Advanced Course

TECHNOLOGICAL INNOVATION FOR INTENSIVE GREENHOUSE PRODUCTION

Almería (Spain), 9-13 March 2020

1. Objective of the course

Greenhouse cultivation is steadily increasing worldwide (with more than 120,000 hectares in the Mediterranean region) since it constitutes the most productive form of primary agricultural production. Some of the reasons that lead to this continuous increase are: (i) unfavourable and unpredictable outside climate conditions, that will be exacerbated as a result of climate change; (ii) water shortage, which is critical especially in Mediterranean countries; (iii) environmental pollution and food security problems; and (iv) ability of greenhouses to provide high-quality products all-year round.

Increased favourable conditions are achieved by both simple and advanced technologies for better crop and climate management, precise application of resources (water, fertilizers, energy and labour) and improved methods to fight pests and diseases, so that the environmental impact can be controlled and the use of resources optimized.

Mediterranean climate conditions enable the development of crop systems with low technology greenhouses but with medium productivity. Based on the current knowledge and the technologies available, it is possible to increase the yields of greenhouses in the Mediterranean area improving their economic and environmental sustainability.

The course presents how these current innovations can be applied and makes an overview of the opportunities offered by future developments. At the end of the course participants will have gained:

- A better understanding of the plant-climate interactions that condition sustainable production and optimal management.
- Knowledge of innovative systems and technologies that reduce energy needs, optimize the use of resources and labour and provide better conditions for crop growing.
- Critical understanding of the advantages and limitations of this technology according to different climate and socioeconomic conditions.
- Insights on the latest developments on IPDM programmes with emphasis on biological control and the new methods to introduce natural enemies in the greenhouses.
- Awareness of the importance of increasing circularity.
- Improved experience on innovation implementation through visits to greenhouses with available modern technology.
- An overview about how future trends in digital technology and new greenhouse conceptions can contribute to a more efficient and sustainable production and to extend economic production to less favourable locations.

2. Organization

The course is jointly organized by the **International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)**, through the **Mediterranean Agronomic Institute of Zaragoza (IAMZ)**, and **Cajamar Foundation.** The course will take place at the **Cajamar Experimental Station in Almería**, and will be given by well qualified lecturers from research centres, universities and private companies in different countries.

The course will be held over a period of one week, from 9 to 13 March 2020, in morning and afternoon sessions.

3. Admission

The course is designed for 30 participants with a university degree. It is intended for professionals of greenhouse production, as well as for technical advisors and researchers dealing with the modernization and intensification of the sector. The course is also open to professionals of the industries and R+D institutions involved in the development and implementation of new greenhouse technologies.

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.

Please display on a notice board if possible

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See updated information at
www.iamz.ciheam.org

INFORMATION CONTINUES OVERLEAF

The deadline for the submission of applications is **2 December 2019**. 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 CIHEAM member countries (Albania, Algeria, Egypt, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Spain, Tunisia and Turkey) may apply for scholarships covering registration fees and full board accommodation.

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.

The programme has an applied approach. Lectures are complemented by examples, practical sessions and technical visits.

Tutored practicals will provide participants with hands-on experience in the resolution of problems related to environmental control and energy balance in the greenhouse. Technical visits will show modern operation systems and management practices in commercial and experimental greenhouses.

8. Programme

1. **General overview: global situation of protected cultivation (1 hour)**
2. **Environmental factors and crop requirements (5 hours)**
   - 2.1. Greenhouse microclimate and plant interactions (radiation, temperature, humidity, CO2)
   - 2.2. Greenhouse energy balance
   - 2.3. Optimal management of greenhouse climate (sensory systems and data management, modelling)
   - 2.4. Practical group work on resolution of problems related with climate and energy balance
3. **Greenhouse design and cladding materials (4 hours)**
   - 3.1. Design criteria for different locations
   - 3.2. New films and additives
   - 3.3. Innovations in glass covers with new properties
4. **Installations for greenhouses (4 hours)**
   - 4.1. Innovation on screen properties: criteria for the selection
   - 4.2. Dehumidification options
   - 4.3. Cogeneration
   - 4.4. Geothermal energy
   - 4.5. Artificial lighting and CO2 enrichment
5. **Integrated pest and disease management (IPM) and biological control (BC) (4 hours)**
   - 5.1. Successful IPM development models: lessons learnt
   - 5.2. Recent innovations provided by public research and bioindustry for pest and disease control
   - 5.3. Challenges and opportunities for future innovation in biocontrol products
6. **Innovative greenhouse technologies for water and nutrients management (3 hours)**
   - 6.1. Sensors and decision support systems for irrigation and fertigation
   - 6.2. Optimum management of closed soilless systems
   - 6.3. Technologies for improving the use of low-quality water
7. **Circular horticulture (2 hours)**
   - 7.1. Use of plant waste from greenhouses
   - 7.2. Use of bio-compostable materials
   - 7.3. Recycling plastic materials from greenhouses
8. **Future trends in greenhouse technology (3 hours)**
   - 8.1. Production systems and energy sources
     - 8.1.1. Renewable energy
     - 8.1.2. (Semi)closed greenhouses
     - 8.1.3. Indoor/vertical farming
   - 8.2. Digitalization
     - 8.2.1. Advanced sensory systems and communication
     - 8.2.2. Automatization and robotization
     - 8.2.3. Modelling and decision support systems
     - 8.2.4. Internet of Things and cloud computing
9. **Technical visits**
   - 9.1. Cajamar experimental greenhouses (structures, cladding materials, CO2 capture from flue gases with active carbon)
   - 9.2. Commercial and experimental greenhouses with BC innovations
   - 9.3. Greenhouses with cogeneration for heating and CO2 enrichment
   - 9.4. Enterprise of valorisation of plastic materials, fabrication of fuels and chemical products

GUEST LECTURERS

L. ÁLVAREZ, Saint-Gobain, Gijón (Spain)
T. BOULARD, INRA/CNRS, Nice (France)
M.D. FERNÁNDEZ, Estación Experimental Cajamar, Almería (Spain)
I. GOYENA, Cicloplast, Madrid (Spain)
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50 CIHEAM IAM ZARAGOZA 1969.2019

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