

## Advanced Course

# WASTEWATER REUSE FOR AGRICULTURE

Zaragoza (Spain), 11-15 May 2020

### 1. Objective of the course

In arid and semiarid regions, suffering from growing water scarcity, water quality deterioration and the uncertainties of climate change, non-conventional water resources development and use for agriculture is of utmost importance in responding to the increasing food demand of the rapidly and ever-growing population. In this regard, where the available water for agriculture is decreasing, the safe use of treated wastewater should be largely adopted. Treated, partially treated, or untreated wastewater has been used in agriculture for many years and in many parts of the world, but currently the challenge is to provide end-users with economically feasible water treatment technologies, protocols, guidelines and effective practices for reclaimed water use, considering safety, environmental, socio-economic and legal constraints. This should be reinforced by promoting social acceptance and providing recommendations to policy makers to overcome challenges regarding public perception.

This advanced course aims to integrate the key elements and technologies involved in the reuse of wastewater for agriculture to enhance the capacity of professionals working in this field. It focuses on the adoption of evidence-based solutions of reuse of treated wastewater at watershed and farm levels and its environmental and safety impacts, according to the principle of integrated water resources management and the circular economy approach.

At the end of the course participants will have:

- Better understanding of the role of wastewater reuse in water resource management and planning.
- Enhanced capacity to assess wastewater suitability for irrigation.
- Better knowledge of current and forthcoming regulatory frameworks on wastewater reuse at national and international levels.
- Knowledge of the necessary treatments for a safe wastewater fit-for purpose reuse, technically and economically viable.
- Insights on irrigation practices and techniques for the use of reclaimed water sources that preserve soil quality and crop production.
- Knowledge about strategies to improve the acceptance of wastewater reuse for food production.
- Awareness about the institutional and socioeconomic implications of wastewater reuse projects.
- Enhanced experience on the development and implementation of wastewater reuse projects through real success cases.

### 2. Organization

The course is jointly organized by the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), through the Mediterranean Agronomic Institutes of Zaragoza (IAMZ) and Bari (IAMB), and the International Center for Agricultural Research in the Dry Areas (ICARDA), in collaboration with the Regional Office for Near East and North Africa of the Food and Agriculture Organization of the United Nations (FAO) and the Action Plan for the Water Strategy of the 5+5 Dialogue.

The course will take place at IAMZ and will be given by well qualified lecturers from international organizations, and research centres, firms and associations in different countries.

The course will be held over a period of one week, from 11 to 15 May 2020, in morning and afternoon sessions.

### 3. Admission

The course is designed for 25 participants with a university degree, and is aimed at public and private professionals involved in water decision making, management, treatment, reuse, technical consultancy and research in the agricultural sector.

Given the diverse nationalities of the lecturers, knowledge of English, French or Spanish will be valued in the selection of candidates, since they will be the working languages of the course. The Organization will provide simultaneous interpretation of the lectures in these three languages.

### 4. Registration

Candidates must apply online at the following address:  
<http://www.admission.iamz.ciheam.org/en/>

Applications must include the *curriculum vitae* and copy of the supporting documents most related to the subject of the course.

The deadline for the submission of applications is **24 February 2020**. The deadline may be extended for candidates not requiring a visa and not applying for a grant if there are free places available.

Applications from those candidates requiring authorization to attend the course, may be accepted provisionally.

Registration fees for the course amount to 500 euro. This sum covers tuition fees only.





## 5. Scholarships

Candidates from Mediterranean CIHEAM member countries, from ICARDA Middle East and North Africa partners, and from FAO Near East and North Africa member countries, may apply for scholarships covering registration fees and for scholarships covering the cost of travel and full board accommodation in the Hall of Residence on the Aula Dei Campus.

Candidates from other countries who require financial support should apply directly to other national or international institutions.

## 6. Insurance

It is compulsory for participants to have medical insurance valid for Spain. Proof of insurance cover must be given at the beginning of the course. Those who so wish may participate in a collective insurance policy taken out by the Organization, upon payment of the stipulated sum.

## 7. Teaching organization

The course requires personal work and interaction among participants and with lecturers. The international characteristics of the course favour the exchange of experiences and points of view.

Formal lectures are illustrated by applied examples, real case studies in various contexts and debates. Practical sessions will be devoted to improve the skills in participatory processes for wastewater reuse projects.

A technical trip to Vitoria (Spain) is envisaged to give participants the opportunity to see a wastewater treatment plant and the wastewater reuse irrigation systems, discussing problem-solving and management strategies with local stakeholders.

Participants will be invited to provide a brief document about experiences in wastewater reuse in their specific regions/countries. These will be distributed to all participants and lecturers and will be the basis for a debate at the beginning of the course.

## 8. Programme

### 1. Water reuse in perspective (3 hours)

- 1.1. Role of wastewater resources in water-scarce conditions
  - 1.1.1. Historical review of the treated wastewater reuse in the agricultural sector
  - 1.1.2. Opportunities and challenges associated with the use of reclaimed water
- 1.2. The water reuse concept
  - 1.2.1. Wastewater sources
  - 1.2.2. Direct and indirect use of wastewater
  - 1.2.3. Treated, partially treated and untreated wastewater
- 1.3. Integration of wastewater resources in an integrated water resource management scheme
- 1.4. Water reuse in the circular economy context
- 1.5. Debate: experiences in participants' countries

### 2. Water quality parameters for assessing wastewater suitability for irrigation (2 hours)

- 2.1. Pathogens, heavy metals, organic compounds, emergent contaminants, nutrients, salts

- 2.2. Relationship of these parameters with the wastewater effects on the environment and the plant production quality and safety
- 2.3. Establishment of monitoring systems

### 3. Regulations and standards at national and international level (2 hours)

- 3.1. Water reuse and food and hygiene standards
- 3.2. The philosophy behind the new European legislation
- 3.3. Differences between Mediterranean countries

### 4. Water reclamation systems and implementation of treatment technologies (4 hours)

- 4.1. Wastewater collection, treatment, storage and distribution
- 4.2. Fit-for-purpose water treatment technologies
- 4.3. Low-cost treatments
- 4.4. Primary, secondary and tertiary wastewater treatments
- 4.5. Advanced treatments
- 4.6. Other products from the wastewater treatment (sludge, biogas, phosphorus, etc.)
- 4.7. Operation and maintenance of water reclamation systems
- 4.8. Continuous production vs seasonal uses
- 4.9. Decentralisation vs large treatment plants
- 4.10. Costs and technological efficiency

### 5. Irrigation with wastewater in arid and semi-arid zones (4 hours)

- 5.1. Quality of the effluent and choice of the irrigation system and devices
- 5.2. Effects in the short and long term on crops and soil
  - 5.2.1. Salinity effects
  - 5.2.2. Nutrient management
  - 5.2.3. Crop yield and quality
- 5.3. Innovative models and adaptation of irrigation techniques and practices
  - 5.3.1. Irrigation district level
  - 5.3.2. Farm level
- 5.4. Risk assessment

### 6. Institutional framework and socioeconomic aspects (2 hours)

- 6.1. Economic analysis
  - 6.1.1. Cost-benefit analysis to assess the economic feasibility
  - 6.1.2. Innovative financing and cost recovery
- 6.2. Social aspects
  - 6.2.1. Stakeholder and consumer acceptance
  - 6.2.2. Strategies to promote irrigation with treated wastewater in Europe and throughout the Mediterranean region
- 6.3. Institutional framework
  - 6.3.1. Inter-sectoral coordination requirements and policy coherence
  - 6.3.2. Development of scenarios for institutional set up/establishment of wastewater reuse management
  - 6.3.3. Public/private partnership

### 7. Experiences in reclaimed water use (6 hours + visit)

- 7.1. Real case studies of reclaimed water use at orchard, district irrigation and watershed scales
  - 7.1.1. Murcia region (Spain)
  - 7.1.2. Samra project (Jordan)
  - 7.1.3. Debate
- 7.2. Practical work – Play to learn exercise: participatory processes for wastewater reuse projects
- 7.3. Technical visit to an irrigation area using wastewater from a wastewater treatment plant

## GUEST LECTURERS

J.J. ALARCÓN, CSIC-CEBAS, Murcia (Spain)  
M. AL-HAMDI, FAO-RNE, Cairo (Egypt)  
A. ALLENDE, CSIC-CEBAS, Murcia (Spain)  
A. BATTILANI, CER, Bologna (Italy)  
B. DESSALEGN, ICARDA, Cairo (Egypt)  
D. ISIDORO, CITA-GA, Zaragoza (Spain)  
S. KOO-OSHIMA, FAO, Roma (Italy)

N. LAMADDALENA, CIHEAM-IAMB, Bari (Italy)  
A. LOPEZ, CNR-IRSA, Bari (Italy)  
J.E. ROUGIER, Lisode, Montpellier (France)  
A. SCARDIGNO, CIHEAM-IAMB, Bari (Italy)  
P. SIMÓN, ESAMUR, Murcia (Spain)  
A. SWELAM, ICARDA, Cairo (Egypt)  
Expert from Jordan to be appointed



5 حوار غرب المتوسط  
+ Dialogue de la Méditerranée Occidentale  
Western Mediterranean Dialogue