Land and Water Resources Management: Irrigated Agriculture

Course Coordinator: Nicola Lamaddalena

- **Aims**
The aim of the Programme in "Land and Water Resources Management: Irrigated agriculture" is to improve capacities of graduate students, researchers, high-ranking officials and professionals, in land and water resources management in the Mediterranean region.

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 irrigation 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 Programme in "Land and Water Resources Management: Irrigated agriculture" is to improve the scientific knowledge and technological know-how of candidates in water saving and land conservation issues through the completion of specific research themes and experimental works.

The course is structured in such a way as to promote land and water resources management in the Mediterranean considering agronomic, engineering, environmental and socio-economic aspects on different scales.
Part 1 - The Master Programme

The programme is organized in **8 Units (66 ECTS)**

**Duration:** 9 months, from October 2019 to June 2020

**1-19 October 2018**

**UNIT 1 – INTRODUCTORY COURSES (7 ECTS)**

**Content:**
Introduction to the general principles of thematic areas of great interest for agriculture that can be shared between the 3 Master courses: biodiversity, climate change and high technology for agriculture.

**Learning outcomes:**
Providing students with in-depth information on relevant issues and topics that have a great impact on agriculture. GIS and remote sensing will be discussed more in depth in Unit 2 on Water and Land Resources Management. Climate change will be deepened in Unit 3 on Irrigation Management: Soil-Water-Plant-Atmosphere Continuum.

**Evaluation procedure:** written examination

**14 October – 29 November 2019**

**UNIT 2 – LAND AND WATER RESOURCES MANAGEMENT (14 ECTS)**

**Content:**
- Pedology and soil survey investigation
- Application of geographic information systems in land and water resources management & remote sensing
- Soil physics: water and solute movements
- Surface Water Hydrology management
- Groundwater hydraulics and pollution in agricultural settings
- Soil erosion and desertification: monitoring, modelling and mitigation technologies
- Water harvesting techniques
Land and Water Resources Management: Irrigated Agriculture

**Learning outcomes:**
Learning how to manage land and water resources by taking into account: Soil quality, interpretation of rainfall data and factors affecting infiltration and runoff in relation to soil physical characteristics, water movement in the soil and water availability, underground water flow, water quality and pollution, factors affecting soil erosion and desertification through monitoring, modelling and mitigation technologies, water harvesting techniques. Knowledge-base techniques on GIS and remote sensing are also provided.

**Evaluation procedure:** written examination

2 December 2018 - 3 January 2020

**UNIT 3 – IRRIGATION MANAGEMENT: SOIL-WATER-PLANT-ATMOSPHERE CONTINUUM (8 ECTS)**

**Content:**
- Agrometeorology and Seminar on Climate Change
- Crop response to water and water use efficiency
- Crop water requirements and practical irrigation scheduling
- Crop growth modelling: Eco-physiological and Engineering aspects
- Seminar on Agricultural aspects of irrigation methods

**Learning outcomes:**
Learning how to manage irrigation in the soil-water-plant-atmosphere continuum starting from studying crop response to water and water use efficiency and its improvement for crop productivity with respect to growth stages and timing of stress occurrence, irrigation practice and management with related effects. Crop growth modelling through “Budget Aquacrop” in relation to climate factors and their effects on plant growth and farm production and climate change.

**Evaluation procedure:** written examination

7-24 January 2020

**UNIT 4 – IRRIGATION MANAGEMENT AT FARM LEVEL (6 ECTS)**

**Content:**
- Design, operation, maintenance and performance evaluation of sprinkler irrigation systems
Land and Water Resources Management: Irrigated Agriculture

- Design, operation, maintenance and performance evaluation of trickle irrigation systems
- Design, operation, maintenance and performance evaluation of surface irrigation systems

**Learning outcomes:**
Learning how to manage on-farm irrigation through design, operation, maintenance and performance evaluation, and methods to improve surface irrigation systems, by sprinkler and micro-irrigation, taking into account agricultural aspects.

**Evaluation procedure:** written examination and group work

**21 January – 8 February 2020**

**UNIT 5 – IRRIGATION MANAGEMENT AT DISTRIBUTION SYSTEMS LEVEL (6 ECTS)**

**Content:**
- Design, operation, maintenance and performance evaluation of large scale open channel distribution systems
- Design, operation, maintenance and performance evaluation of large scale pressurized distribution systems
- Seminar on Determining soil hydraulic properties by field-measured infiltration rates
- Water management optimization
- Seminar on Water resources management: the FAO approach

**Learning outcomes:**
Learning how to manage irrigation of large-scale distribution systems through design, operation, maintenance and performance evaluation of open channels and pressurized irrigation systems; optimization of water management through planning and the application of dynamic management.

**Evaluation procedure:** written examination and group work

**17 February – 13 March 2020**

**UNIT 6 – USE OF NON-CONVENTIONAL WATER RESOURCES: TECHNICAL AND ENVIRONMENTAL ISSUES (8 ECTS)**
Land and Water Resources Management: Irrigated Agriculture

Content:
- Salinity control in relation to irrigation
- Drainage and drainage systems design and management
- Use of low quality waters: environmental and technical aspects
- Seminar on Wastewater reuse in irrigation farming
- Seminar on Non-conventional water use
- Urban wastewater treatment for agricultural reuse.

Learning outcomes:
Learning how to control salinity as related to water, climate and crop tolerance, leaching and reclamation techniques, management of unconventional waters for irrigation, study of water quality and pollution monitoring systems. Treatment of wastewater, wastewater reuse in irrigation farming. Management and design of drainage systems.

Evaluation procedure: written examination and group work

16 March - 17 April 2020

UNIT 7 - IRRIGATION MANAGEMENT: INSTITUTIONAL, ECONOMIC AND ENVIRONMENTAL ASPECTS (10 ECTS)

Content:
- Principles of farm economics
- Optimal water allocation in irrigation sector
- Cost/Benefit Analysis
- Participatory irrigation management (PIM) and transfer (IMT) in a monitoring & evaluation perspective
- Cost Recovery
- International economics and the role of agriculture in economic development
- Seminar on Geopolitics of water in the Mediterranean and Middle East

Learning outcomes:
Learning how to perform economic analysis and determine the economic benefits at the irrigated farm level, to perform optimal irrigation water allocation through environmental planning at farm scale, to perform cost/benefit analysis, participatory irrigation management and transfer in a monitoring & evaluation
Land and Water Resources Management: Irrigated Agriculture

perspective, assessment water cost recovery. The role of agriculture in the economic development.

**Evaluation procedure:** written examination and group work.

27 April – 12 June 2020

**UNIT 8 – CASE STUDY – IRRIGATION PROJECT DESIGN (10 ECTS)**

**Content:**

**Learning outcomes:**
The design of an irrigation project based on a case study of southern Italy will allow for applying the knowledge acquired in the previous seven sections and working in a team work. Such a work will enable to analyse and process data on climate, soil, crops, and quality-oriented crop water requirements, to choose the optimal cropping system based on different simulation scenarios (water availability, quality, economic criteria, etc.). Hydraulic design of large scale distribution networks, environmental impact, cost/benefit analysis. Synthesis, conclusions.

**Evaluation procedure:** written examination and group work.

15-16 June 2020

**FINAL EXAMS**
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 international Examination Board.

WORKING LANGUAGE: English

ACADEMIC STAFF
Master courses are given by MAIB scientific staff and international prestigious visiting professors (from universities, higher institutions, research centres, international organizations); field lectures are also given by experts from reclamation consortia.

Part 2 - The Master of Science Programme
Duration: 12 months, from November 2019 to October 2020

MASTER OF SCIENCE ORGANIZATION

Research work: thesis and defence (60 ECTS)
Research activities on Land and Water Resources Management cover different scales of application (from leaf - plant to watershed and region) and allow a multilevel approach through the interaction of various aspects (agronomic, engineering and economic) at different levels of investigation: on the one hand, agricultural management practices are scaled up, from leaf to irrigation district level, which leads to the irrigation water demand of an entire district. This demand is translated into water released from the source and down-scaled through water management practices, from the source of water to farms and single plants.
Such activities are carried out under the supervision of L&W staff and/or national-international experts belonging to the L&W networking.
Land and Water Resources Management: Irrigated Agriculture

**Topics generally available for Master of Science theses**

- Eco-Efficiency analysis of irrigation
- Impact of treated wastewater use on the cropping pattern, irrigation management and hydraulic performance of irrigation network
- Generation of the discharge hydrograph in large scale irrigation system
- Modernization of an on-demand pressurized irrigation systems: Assessment of the flexibility impact on the cost effectiveness
- Formulation of a physically-based pedotransfer function to determine soil hydraulic parameters for an agro-hydrological model
- Energy and Hydraulic Performance-Based Management of Large-Scale Pressurized Irrigation Systems
- Actual soil erosion loss and sediment yield estimation in the Candelaro watershed of Apulia region in Italy using the G2 model
- Characterization, modelling and participatory simulations of water use and development strategies at the level of rural households and rural territories
- The impact of conversion from surface irrigation to drip irrigation on groundwater exploitation
- Combination of new sensor technologies, satellite navigation and positioning technology to manage irrigation, fertilisation and applying automated optical sensing to detect diseases undetectable by traditional means

**MASTER OF SCIENCE - EVALUATION**

**EXAMINATIONS**

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

- **1st Seminar**: bibliographic search; project proposal (objectives, materials and methods) and related written draft;
- **2nd Seminar**: presentation and scientific value of the research work (modelling, laboratory or field activity) and related written draft.

**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 course, students discuss their thesis and pass a final comprehensive oral exam before an international Examination Board.

**WORKING LANGUAGE:** English

**ACADEMIC STAFF**

Students’ research theses are supervised by CIHEAM Bari researchers and external professors in collaboration with CIHEAM Bari staff.

**Indicative Master of Science theses realized within the area**

I.

- **Title:** “Treated wastewater use on citrus in morocco: assessing the economic feasibility of irrigation and nutrient management strategies”
- **Author:** Oubelkacem Abdellah, Agricultural Engineer, Morocco (2018)
- **Place of realization:** MAI-Bari, Italy
- **Thesis supervisors:** A. Scardigno, G. Dragonetti, & R. Khadra, CIHEAM -Bari, Italy

II.

- **Title:** “Assessing field spatial variability of soil hydraulic properties by combining a multiple dripper system, 2D soil water flow numerical modeling and Time Domain Reflectometry (TDR)”
- **Author:** Moghrani Siham, hydraulic engineering, Algeria (2017)
- **Place of realization:** MAI-Bari, Italy
- **Thesis supervisors:** A. Coppola & G. Dragonetti

III.

- **Title:** “Perturbation indicators for pressurized irrigation systems”
- **Author:** Derardja Bilal, hydraulic engineering, Algeria (2016)
- **Place of realization:** MAI-Bari, Italy
- **Thesis supervisors:** N. Lamaddalena, R. Khadra & M. A. Moreno

IV.

- **Title:** “Modelling the spatial distribution of evapotranspiration of main crops in the Apulia region using dual crop coefficient approach”
Author: Assif El Mahdi, rural engineering, Morocco (2015)
Place of realization: MAI-Bari, Italy
Thesis supervisors: L. S. Pereira & D. D’Agostino

Title: “Application of ground based remote sensing techniques to evaluate physiological and biometric variables of potato (Solanum tuberosum L.) grown under different water treatments”
Author: Imen Ben Charfi, Agricultural Engineer, Tunisia (2014)
Place of realization: MAI-Bari, Italy
Thesis supervisors: R. Albrizio & M. Todorovic

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

Course Coordinator: Lina Al Bitar

- **Aims**

  The Programme aims at preparing the participants to produce innovation in Mediterranean organic agriculture, creating and maintaining sustainability in the farming system, assisting and contributing to national development of organic legislations and regulatory framework.

- **Objectives**

  The main objective of the Programme is to train graduates, young researchers and professionals for future professional careers in the domain of Organic Agriculture. Within this framework, the general learning outcomes are:
  - developing agronomic skills related to practices and techniques of Mediterranean Organic Agriculture production and management;
  - developing skills related to legislation, inspection, certification and labelling of organically-produced food and fibres;
  - building capacity in socio-economic analysis and market strategy for organic agriculture;
  - providing trainees with the necessary tools and expertise to assess the agricultural, environmental, and socio-economic opportunities and constraints of organic agriculture in different Mediterranean areas.
Part 1 - The Master Programme

The programme is organized in **11 Units (63 ECTS)**
Duration: **9 months, from October 2019 to June 2020**

**30 September – 11 October 2019**
**UNIT 1 – INTRODUCTORY COURSES (4 ECTS)**
**Content:**
Introduction to the general principles of the thematic areas of great interest for agriculture:
- Information and Communication Technologies
- Criteria for bibliographic and technology of search
- Climate change and agriculture
- Biodiversity & crops
- Transboundary pests & diseases
- Communication skills
- High technologies for agriculture and natural resources management: Geographical Information Systems (GIS), Remote Sensing and Information Technology
- English language

**Learning outcomes:**
Students learn how to develop familiarity and search through Internet, use excel, and develop the ability to search for, collect, process, read and interpret research results. Students also learn in-depth information on relevant issues and topics that have a great impact on agriculture. Biodiversity and crops will be discussed more in detail in Unit 2.

**Evaluation procedure:** written examination

**14 - 31 October 2019**
**UNIT 2 – INTRODUCTION TO ORGANIC AGRICULTURE, AGROECOLOGY AND BIODIVERSITY (4 ECTS)**
**Content:**
- Principles of organic agriculture and agroecology
- Biodiversity and crops
Learning outcomes:
Students should become knowledgeable on sustainable farming practices and conversion to organic agriculture and ways and means to enhance the quality of agroecosystems and biodiversity protection. They would be able to plan for an assessment of biodiversity from the field level to landscape level through farm level.

Evaluation procedure: written exams and practical work (exercises, assignments)

4 - 29 November 2019
UNIT 3 - SOIL FERTILITY MANAGEMENT IN ORGANIC FARMING (8ECTS)
Content:
- The soil: biotic and abiotic components
- Cover crops, fertilizers and biomasses recycling for managing the soil fertility in organic farming
- Organic ruminants farming
- Plant nutrients management in organic farming

Learning outcomes:
Students will learn to evaluate the environmental and agronomical importance of specific interactions among soil constituents, nutrients and pollutants, underlining sustainable strategies to maintain and increase soil fertility in organic agriculture. They will also learn how soil biological parameters react on organic fertilization and how soil microorganisms and humus formulation can be enhanced by farmyard manure (FYM) and other organic fertilizers. They acquire the competence about principal feedstuffs for ruminants and the different feeding.

Evaluation procedure: written exams and practical work (exercises, assignments)

2 - 20 December 2019
UNIT 4 - INSECT, DISEASE AND WEED MANAGEMENT (6ECTS)
Content:
- Organic weeds management
- Plant protection against diseases in organic production
- Organic insect management
**Learning outcomes:**
Students learn how to organize plant protection in organic production and to select the best tools to combat pathogens. They gain skills on main biological control practices as a method of pest control. Students become knowledgeable on weed biology and ecology, and learn how to manage weeds in organic farming and the positive function of weeds.

**Evaluation procedure:** written exams and practical work (exercises, assignments, group presentations)

2 - 31 January 2020

**UNIT 5 - GLOBAL MARKETS AND MARKETING FOR ORGANIC AGRO-FOOD PRODUCTS (4 ECTS)**

**Content:**
- Appraisal and assessment of local food systems through participatory methods: exploring the potential of organic farming
- Principles of farm economics
- Marketing of agro-food products
- Sustainable supply chain
- Consumer and Organic Value Chain: Analysis and Research

**Learning outcomes:**
Participants understand business performance through evaluation of productivity, efficiency and profitability. Students acquire knowledge of tasks and approaches in marketing to be enabled to independently develop a marketing concept for an organic company. Students will get practical insights into the overall trade policy issues that affect the outcomes for farming communities and the adoption of organics. They learn the multiple linkages between organic farming and rural development, especially from the perspective of resilience and risk management.

**Evaluation procedure:** written exams and practical work (exercises, assignments)
3 - 14 February 2020

UNIT 6 - ORGANIC FARMING ECONOMICS, POLICY DEVELOPMENT AND SOCIAL ASPECTS (4ECTS)

Content:
- Support policies for organic agro-food systems
- National Action Plan for organic agriculture

Learning outcomes:
Trainees understand business performance through evaluation of productivity, efficiency and profitability, to identify strengths and weaknesses of business choices. They acquire some basic knowledge/terminology about several tools and procedures of agricultural policies, with special reference to organic food productions. Students become familiar with basic concepts of farm development and would be able to relate the development of organic farming in their countries to global trends.

Evaluation procedure: written exams and practical work (exercises, assignments)

17 February - 6 March 2020

UNIT 7 - ORGANIC STANDARDS AND LEGISLATION (4ECTS)

Content:
- Organic regulation in the EU and Mediterranean countries
- Accreditation, certification and inspection in organic system

Learning outcomes:
Students gain a direct understanding of the knowledge and skills needed to work in an organic certification agency. Students get familiar with the European regulation on organic standards and how to implement it for certifying organic products or production processes and they also learn the importing rules.

Evaluation procedure: written exams and practical work (exercises, assignments); student project design and presentation in a written and oral format.
UNIT 8 - QUALITY, SAFETY AND POST-HARVEST HANDLING OF ORGANIC CROPS (8 ECTS)

Content:
- Organic food quality and safety
- Post-harvest techniques
- Food Hygiene Regulations: rules and new requirements
- Food quality and safety certification schemes
- Sustainable food systems

Learning outcomes:
Students become knowledgeable on the implementation of food quality and safety systems on farm according to the main internationally recognized standards. They learn principles of voluntary and compulsory regulations of food safety and food quality in the EU, principles to realize a risk analysis, methods to lead external/internal audits. They also learn the post-harvest handling of fresh produce and how to retain the quality of the products and extend market life.

Evaluation procedure: written exams and reports

UNIT 9 - ORGANIC MEDITERRANEAN COMMODITIES PRODUCTION (8 ECTS)

Content:
- Organic horticulture growing
- Organic grapevine growing
- Organic olive growing

Learning outcomes:
Students become knowledgeable of the main agronomic practices, soil fertility management, advantages and disadvantages of compost and organic fertilizers utilization and the main regulatory aspects related to organic horticulture and growing media production in organic vegetable production. Students learn how to design a soil fertility and crop nutrition plan and pest management plan based on the basic principles of organic farming. They acquire a detailed knowledge of all aspects of organic olive production systems and learn how to
manage vineyards under organic conditions (choice of rootstock, the most suitable form of training, soil management with particular attention to fertilization, phytosanitary protection, etc.).

**Evaluation procedure:** written exams and practical work (exercises, assignments), case-study presentation.

11 May – 12 June 2020

**UNIT 10 – Concepts in sustainable development (6ECTS)**

**Content:**
- The role of the technical advisor in designing and managing a sustainable organic farm
- Regulations and procedures for the authorization to the use of organic pesticides and fertilizers
- Organic Production and Sustainable Development: Frameworks and Strategies
- Economic Feasibility of Small Scale Organic Production and Risk Management Strategies

**Learning outcomes:**
Students understand how the Principles of Organic Agriculture are translated into regulatory frameworks. Students become knowledgeable on the 3-tiered system of oversight in current use within the organic trade. They learn about legislations, elements of toxicology and document preparation in relation to the preparation of a dossier for the authorization to the use of organic fertilisers and pesticides.

**Evaluation procedure:** written exam and practical work (exercises, assignments)

October 2018 - June 2020

**UNIT 11 - PROJECT (7ECTS)**

**Content:**
The project is an “Action learning for preparing operators of Sustainable Agriculture”. It focuses on the following activities:

1- Sustainable Agriculture Project (SAP): the training involves an action-based learning and envisages working on Sustainable Agriculture Projects (SAPs). Students form small groups (3/4 students each group
max) and they work on a SAP in a multi-disciplinary and inter-sectoral way through the direct interaction with stakeholders related to the subjects at the core of SAPs. These stakeholders, also defined as Active Actors (AA), and representing a farm, company, institution, cooperative, etc., are assigned to each SAP, together with a learning facilitator (CIHEAM academic staff, expert in the field of the specific SAP sector). SAPs will be implemented through several phases, based on observation, dialogue and reflection, leading the students to experience an action base and oriented learning. SAPs phases are connecting, planning, acting and observing, restitution and sharing.

2- Classroom activities: The SAP activities are supported by classroom sessions during which key topics for SAP implementation are presented and discussed, and or group activities and exercises functional to SAP are implemented.

3- Practical days: for each group for sustaining the implementation of the 4 SAP phases. Through the practical days students approach real-life contexts, visiting stakeholders, setting up meetings, collecting information and observing, surveying fields and other key places, etc.

4- Workshops: involving all the groups, SAPs active actors and learning facilitators, will be organized. The first workshop at the beginning of the master courses and for adjusting and the second workshop for sharing SAPs results.

Learning outcomes:

Action Learning is an experiential and collective learning process that has shown to be an efficient approach for “transforming learners” and driving changes towards sustainability of agriculture. Students work at a collective real project, interacting with key stakeholders (researchers, farmers, policy makers, etc.) undertaking practical activities, and challenging one another to question their assumptions as they reflect on their experiences.

The training is oriented to create a set of soft skills and technical competencies in future operators of Sustainable Agriculture. This is based on the acknowledgement that the complexity of real-life contexts requires professionals (teachers, researchers, practitioners, operators, etc.) who can offer a wide range of skills and competencies that allow them to work using multidisciplinary and cross-sectorial approaches so that they can interact with a multitude of stakeholders, thus facilitating dialogue, mobilization, participation, engagement.
Evaluation procedure:
Final written report and presentation.

15–19 June 2020
FINAL EXAMS

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 seminars topics, field lectures and technical visits. Evaluation is made by the 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 international Examination Board.

WORKING LANGUAGE: English

ACADEMIC STAFF
Master courses are given by MAIB scientific staff and international prestigious visiting professors (from universities, higher institutions, research centres, international organizations); field lectures are also given by MOA experts from the private sector.
Part 2 - The Master of Science Programme

The Master of Science Programme is organized in two parts: Preparatory research methodologies and supervised research work: thesis and defence (60 ECTS).

Duration: 12 months, from November 2019 to October 2020

MASTER OF SCIENCE ORGANIZATION

PREPARATORY RESEARCH METHODOLOGIES (10 ECTS)

Content:

Learning outcomes:
Basic and technical knowledge on how to set up a research project, define methodology, collect and analyse data, care about content and style in thesis writing.

RESEARCH WORK (50 ECTS)

Content:
Conducting a research activity in the field of organic agriculture and elaborate an original thesis, related to agronomic, legal or social and economic aspects of Mediterranean organic agriculture. The MSc thesis is mainly carried out at CIHEAM Bari or at research Institutions of the student’s country of origin under the supervision of CIHEAM Bari researchers and external professors.

Topics of MSc theses are chosen among the following research lines:
- Evaluating the impact of agricultural innovation in cropping systems and soil fertility management
- Innovative biocontrol preventive and curative strategies of new and emerging pests in Mediterranean climates
- Quality valorization of organic food through novel food product
- Sustainability of agricultural and natural systems
- Economic and market research
- Socio-economic impacts and impacts of support policies
**Learning outcomes:**
Acquiring knowledge and ability in:
- Conducting a research work
- Writing an experimental thesis
- Delivering seminars
- Preparing scientific paper to announce at National and International Conferences and/or published in scientific journals
- Elaborating strategies for managing pests and soil fertility
- Developing action plans and legislations for organic agriculture
- Conducting surveys and developing questionnaires for consumer and market analysis
- Organic food processing and safety

**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 in front of a national committee twice during the academic year.

**Supervised research work:** the research work carried as well as the student attitude and dedication are assessed by the Supervising Team.

**Final exam and thesis evaluation:** At the end of the programme, they submit a thesis and pass a final comprehensive oral exam in front of 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: Comparison of organic and conventional farms/wineries in Batroun region - Lebanon: sustainability case study. – 108 p.
- Author: SKAF Ludmila (Lebanon)
- Place of realization: IAMB - ITALY
- Thesis directors: G. Calabrese and S. Rouphael

II.
- Title: Development of strategies for biocontrol of the invasive pest Drosophila suzukii in Italy by means of Hymenopteran parasitoids – 87 p.
- Author: PANEL Aurore, Danièle, Claudine (France)
- Place of realization: IAMB - ITALY
- Thesis directors: N. Baser and G. Anfora

III.
- Title: Exploitation of organic palm date (Phoenix dactylifera L. cultivar Siwi) fruits collected from Bahariya Oasis (Egypt) through bioprocessing technology. – 56 p
- Author: HASSAN Bahaaaldin Mamdouh Mohamed Hassanin (Egypt)
- Place of realization: IAMB – ITALY
- Thesis directors: I. Cavoski and R. Di Cagno

IV.
- Author: IBRAHIM Mahmoud Mohamed Said Mohamed (Egypt)
- Place of realization: IAMB – ITALY
- Thesis directors: L. Guarrera and A. Abdelaziz

Further detailed information is available on: www.iamb.ciheam.org
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
Precision Integrated Pest Management (IPM) for Fruit and Vegetable Crops

- 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: **9 months, 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.
Precision Integrated Pest Management (IPM) for Fruit and Vegetable Crops

Evaluation procedure: written examination

14 October – 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 January 2020

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
31 January – 28 February 2020

UNIT 4 - SMART DECISION SUPPORT SYSTEMS IN 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
Precision Integrated Pest Management (IPM) for Fruit and Vegetable Crops

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 – 15 May 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

18 May – 05 June 2020
UNIT 8 - GLOBAL MARKET, COMMUNICATION, ENTREPRENEURSHIP & PROJECT (10 ECTS)
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
Precision Integrated Pest Management (IPM) for Fruit and Vegetable Crops

- 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)
**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:

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
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 Monilinia fructicola in stone fruits and monitoring of Erwinia 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
MASTER & MASTER OF SCIENCE PROGRAMMES IN “PRECISION INTEGRATED PEST MANAGEMENT (IPM) FOR FRUIT AND VEGETABLE CROPS” ACADEMIC YEAR 2019-2020

OBJECTIVES
The Master of Science Programme in “Precision IPM for Fruit and Vegetable Crops” has been designed to train graduate students with a background in plant health and food safety in a modern and sustainable integrated management of economically important pests affecting Mediterranean fruit and vegetable crops. The two-year programme is structured as follows: the first year (Master) is based on an intensive learning course and on the preparation of an IPM project, whereas the second year (Master of Science) is dedicated to scientific research on a plant or food health problem of major economic importance for the Mediterranean region. The main objective of the Master course is to prepare experts able to apply and transfer the IPM approach by combining all appropriate and innovative technologies in a total management system and by minimizing economic, health and environmental risks.

A one-week IPPC-FAO/CIHEAM Bari short-course is also organized, as integral part of the Master programme, to upgrade knowledge on the main principles and regulations on plant quarantine, certification of plant propagating material, trade facilitation and International Standards for Phytosanitary Measures (ISPMs).

In the MSc programme, students who have successfully completed the first year and have met all the prerequisites set by the Institute, carry out scientific research and draft a final thesis on an original topic related to a plant or food health problem of major interest for the Mediterranean region. The aim is to provide practical technical solutions and promote the transfer of knowledge to and between the Mediterranean countries. The scientific outcome of the research work is usually announced on the occasion of national and international conferences and/or published in scientific journals.

ORGANIZATION
First Year: 72 ECTS
• Nine Teaching Units 72 ECTS
Diploma: Master of MAIB / Master Universitario di I livello
Duration: 9 months

Second Year: 60 ECTS
• Preparatory research methodologies 10 ECTS
• Supervised research work 50 ECTS
Diploma: Master of Science
Duration: 12 months

ACCESS TO FURTHER STUDIES
Students who have been awarded the CIHEAM Master of Science Diploma have access to PhD programmes. CIHEAM Bari gives support to Doctoral studies in the framework of its collaboration with Italian and foreign Universities.

CANDIDATES’ PROFILE
Courses are addressed to graduate students, researchers, managers of research centres or public administrations, professionals in the following disciplines: plant health, crop production and protection, biology, biotechnology, agricultural engineering, horticultural sciences, farm management, natural sciences, environmental sciences (with basic background in plant protection).

Required level:
• Three years (180 ECTS) or Four years (240 ECTS) of university studies;
• Four years out of five of university studies (240 ECTS), upon agreement between the sending University and CIHEAM Bari;
• Five years of university studies (300 ECTS);
• Professionals having a degree (3-4years) and at least 2 years of experience in a field related to the Master Programme.

ADMISSION
Selection of students is based on:
1. Screening of documents sent online by candidates to support their application;
2. Online test to assess candidates’ technical skills and abilities;
3. Online English test;
4. Skype interview.

Submission of applications through the Online procedure
Deadline: May 31, 2019

COSTS
Registration fee: 200.00€/year.
Tuition fee: 500.00€/month (travel, accommodation and insurance expenses not included).

BENEFICIARIES
Master and MSc programmes are open to candidates of any nationality.

SCHOLARSHIPS
CIHEAM BARI grants full or partial scholarships to candidates according to a ranking list. Priority is given to students coming from CIHEAM-Member countries and other Mediterranean, Balkan and Middle Eastern Countries.

LANGUAGE OF INSTRUCTION: English

For further information and application procedure: www.iamb.ciheam.org
In the 1st year programme students build knowledge and develop skills in:

- basic IPM principles and methodologies
- proactive measures; sustainable use of pesticides and relative regulations; applications of alternative non-chemical pest management methods
- sound management of biotic and abiotic disorders in pre- and post-harvest; food quality and safety
- smart decisions support systems
- communication and entrepreneurship

In the 2nd year programme students build capacity and develop skills in:

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

FIRST-YEAR PROGRAMME
MASTER/MASTER UNIVERSITARIO DI I LIVELLO
OCTOBER 2019 – JUNE 2020

Unit I: Introductory courses
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. English language. Information and Communication Technologies (ICTs). Criteria for bibliographic research.

Unit II: Introduction to IPM
Basic principles 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.

Unit III: Pest/pathogen control

Unit IV: Smart Decision Support Systems in IPM

Unit V: IPM of vegetable crops in pre-harvest
Morphological, ecological, epidemiological characteristics of key pests and pathogens of vegetable crops. Pest monitoring, identification/detection and IPM in accordance with EU Regulations.

Unit VI: IPM of fruit tree crops in pre-harvest
Morphological, ecological, epidemiological characteristics of key pests and pathogens of fruit tree crops. Pest monitoring, identification/detection and IPM in accordance with EU Regulations.

Unit VII: Food safety

Unit VIII: Global market, communication, entrepreneurship & project
Good Agriculture Practices and Certification in the global market. Communication skills. Social innovation and Entrepreneurship ideas. IPM Project preparation and presentation.

Unit IX: IPPC-FAO/CIHEAM Bari short-course on ‘Developing phytosanitary capacity’

SECOND-YEAR PROGRAMME
MASTER OF SCIENCE

Preparatory research methodologies

Supervised research work
Topics of MSc theses on pests of fruit and vegetable crops are to be chosen among the following research lines:

- Sampling methodology and technical protocols
- Pests 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 mycotoxins and contaminants in agricultural products. Assessment of damages and losses.
The Master of Science Programme in "Land and Water Resources Management: Irrigated Agriculture" provides a two-year curriculum for graduates holding the title of agricultural or hydraulic engineers. The main objective of the Programme is to enhance the scientific knowledge and technological know-how of the candidates in water saving and land conservation issues especially in Mediterranean environments. The two-year programme is structured as follows: the 1st year is based on the completion of a series of specific one-week courses and the preparation of an irrigation project, whereas the 2nd year is dedicated to the development of applied research themes and experimental works.

The major topics are related to the following thematic areas:

- Water use efficiency and water productivity;
- On-farm irrigation systems performance;
- Large-scale irrigation systems performance and new technologies;
- Use of non-conventional water resources in agriculture;
- Integration and up-scaling of the above issues at the basin level;
- Sustainable use and management of Mediterranean soils;
- Economic aspects of Mediterranean agriculture.

Most of the above-said topics take into account the impact of climate variability.

A one-week Diploming Course is another opportunity offered to students: from a business idea to its project design: the enterprise culture in the innovation process management. Attending this module students will receive knowledge and basic skills to create, develop and communicate an innovative entrepreneurial idea, through a new and attractive method.

Access to the 2nd year is only guaranteed to students who have successfully completed the first year and have met all the prerequisites set by the Institute.

The 2nd year programme is based on the “problem solving” approach and research themes are derived from specific and relevant problems for which a practical technical solution is sought. In a rigorous scientific framework, works are targeted to innovatory solutions that are feasible in the integrated land and water system they are designed for. The Programme is carried out by MAIB staff in collaboration with national and international Institutions and Universities from Europe, Middle East, North Africa and the U.S.A.

**OBJECTIVES**

**ORGANIZATION**

First Year: 66 ECTS
- Seven Teaching Units 56 ECTS
- Irrigation Project 10 ECTS

Diploma: Master of MAIB / Master Universitario di I Livello
Duration: 9 months

Second Year: 60 ECTS
- Preparatory research methodology 10 ECTS
- Supervised research work: Thesis and Defence 50 ECTS

Diploma: Master of Science
Duration: 12 months

**ACCESS TO FURTHER STUDIES**

Students who have been awarded the CIHEAM Master of Science Diploma have access to PhD programmes. CIHEAM Bari gives support to Doctoral studies in the framework of its collaboration with Italian and foreign Universities.

**CANDIDATES’ PROFILE**

Courses are addressed to graduate students, researchers, managers of research centres or public administrations, professionals in the following disciplines: Agronomy/Agriculture engineering; Civil Engineering (Irrigation and Hydraulics); Agricultural Economics; Computer and Communications Engineering; Eco-system Management; Environmental and Water Resources Engineering; Irrigation; Plant Science/Horticulture; Hydrotechnic Engineering; Farm management; Soil Science/Geology

**ADMISSION**

Selection of students is based on:
1. Screening of documents sent online by candidates to support their application;
2. Online test to assess candidates’ technical skills and abilities;
3. Online English test;
4. Skype interview.

**COSTS**

Registration fee: 200.00€/year.
Tuition fee: 500.00€/month (travel, accommodation and insurance expenses not included).

**BENEFICIARIES**

Master and MSc programmes are open to candidates of any nationality.

**SCHOLARSHIPS**

CIHEAM BARI grants full or partial scholarships to candidates according to a ranking list. Priority is given to students coming from CIHEAM-Member countries and other Mediterranean, Balkan and Middle Eastern Countries.

**LANGUAGE OF INSTRUCTION:** English

For further information and application procedure: www.iamb.ciheam.org

**OBJECTIVES**

The Master of Science Programme in "Land and Water Resources Management: Irrigated Agriculture" provides a two-year curriculum for graduates holding the title of agricultural or hydraulic engineers. The main objective of the Programme is to enhance the scientific knowledge and technological know-how of the candidates in water saving and land conservation issues especially in Mediterranean environments. The two-year programme is structured as follows: the 1st year is based on the completion of a series of specific one-week courses and the preparation of an irrigation project, whereas the 2nd year is dedicated to the development of applied research themes and experimental works.

The major topics are related to the following thematic areas:

- Water use efficiency and water productivity;
- On-farm irrigation systems performance;
- Large-scale irrigation systems performance and new technologies;
- Use of non-conventional water resources in agriculture;
- Integration and up-scaling of the above issues at the basin level;
- Sustainable use and management of Mediterranean soils;
- Economic aspects of Mediterranean agriculture.

Most of the above-said topics take into account the impact of climate variability.

A one-week Diploming Course is another opportunity offered to students: from a business idea to its project design: the enterprise culture in the innovation process management. Attending this module students will receive knowledge and basic skills to create, develop and communicate an innovative entrepreneurial idea, through a new and attractive method.

Access to the 2nd year is only guaranteed to students who have successfully completed the first year and have met all the prerequisites set by the Institute.

The 2nd year programme is based on the “problem solving” approach and research themes are derived from specific and relevant problems for which a practical technical solution is sought. In a rigorous scientific framework, works are targeted to innovatory solutions that are feasible in the integrated land and water system they are designed for. The Programme is carried out by MAIB staff in collaboration with national and international Institutions and Universities from Europe, Middle East, North Africa and the U.S.A.
FIRST-YEAR PROGRAMME
MASTER/MASTER UNIVERSITARIO DI I LIVELLO
SEPTEMBER 2019 – JUNE 2020

Unit I: Introductory Courses
Introduction to the general principles of thematic areas of great interest for agriculture that can be shared between the 3 Master's courses: biodiversity, climate change and high technology for agriculture

Unit II: Land and Water Resources Management
Pedology and soil survey investigation; Application of geographic information systems in land and water resources management & remote sensing; Soil physics: water and solute movements; Surface Water Hydrology management; Groundwater hydraulics and pollution in agricultural settings; Soil erosion and desertification: monitoring, modelling and mitigation technologies; Water harvesting techniques.

Unit III: Irrigation Management: Soil-Water-Plant-Atmosphere Continuum
Agrometeorology and Seminar on Climate Change; Crop response to water and water use efficiency; Crop water requirements and practical irrigation scheduling; Crop growth modelling: Eco-physiological and Engineering aspects; Seminar on Agricultural aspects of irrigation methods.

Unit IV: Irrigation Management at Farm Level
Design, operation, maintenance and performance evaluation of sprinkler irrigation systems; Design, operation, maintenance and performance evaluation of trickle irrigation systems; Design, operation, maintenance and performance evaluation of surface irrigation systems.

Unit V: Irrigation Management at Distribution Systems Level
Design, operation, maintenance and performance evaluation of large scale open channel distribution systems; Design, operation, maintenance and performance evaluation of large scale pressurized irrigation systems; Seminar on Determining soil hydraulic properties by field-measured infiltration rates; Water management optimization; Seminar on Water resources management: the FAO approach.

Unit VI: Use of Non-Conventional Water Resources: Technical and Environmental Issues
Salinity control in relation to irrigation; Drainage and drainage systems design and management; Use of low quality waters: environmental and technical aspects; Seminar on Wastewater reuse in irrigation farming; Seminar on Non-conventional water use; Urban wastewater treatment for agricultural reuse.

Unit VII: Irrigation Management: Institutional, Economic and Environmental Aspects
Principles of farm economics; Optimal water allocation in irrigation sector; Cost/Benefit Analysis; Participatory irrigation management (PIM) and transfer (IMT) in a monitoring & evaluation perspective; Cost Recovery; International economics and the role of agriculture in economic development; Seminar on Geopolitics of water in the Mediterranean and Middle East

Case study - Irrigation Project Design

SECOND-YEAR PROGRAMME
MASTER OF SCIENCE
NOVEMBER 2019 – OCTOBER 2020

Preparatory research methodology
• Scientific English. Bibliographic research. Scientific writing (common to all students)
• Safe laboratory practices/ Modelling approaches and Statistical analysis/Laboratory and field methodologies (according to the thesis subject)

Supervised Research work: Thesis and Defence
Topics generally available for Master of Science theses are:
• Nexus Energy - Hydraulic Performance, based on Management of Large-Scale Pressurized Irrigation Systems
• Modernization techniques of pressurized irrigation system and related technical and socio-economic impacts
• Combination of new sensor technologies, satellite navigation and positioning technology to manage irrigation and fertilisation, and to face climate change impacts on agriculture
• Crop and soil-water modelling
• Eco-Efficiency analysis of irrigation
• Impact of treated wastewater use on the cropping pattern, irrigation management and irrigation systems performance
• Agro-hydrological modelling and modern techniques to estimate soil hydraulic parameters
• Land evaluation, agro-ecological characterization and action to reduce soil erosion losses
• Characterization, modelling and participatory simulations of water use and development strategies at the level of rural households and rural territories
• Economic policies and tools for an effective implementation of Water Demand Management in agriculture.
OBJECTIVES

The main objective of the Master of Science Programme in “Mediterranean Organic Agriculture” is to train graduate agronomists and agricultural engineers to produce innovation in the Mediterranean organic agriculture, creating and maintaining sustainability in the farming system, assisting and contributing to the development of the Organic Sector both at national and regional level. The two-year programme is structured as follows: the 1st year is based on the completion of a series of specific one-week courses and the preparation of an individual project, whereas the 2nd year is dedicated to the development of applied research themes and experimental works.

In this framework, further goals are:

• developing agronomic skills related to practices and techniques of Mediterranean Organic Agriculture production and management;
• developing skills related to legislation, inspection, certification and labelling of organically-produced food and fibres;
• building capacity in socio-economic analysis and market strategy for organic agriculture;
• providing trainees with the necessary tools and expertise to assess agricultural, environmental, and socio-economic opportunities and constraints of organic agriculture in different Mediterranean areas.

During the second year, students who have successfully completed the first year and who have met all the prerequisites set by the Institute, draft a thesis based on experimental research work. The scientific results derived from research work are usually announced on the occasion of International Conferences and/or published in scientific journals.

ORGANIZATION

First Year: 63 ECTS

• Eleven Teaching Units 56 ECTS
• Individual Project 7 ECTS
Diploma: Master / Master Universitario di I livello
Duration: 9 months

Second Year: 60 ECTS

• Preparatory research methodologies 10 ECTS
• Supervised research work 50 ECTS
Diploma: Master of Science
Duration: 12 months

ACCESS TO FURTHER STUDIES

Students who have been awarded the CIHEAM Master of Science Diploma have access to PhD programmes. CIHEAM Bari gives support to Doctoral studies in the framework of its collaboration with Italian and foreign Universities.

CANDIDATES’ PROFILE

Courses are addressed to graduate students, researchers, managers of research centres or public administrations, professionals in the following disciplines: Agricultural Sciences, Natural Sciences, Biology, Biotechnology, Food Sciences, Ecological/Environmental Sciences, Rural Sociology, Economy, Agribusiness.

Required level:

• Three years (180 ECTS) or Four years (240 ECTS) of university studies;
• Four years out of five of university studies (240 ECTS), upon agreement between the sending University and CIHEAM Bari;
• Five years of university studies (300 ECTS);
• Professionals having a degree (3-4years) and at least 2 years of experience in a field related to the Master Programme.

ADMISSION

Selection of students is based on:
1. Screening of documents sent online by candidates to support their application;
2. Online test to assess candidates’ technical skills and abilities;
3. Online English test;
4. Skype interview.
Submission of applications through the Online procedure
Deadline: May 31, 2019

COSTS

Registration fee: 200.00€/year.
Tuition fee: 500.00€/month (travel, accommodation and insurance expenses not included).

BENEFICIARIES

Master and MSc programmes are open to candidates of any nationality.

SCHOLARSHIPS

CIHEAM BARI grants full or partial scholarships to candidates according to a ranking list. Priority is given to students coming from CIHEAM-Member countries and other Mediterranean, Balkan and Middle Eastern Countries.

LANGUAGE OF INSTRUCTION: English

For further information and application procedure:

www.iamb.ciheam.org
FIRST-YEAR PROGRAMME
MASTER/MASTER UNIVERSITARIO DI I LIVELLO
OCTOBER 2019 - JUNE 2020

Unit I: Introductory Courses
Information and Communication Technologies; Criteria for bibliographic search and technology of search; Climate change and agriculture; Biodiversity & crops; Transboundary pests & diseases; Communication skills; High technologies for agriculture and natural resources management: Geographical Information Systems (GIS), Remote Sensing and Information Technology; English language

Unit II: Introduction to organic agriculture, agroecology and biodiversity
Principles of organic agriculture and Agroecology; Biodiversity and crops.

Unit III: Soil fertility management in organic farming
The soil: biotic and abiotic components; Cover crops, fertilizers and biomasses recycling for managing the soil fertility in organic farming; Plant nutrients management in organic farming; Organic ruminants farming.

Unit IV: Insect, disease and weed management
Plant protection against diseases in organic production; Organic insect management; Organic weeds management; Organic beekeeping.

Unit V: Global markets and marketing for organic agro-food products
Appraisal and assessment of local food systems through participatory methods: exploring the potential of organic farming; Principles of farm economics; Marketing of agro-food products; Sustainable supply chain; Consumer and Organic Value Chain: Analysis and Research.

Unit VI: Organic farming policy development and social aspects
Support policies for organic agro-food systems; National Action Plan for organic agriculture

Unit VII: Organic standards and legislation
Organic regulation in the EU and Mediterranean countries; Accreditation, certification and inspection in organic system

Unit VIII: Quality, safety and post-harvest handling of organic crops
Organic food quality and safety; Food Hygiene Regulations: rules and new requirements; Food quality and safety certification schemes; Sustainable food systems

Unit IX: Organic Mediterranean commodities production
Organic olive growing; Organic horticulture growing; Organic grapevine growing.

Unit X: Concepts in sustainable development
The role of the technical advisor in designing and managing a sustainable organic farm; Regulations and procedures for the authorization to the use of organic pesticides and fertilizers; Organic Production and Sustainable Development: Frameworks and Strategies; Economic Feasibility of Small Scale Organic Production and Risk Management Strategies

Unit XI: Project
The project is on “Action learning for preparing operators of Sustainable Agriculture” It focuses on the main following activities: Sustainable Agriculture Project (SAP); classroom activities; practical days; workshops

SECOND-YEAR PROGRAMME
MASTER OF SCIENCE
NOVEMBER 2019 - OCTOBER 2020

Preparatory research methodologies:

Supervised research work: Thesis and Defence

Topics generally available for Master of Science theses are:
Management of cropping systems and soil fertility, quality of agricultural products and agricultural by-product recovery
Biological control and natural biomolecules
Sustainability of agricultural and natural systems
Economic and market research
Socio-economic impacts and impacts of support policies