Conventional and non-conventional control methods
- ✓ Regulated pesticides and bio-pesticides
- ✓ Chemical and non-chemical means of pest control
- ✓ Natural enemies application

Learning outcomes:

- ✓ Gaining knowledge on basic principles of modern plant breeding (e.g. genomics and genetic engineering in plant) as a proactive approach in the IPM strategy
- ✓ Safe and sustainable use of agrochemicals and bio-rationales pesticides and relative regulations for food quality and safety in IPM
- ✓ Efficient use of beneficial arthropods

Evaluation procedure: written examination

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31January – 28 February 2020

UNIT 4 -SMART DECISION SUPPORT SYSTEMSIN IPM (8 ECTS)

Content:

- ✓ Remote sensing, GPS and GIS applications
- ✓ Spatial pest/disease analyses
- ✓ Forecasting and modelling
- ✓ Statistical analyses
- ✓ Decision Support Systems

Learning outcomes:

- ✓ Providing concepts and applications of current technologies in precision crop protection for a smart and sustainable IPM approach

Evaluation procedure: written examination

02 –27 March 2020

UNIT 5 - IPM OF VEGETABLE CROPS IN PRE-HARVEST (8 ECTS)

Content:

- ✓ Morphological, ecological, epidemiological characteristics of key pests and pathogens of vegetable crops
- ✓ Pest monitoring, identification/detection and IPM in accordance with EU Regulations

Learning outcomes:

- ✓ Deepening knowledge on the main phytosanitary problems affecting vegetable crops in pre-harvesting
- ✓ Providing useful tools for a sustainable IPM approach

Evaluation procedure: written examination

30 March –24 April 2020

UNIT 6 - IPM OF FRUIT TREE CROPS IN PRE-HARVEST (8 ECTS)

Content:

- ✓ Morphological, ecological, epidemiological characteristics of key pests and pathogens of fruit tree crops
- ✓ Pest monitoring, identification/detection and IPM in accordance with EU Regulations

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Learning outcomes:

- ✓ Deepening knowledge on the main phytosanitary problems affecting fruit tree crops in pre-harvesting
- ✓ Providing useful tools for a sustainable IPM approach

Evaluation procedure: written examination

27 April –15May 2020

UNIT 7 -FOOD SAFETY (4 ECTS)

Contents:

- ✓ Pests/pathogens biology in post-harvest
- ✓ Food contaminants and related regulations
- ✓ Quality systems for certification in the agro-food sector (International Food Standards)
- ✓ Post-harvest technology

Learning outcomes:

- ✓ Deepening knowledge on the main phytosanitary problems affecting fruits and vegetables in post-harvest and on food contaminants
- ✓ Providing useful tools for pest identification and prevention, food detoxification
- ✓ Gaining knowledge on legislation of toxic contaminants present on the food commodities

Evaluation procedure: written examination

18May – 05June 2020

UNIT 8 - GLOBAL MARKET, COMMUNICATION, ENTERPRENEURSHIP& PROJECT (10ECTS)

Content:

- ✓ Good Agriculture Practices
- ✓ Certification in the global market
- ✓ Communication skills: training model and approaches to training; key processing and learning styles; facilitating rainbow and feedback; body language

- ✓ Social innovation and development of entrepreneurship ideas
- ✓ Project preparation (during the whole year) and presentation

Learning outcomes:

- ✓ Enhancing ability in the field application of IPM guidelines and GAP regulations in the international market
- ✓ Acquisition of communication skills for transferring the IPM knowledge in the framework of extension programmes and technical events
- ✓ Enhancing ability to integrate course information in the application of the IPM to specific crops
- ✓ Developing an entrepreneurship project

Evaluation procedure: written and oral examination

08 – 12 June 2020

UNIT 9 - IPPC-FAO/CIHEAM Bari SHORT-COURSE ON DEVELOPING PHYTOSANITARY CAPACITY (3 ECTS)

Content:

- ✓ Principles and international regulations on quarantine pests/pathogens
- ✓ Pest Risk Analysis. Pest/disease monitoring procedures
- ✓ Production and use of certified propagating material and related regulation
- ✓ European Mediterranean Plant Protection Organization (EPPO)
- ✓ International Plant Protection Convention (IPPC)
- ✓ International Standards for Phytosanitary Measures (ISPMs)
- ✓ Implementation of Pest Risk Assessment activities
- ✓ Implementation and organization of import verification and export
- ✓ Certification. Market access for plants and plant products
- ✓ Establishment and management of NPPO

Learning outcomes:

- ✓ Plant quarantine principles and EPPO standards. Upgrading knowledge on a proactive IPM approach, combining the monitoring and control of quarantine pests with the use of certified propagating materials
- ✓ Providing background information on trade facilitation, International Standards for Phytosanitary Measures (ISPMs) and guidance material on phytosanitary issues (e.g. NPPO establishment and management, relations with stakeholders, import and export certification, surveillance)

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Evaluation procedure: written and oral examination

15 – 16 June 2020
FINAL ORAL EXAM

Master Course organization

EXAMINATIONS:
Participants take an examination at the end of each subunit. Examinations are in the form of oral or written exams (i.e. sets of questions, exercises, multiple-choice). Questions can also cover seminar topics, field lectures and technical visits. Evaluation is made by lecturers or by the scientific tutor of the course.
Participants may retake failed exams only once and up to 8 ECTS.

At the end of the course, participants have to pass a final comprehensive oral exam before an Examination Board.

WORKING LANGUAGE: English

ACADEMIC STAFF: Master courses are given by CIHEAM of Bari scientific staff and international prestigious visiting professors/experts (from universities, higher institutions, research centres, international organizations, private institutions etc.); field lectures are also given by IPM experts from the private sector.

Part 2 - The Master of Science Programme

MASTER OF SCIENCE ORGANIZATION

The programme is organized in 3 parts **(60 ECTS):**

- ✓ Theoretical lectures
- ✓ Supervised research work
- ✓ Thesis presentation and defence

Duration: **12 months, from November 2019 to October 2020**

Theoretical lectures on research methodologies (14 ECTS)

Content:

Scientific English. Bibliographic research. Scientific writing. Safe laboratory practices. Statistical analysis. Dedicated courses on conventional and advanced laboratory/field techniques related to the research topic.

Learning outcomes:

Basic and technical knowledge on bibliographic research, field and laboratory methodologies to support the research work.

Supervised research work (10 ECTS)

Content:

Drafting an original thesis, related to pests/pathogens of great social and economic interest for the Mediterranean region.

The MSc thesis is mainly carried out at CIHEAM of Bari or at research Institutions of the student's country of origin.

Topics of MSc theses are chosen among the following research lines:

- ✓ Sampling methodologies and technical protocols
- ✓ Pest monitoring, identification, detection, characterization and management
- ✓ Pest epidemiology
- ✓ Remote sensing, GIS and Information technology applications to plant health
- ✓ Pest forecasting models
- ✓ Detection and control of contaminants in agricultural products

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Learning outcomes:

- ✓ Knowledge and application of innovative field and/or laboratory techniques/methodologies/technical protocols relating to the research topic (e.g. application of remote sensing for precise pest surveillance, spatial and temporal analyses at farm and territorial levels; enhancement and conservation of native germplasm; preservation of food quality in post-harvest)
- ✓ In-depth and critical analysis of research data
- ✓ Ability to work independently and in teamwork
- ✓ Skills in bibliographic research on English scientific material
- ✓ Ability in preparing a scientific paper to announce at National and International Conferences and/or publish in scientific journals

Thesis presentation and defence (36 ECTS)

Content:

The written text and oral presentation of the thesis for a final comprehensive exam.

Learning outcomes:

Ability in preparing a written text and an oral presentation of the thesis and in defending the thesis before an International Scientific Committee.

MASTER OF SCIENCE - EVALUATION

Theoretical lectures: Students take an examination at the end of each topic. Examinations are in the form of oral or written exams (i.e. sets of questions, exercises, multiple-choice). Evaluation is made by lecturers.

Seminars: Students present the progress of their research work before a Supervising Team twice during the academic year:

- 1st Seminar: ppt. presentation and preparation of the first written part of the thesis: introduction, historical review, objectives, materials & methods and bibliography
- 2nd Seminar: ppt. presentation and preparation of the second written part of the thesis: results, discussion and conclusion

Supervised research work: the research work carried out by the student is assessed by the supervisor(s).

Final exam and thesis evaluation: At the end of the programme, they defend their thesis and pass a final comprehensive oral exam before an international Examination Board.

WORKING LANGUAGE: English

ACADEMIC STAFF

In the Master of Science Programme, students' research theses are mainly supervised by CIHEAM Bari researchers; specific research topics are supervised by external professors in collaboration with CIHEAM Bari researchers.

Indicative Master of Science theses realized within the area

I

- ✓ Title: Evaluation of forecasting models for *Moniliniafructicola* in stone fruits and monitoring of *Erwiniaa amylovora* using RT-LAMP in Sicily(2018)
- ✓ Author: Oualguirah Lahsen (Morocco)
- ✓ Place of realization: CIHEAM of Bari
- ✓ Thesis supervisors: Franco Santoro; Franco Valentini; Marilita Gallo; Antonio Ippolito

II

- ✓ Title: Isolation and molecular characterization of *Xylella fastidiosa* from different host plant species in Apulia region, Italy (2018)
- ✓ Author: Mourou Marwa(Tunisia)
- ✓ Place of realization: CIHEAM of Bari
- ✓ Thesis supervisors: Annalisa Giampetruzzi; Franco Valentini

III

- ✓ Title: Measuring intrapopulation genetic variation behavioural traits in an egg parasitoid (2018)
- ✓ Author: Sevarika Milos(Bosnia)
- ✓ Place of realization: University of Palermo, Italy
- ✓ Thesis supervisors: Stefano Colazza; Ezio Peri; Khaled Djelouah

Further detailed information is available on:www.iamb.ciheam.org