“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.

Part 1
Post graduate specialization programme

The programme is organized in 8 Units (60 ECTS)

Unit I
02-28 Nov.'09

Advanced knowledge basis (8 ECTS)

Content:

Application of Geographic Information Systems in land and water resource management
Pedology and soil survey investigation
Soil physics: water and solute movements
Agrometeorology

Learning outcomes:

Acquiring advanced knowledge-base through the application of GIS in land and water resources management, taking into account soil suitability on the basis of soil survey, and the soil physical characteristics. Water movement in the soil and water availability in relation to climate factors and their effects on plant growth and farm production and climate change

Unit II
30 Nov '09 –
09 Jan '10

WATER AND LAND RESOURCES MANAGEMENT (8 ECTS)

Content:

Surface Water Hydrology management
Groundwater Hydraulics and management
Erosion and soil conservation: new technologies and techniques
Land degradation and desertification: monitoring, assessment and mitigation technologies and policies

Learning outcomes:

Learning how to manage land and water resources: from processing to interpretation of rainfall data and factors affecting infiltration and runoff, underground water flow, underground water quality and pollution, factors affecting soil erosion, risk evaluation, monitoring and strategies of cultivated and bare land conservation, major causes of land degradation and strategies to combat desertification

Unit III
11 – 30 Jan ’10

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 of 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
01-20 Feb ’10

IRRIGATION MANAGEMENT AT FARM LEVEL (6 ECTS)

Content:
Design, operation, maintenance and performance evaluation of surface irrigation system 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
22 Feb – 13 March ’10

IRRIGATION MANAGEMENT AT WATER 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; and optimization of water management through planning and the application of dynamic management

Unit VI
15 March – 03 Apr '10

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
06 April – 08 May '10

IRRIGATION MANAGEMENT: INSTITUTIONAL, ECONOMIC AND ENVIRONMENTAL ASPECTS (6 ECTS)

Content:
Principles of farm economics
Optimal water allocation in irrigation sector
Cost/Benefit Analysis
Environmental Impact Assessment Applications
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 the farm scale, to perform cost/benefit analysis, to assess water cost recovery

10-15 May '10 **STUDY TOUR**

Unit VIII
17 May – 29 June '10

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. Synthesis, conclusions and reporting.

Learning outcomes:
The design of an irrigation project based on a case study of southern Italy will enable applying the knowledge acquired in the previous seven sections and working in a team work. Such a work will allow analysing and processing the data on climate, soil, crops, quality-oriented crop water requirements, choosing 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.

21 to 26 June '10 **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 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, then after, 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 focussed 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, the Land and Water Department of IAMB completed coordinating in 2007 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 to the problems of land degradation and desertification in the Mediterranean Basin.

This creates presuppositions 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 means not only the continuation of the research activities but, even more, 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 Resource Management cover different scales of application (from leaf - plant to watershed and region) and allow multilevel approach by means of interaction of various aspects (agronomic, engineering and economic) at different levels of investigation: on one side, agricultural management practices are scaled up, from leaf to irrigation district level, resulting in irrigation water demand of a entire district; on other side, this demand is translated into water release from the source and down-scaled through the water management practices from the source of water to the farms and single plants.

At any specific scale, particular agronomic and engineering aspects of management act together 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 with, both, L&W Dept staff and/or national-international expertises belonging to the L&W networking.

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

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:** 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

2. **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

3. **Title**: Subirrigation vs. drip-irrigation: Effects on yield, fruit quality and nutrients concentration into the substrate and nutrient solution of soilless grown salad tomato (2007)
   Author: AJNAOU Imad **,** Agricultural Engineer, Morocco
   Place of realization: MAI-Bari, Italy
   Thesis directors: P. Santamaria & R. Choukrallah

4. **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

5. **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

Detailed additional information is available at http://www.iamb.it