

# **Land and Water Resources Management: Irrigated Agriculture**

Organized by

Mediterranean Agronomic Institute of Bari

# Land and Water Resources Management: Irrigated Agriculture

MAI coordinator: Nicola LAMADDALENA

**Aims:** The aim of the Master Programme on "Land and Water Resources Management: Irrigated agriculture" is to improve capacities of high ranking officials and professionals, both agronomists and engineers, in land and water resources management in the Mediterranean region.

**Objectives:** The main objective of the Master Program in "Land and Water Resources Management: Irrigated agriculture" is to improve scientific knowledge and technological know-how of the 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 integrated management of land and water resources in Mediterranean agriculture considering agronomic, engineering, environmental and socio-economic aspects on different scales.



**Unit III**  
10-29 Jan '11

**IRRIGATION MANAGEMENT: SOIL-WATER-PLANT ATMOSPHERE CONTINUUM (6 ECTS)**

***Content:***

Crop response to water and water use efficiency.  
Crop water requirements and practical irrigation scheduling.  
Crop growth modelling: Eco-physiological and Engineering aspects.

***Learning outcomes:***

Learning how to manage irrigation in the soil-water-plant 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".

**Unit IV**  
31 Jan-19 Feb  
'11

**IRRIGATION MANAGEMENT AT FARM LEVEL (6 ECTS)**

***Content:***

Design, operation, maintenance and performance evaluation of surface irrigation systems .  
Design, operation, maintenance and performance evaluation of farm trickle irrigation systems.  
Design, operation, maintenance and performance evaluation of sprinkler 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.

**Unit V**  
21 Feb – 12  
March '11

**IRRIGATION MANAGEMENT AT DISTRIBUTION SYSTEMS LEVEL (6 ECTS)**

***Content:***

Design, operation, maintenance and performance evaluation of large-scale pressurized irrigation systems.  
Design, operation, maintenance and performance evaluation of large-scale open channel distribution systems.  
Water management optimisation.

***Learning outcomes:***

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

**Unit VI**  
14 March-2 Apr  
'11

**USE OF NON-CONVENTIONAL WATER RESOURCES: TECHNICAL AND ENVIRONMENTAL ISSUES (6 ECTS)**

***Content:***

Salinity Control in Relation to Irrigation.  
Drainage and drainage systems design and management.  
Use of low quality waters: environmental and technical aspects.

***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. Management and design of drainage systems.

**Unit VII**  
4-30 April '11

**IRRIGATION MANAGEMENT: INSTITUTIONAL, ECONOMIC AND ENVIRONMENTAL ASPECTS (8 ECTS)**

***Content:***

Principles of farm economics.  
Optimal water allocation in irrigation sector.  
Cost/Benefit Analysis.  
Cost Recovery.  
International economics and the role of agriculture in economic development.

***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, to assess water cost recovery.

2-7 May '11

**STUDY TOUR**

**Unit VIII**  
9 May – 18 June  
'11

**CASE STUDY - IRRIGATION PROJECT DESIGN (10 ECTS)**

***Content:***

Collection and analysis of climatic, soil and crop data. Determination of crop water requirements and gross irrigation requirements. Choice of the optimal cropping pattern based on different simulation scenarios (limited water availability, use of saline water, etc.) and economic criteria. Determination of specific continuous discharge.  
Hydraulic design of a large scale distribution network. Cost/Benefit analysis. Environmental Impact Assessment Applications  
Synthesis, conclusions and reporting.

***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, 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, conclusion.

20 - 25 June  
'11                      **FINAL EXAMS**

**EXAMINATIONS**

Participants take a written examination at the end of each Unit. Examinations are in the form of written exams in classroom, including problems, sets of questions, exercises or multiple choice questions.

Participants may retake failed exams once, and up to 8 ECTS credits (for full details, read the academic regulation).

For the elaboration of the irrigation project, the MAI scientific staff evaluates the group guided work as well as the individual contribution of each participant. The project is presented and defended orally during the final exam before the jury.

At the end of the course, participants take a comprehensive oral examination before an international jury.

**Language of instruction: ENGLISH and FRENCH**

**ACADEMIC STAFF**

In the Postgraduate specialization programme, instruction is given by MAIB internal staff and by 25 prestigious visiting professors from all over the world, coming from universities, higher institutions, international organizations and research centres.

In the Master of Science programme, student's research theses are supervised by MAIB researchers or external professors in collaboration with MAIB staff.

## **Part 2**

### **The Master of Science Thesis**

#### **Project (60 ECTS)**

Since the beginning of nineties up to the recent years, the research activities had been carried out following three parallel research lines, namely “Non-conventional Water Resources Management (NWRM)”, “Water Use Efficiency (WUE)” and “Collective Irrigation Systems (CIS)”. In the last years, these research lines have been integrated under the umbrella of a Collaborative Research Network on the topic of “Water Resources Management” in order to facilitate the exchange of information and to strengthen new strategies for water management in the Mediterranean region. This integration has been particularly promoted through the joint development of the Research Project on "Water Saving in Irrigated Agriculture" (RAP EU-DGI - CIHEAM 1998-2003) and, afterwards, it has been consolidated through the coordination of Thematic Network on “Water Saving in Mediterranean Agriculture” – WASAMED (2002-2007), founded by the European Commission 5th Framework Program and including 42 partners from 16 countries.

The on-going activities of the Land and Water Department are focused on joining the actions on water management with those on land conservation to achieve the overall goal of sustainable management of natural resources in the Mediterranean region. In fact, in 2007, the Land and Water Department of IAMB completed the coordination of a Thematic Network on “Land Conservation Management to Combat Desertification for the Sustainable Use of Natural Resources in the Mediterranean Coastal Zones” – MEDCOASTLAND, founded by the European Commission 5th Framework Program, and addressed itself to the problems of land degradation and desertification in the Mediterranean Basin.

This creates preconditions to acquire the characteristics of a Mediterranean Network on Land and Water Resources Management taking into consideration the above achievements and impacts of both Thematic Networks at local, regional and international level. This results not only in the continuation of the research activities but, even more, in the creation and maintenance of a comprehensive data-bank on natural resources (land and water) and other related issues in the Mediterranean region. Certainly, this would allow for a broad recognition of the new roles of IAMB Network such as the monitoring and assessment of land and water resources in the Mediterranean region, and development, evaluation and standardization of the strategies for their management.

The research activities of IAMB Dept. on Land and Water Resources Management cover different scales of application (from leaf - plant to watershed and region) and allow for 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; on the other hand, 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.

At any specific scale, particular agronomic and engineering aspects of management interact and transfer, throughout the scales, positive and negative effects of applied practices: a) water application efficiency and land management practices at plant and canopy scale; b) efficiency of irrigation method at field scale, c) performances of water distribution network at district scale and d) water quality and quantity at watershed scale. Within a regional context of sustainable development, these processes embrace also specific climatic conditions (and their variability and change) and integrate environmental and socio-economic aspects of land and water management.

The above activities are carried out both with L&W Dept staff and/or national-international expertise belonging to the L&W networking.

Actually, the research activities of Land and Water Division are going on through the Master of Science Program, PhD works and research projects as well.

#### **Research activities: topics generally available for Master of Science theses**

- Water use efficiency and water productivity
- Deficit irrigation and supplemental irrigation
- Crop water requirements and irrigation scheduling
- Soil-plant-atmosphere relationships and crop growth modelling
- Saline irrigation practice and management
- Treated sewage water and its use in agriculture
- Climate variability and changes and their impacts on agriculture
- Land evaluation and Agro-ecological characterization
- Performance assessment of CIS: operational analysis and rehabilitation
- Management and design of CIS and optimization of on-farm/CIS interaction
- Water energy consumption: irrigation water supply and pumping station regulation
- Water resources management: reservoir operation and groundwater exploitation

#### **INDICATIVE MASTER THESES REALIZED WITHIN THE AREA**

- 1. Title:** Water Allocation Strategies under Scarcity and specific socio-economic and environmental conditions in the Central Jordan Valley  
**Author:** Majd Azzam fadian Al Naver, Agricultural Engineer, Jordan (2009)  
**Place of realization:** MAI-Bari, Italy  
**Thesis directors:** M. Shatanawi, M. Todorovic & G. Flichman
- 2. Title:** Evaluation of Annualized Agricultural Non Point Source model (AnnAGNPS) for Runoff, Peak flow and Sediment yield estimations in the Carapelle watershed, Puglia Region (Southern Italy).  
**Author:** Wafa Chouaieb, Agricultural Engineer, Tunisia (2009)  
**Place of realization:** MAI-Bari, Italy  
**Thesis directors:** F. Gentile & T. Bisantino
- 3. Title:** L'effet combiné de la salinité et de la sècheresse sur le fonctionnement hydrique, le développement, la croissance et la productivité de la fève.  
**Author:** Atif Adil, Agricultural Engineer, Morocco (2008)  
**Place of realization:** MAI-Bari, Italy  
**Thesis directors:** N. Katerji
- 4. Title:** Optimisation du fonctionnement des réservoirs dans les systèmes d'irrigation à la demande par emploi des algorithmes génétiques (2007).  
**Author:** El ferchichi Abderraouf , Hydraulic and agricultural engineering, Tunisia  
**Place of realization:** MAI-Bari, Italy  
**Thesis directors:** N. Lamaddalena & F. Lebdi

- 5. Title:** Subirrigation vs. drip-irrigation: Effects on yield, fruit quality and nutrients concentration into the substrate and nutrient solution of soil-less grown salad tomato (2007).  
**Author:** AJNAOU Imad , Agricultural Engineer, Morocco  
**Place of realization:** MAI-Bari, Italy  
**Thesis directors:** P. Santamaria & R. Choukrallah
- 6. Title:** Investigation on soil erosion. Evaluation of the protective action of Vetiver grass hedges (2005).  
**Author:** Alban Janushaj, Civil Engineer, Albania  
**Place of realization:** MAI-Bari, Italy  
**Thesis directors:** Vito Sardo, Fadhila Lahmer & Atef Hamdy
- 7. Title:** Deficit irrigation of sunflower under Mediterranean environmental conditions: on-field experiment and modelling application (2005).  
**Author:** Ljubomir Zivotic, Agricultural Engineer, Serbia and Montenegro  
**Place of realization:** MAI-Bari, Italy  
**Thesis directors:** Mladen Todorovic, Rossella Albrizio & Atef Hamdy

*Further detailed information is available at <http://www.iamb.it>*