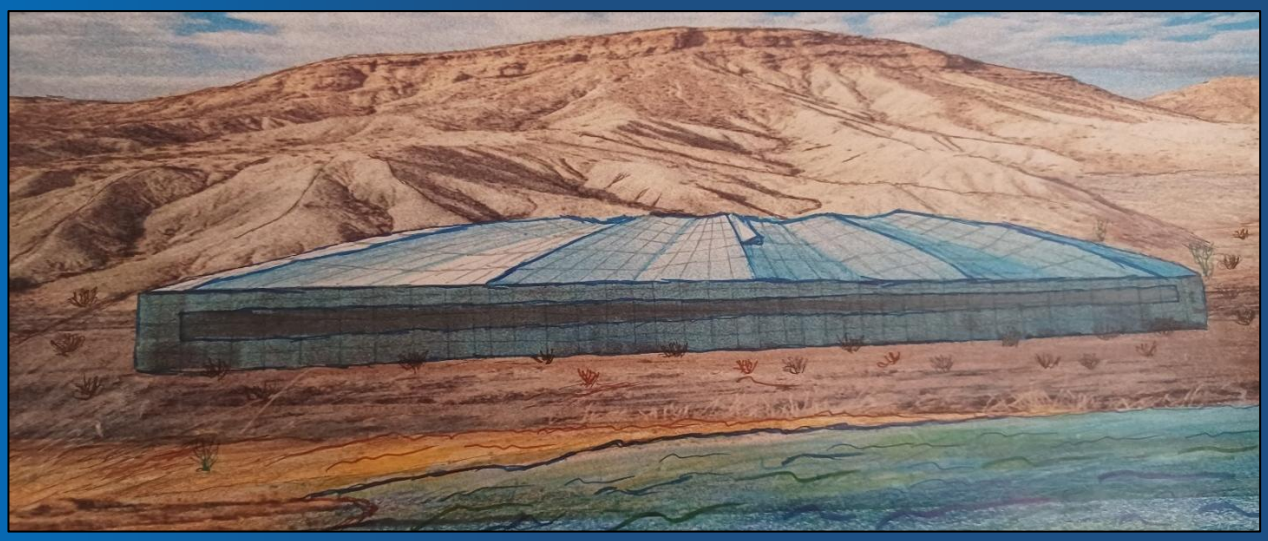
GreenSys 2025

International Symposium on Advanced Technologies and Management for Sustainable Greenhouse Systems



22-27 JUNE 2025
UNIVERSIDAD DE ALMERÍA
ALMERIA-SPAIN

Sustainable Controlled Environment Horticulture for the adaptation to Climate Change

UNIVERSIDAD DE ALMERÍA

ISHS
International Society for Horticultural Science

Welcome to Almería, Spain, for - International Symposium on Advanced Technologies and Management for Sustainable Greenhouse Systems (GreenSys 2025)

Spanish scientists welcome you to GreenSys2025, a great event to promote horticultural sciences and innovation worldwide around greenhouse technology.

Spain, a horticultural country

Spain is the leading producer of fruit and vegetables in the European Union, with a volume of more than 26 million tons in 2023.

Spain has fast become one of the most desired tourist destinations on the planet, being the second most visited country in the world, recording more than 85 million tourists in 2023.

Producer of fruit and vegetables in Europe

Tourist destination in the World

Almería, the province of protected crops

Almería is a modern city located in the historical Andalusian region of Spain. It has a long tradition in agriculture, starting during the transition from the Neolithic to the Bronze Age (4000-1800 b.C.) with the development of *Los Millares* complex, an archaeological site located 20 km northwest of Almeria. Today, the 33,000 ha of plastic greenhouses provide 3.7 million tonnes of fruits and vegetable along the year, allowing Almería to be the first horticultural production area in Spain with more than 100,000 jobs.

Institutions supporting the symposium

University of Almería (UAL) - https://www.ual.es/

International Society for Horticultural Science (ISHS) - https://www.ishs.org/

Chairs of the ISHS Divisions involved

Dr. In-Bok Lee - Precision Horticulture and Engineering.
Prof. Youssef Rouphael - Protected Cultivation and Soilless Culture.

Chairs of the ISHS Working Groups

Dr. Hicham Fatnassi - Computational Fluid Dynamics
Prof. Rafael Poyatos - Sensing Plant Water Status
Prof. Dr. Myung-Min Oh - Light in Horticulture
Prof. Luigi Manfrini - Mechanization, Digitization, Sensing and Robotics
Prof. Ningyi Zhang - Modelling Plant Growth, Environmental Control, Greenhouse Environment
Dr. Wei Lu - Design and Automation in Integrated Indoor Production Systems
Prof. Dr. Francisco Domingo Molina Aiz - Greenhouse Environment and Climate Control

Conveners

Prf. Dr. Diego Luis Valera Martínez - University of Almería. *ISHS Member of Division Precision Horticulture and Engineering.*
dvalera@ual.es

Prf. Dr. Francisco Domingo Molina Aiz – University of Almería - *ISHS Member of Division Precision Horticulture and Engineering and Workgroup Modelling Plant Growth, Environmental Control, Greenhouse Environment.*
fmolina@ual.es

Local Organizing Committee

Roberto García Torrente (CAJAMAR) – Director of Sustainability and Agri-Food Development of Grupo Cajamar.

Luis Miguel Fernández Sierra (COEXPHAL) – General Manager.

Alicia Cañadas Sánchez (PITA) – General Manager.

Antonio Jesús Zapata Sierra (UAL) - Director in Almería of the Official College of Agronomists (COAG).

Fernando Paniagua Salvador (COITAAL) – President of College of Agricultural Engineers of Almería (COITAAL).

Rosa María Ayala Palenzuela (UAL) - Director of Engineering School (ESI).

Fernando del Moral Torres (UAL) - Deputy Director of Agricultural Engineering of the ESI.

Alfredo Alcayde García (UAL) - Deputy Director of Industrial Engineering of the ESI.

Ángel Jesús Callejón Ferre (UAL) - Director of Engineering Department.

Jorge Antonio Sánchez Molina (UAL) - European and International Projects Office Coordinator.

Francisco Camacho Ferre (UAL) - ISHS Member of Division Protected Cultivation and Soilless Culture.

María Luisa Gallardo Pino (UAL) - ISHS Member of Division Protected Cultivation and Soilless Culture and Working Group Modelling Plant Growth, Environmental Control, Greenhouse Environment.

Miguel Urrestarazu Gavilán (UAL) - Member of the Research Group AGR-198 of the University of Almería.

Juan Reca Cardeña (UAL) - Member of the Research Group AGR-198 of the University of Almería.

Alejandro López Martínez (UAL) - Member of the Research Group AGR-198 of the University of Almería.

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Juan Martínez López (UAL) - Member of the Research Group AGR-198 of the University of Almería.

Mireille Nathalie Honoré (UAL) - ISHS Member of Division Precision Horticulture and Engineering and of Working Group Greenhouse Environment and Climate Control.

Maria de los Ángels Moreno Teruel (UAL) - Member of the Research Group AGR-198 of the University of Almería.

Patricia Marín Membrive (UAL) - Member of the Research Group AGR-198 of the University of Almería.

Technologies and management of Controlled Environment Agriculture (CEA) for adapt to Climate Change

Spirit of GreenSys 2025

The spirit of the GreenSys2025 symposium is to be able to exchange experiences among all the scientists who work on fruit and vegetable crops in Controlled Environment Agriculture (CEA). In addition, given the incomparable setting of the province of Almeria, with the second largest concentration of greenhouses in the world, the last day of the symposium will allow the incorporation of engineers who carry out their activity in the greenhouses of Almeria. In this way we will be able to contribute to the transfer of knowledge from the scientific community represented by the members of the ISHS to the productive sector of Almeria. The main topics of the papers presented at the congress are climate control in greenhouses and other systems where the environment surrounding plants can be controlled, such as urban greenhouses, vertical farming and plant factories. The optimization of nutrition and irrigation of the crops developed in CEA is another of the major topics of interest.

The development of new technologies such as LED lighting has made it possible to optimise the use of light for the development of horticultural crops, mainly in new CEA systems without the availability of natural light as plant factories and vertical farming. Systems for the mechanization or monitoring of the different components of protected crops are also presented. The environmental and socio-economic sustainability of protected crops emerges as a cross-cutting theme for all technologies and systems, as well as their resilience to Climate Change. All these topics will be addressed at the symposium from different points of view, as there are works dedicated to the study of new systems and technologies, the development of control systems for existing systems or their numerical modelling.

Thematic areas

- **Topic 1: Greenhouse Environment and Climate Control**.
  - 1.1. Climate control technologies.
  - 1.2. Computational Fluid Dynamics (CFD) in controlled environment horticulture.
  - 1.3. Energy in controlled environment agriculture systems.
  - 1.4. Modelling greenhouse environment.
  - 1.5. Semi-protected cultivation systems.

- **Topic 2**: **Mechanization, Digitization, Sensing and Robotics.**
  - 2.1. Artificial Intelligence (AI) and automation in indoor production systems.
  - 2.2. Digital twins.
  - 2.3. Labor in greenhouses.
  - 2.4. Precision horticulture and engineering.
  - 2.5. Robotics and sensing in greenhouses.

- **Topic 3: Crop production in controlled environment horticulture.**
  - 3.1. Crop management.
  - 3.2. Fruit quality in greenhouse horticulture.
  - 3.3. Plant genomics and breeding.
  - 3.4. Modelling plants physiology.
  - 3.5. Organic greenhouse horticulture.
  - 3.6. Plant protection.

- **Topic 4: Fertigation, water and growing medium.**
  - 4.1. Fertigation management.
  - 4.2. Greenhouse crops nutrition.
  - 4.3. Sensing plant water status and stress response.
  - 4.4. Soilless culture and growing media.
  - 4.5. Microalgae cultivation in photobioreactors.
  - 4.6. Aquaponics and aeroponic production.

- **Topic 5: Light in Horticulture.**
  - 5.1. Covering materials.
  - 5.2. Lighting technology.
  - 5.3. Effect of light on plant growth.
  - 5.4. Plant factory with artificial lighting (PFAL).
  - 5.5. Urban Horticulture.
  - 5.6. Vertical Farming.

- **Topic 6: Sustainable greenhouse production.**
  - 6.1. Circular bioeconomy in controlled environments.
  - 6.2. Environmental impacts of controlled environment agriculture.
  - 6.3. Life cycle assessment (LCA) in greenhouse production.
  - 6.4. Carbon and water footprints.
  - 6.5. Sustainable greenhouse systems and environmentally friendly technologies.
  - 6.6. Vulnerability and resilience of protected crops against Climate Change.

Keynote Speakers

• **François Laurens** (President of ISHS)
"*Practical uses and impacts of AI on Horticulture Research; what could be the role of ISHS*."
Institut National de Recherche pour l'Agriculture, l'alimentation et l'Environnement (INRAe), IRHS - VaDiPom, Beaucouzé – France.
https://irhs.angers-nantes.hub.inrae.fr/recherche/valorisation-de-la-diversite-des-pomoidees/personnel/laurens-f

• **Irineo Lorenzo López-Cruz** (Convener GreenSys 2023)
"*Horticulture and precision engineering*."
Universidad Autónoma Chapingo (UACh), Chapingo – México.
https://posgrado.chapingo.mx/profesor/dr-irineo-lorenzo-lopez-cruz/

• **In-Bok Lee** (Chair of the Division Precision Horticulture and Engineering of ISHS)
"*The role of Information and Communication Technology (ICT) for sustainable CEA systems and its development direction*."
Aero-Environmental Engineering Laboratory
Department of Rural Systems Engineering. Seoul National University (SNU) – South Korea. https://calslab.snu.ac.kr/a3ele/

• **Stefania De Pascale** (Convener GreenSys 2007)
"Fertigation, water and growing medium."
Department of Agriculture, University of Naples Federico II – Italy.
https://www.docenti.unina.it/#!/professor/53544546414e494144452050415343414c4544505353464e3635443437463833395 3/riferimenti

• **Feije de Zwart**
"*Light and energy in controlled environment agriculture systems*."
Greenhouse Horticulture & Flower Bulbs. Wageningen University & Research, Wageningen – The Netherlands.
https://www.wur.nl/en/persons/feije-de-zwart-1.htm

• **Fátima Baptista** (Convener GreenSys 2015)
"Sustainable greenhouse production."
Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento (MED), Universidade de Évora – Portugal.
https://www.med.uevora.pt/fatima-baptista-elected-director-of-the-med-for-the-mandate-2023-2026/

• **Roberto García Torrente**
"60 years of innovation for more sustainable agriculture in Almería."
Director of Sustainability and Agri-Food Development at Grupo Cajamar. Almería - Spain. https://www.plataformatierra.es/autor/roberto-garcia-torrente

Scientific Committee

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Colegio Oficial de Ingenieros Agrónomos de Andalucía

"Professional Commitment in Service to Society"

The Official Association of Agronomist Engineers of Andalusia (COIAA) is a public-law corporation that represents, protects, and defends the professional interests of its registered agronomist engineers, ensuring the proper practice of Agronomic Engineering for the benefit of society.

The profession of agronomist engineer has undergone a deep and continuous transformation over recent decades, adapting to the challenges of a globalized, dynamic, and demanding world. Today, agronomists are involved in every stage of the agri-food chain: from crop and livestock production to the design of agro-industrial facilities, water and natural resource management, land-use planning, and the application of technological innovation to the sector. This versatility makes us a key player in addressing today's major challenges: food security, climate change, energy efficiency, economic sustainability, and rural development.

In this context, COIAA's presence at GreenSys2025 reflects our institution's active commitment to the promotion of innovation, science, and knowledge transfer. With the active participation of agronomist engineers in the drafting of projects and site management of over 350 new greenhouses in recent years, Andalusia has become a benchmark in agronomic development applied to intensive horticulture. These professionals have been instrumental in technical planning, resource optimization, and the implementation of innovative solutions that ensure efficient, safe structures tailored to both local climatic conditions and the sector's demands for sustainability and productivity. In this model, the role of the agronomist engineer is essential: leading projects, advising companies and cooperatives, conducting research into new solutions, and ensuring that production is carried out according to the highest technical, environmental, and social standards.

Official Association of Agronomist Engineers of Andalusia ***Feeding the present and the future***

Politiv Europa SL

We are a subsidiary of **AA Politiv Ltd.**, a globally recognized Israeli company and a leader in the production of agricultural plastics and nets. Since its foundation, the company has focused on manufacturing high-quality films, using premium raw materials and cutting-edge production processes, with the clear objective of enhancing agricultural productivity.

With factories in Israel and Mexico, Politiv exports to nearly 50 countries, including key markets such as Mexico, Italy, Northern Europe, the Balkans, Russia, and Australia. We also operate distribution centers in the USA, South Africa, the Netherlands, and India, in addition to our European base in Spain.

Since 2016, Politiv Europe has been based in El Ejido, from where we serve the Spanish market comprehensively. We work closely with exclusive distributors in Motril and Huelva, offering specialized and locally adapted solutions to meet the specific needs of regional crops.

Sustainability is one of our fundamental pillars. We are committed to minimizing environmental impact by developing longer-lasting, recyclable, and more efficient plastic films. In parallel, **research and innovation** are at the core of our strategy, driving the continuous development of smart materials that address the evolving challenges of modern agriculture and climate variability.

Our mission is to position agricultural plastic as a **high-technology input**, capable of making a decisive difference in crop performance and farm profitability. To that end, we combine **technical expertise**, **product excellence**, and a **personalized service approach**, ensuring that our clients—whether farmers, installers, or distributors—receive trustworthy, high-value solutions tailored to their needs. At **Politiv Europe**, we work with a clear purpose: **to contribute to more efficient, productive, and sustainable agriculture**, while building long-term relationships based on trust, professionalism, and added value. https://www.politiveuropa.com/

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Pelemix is one of the leading companies in the production of high quality coco fibre and professional substrates for all types of crops (Vegetables, Berries, Nurseries, Seedlings & Propagation, Cannabis Cultivation) offering innovative and sustainable solutions for growers and agronomists all over the world. With a wide range of coir-based products (5 Kg blocks, Grow Bags, Open Tops, Grow Slabs...), Pelemix is committed to providing high quality substrates that improve plant growth, increase yields and promote sustainable agricultural practices. With more than 25 years of experience in the industry, Pelemix stands out for its commitment to excellence and customer satisfaction, has 7 own factories around the world and remains the sustainable, cost-effective and preferred choice of growing professionals worldwide. For more information, contact us via WhatsApp: https://shorturl.at/37Kex or visit www.pelemix.com.

Fundación Finca Experimental Universidad de Almería-ANECOOP

The UAL - ANECOOP Foundation was established in 2003 to coordinate research and experimentation between the ANECOOP Agricultural Cooperative and the University of Almeria. ANECOOP aims to develop horticultural projects that improve production processes economically, socially and environmentally. The University of Almeria supports this initiative by providing practical training and research opportunities for students and staff in agronomy. The Experimental Farm covers 11 ha, including 5 ha of greenhouses, two water ponds and three warehouses equipped for irrigation, laboratories, cold storage, cultivation chambers, workshops and offices (https://www.fundacionualanecoop.com/).

SYMPOSIUM SCHEDULE

Time	Monday 23				Tuesday 24				Wednesday 25				Thursday 26
8:00-8:30	Registration 8:00-18:00				Registration 8:00-18:00				Registration 8:00-18:00				Registration 8:00-12:00
8:30-8:45	Welcome by the conveners & ISHS ***(Paraninfo - A)***				**Topic 1 - Greenhouse Climate Control (A)** *Keynote speaker:* In-Bok Lee				**Topic 5: Light in Horticulture (A)** *Keynote speaker:* Feije de Zwart				**Technical sessions - Almería Horticulture (A)** *Invited speaker: Roberto García Torrente*
8:45-9:00	**Topic 2: Mechanization, Digitization and Robotics (A)** *Keynote speaker:* François Laurens												
9:00-9:15					**Coffee Break – *Paraninfo* Hall**				**Coffee Break – *Paraninfo* Hall**				**Coffee Break – *Paraninfo* Hall**
9:15-9:30	**OS-01 (A)** 1.1. Climate control technologies												
9:30-9:45					**OS-14 (A)** 1.1. Climate Control 1.3. Energy in CEA	**OS-15 (B)** 4.1. Fertigation management	**OS-16 (C)** 5.5. Urban Horticulture 5.6. Vertical Farming	**OS-17 (D)** 2.2. Digital twins	**OS-30 (A)** 5.3. Effect of light	**OS-31 (B)** 6.5. Sustainable greenhouses	**OS-32 (C)** 3.2. Fruit quality 3.3. Plant genomics 3.4. Modelling plants	**OS-33 (D)** 2.4. Precision horticulture and engineering	**TS-1 (*Paraninfo - A*)** Oral sessions for scientists and engineers of Almería companies
9:45-10:00	**Coffee Break – *Paraninfo* Hall**												
10:00-10:30	***Opening Ceremony (Paraninfo - A)*** Welcome by the authorities												
10:30-11:00	**Coffee Break – *Paraninfo* Hall**				**Coffee Break – *Paraninfo* Hall**				**Coffee Break – *Paraninfo* Hall**				**Coffee Break – *Paraninfo* Hall**
11:00-11:30	**OS-02 (A)** 1.1. Climate Control 1.3. Energy in CEA	**OS-03 (B)** 4.1. Fertigation management	**OS-04 (C)** 5.6. Vertical Farming	**OS-05 (D)** 3.4. Modelling plants physiology	**OS-18 (A)** 1.2. CFD	**OS-19 (B)** 4.5. Microalgae 4.6. Aquaponics	**OS-20 (C)** 5.4. Plant factory	**OS-21 (D)** 3.1. Crop management	**OS-34 (A)** 5.6. Vertical Farming	**OS-35 (B)** 6.5. Sustainable greenhouses	**OS-36 (C)** 1.2. CFD	**OS-37 (D)** 4.1. Fertigation management	**TS-2 (*Paraninfo - A*)** Oral sessions for scientists and engineers of Almería companies
11:30-12:00													
12:00-12:30													
12:30-13:00	***Poster presentations – Session 1*** **(Hall *Ciencias Salud* E)**				***Poster presentations – Session 4*** **(Hall *Ciencias Salud* E)**				***Poster presentations – Session 7*** **(Hall *Ciencias Salud* E)**				***Poster presentations – Session 10*** **(E)**
13:00-14:30	**Lunch – Restaurant of the University of Almería (F)**				**Lunch – Restaurant of the University of Almería (F)**				**Lunch – Restaurant of the University of Almería (F)**				**Lunch – Restaurant of the UAL (F)**
14:30-15:00													
15:00-15:30	**Topic 2: Mechanization, Digitization and Robotics** *Keynote speaker:* Irineo Lorenzo López-Cruz				**Topic 4: Fertigation, water and growing medium** *Keynote speaker:* Stefania De Pascale				**Topic 6: Sustainable greenhouse production** *Keynote speaker:* Fátima Baptista				***Farewell Speech - Closing ceremony*** **(A)** ISHS Young Minds Award Presentation of the next GreenSys2027 in Wageningen Final remarks by the Organizing Committee
15:30-16:00	***Poster presentations – Session 2*** **(Hall *Ciencias Salud* E)**				***Poster presentations – Session 5*** **(Hall *Ciencias Salud* E)**				***Poster presentations – Session 8*** **(Hall *Ciencias Salud* E)**				
16:00-16:30	**OS-06 (A)** 1.4. Modelling environment	**OS-07 (B)** 4.2. Crops nutrition	**OS-08 (C)** 5.6. Vertical Farming	**OS-09 (D)** 3.1. Crop management	**OS-22 (A)** 1.4. Modelling environment	**OS-23 (B)** 4.2. Crops nutrition	**OS-24 (C)** 5.1. Covering materials 5.2. Lighting technology	**OS-25 (D)** 2.1. AI and automation 2.2. Digital twins	**OS-38 (A)** 5.2. Lighting technology 5.4. Plant factory	**OS-39 (B)** 6.1. Circularity 6.3. LCA 6.5. Sustainability 6.6. Resilience	**OS-40 (C)** 2.4. Precision horticulture and engineering	**OS-41 (D)** 5.3. Effect of light on plant growth	
16:30-17:00													***Technical Tours*** *- Visit to the University of Almería Experimental Farm UAL-ANECOOP* *- Visit to commercial (Agricola Vasan S.L.) and experimental (IFAPA Centro La Mojonera) greenhouses in Almería*
17:00-17:30													
17:30-18:00	***Poster presentations – Session 3 / Coffee Break*** **(E)**				***Poster presentations – Session 6*** **/ Coffee Break (E)**				***Poster presentations – Session 9*** **/ Coffee Break (E)**				
18:00-18:30	**OS-10 (A)** 1.1. Climate control technologies	**OS-11 (B)** 4.4. Soilless culture	**OS-12 (C)** 5.2. Lighting technology	**OS-13 (D)** 3.5. Organic 3.6. Protection	**OS-26 (A)** 1.4. Modelling environment	**OS-27 (B)** 4.3. Water status	**OS-28 (C)** 5.3. Effect of light	**OS-29 (D)** 2.4. Precision horticulture 2.5. Robotics and sensing	***Business Meeting of ISHS Divisions*** **(A)**				
18:30-19:00													
19:00-19:15													
19:15-19:30	**Break to go to the workshop rooms**				**Break to go to the workshop rooms**								
19:30-20:00	**Workshop 1 (C)** – FAO Global South experiences		**Workshop 2 (B)** – Robotics and automation in greenhouses		**Workshop 3 (B)** CFD		**Workshop 4 (C)** Carbon and water footprint	**Workshop 5** Resilient CEA systems **(D)**	**Transport to the city of Almería**				
20:00-20:30													
20:30-21:00	**Assistance to Flamenco show (*Paraninfo* - A)**				**Transport to the city of Almería**				**Guided visit to the *Alcazaba* castle in the city of Almería**				
21:00-21:30													
21:30-22:30	**Catering - *Paraninfo* Hall and outside** **Transport to the city of Almería**				**Gala Dinner Restaurant *El Candelero* (Club de Mar)**								**Transport to the city of Almería**
22:30-23:00													

(A) ***Paraninfo*** **– capacity for 700 attendees**

(B) ***Salón de Grados*** **–** *capacity for 180 attendees*

(C) ***Economicas*** **– capacity for 130 attendees**

(D) ***Ciencias de la Salud*** **– capacity for 100 attendees**

(E) Hall ***Ciencias Salud*** **– Poster exhibition**

MAP OF THE UNIVERSITY OF ALMERIA

OFFICIAL/SOCIAL PROGRAM

Welcome Reception

All registered participants and accompanying persons are invited to attend the Welcome Reception. The Welcome Reception of the GreenSys 2025, where food and drinks will be served, marks the start of our symposium with an evening dedicated to relaxation, networking and entertainment.

Location: *Ayuntamiento de Almería* (Almería City Council) – *Plaza de la Constitución*
Date & Time: Sunday June 22 at 20:00-21:00

Opening Ceremony

All registered participants are invited to attend the Opening Ceremony.

Location: *Paraninfo* room at University of Almería Campus.
Date & Time: Monday June 23 at 8:30-8:45 (Scientific) and 10:00-10:30 (Authorities)

Flamenco Show

All registered participants and accompanying persons are invited to attend the Flamenco Show at GreenSys 2025 that will be a unique opportunity to admire one of the main exponents of Andalusian culture. Flamenco was recognized as an Intangible Cultural Heritage of Humanity by UNESCO on November 16, 2010.

Location: *Paraninfo* room at University of Almería Campus.
Date & Time: Monday June 23 at 20:30-21:30

Night of San Juan

Following the Flamenco Show, all registered participants and accompanying persons will be offered a cocktail dinner, providing another opportunity to chat in a relaxed atmosphere to celebrate the Night of San Juan. Celebrated every 23rd of June, San Juan Night marks the beginning of summer with fire, tradition, and celebration. In Andalucia, San Juan is celebrated on some towns, such as Almería, allowing the beaches to be used as campsites for a single night.

Location: Hall of *Paraninfo* and garden at University of Almería Campus.
Date & Time: Monday June 23 at 21:30-22:30

Banquet Dinner

The Banquet Dinner will allow those registered for this event to enjoy the cuisine of Almería next to the marina. A few meters from the restaurant is the pedestrian access to the "*El Alquife*" mineral loading dock (Cable Inglés). This historic monument, located on Las Almadrabillas beach, was built between 1902 and 1904 by The Alquife Mines and Railway Company Limited and is one of the most significant landmarks in the city of Almería.

Location: Restaurante Club de Mar El Candelero (closet to the Port of Almería)
Date & Time: Tuesday June 24 at 21:30-23:00 h

Visit to the Alcazaba

All registered participants and accompanying persons are invited to attend the guided visit to the Alcazaba. This historical monument, with its 1,430 m walled perimeter, is, after the Alhambra, the largest Muslim structure in Spain. It was built at the behest of Abd al-Rahman III in the 10th century, after the city's founding. It is a fortress consisting of three enclosures, the first two Muslim and the last Christian, built after the city's conquest by the Catholic Monarchs in 1489.

Location: *Conjunto Monumental de la Alcazaba de Almería* (close to the Almería City Council)
Date & Time: Wednesday June 25 at 20:00 - 21:30 h

Closing Ceremony

All registered participants are invited to attend the Closing Ceremony.

Location: *Paraninfo* room at University of Almería Campus.
Date & Time: Thursday June 26 at 15:00-17:00 h

Technical Tour

Following the Closing Ceremony at the University of Almería, participants in the GreenSys 2025 symposium will have the opportunity to visit the experimental greenhouses of the UAL-ANECOOP Foundation. The visit will also include greenhouses in the western part of Almería: at the Cajamar Experimental Station, at the IFAPA Research Center in La Mojonera, and at Agrícola Vasán S.L. (participants will be divided among the three centers).

Location: Departure of bus from the University of Almería Campus and arrival of bus to hotels in the city of Almería.

Date & Time: Thursday June 26 at 18:00 - 21:30 h

We draw the attention of participants to the fact that due to the busy time schedule and possible traffic jams, the return to the Hotels in Almería city may be delayed.

Lunches

Lunch will be provided for three days.

Location: Restaurant of the University of Almería
Date & Time: 23, 24, 25 & 26 June 13:20-15:00

Coffee Breaks

Coffee and tea will be served to all participants.

Location: *Paraninfo* Hall and garden at University of Almería Campus.
Date & Time: 23, 24, 25 & 26 June 9:00-9:30

Location: Hall and garden of *CC. de la Salud* building at University of Almería Campus.
Date & Time: 23, 24 & 25 June 17:30-18:00 with poster presentation.

Group Photo

A commemorative group photo will take place.

Location: *Paraninfo* Hall and garden at University of Almería Campus.
Date & Time: Thursday June 26 at 15:30-15:35 h

Post-symposium tour

After 4 intense days of work at the GreenSys 2025 symposium, participant swill have the opportunity to visit the Western theme park Minihollywood Oasys. A living West village, more than 800 animals and an aquatic area with a large refreshing oasis await you at Minihollywood Oasys, in the heart of the Tabernas desert.

Location: Departure and arrival of bus on Elba Almería Business & Convention Hotel
Date & Time: Friday June 27 at 10:00 - 17:00 h

This activity is not included in the conference registration fee. GreenSys2025 participants can indicate their interest in participating in this activity when collecting their conference accreditation at the registration desk. The cost of the activity will be 25 € which must be paid when boarding the bus for the trip on Friday, June 28th. This fee only covers admission to the park, with each participant responsible for meals at the various restaurants located within the park.

Workshops

WS1 - FAO Workshop: Experiences from the Global South on Climate and Water Management

Moderators:

Melvin Medina Navarro – FAO Sub-Regional Office for the Caribbean
Nazim Gruda – University of Bonn, Germany

Modality: Expert Keynotes and Roundtable Discussion
Date: Monday 23 June
Time: 19:30–20:30
Location: Salón de Grados of *Paraninfo* building (**C**)

Workshop objectives:

This workshop focuses on practical, sustainable strategies to improve the efficiency and resilience of horticultural systems for small-scale farmers. It emphasizes making research more useful, inclusive, and directly applicable, ensuring that small-scale farmers can access affordable innovations that enhance food security, climate resilience, and increase income. The workshop has the following objectives:

- Showcase low-cost, effective technologies that optimize water use, improve soil health, and enhance pest and disease management.
- Present the experience of climate-smart innovations implemented at small-scale farming conditions.
- Highlight the opportunities and challenges of bridging research and practice on greenhouse technology.

Workshop description:

A panel of experts from diverse regions and backgrounds shares insights from their experience applying protected cultivation technology to small-scale farmers' high-value vegetable production. They demonstrate ways to improve smallholder livelihoods while minimizing investment and operating costs. An interactive discussion follows, fostering idea exchange and actionable takeaways.

Program: Presentations (8–10 minutes each) + 10-minute roundtable discussion

19:30 – 19:35 Welcome and Introduction – Melvin Medina Navarro & Prof. Dr. Nazim Gruda.

19:35 – 19:45 Jervis Rowe (Jamaica) – “Evolution of greenhouse sector in Jamaica to address climate change effects and achieve food security”.

19:45 – 19:55 Gaius Eudoxie & Oral Daley (Trinidad & Tobago) – “Challenges and opportunities for research on greenhouse technologies in the context of the Caribbean region”.

19:55 – 20:05 Theodore Francis (Antigua & Barbuda) – “The use of new covering materials in low-cost structures for hydroponics to address water scarcity in the Caribbean”.

20:05 – 20:15 MSC Staff (Spain) – “Results on the use of anti-thermic plastic films to reduce temperature and increase the quality of vegetables under greenhouses in different locations”.

20:15 – 20:25 Leone Magliochetti Lombi (FAO) – “Adapted technology for efficient hydroponic vegetable production in Son La Province, Vietnam”.

20:25 – 20:30 Interactive Roundtable Discussion & Q&A – Moderated by Medina Navarro & Prof. Gruda.

WS2 - Automation and AI in Agriculture: Realistic Pathways to Industry?

Moderators:

José Luis Guzmán Sánchez and Jorge Antonio Sánchez Molina – University of Almeria, Spain

Modality: Debate
Date: Monday 23 June
Time: 19:30–20:30
Location: Salón de Grados of *Economicas* building (**B**)

Workshop objectives:

The main objectives of the Workshop are to explore some of the following questions:

- What are the current technological capabilities and limitations of process automation in agriculture?
- How far can existing tools go in automating complex agricultural tasks?
- In what ways can artificial intelligence enhance agricultural efficiency, decision-making, and sustainability?
- What types of AI models are most applicable to agricultural challenges?
- What are the primary barriers—technical, economic, or social—to adopting AI-driven automation in farming?
- How do these barriers vary between regions or types of agricultural systems?
- What were the critical factors for success or failure in those cases?
- How can we ensure that AI solutions are accessible and beneficial to small and medium-sized farms, not just large-scale operations?
- What ethical considerations arise when deploying AI and automation in agricultural settings?
- What stakeholders must be involved from the start?

Workshop description:

This workshop explores the current landscape of process automation in agriculture, with a particular focus on the integration of artificial intelligence (AI)-based solutions. Participants will engage in a critical analysis of the technical, economic, and social challenges faced in implementing automation technologies in agricultural settings. The session will also showcase real-world applications, examine the readiness of existing infrastructures, and foster discussion around the opportunities and limitations of AI in transforming agricultural practices. Designed for researchers, practitioners, and students, this workshop aims to bridge the gap between theoretical potential and practical deployment.

WS3 - How can the integration of Artificial Intelligence with Computational Fluid Dynamic modelling advance microclimate analysis in agricultural production systems?

Moderators:

Hicham Fatnassi – PSH-INRAE Avignon, Avignon, France

Modality: Debate
Date: Tuesday 24 June
Time: 19:30–20:30
Location: Salón de Grados of *Paraninfo* building (**B**)

Workshop objectives:

The main objectives of the Workshop are to explore some of the following questions:

- Examine how AI-driven approaches can improve the precision and computational efficiency of CFD-based simulations in agricultural production systems.
- Analyze how the integration of AI and CFD can contribute to more sustainable and efficient agricultural management practices.
- Establish a working group of researchers and practitioners interested in this topic to exchange experiences, share knowledge, and collaborate on overcoming challenges.

Workshop description:

This workshop explores the integration of Computational Fluid Dynamics (CFD) and Artificial Intelligence (AI) to enhance the accuracy, efficiency, and predictive capabilities of microclimate simulations in agricultural production systems. While CFD models are well-established, their application, particularly in three-dimensional simulations with high mesh resolution, remains computationally demanding and time-intensive. AI techniques, including machine learning algorithms, offer transformative potential by identifying complex patterns, improving data assimilation, and significantly accelerating computational processes.

Through contributions from specialists in CFD modelling, this session will highlight key areas where AI can enhance CFD applications, such as optimizing boundary condition settings, refining turbulence modelling, and developing real-time predictive models. Ultimately, the workshop will explore how the synergy between AI and CFD can contribute to more sustainable and efficient agricultural management practices.

Endorsement by ISHS Working groups:

Working Group Computational Fluid Dynamics.

WS4 - How to establish the right metrics to quantify the environmental sustainability of greenhouse systems?

Moderators:

Esteban José Baeza Romero – CIT COEXPHAL Almería, Spain

Modality: Debate
Date: Tuesday 24 June
Time: 19:30–20:30
Location: Salón de Grados of *Economicas* building (**C**)

Workshop objectives:

The main objectives of the Workshop are to explore some of the following questions:

- Identify and define key sustainability metrics for greenhouse systems.
- Critically examine existing sustainability assessment frameworks.
- Debate metric applicability across greenhouse types and regions.
- Identify gaps in current metrics (e.g. circularity and biodiversity) and their limitations.
- Propose refinements or hybrid approaches for better sustainability metrics.

Workshop description:

Defining robust, practical metrics to evaluate the environmental sustainability of greenhouse systems is an urgent priority for researchers, growers, and policymakers worldwide. Greenhouse systems vary enormously — from passive structures in Mediterranean climates to fully automated high-tech facilities in northern regions — yet sustainability assessments often rely on partial or inconsistent indicators. This interactive workshop will bring together an international community of greenhouse researchers to address a fundamental question: How can we agree on the right metrics to comprehensively measure and compare the environmental performance of greenhouse production systems across diverse contexts?

Participants will:

- Identify and define key sustainability dimensions — including energy use, water footprint, carbon emissions, resource circularity, and biodiversity impacts — and discuss suitable quantitative indicators for each.
- Critically examine the strengths and limitations of existing assessment frameworks, such as Life Cycle Assessment and carbon footprint protocols, in capturing the full range of environmental impacts.
- Explore how these metrics apply across different greenhouse technologies, climates, and regions, recognizing the trade-offs and variability in sustainability outcomes.
- Highlight gaps in current metrics, especially for aspects like circular resource use and biodiversity, and consider how to address them with better data and methodologies.
- Collaboratively discuss potential refinements or hybrid approaches that combine complementary tools and indicators, aiming to develop more holistic, adaptable sustainability benchmarks for greenhouse horticulture.

This workshop offers an open forum to share experiences, debate current practices, and sketch a path toward harmonized, scientifically sound sustainability metrics that support the greenhouse industry's transition toward more climate-resilient and environmentally responsible food production.

WS5 - How can we create sustainable and climate resilient CEA systems?

Moderators:

Leo Marcelis, Silke Hemming and Ep Heuvelink –Wageningen University and Research, The Netherlands

Modality: Debate
Date: Tuesday 24 June
Time: 19:30–20:30
Location: *Aula 9 of CC. de la Salud* building (**D**)

Workshop objectives:

Creating awareness of systems thinking about sustainable and climate resilient CEA production systems, aiming to secure the production of healthy fruit and vegetables.

This workshop focuses on young minds and strives to stimulate lively discussion among people of different backgrounds (expertise, culture, experience level, regional climates, etc).

Workshop description:

The workshop starts with two invited pitches:

- Environmental sustainability of CEA (high tech greenhouse, low tech greenhouse, vertical farm).
- Socio-economic viability of CEA (high tech greenhouse, low tech greenhouse, vertical farm).

Thereafter there will be lively discussion, starting with a debate on some provocative propositions.

Endorsement by ISHS Working groups:

Division of Precision Horticulture and Engineering
Division protected cultivation and soilless cultivation

PROGRAM

MONDAY

23 JUNE

Monday June 23, 2025

Time	Monday 23-06-2025			
8:00-8:30	Welcome – Registration 8:00-18:00			
8:30-8:45	***Opening Ceremony (Paraninfo - A)*** – Introduction by the conveners			
8:45-9:15	**Topic 2: Mechanization, Digitization, Sensing and Robotics** – *Keynote speaker:* François Laurens			
9:15-9:45	**OS-01 (A)** ***1.1. Climate control technologies*** OS01-01: Gene A. Giacomelli OS01-02: Jouke Campen			
9:45-10:00	**Coffee Break – *Paraninfo* Hall**			
10:00-10:30	***Opening Ceremony (Paraninfo - A)*** – Welcome by the authorities			
10:30-11:00	**Coffee Break – *Paraninfo* Hall**			
11:00-11:30 11:30-12:00 12:00-12:30	**OS-02 (A)** ***1.1. Climate Control*** ***1.3. Energy in CEA*** OS02-01: Yuxin Tong OS02-03: Ji-Yoon Lee OS02-04: L. Rossdeutsch OS02-05: Pinglin Zhang	**OS-03 (B)** ***4.1. Fertigation management*** OS03-01: S. Teoman Duran OS03-02: Afroditi Tsampalla OS03-03: Dharti Thakulla OS03-04: Jorge Flores OS03-05: Marisa Gallardo	**OS-04 (C)** ***5.6. Vertical Farming*** OS04-01: Akhil s Anand OS04-02: Aleksander Dabek OS04-03: G. Pennisi OS04-04: Kami Baghalian OS04-05: Michele D'Ostuni OS04-06: R.O. Malekroodi	**OS-05 (D)** ***3.4. Plants physiology*** OS05-01: Ilias Tsafaras OS05-02: Kyungmin Kim OS05-03: Sung Kyeom Kim OS05-04: Sungjay Kim OS05-05: Yasunaga Iwasaki
12:30-13:00	***Poster presentations – Session 1* (Hall *Ciencias Salud* E)** PS01-02: Diego L. Valera PS01-03: E. Romantchik PS01-04: J.E. Rosales Vicelis	PS01-05: Miguel Guzmán PS01-06: N. Katsoulas PS01-07: Nurrahmi Fadilah PS01-08: P.E. Bournet	PS01-09: Qichang Yang PS01-10: Rack-woo Kim PS01-11: R. Gil Castañeda PS01-12: Ruxandra Pop	PS01-13: Santiago Velez PS01-14: Seongha Kang PS01-15: S. Mirabella PS01-16: T. Seyoum Workneh PS01-17: Mengmeng Yang
13:00-15:00	**Lunch – Restaurant of the University of Almería (F)**			
15:00-15:30	**Topic 2: Mechanization, Digitization and Robotics** – *Keynote speaker:* Irineo Lorenzo López-Cruz			
15:30-16:00	***Poster presentations – Session 2*** PS02-01: E. Medrano PS02-02: Fang Wang PS02-03: Gil Carron PS02-04: Hiroki Umeda S02-05: Hyo In Yoon	PS02-06: Jaeyoung Jung PS02-07: J.A. Sánchez Molina PS02-08: Juyoung Hong PS02-09: Ken-ichiro Yasuba PS02-10: M. Moosavi-Nezhad	PS02-11: Hernandez Martinez PS02-12: Qichang Yang PS02-13: Rack-woo Kim PS02-14: Se-Yeon Lee PS02-15: Wei Wang	PS02-16: Yoon Jin Kim PS02-17: Ieltxu Gómez Iturrioz PS02-18: C. Gilarranz-Casado
16:00-16:30 16:30-17:00 17:00-17:30	**OS-06 (A)** ***1.4. Modelling environment*** OS06-01: E.A. Villagran Munar OS06-02: David Katzin OS06-03: V. Torres-Cervantes OS06-04: Peter Ling OS06-05: Soma Sugano OS06-06: Young-Bae Choi	**OS-07 (B)** ***4.2. Crops nutrition*** OS07-01: Abdullah Al Hosni OS07-02: C. El Nakhel OS07-03: Elise Tardy OS07-04: Mojtaba Delshad OS07-05: Zienab Ahmed OS07-06: Andrea D'Aprile	**OS-08 (C)** ***5.6. Vertical Farming*** OS08-01: Hwi-Chan Yang OS08-02: L. Mantovani OS08-03: Bert Deruyck OS08-04: M.M. Hossain OS08-05: Murat Kacira OS08-06: Sigurd Sannan	**OS-09 (D)** ***3.1. Crop management*** OS09-01: Akvile Virsile OS09-02: Helena Clauw OS09-03: Lichun Wang OS09-04: Reza Salehi OS09-05: Seungyong Hahm
17:30-18:00	***Poster presentations – Session 3 / Coffee Break*** PS03-01: Antonio J. Alvarez PS03-02: Caroline Provost PS03-03: Cédric Camps PS03-04: C. Giard-Laliberté	PS03-05: F. del Moral Torres PS03-06: Filipe Souza PS03-07: G. Samuoliene PS03-08: Grégory Calado	PS03-09: Luis Cendan PS03-10: Miguel Guzmán PS03-11: M. Urrestarazu	PS03-13: Helena Clauw PS03-14: Seul-Ki Lee PS03-15: Steffi Pot PS03-16: Won Jun Jo
18:00-18:30 18:30-19:00	**OS-10 (A)** ***1.1. Climate control*** OS10-01: M.N. Honoré OS10-02: L. Gourdo OS10-03: N. Katsoulas OS10-04: Seongheon Kim OS10-05: Adnan Rasheed	**OS-11 (B)** ***4.4. Soilless culture*** OS11-01: U. Samarakoon OS11-02: Marcus Travers OS11-03: Rui Yang OS11-04: T. Barbagli	**OS-12 (C)** ***5.2. Lighting technology*** OS12-01: Xiuming Hao OS12-02: Jung-Sun Kim OS12-03: Cristian Collado OS12-04: Anja Dieleman	**OS-13 (D)** ***3.5. Organic - 3.6. Protection*** OS13-01: E. Campana OS13-02: E. Hernandez OS13-03: Raúl Ortega Pérez OS13-04: Séverine Persello
19:00-19:30	**Break to go to the workshop rooms**			
19:30-20:00 20:00-20:30	**Workshop 1** – Experiences from the global South on climate and water management in the context of small-scale producers of high-value vegetables (Building **C**) **Moderators**: Melvin Medina Navarro and Nazim Gruda		**Workshop 2** – Robotics and automation in greenhouses (Building **B**) **Moderators**: J.A. Sanchez Molina, J.L. Guzmán-Sánchez and F. Rodríguez Díaz	
20:30-21:30	**Assistance to Flamenco show (Paraninfo - A)**			
21:30-22:30	**Catering - *Paraninfo* Hall and outside**			

Oral presentations: Monday June 23, 2025

KEYNOTE LECTURE 1 - Monday 23 (8:45-9:15 h)

Topic 2: Mechanization, Digitization, Sensing and Robotics. / *2.1. Artificial Intelligence (AI) and automation in indoor production systems.*

Chair: F.D. Molina-Aiz (*University of Almería - Dept. Engineering, CIAMBITAL, Almería, Spain*)

KN1

Practical uses and impacts of AI on Horticulture Research; what could be the role of ISHS

François Laurens
Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAe) - Institut de Recherche en Horticulture et Semences (IRHS) - VaDiPom - Valorisation de la Diversité des Pomoïdées. Centre d'Angers, 49071 Beaucouzé, France.

ORAL SESSION 01 - Monday 23 (10:00-10:30 h)

Topic 1: Greenhouse Environment and Climate Control / *1.1. Climate control technologies.*

9:15-9:30

OS01-01

Considerations for CEA greenhouse grape production

Gene A. Giacomelli
University of Arizona, Controlled Environment Agric. Ctr., CEA Building, 1951 E. Roger Road, Tucson, AZ 85719, United States of America.

9:30-9:45

OS01-02

Effect of fan capacity in a pad and fan greenhouse on the climate and water use efficiency

Jouke Campen
Wageningen University Research WUR, Hazenhoeve 48, Bennekom, Netherlands.

ORAL SESSION 02 - Monday 23 (11:00-12:30 h)

Topic 1: Greenhouse Environment and Climate Control */ 1.1. Climate control technologies – 1.3. Energy in controlled environment agriculture systems.*

Chair: Feije de Zwart (*Wageningen University and Research, Wageningen, The Netherlands*)

11:00-11:15

OS02-01

Double aeration system for partial heating in winter greenhouse production: Simulation analysis and experimental study

Yuxin Tong
IEDA, Chinese Academy of Agricultural Sciences, Zhongguancun South Street 12, Beijing, China.

11:30-11:45

OS02-03

Cost-effective CO_2 enrichment in a ventilated greenhouse

Ji-Yoon Lee
The University of Tokyo, 1-1-1 Yayoi, Bunkyo, Tokyo 113-8657, Japan.

11:45-12:00

OS02-04

Optimizing microclimate data for energy-efficient tomato cultivation: balancing yield, disease control, and sustainable heating strategies

Landry Rossdeutsch
Centre Technique Interprofessionnel des Fruits et Légumes (CTIFL), ZI Belle Etoile - Antarès, 35, allée des Sapins, 44483 Carquefou, France.

12:00-12:15

OS02-05

Rainwater basin as energy storage for heat pump-heated greenhouses

Pinglin Zhang
Wageningen University Research, Business Unit Greenhouse Horticulture, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands.

ORAL SESSION 03 - Monday 23 (11:00-12:30 h)

Topic 4: Fertigation, water and growing medium */ 4.1. Fertigation management.*

Chair: Giorgio Gianquinto (*University of Bologna, Bologna, Italy*)

11:00-11:15

OS03-01

Use of VegSyst-DSS for nutrients recommendations in perlite grown tomato in Mediterranean greenhouses

Marisa Gallardo
Universidad de Almería, Dept. Agronomy, Escuela Superior de Ingeniería, 04120 Almería, Spain

11:15-11:30

OS03-02

Molecular responses of tomato plants irrigated with treated wastewater in a controlled environment agriculture greenhouse

Afroditi Tsampalla
Institute of Plant Breeding and Genetic Resources (IPBGR), ELGO-Dimitra, 57001 Central Macedonia Thermi, Greece.

11:30-11:45

OS03-03

Evaluating cold plasma treatment for biofilm control and plant performance in hydroponic systems

Dharti Thakulla
University of Florida, 2550 HULL RD RM 1529, Room 1529, Gainesville Florida 32611, United States of America.

11:45-12:00

OS03-04

Effect of sodium chloride in the nutritive solution on quality of tomato crop (*Solanum Lycopersicon,* Miller var. Marmande Raf) in greenhouse

Jorge Flores
Posgrado en Hidrociencias, Colegió de postgraduados, Carr. Mex-Tex. Km 36.5, Montecillo, 56264, Mexico.

12:00-12:15

OS03-05

Use of organic fertilizers as an alternative for chemical products in curly lettuce production

Sevin Teoman Duran
Bursa Uludag University, Karacabey Vocatonal School, Crop and Animal Production Department, 16700 Bursa, Turkey.

ORAL SESSION 04 - Monday 23 (11:00-12:30 h)
Topic 5: Light in Horticulture / *5.6. Vertical Farming.*

Chair: Sigurd Sannan (*SINTEF Energy Research, Trondheim, Norway*)

11:00-11:15
OS04-01
Optimal integration of vertical farming and energy grid
Akhil S. Anand
Department of Engineering Cybernetics, Norwegian University of Science and Technology, D351 A, O. S. Bragstads Plass 2D, Glshaugen, 7034 Trondheim, Norway.

11:15-11:30
OS04-02
Hyperspectral imaging application for chemical compounds detection in a vertical farming production
Aleksander Dabek
Politecnico di Milano, Dipartimento di Meccanica, Campus Bovisa Sud, Via La Masa 1, 20156 Milano, Italy.

11:30-11:45
OS04-03
A critical analysis of yield potential, environmental impact and resource use of vertical farming
Giuseppina Pennisi
University of Bologna, Viale Giuseppe Fanin 44, 40127 Bologna, Italy.

11:45-12:00
OS04-04
Extending the sustainable application of vertical farming in horticulture: enhancing climate resilience and energy efficiency
Kami Baghalian
Anglia Ruskin University, ARU-Writtle, Lordship Road Writtle CM1 3RR, Chelmsford, United Kingdom.

12:00-12:15
OS04-05
Optimizing the design strategies of AlmaVFarm in Bologna: from a research facility to a hypothetical commercial upscaling
Michele D'Ostuni
Universidad de Bolonia, Via Madonna Della Tosse, 22, Florence, Italy.

12:15-12:30
OS04-06
Investigating biomass production potential of *Lemna minor* L. in a Vertical Farming System
Reyhaneh Ostad Malekroodi
University of Tehran, Dept. of Horticultural Science, Faculty of Agriculture, College of Agriculture, Natural Resources, 31587-77871 Karaj, Iran.

ORAL SESSION 05 - Monday 23 (11:00-12:30 h)

Topic 3: Crop production in controlled environment horticulture */ 3.4. Modelling plants physiology.*

Chair: Ep Heuvelink (*Wageningen University, Wageningen, The Netherlands*)

11:00-11:15

OS05-01

A self-calibrated transpiration model, ideal for greenhouse climate and irrigation control

Ilias Tsafaras
Wageningen University & Research, Wageningen, Netherlands.

11:15-11:30

OS05-02

Greenhouse evapotranspiration model analysis using deep learning predicted leaf area application

Kyungmin Kim
Seoul National University, Bdlg 200, Unit 3210, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea.

11:30-11:45

OS05-03

Cucumber Process Based Models for Smart Farming Decision Support

Sung Kyeom Kim
Kyungpook National University, 80 Daehak-ro, 41566 Daegu, Republic of Korea.

11:45-12:00

OS05-04

Enhancing size estimation of on-plant oriental melons using occlusion recovery models and diffusion model-based data augmentation

Sungjay Kim
Seoul National University, Gwanak-ro 1, Gwanak-gu, 08826 Seoul, Republic of Korea.

12:00-12:15

OS05-05

Estimation of the carbohydrates contents in leaves and stems of tomato using the N-C balance model

Yasunaga Iwasaki
Meiji University, Faculty of Agriculture, 2060-1 Kurokawa Asao ward, Kawasaki city 2150035, Japan.

POSTER SESSION 01 - Monday 23 (12:30-13:00 h)

Topic 1: Greenhouse Environment and Climate Control

PS01-02

Effect of the combination of double roof with sunlight spectrum photoconverter film and increased natural ventilation on the development of fungal diseases in a cucumber crop

Diego L. Valera
Dpto. Ingeniería, Universidad de Almería, Ctra Sacramento s/n, 04120 Almería, Spain.

PS01-03

Application of extractor with double rotor wind turbine in a greenhouse, for air energy recovery

Eugueni Romantchik
Universidad Autónoma Chapingo, Km. 38.5 Carretera México Texcoco Chaping, 56230 México, Mexico.

PS01-04

Calibration of a greenhouse-environment model with bio-inspired and evolutionary algorithms

Jose Eduardo Rosales Vicelis
Universidad Autonoma Chapingo, Km 38.5, Texcoco, Estado de Mexico, 56230, Mexico.

PS01-05

A Model to Predict Crop Transpiration in a Vertical Crop in a Greenhouse Based on Plant Position

Miguel Guzmán
Dpto. Agronomy, Universidad de Almería, Crtra. Sacramento s/n, 04120 Almería, Spain.

PS01-06

Evaluation of nitrogen and phosphorus leaching reduction in a cascade soilless system with cluster-cherry tomato combination

Nikolaos Katsoulas
University of Thessaly, Department of Agriculture Crop Production and Rural Environment, Fytokou St., 38446, Volos, Greece.

PS01-07

Predicting greenhouse heat demand and crop yield with optimised geothermical heat supply in tomato production in cool climates

Nurrahmi Fadilah
Leibniz-Institute of Vegetable , and Ornamental Crops (IGZ), Theodor-Echtermeyer-Weg 1, 14979 Grossbeeren, Germany.

PS01-08

Impact of insect nets on climate, aphid spread, fungal disease and yield in an unheated tunnel greenhouse with a lettuce crop

Pierre-Emmanuel Bournet
L'Institut Agro, 2, rue Le Nôtre, 49045 Angers, France.

PS01-09

Progress in Facility Agriculture Technology in the Gobi Desert

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), 12#, Zhongguancun South Street, Haidian District, Beijing City, 100081, China.

PS01-10

Dynamic Energy Model of a Naturally Ventilated Greenhouse and Analysis of Energy Loads

Rack-woo Kim
Kongju National University, Smartfarm Engineering, 54, Daehak-ro, 32439 Chungcheongnam-do, Yesan-eup, Yesan-gun, Republic of Korea.

PS01-11

Revolutionizing Intertropical Greenhouses: Modeling and Optimization of Natural Ventilation

Rodrigo Gil Castañeda
Universidad Nacional de Colombia, Calle 7 A Bis A 72 92, Casa 34, Bogotá 110821, Colombia.

PS01-12

Greenhouse systems and management in agriculture: optimizing sustainable practices for modern farming

Ruxandra Pop
The Research Institute for Agriculture, Economy and Rural Development - ICEADR, Marasti Boulevard nr 61, 011464 District 1 Bucharest, Romania.

PS01-13

Winter microclimate in a sweet pepper crop grown in a Mediterranean greenhouse with two combined passive heating systems

Santiago Velez
Universidad de Almería, 04120 Almería, Spain.

PS01-14

Analysis of air flow inside greenhouse by application of BLDC motor-based air circulation fan control system

Seongha Kang
Gyeongsang National University (GNU), 501 Jinju-daero, Jinju-si, Gyeongsangnam-do, Republic of Korea.

PS01-15

CFD-based analysis of crop transpiration dynamics for optimizing humidity control in small-scale vertical farming systems

Susanna Mirabella
Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133, Milano, Italy.

PS01-16

Performance, feasibility, and economic evaluation of a low-cost evaporative cooling system for fruit and vegetable storage

Tilahun Seyoum Workneh
Workneh, University of Kwa-Zulu Natal, Carbis Road, Scottsville, Pietermaritzburg, 3201, South Africa.

PS01-17

A preliminary research on temperature changes and regional adaptability of insulated plastic greenhouses

Mengmeng Yang
College of engineering, Shenyang Agricultural University, Shenyang 110866, China.

KEYNOTE LECTURE 2 - Monday 23 (15:00-15:30 h)

Topic 2: Mechanization, Digitization and Robotics / *2.4. Precision horticulture and engineering.*

Chair: Diego Luis Valera-Martínez (*University of Almería - Dept. Engineering, Almería, Spain*)

KN2

Controlled environment precision and smart horticulture: an overview

Irineo Lorenzo López-Cruz
Universidad Autónoma Chapingo (UACh), Chapingo, México.

POSTER SESSION 02 - Monday 23 (15:30-16:00 h)

Topic 2: Mechanization, Digitization, Sensing and Robotics

PS02-01

Development of a Decision Support System for the management of resource consumption of a cucumber crop in a Mediterranean greenhouse

Evangelina Medrano
IFAPA Centro La Mojonera, Camino San Nicolas, 1, 04745 Almería La Mojonera, Spain

PS02-02

Crop production in controlled environment horticulture

Fang Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), No. 36 Lazi East Street, Tianfu New District, Chengdu City, China

PS02-03

Agri-Photovoltaic in greenhouse: optimization of sunlight

Gil Carron
Agroscope, Route des Eterpys 18, 1964 Conthey, Switzerland

PS02-04

Non-destructive measurement technology for evaluating nutrient water flux in Strawberries

Hiroki Umeda
Nihon University, 1866 Kameino Fujisawa, Kanagawa 252-0880, Japan

S02-05

Correlation between tipburn severity and growth parameters in kimchi cabbage under high temperature

Hyo In Yoon
National Institute of Horticultural, and Herbal Science, 100 Nongsaengmyeong-ro, Wanju-gun, Jeonbuk State 55365, Republic of Korea

PS02-06

Development of a Land Use Change Estimation Model for Greenhouse-Concentrated Farmlands Using Satellite and Drone Imagery

Jaeyoung Jung
Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, 54896 Jeollabuk State Jeonju, Republic of Korea

PS02-07

Enhancing Greenhouse Automation Education: A Digital Twin Approach Using Immersive Technologies for Interactive and Remote Learning

Jorge Antonio Sánchez Molina
University of Almería, Department of Computer Science, Carretera Sacramento, s/n, 04120 La Cañada de San Urbano, Almería, Spain.

PS02-08

Comparison of Sprouting Period, Yield, and Bioactive Compounds in Male Asparagus Cultivars Under Shading Cultivation

Juyoung Hong
Department of Horticulture Industry, Wonkwang University, Iksan 54538, Republic of Korea

PS02-09

Analysis of the frequency of strawberry flower visitation using AI-based software for evaluating the activity of flower-visiting insects

Ken-ichiro Yasuba
Okayama University, 1-1-1 Tsushimanaka Kitaku, Okayama, Japan.

PS02-10

Optimizing Stock Plant Density to Enhance Resource Use Efficiency in Strawberry Propagation: Yield Gains vs. Quality Trade-offs

Moein Moosavi-Nezhad
Department of Horticulture, NC State University, Raleigh, United States of America

PS02-11

Identifying training needs and preferences for non-formal education in the horticulture industry workforce

Nelda Raquel Hernandez Martinez
University of Florida, 2550 Hull Road, Fifield Hall, Gainesville FL 32611, United States of America

PS02-12

Deep reinforcement learning for plant stem occlusion

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), 12#, Zhongguancun South Street, Haidian District, Beijing City, 100081, China

PS02-13

A Study on the Estimation Criteria for Wind Coefficient in Open Agricultural Facilities and Standardization of Disaster-resistant Specifications

Rack-woo Kim
Smartfarm Engineering, Kongju National University, 54, Daehak-ro, 32439 Chungcheongnam-do, Yesan-eup, Yesan-gun, Republic of Korea

PS02-14

Pesticide exposure assessment for operators, residents, and bystanders across different sprayer type

Se-Yeon Lee
Chonnam National University, College of Agriculture Life Sciences, 77, Yongbong-ro, 61186 Gwangju, Republic of Korea

PS02-15

Analysis and Optimization of Buried Pipe System for Desert Multi-span Plastic Greenhouse

Wei Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Sichuan, China

PS02-16

Development of a CAM Plant Production Digital Twins System for Schlumbergera truncanta Photosynthesis Pattern

Yoon Jin Kim
Seoul Women's University, 621 Hwarang-ro, Nowon-gu, Seoul, Republic of Korea.

PS02-17

Implementation of Lean Manufacturing in horticultural greenhouse in Almería (Spain)

Ieltxu Gómez Iturrioz
Agrícola Vasán, SL, Las Norias de Daza, Almería, Spain.

PS02-18

Smart irrigation head: enhancing water use in agriculture through IoT

Carlos Gilarranz-Casado
Escuela Técnica Superior de Ingeniería Agronómica, Alimentaria y de Biosistemas (ETSIAAB), Universidad Politécnica de Madrid, Avenida Puerta de Hierro 2, Madrid, Spain.

ORAL SESSION 06 - Monday 23 (16:00-17:30 h)

Topic 1: Greenhouse Environment and Climate Control */ 1.4. Modelling greenhouse environment.*

Chair: In-Bok Lee (*Seoul National University, Seoul, Republic of Korea*)

16:00-16:15

OS06-01

Modelling and microclimatic control in Colombian greenhouses using artificial neural networks

Edwin Andres Villagran Munar
Corporación Colombiana de Investigación Agropecuaria - AGROSAVIA, Sede Central, Mosquera, Cundinamarca, Colombia.

16:15-16:30

OS06-02

GreenLight2.0: an open modular platform for greenhouse modelling

David Katzin
Wageningen University and Research, Greenhouse Horticulture and Flower Bulbs, PO Box 644, 6700AA Wageningen, Netherlands.

16:30-16:45

OS06-03

Sensitivity analysis and calibration of dynamic model for spinach crop grown in a mini plant factory with artificial light

Victor Torres-Cervantes
Universidad Autónoma Chapingo (UACh), Chapingo – México.

16:45-17:00

OS06-04

Enhancing Short Term Forecasting of High Tunnel Temperature with Deep Learning

Peter Ling
Ohio State University, Department of Food, Agricultural and Biological Engineering 1680 Madison Avenue, Columbus Ohio, United States of America.

17:00-17:15

OS06-05

Design requirements for facilities and equipment in net zero energy greenhouse (ZEG) for decarbonizing greenhouse horticulture

Soma Sugano
Waseda University, Room701, Building N55, 3-4-1, Okubo, Shinjuku, Tokyo 169-8555, Japan.

17:15-17:30

OS06-06

Development of Physics-Informed Neural Network-Based Optimal Control Model for Greenhouse Environment

Young-Bae Choi
Seoul National University, Gwanak-ro 1, Seoul, Republic of Korea.

ORAL SESSION 07 - Monday 23 (16:00-17:30 h)

Topic 4: Fertigation, water and growing medium */ 4.2. Greenhouse crops nutrition.*

Chair: Rodney Thompson (*University of Almería, Department of Agronomy, Higher School of Engineering, Almeria, Spain*)

16:00-16:15

OS07-01

Effects of sodium chloride on tomato plant growth and fruit quality under constant water table

Abdullah Al Hosni
Oman Botanic Garden, Seeb, Muscat, P.O. Box: 808, Postal code 808, Oman.

16:15-16:30

OS07-02

Effect of plant-derived protein hydrolyzate and its minor molecular fraction on lettuce under combined saline and nutritional stress

Christophe El Nakhel
Università degli Studi di Napoli Federico I, Corso Garibaldi, 82, 80055 Portici NA, Italy.

16:30-16:45

OS07-03

Circular fertilizers originating from manure as a sustainable alternative for fertigation of hydroponic cultivation of strawberry, lettuce and tomato

Elise Tardy
INAGRO, Ieperseweg 87, 8800 Rumbeke-Beitem, Belgium.

16:45-17:00

OS07-04

Economic optimization of nutrient solutions using linear programming, case study: nutrient solution nitrogen levels for spinach growing

Mojtaba Delshad
Department of Horticultural Science, Faculty of Agriculture, College of Agriculture, Natural Resources, University of Tehran, 31587-77871 Karaj, Iran.

17:00-17:15

OS07-05

Enhancing Ghaf microgreen production through ZnO nanoparticle seed priming for sustainable agriculture

Zienab Ahmed
United Arab Emirates University UAEU, Collage of Food and Agriculture, Integrative Agriculture department, 15551 Abo Dhabi Al Ain, United Arab Emirates.

OS07-06

Comparative assessment of hydroponics, bioponics and aquaponics nutrient solutions for low-tech soilless cultivation of chili pepper (*Capsicum annuum*) in urban settings

Andrea D'Aprile
University of Bologna, Department of Agricultural and food science, Viale Fanin 44-46, 40127, Bologna, Italy.

ORAL SESSION 08 - Monday 23 (16:00-17:30 h)

Topic 5: Light in Horticulture / *5.6. Vertical Farming.*

Chair: Leo F.M. Marcelis (*Wageningen University Research WUR, Wageningen, The Netherlands*)

16:00-16:15

OS08-01

Comparison of growth and yield of different domestic micro dwarf tomato varieties and tomatoton concentrations

Hwi-Chan Yang
Kangwon National University, 1, Kangwondaehak-gil, Chuncheon-si, Gangwon, Chuncheon-si, Republic of Korea.

16:15-16:30

OS08-02

Advancing indoor farming: biodegradable substrates for cost-effective and sustainable agriculture

Lorenzo Mantovani
Politecnico di Milano, Dipartimento di Meccanica, Via Giuseppe La Masa 1, 20156 Milano, Italy.

16:30-16:45

OS08-03

Optimizing far-red light supplementation for enhanced growth and quality in butterhead lettuce

Bert Deruyck
Inagro VZW, Ieperseweg 87, 8800 Roeselare, Belgium.

16:45-17:00

OS08-04

Optimizing winter watermelon cultivation: enhanced chlorophyll content, photosynthesis rate, yield and quality using high-intensity LED supplementary lighting

Md Mukhtar Hossain
Faculty of Agriculture, Saga University, Saga-shi, SAGA 840-0027, Japan.

17:00-17:15

OS08-05

Optimizing airflow strategies and energy savings in vertical farm lettuce

Murat Kacira
Dept. of Biosystems Engineering, 1177 East 4th Street, Room 403, Shantz Building, 38, Tucson, AZ 85721-0038, United States of America.

17:15-17:30

OS08-06

Hybrid greenhouses: combining vertical farming and traditional greenhouse production

Sigurd Sannan
SINTEF Energy Research, Sem Saelands vei 11, 7465 Trondheim, Norway.

ORAL SESSION 09 - Monday 23 (16:00-17:30 h)

Topic 3: Crop production in controlled environment horticulture */ 3.1. Crop management.*

Chair: Eddie Schrevens (*Katholieke Universiteit Leuven, Biosystems Department, Heverlee, Belgium*)

16:00-16:15

OS09-01

Controlled environment agriculture for high-value, consistent medicinal plant material

Akvile Virsile
Lithuanian Research Centre for Agriculture, 30 Kaunas str., LT-54333 Kaunas distr. Babtai, Lithuania.

16:15-16:30

OS09-02

Mechanical pressure promotes pea germination for microgreen production

Helena Clauw
Ghent University, Faculty of Bioscience Engineering, Coupure links 653, 9000 Ghent, Belgium.

16:30-16:45

OS09-03

Comparison of growth, yield, fruit quality and economic benefit of short-term growth protected tomato under three cultivation modes

Lichun Wang
National Engineering Research Center for Information Technology in Agriculture, No.11 Shuguang Huayuan Middle Road, Haidian District, Beijing 100097, China.

16:45-17:00

OS09-04

Advancing grafted seedling production in Iran: A journey from traditional methods to modern plant factories

Reza Salehi
Department of Horticultural Sciences, College of Agriculture & Natural Resources, University of Tehran, Karaj 31587-77871, Iran.

17:00-17:15

OS09-05

The application of cut-flower technology to hemp (Cannabis sativa) increases yield in vertical farming systems

Seungyong Hahm
Chungnam National University, 99, Daehak-ro, Yuseong-gu, 34138 Daejeon, Republic of Korea.

POSTER SESSION 03 - Monday 23 (17:30-18:00 h)
Topic 3: Crop production in controlled environment horticulture
Topic 4: Fertigation, water and growing medium

PS03-02
Identification and evaluation of effective biological control agents and biopesticides in greenhouse winter crops in eastern Canada
Caroline Provost
Centre de Recherche Agroalimentaire de Mirabel, 9850 rue de Belle-Rivière, Mirabel J7N 2X8, Québec, Canada.

PS03-03
Varietal testing of ToBRFV-resistant tomato varieties in Swiss greenhouses
Cédric Camps
Agroscope, Research Division, Plant Production Systems, CH-1964 Conthey, Switzerland.

PS03-04
Enhancing the Health of Organic Greenhouse Agroecosystems While Maintaining Crop Productivity Through Plant-Based Fertilizers
Charlotte Giard-Laliberté
Laval University, 2325 Rue de l'Université, Quebec Quebec G1V 0A, Canada, Canada.

PS03-05
Impact of oxygen and air nanobubbles on metal micronutrient availability in tomato greenhouse cultivation
Fernando del Moral Torres
Departamento Agronomía, Universidad de Almería, 04120 Almeria Almería, Spain.

PS03-06
Effect of Magnetic Induction and Irrigation Levels on Lettuce Cultivation in Greenhouses
Filipe Souza
Universidade de Brasília, Campus Darcy Ribeiro, Asa Norte, 70910-900 Brasília-Distrito Federal, Brazil.

PS03-07
The potential of legumes in control environment agriculture
Giedre Samuoliene
Institute of Horticulture, Lithuanian Research Centre for Agriculture, and Forestry, Kaunas str. 30, LT-54333 Babtai, Lithuania.

PS03-08
Effect of four irrigation coefficients on yield, fruit quality, and water use efficiency of greenhouse-grown *Physalis peruvianum* L.
Edwin Andres Villagran Munar
Corporación Colombiana de Investigación Agropecuaria - AGROSAVIA, Sede Central, Mosquera, Cundinamarca, Colombia.

PS03-09
Assessing the efficacy of green manure and mycorrhizae in reducing salt stress on tomatoes grown inside a greenhouse
Luis Cendan
Florida International University, 11200 SW 8th Street, Miami Florida 33199, United States of America.

PS03-10
Amorphous Calcium Phosphate Nanofertilizers (nACP). Effects on Growth of Aquatic Macrophytes
Miguel Guzmán
Dpto. Agronomy, Universidad de Almería, Ctra. Sacramento s/n, 04120 Almería, Spain.

PS03-11

Effect of silicon application in the nutrient solution on fertigation parameters and yield of zucchini crop in soilless culture

Miguel Urrestarazu Gavilán
Universidad de Almería, La Cañada de San Urbano, 4120 Almeria, Spain

PS03-13

How tomato plants respond to blossom end rot conditions in greenhouse cultivation

Helena Clauw
Ghent University, Coupure Links 653, 9000 Gent, Belgium

PS03-14

Effect of nutrient sprays in mitigating frost damage during the apple bloom period

Seul-Ki Lee
Fruit Research Division, National Institute of Horticultural and Herbal Science (NIHHS), 100, Nongsaengmyeong-ro, Iseo-Myeon, 55365 Wanju-gun, Republic of Korea

PS03-15

Evaluating the potential of organic substrates as sustainable alternatives to stone wool for tomato and bell pepper cultivation

Steffi Pot
Proefcentrum Hoogstraten, Voort 71, 2328 Meerle, Belgium

PS03-16

Estimation of lily evapotranspiration at different phenological growth stages in a greenhouse

Won Jun Jo
Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, Republic of Korea

ORAL SESSION 10 - Monday 23 (18:00-19:15 h)

Topic 1: Greenhouse Environment and Climate Control */ 1.1. Climate control technologies.*

Chair: José Luis Guzmán-Sánchez (*University of Almería, Almeria, Spain*)

18:00-18:15

OS10-01

Influence of natural ventilation on crop productivity and fruit quality in Mediterranean greenhouses

Mireille Nathalie Honoré
University of Almería – Department of Engineering, CIAMBITAL, Ctra. Sacramento s/n, 04120 Almería, Spain.

18:15-18:30

OS10-02

Greenhouse Climate Optimization with Flexible Solar Panels and Innovative Thermal Storage Systems

Lahoucine Gourdo
Université Ibn Zohr, APTT 144 HAY Dkhla, 80000 Agadir, Morocco.

18:30-18:45

OS10-03

Effect of greenhouse shading screen control during summer on tomato and cucumber crop growth and yield

Nikolaos Katsoulas
University of Thessaly, Department of Agriculture Crop Production and Rural Environment, Fytokou St., 38446, Volos, Greece.

18:45-19:00

OS10-04

Estimation of heating and cooling load for optimization of air-source heat pump design using building energy simulation: a case study of the advanced digital greenhouse in South Korea

Seongheon Kim
National Institute of Agricultural Sciences, 310, Nongsaengmyeong-ro, Deokjin-gu, Jeonju, Republic of Korea.

19:00-19:15

OS10-05

Design and optimizing of Solar Reflector for Improved Daylighting and Energy Efficiency in Cold-Climate Greenhouses

Adnan Rasheed
University of Alberta, 11112A University Ave, Edmonton Alberta T6G 1Y6, Canada.

ORAL SESSION 11 - Monday 23 (18:00-19:00 h)

Topic 4: Fertigation, water and growing medium */ 4.4. Soilless culture and growing media.*

Chair: María del Carmen Salas (*Department of Agronomy, University of Almeria, Almeria, Spain*)

18:00-18:15

OS11-01

Effects of Substrate and Irrigation Frequency on Propagation of Tomato and Cucumber in Hydroponics

Uttara Samarakoon
Ohio State University ATI, 132B Halterman Hall, 1328 Dover Rd, Wooster, OH 44691, United States of America.

18:15-18:30

OS11-02

The use of aeroponics within glasshouse production to derisk supply chains

Marcus Travers
Anglia Ruskin University, Peterborough, PE1 3BW Cambridgeshire, United Kingdom.

18:30-18:45

OS11-03

Superheated steam torrefaction could upgrade spent coffee ground to peat alternative

Rui Yang
XiAn Jiaotong University, 36 East Lazi Street, Chengdu, Sichuan, 610213, China.

18:45-19:00

OS11-04

Dealing with Na accumulation in soilless systems with recirculation of drain water: a case study with high wire cucumber (*Cucumis sativus*)

Tommaso Barbagli
Wageningen University Research WUR, Violierenweg 1, 2665MV Bleiswijk, Netherlands.

ORAL SESSION 12 - Monday 23 (18:00-19:15 h)
Topic 5: Light in Horticulture */ 5.2. Lighting technology.*

Chair: Ningyi Zhang (*Nanjing Agricultural University, Nanjing, China*)

18:00-18:15

OS12-01

Reduced greenhouse gas emissions and energy costs in year-round controlled environment food production via sustainable lighting strategies

Xiuming Hao
Harrow Research and Development Centre, Agriculture and Agri-Food Canada, 2585 County Road 20, Harrow, ONT, N0R 1G0, Canada.

18:15-18:30

OS12-02

Potential applications of on-plant photodetectors for enhanced light management in plant cultivation systems

Jung-Sun Kim
Seoul National University, Gwanak-ro 1, 08826 Gwanakgu Seoul, Republic of Korea.

18:30-18:45

OS12-03

Photoperiod and light spectrum manipulation optimize soybean speed breeding

Cristian Collado
North Carolina State University, 5304 Kaplan Dr, Raleigh, NC 27606, United States of America.

18:45-19:00

OS12-04

Dynamic lighting: from physiological processes to application in commercial practice

Anja Dieleman
Wageningen UR Greenhouse Horticulture, PO Box 644, 6700 AP Wageningen, Netherlands

ORAL SESSION 13 - Monday 23 (18:00-19:15 h)

Topic 3: Crop production in controlled environment horticulture */ 3.5. Organic greenhouse horticulture. – 3.6. Plant protection.*

Chair: Martine Dorais (*Laval University, Quebec, Canada*)

18:00-18:15

OS13-01

Reducing Synthetic Fertilizers in Lettuce Cultivation through Biochar and Compost: A Sustainable Approach under the Farm to Fork Strategy

Emanuela Campana
Universidad de Napoles, Via Università, 100 - Portici 80138 Napoli, Italy.

18:15-18:30

OS13-02

Air monitoring in the greenhouse

Estuardo Hernandez
Wageningen University Research WUR, Violerenweg 1, 2665 MV Bleiswijk, Netherlands.

18:30-18:45

OS13-03

Organic farming increases soil fertility and microbiological diversity in intensive agriculture

Raúl Ortega Pérez
Department Agronomy. University of Almeria, CIAIMBITAL, Ctra. Sacramento sn 04120., Almería, Spain.

18:45-19:00

OS13-04

Dynamic Agrivoltaics as a Tool for Reducing Pest Pressure in Crops

Séverine Persello
Sun'Agri, 45 allée Yves Stourdze, 34830 Clapiers, France.


PROGRAM
TUESDAY
24 JUNE

Tuesday June 24, 2025

Time	Tuesday 24-06-2025			
8:00-8:30	Welcome – Registration 8:00-18:00			
8:30-9:00	**Topic 1 - Greenhouse Climate Control (A)** – *Keynote speaker:* In-Bok Lee			
9:00-9:30	**Coffee Break – *Paraninfo* Hall**			
9:30-10:00 10:00-10:30	**OS-14 (A)** ***1.1. Climate Control*** ***1.3. Energy in CEA*** OS14-01: Yuta Ohashi OS14-02: Hatterman-Valenti OS14-03: N. Katsoulas OS14-04: T.S. Workneh	**OS-15 (B)** ***4.1. Fertigation management*** OS15-01: Doudou Guo OS15-02: I. Chatzigeorgiou OS15-03: J.E. Rubiños Panta OS15-04: Qingwu Meng	**OS-16 (C)** ***5.5. Urban Horticulture*** ***5.6. Vertical Farming*** OS16-01: Scarascia-Mugnozza OS16-02: Jin-Seok Lee OS16-03: Michele D'Ostuni OS16-04: Ryo Matsuda	**OS-17 (D)** ***2.2. Digital twins*** OS17-01: Jack Verhoosel OS17-02: J.A. Sánchez Molina OS17-03: M. van der Meer OS17-04: Athanasios Sapounas
10:30-11:00	**Coffee Break – *Paraninfo* Hall**			
11:00-11:30 11:30-12:00 12:00-12:30	**OS-18 (A)** ***1.2. CFD*** OS18-01: Ilias Tsafaras OS18-02: Jung-Hoo Song OS18-03: R. Gil Castañeda OS18-04: Wito Plas OS18-05: Yunwoo Cho OS18-06: Zouhair Charqui	**OS-19 (B)** ***4.5. Microalgae - 4.6. Aquaponics*** OS19-01: Faiqa Atique OS19-02: Teresa Piovano OS19-03: Helena Vitoshkin OS19-04: Maria Ravani OS19-05: Michele Ciriello OS19-06: Faiqa Atique	**OS-20 (C)** ***5.4. Plant factory*** OS20-01: E. Fitz-Rodríguez OS20-02: Eiji Goto OS20-03: Qichang Yang OS20-04: Qingming Li OS20-05: Rongmei Fu OS20-06: Takashi Ishii	**OS-21 (D)** ***3.1. Crop management*** OS21-02: Jingu Kim OS21-03: Nick Cooley OS21-04: Nick Gould OS21-05: Yune Cao OS21-06: Zixin Yao
12:30-13:00	***Poster presentations – Session 4* (Hall *Ciencias Salud* E)** PS04-01: A. Sripawatakul PS04-03: Bingjie Shao PS04-04: Fang Wang	PS04-05: Jinwoo Lee PS04-06: Jeongmin Yun PS04-07: Kurumi Torigoe PS04-08: Miguel Guzmán	PS04-09: Nam Hyun Im PS04-10: Xiaomin Wang PS04-11: Taewon Moon PS04-12: Tomohiro Jishi PS04-13: Wei Wang	PS04-14: Xinlan Luo PS04-15: Yuta Ohashi PS04-16: Yuya Mochizuki PS04-17: Lui Mei
13:00-15:00	**Lunch – Restaurant of the University of Almería (F)**			
15:00-15:30	**Topic 4: Fertigation, water and growing medium** – *Keynote speaker:* Stefania De Pascale			
15:30-16:00	***Poster presentations – Session 5* (Hall *Ciencias Salud* E)** PS05-01: Diego L. Valera PS05-02: A. Nematpour PS05-03: E. Romantchik PS05-04: Fang Wang	PS05-05: Geon Hyeong Kim PS05-06: G. Pennisi PS05-07: Gregorio Grassi PS05-08: I. Lycoskoufis	PS05-09: Koichi Yoshi PS05-10: M. Carmen Salas PS05-11: Michel Verheul PS05-12: Miguel Guzmán	PS05-13: Moon-Sun Yeom PS05-14: Qichang Yang PS05-15: Qichang Yang PS05-16: Xiuming Hao
16:00-16:30 16:30-17:00 17:00-17:30	**OS-22 (A)** ***1.4. Modelling environment*** OS22-01: Caterina Carpineti OS22-02: Murat Kacira OS22-03: Gert-Jan Swinkels OS22-04: Hyo-Hyeog Jeong OS22-05: Simon van Mourik OS22-06: Takaya Ishimori	**OS-23 (B)** ***4.2. Crops nutrition*** OS23-01: Abdullah Al Hosni OS23-02: Garrett Owen OS23-03: H. Restrepo-Diaz OS23-04: Raul I Cabrera OS23-05: Rosa Raudales OS23-06: Wei Wang	**OS-24 (C)** ***5.1. Covering materials*** ***5.2. Lighting technology*** OS24-01: Cristian Collado OS24-02: Chun-Ting Cho OS24-03: I. Schouten OS24-04: L. Cammarisano OS24-05: Yao Hervé Yao OS24-06: Young-Ho Kim	**OS-25 (D)** ***2.1. AI and automation*** ***2.2. Digital twins*** OS25-01: Kota Shimomoto OS25-02: Gaia Moretti OS25-03: Jack Verhoosel OS25-04: Anja Dieleman
17:30-18:00	***Poster presentations – Session 6 / Coffee Break*** PS06-02: C.C. Martínez Gaitán PS06-03: Jie He PS06-04: Michael Zankel	PS06-05: Miguel Guzmán PS06-06: Mi-Young Roh PS06-07: P. Marín-Membrive PS06-08: P. Marín-Membrive	PS06-09: Raul I Cabrera PS06-10: Helena Clauw PS06-11: S. Bonachela Castaño PS06-12: Wei Wang	PS06-13: Wei Wang PS06-14: YongJae Lee PS06-15: Vito Aurelio Cerasola
18:00-18:30 18:30-19:00 19:00-19:15	**OS-26 (A)** ***1.4. Modelling environment*** OS26-01: L. Gourdo OS26-02: E. Chantoiseau OS26-03: Weituo Sun OS26-04: Yi Zhang OS26-05: H. Hatterman-Valenti	**OS-27 (B)** ***4.3. Water status*** OS27-01: Ankit Kumar Singh OS27-02: Eddie Schrevens OS27-03: H. Restrepo-Diaz OS27-04: Rosa Raudales	**OS-28 (C)** ***5.3. Effect of light*** OS28-01: Riccardo Prandi OS28-02: Fang Wang OS28-03: K. Restu Susilo OS28-04: River Dean OS28-05: S. Loketsatian	**OS-29 (D)** ***2.4. Precision horticulture*** ***2.5. Robotics and sensing*** OS29-01: F. Cañadas Aránega OS29-02: Hongbin Jin OS29-03: Hyo Jae Seo OS29-04: Masahisa Ishii
19:15-19:30	**Break to go to the workshop rooms**			
19:30-20:00 20:00-20:30	**Workshop 3 (B)** – How can the integration of Artificial Intelligence with Computational Fluid Dynamic modelling advance microclimate analysis in agricultural production systems? **Moderators**: Hicham Fatnassi	**Workshop 4 (C)**– Carbon and water footprint in Controlled Environment Agriculture (CEA) **Moderator**: Esteban José Baeza Romero	**Workshop 2 (D)**– How can we create sustainable and climate resilient CEA systems? **Moderators**: Leo Marcelis, Silke Hemming and Ep Heuvelink	

Oral presentations: Tuesday June 24, 2025

KEYNOTE LECTURE 3 - Tuesday 24 (8:30-9:00 h)
Topic 1: Greenhouse Environment and Climate Control.

Chair: F.D. Molina-Aiz (*University of Almería - Dept. Engineering, CIAMBITAL, Almería, Spain*)

KN3
The role of Information and Communication Technology (ICT) for sustainable CEA systems and its development direction
In-Bok Lee
Aero-Environmental and Energy Engineering Laboratory – College of Agriculture and Life Sciences, Seoul National University, San 56-1, Silim-dong, Gwanak-Gu, Seoul, Republic of Korea.

ORAL SESSION 14 - Tuesday 24 (9:30-10:30 h)
Topic 1: Greenhouse Environment and Climate Control / *1.1. Climate control technologies – 1.3. Energy in controlled environment agriculture systems.*

Chair: Etienne Chantoiseau (*Institut Agro, EPHor, SFR QuaSaV, Angers, France*)

9:30-9:45
OS14-01
Evaluating the heat insulation performance of agricultural curtains for greenhouses using heat balance analysis
Yuta Ohashi
Institute for Rural Engineering, NARO, Tsukuba, Ibaraki 305-8609, Japan.

9:45-10:00
OS14-02
Utilizing low-tech portable caterpillar tunnels to increase productivity of tomatoes and peppers in North Dakota, USA
Harlene Hatterman-Valenti
North Dakota State Univ., Dept 7670, PO Box 605, Fargo ND 58106-6050, United States of America.

10:00-10:15
OS14-03
Shading effects of a solar-tracking photovoltaic system in a soilless cucumber crop: preliminary results
Nikolaos Katsoulas
University of Thessaly, Department of Agriculture Crop Production and Rural Environment, Fytokou St., 38446, Volos, Greece.

10:15-10:30
OS14-04
Low-cost greenhouse designs for vegetable production
Tilahun Seyoum Workneh
University of Kwa-Zulu Natal, Carbis Road, Scottsville, Pietermaritzburg, 3201, South Africa.

ORAL SESSION 15 - Tuesday 24 (9:30-10:30 h)

Topic 4: Fertigation, water and growing medium */ 4.1. Fertigation management.*

Chair: Marisa Gallardo (*University of Almería, Department of Agronomy, Higher School of Engineering, Almeria, Spain*)

9:30-9:45

OS15-01

Optimizing irrigation under plastic greenhouse conditions: effects on Chinese cabbage growth and physiology at different growth stages

Doudou Guo
Beijing Jingwa Agricultural Science and Technology Innovation Center, No. 1, Yuda Road, Yukou Town, Pinggu District, Beijing, China.

9:45-10:00

OS15-02

Hydroponics meets sustainability: Grey water used in greenhouse grape-tomato cultivation

Ioanna Chatzigeorgiou
SASRER Lab, Hellenic Agricultural Organization-DIMITRA, 57001 Central Macedonia Thermi, Thessalonik, Greece.

10:00-10:15

OS15-03

Water, productive and post-harvest life response of cucumber to chemical and organic fertilization

Juan Enrique Rubiños Panta
Postgraduate College, Carretera Federal Mexico-Texcoco Km 36.5, Montecillo, México. Z.C. , Texcoco, 56264, México.

10:15-10:30

OS15-04

Current and new strategies to control lettuce tipburn in controlled-environment hydroponic production systems

Qingwu Meng
University of Delaware, 531 S College Ave, Newark, Delaware 19716, United States of America.

ORAL SESSION 16 - Tuesday 24 (9:30-10:30 h)

Topic 5: Light in Horticulture */ 5.5. Urban Horticulture – 5.6. Vertical Farming.*

Chair: F.D. Molina-Aiz (*University of Almería - Dept. Engineering, CIAMBITAL, Almería, Spain*)

9:30-9:45

OS16-01

Investigating indoor vertical greening through an experimental protype

Giacomo Scarascia-Mugnozza
Dipartimento DICATECh, Politecnico di Bari, Via Orabona 4, I-70125 Bari, Italy.

9:45-10:00

OS16-02

Building energy simulation analysis of design variables for building integrated rooftop greenhouse system

Jin-Seok Lee
Seoul National University, 1, Gwanak-ro, Seoul, Republic of Korea.

10:00-10:15

OS16-03

Boosting *stevia rebaudiana* growth: evaluating upconversion nanoparticle films for mediterranean climates

Michele D'Ostuni
University of Bologna, Dept. of Agricultural and Food Sciences, Viale Giuseppe Fani, 50, 40126 Bologna, Italy.

10:15-10:30

OS16-04

Vertical farming for producing highly valuable bioproducts: Optimizing controlled environments for plant-made biopharmaceutical protein production

Ryo Matsuda
University of Tokyo, 1-1-1 Yayoi, Bunkyo, Tokyo, 113-8657, Japan.

ORAL SESSION 17 - Tuesday 24 (9:30-10:30 h)

Topic 2: Mechanization, Digitization, Sensing and Robotics. */ 2.2. Digital twins.*

Chair: Silke Hemming (*Wageningen University & Research-WUR, Business Unit Greenhouse Horticulture, Wageningen, The Netherlands*)

9:30-9:45

OS17-01

Semantic interoperability between digital twins in horticulture

Jack Verhoosel
TNO Soesterberg, Soesterberg, Netherlands.

9:45-10:00

OS17-02

Bridging real and virtual: a digital twin approach for enhancing greenhouse management through immersive technologies

Jorge Antonio Sánchez Molina
University of Almería, Department of Computer Science, Carretera Sacramento, s/n, 04120 La Cañada de San Urbano, Almería, Spain.

10:00-10:15

OS17-03

An easy to inject 3D digital twin into a running cultivation: tomato crop use case

Maarten van der Meer
Wageningen University, Droevendaalsesteeg 1, Wageningen, Netherlands.

10:15-10:30

OS17-04

Analysing the performance of coupled digital twins for hands-off energy-efficient production in tomato trial

Athanasios Sapounas
TNO, Molengraaffsingel 8, 2629 JD Zuid-Holland Delft, Netherlands.

ORAL SESSION 18 - Tuesday 24 (11:00-12:30 h)

Topic 1: Greenhouse Environment and Climate Control */ 1.2. Computational Fluid Dynamics (CFD) in controlled environment horticulture.*

Chair: Pierre-Emmanuel Bournet (*L'Institut Agro, Angers, France*)

11:00-11:15

OS18-01

3D climate simulation of pad and fan greenhouse indicate design adjustments to reduce cooling water use

Ilias Tsafaras
Wageningen University & Research, Wageningen, Netherlands

11:15-11:30

OS18-02

Development of a real-time flow analysis simulation model for naturally ventilated greenhouses using physics-informed neural networks and Computational Fluid Dynamics

Jung-Hoo Song
Seoul National University, 1, Gwanak-ro, Gwanak-gu, Seoul, Republic of Korea

11:30-11:45

OS18-03

Microclimatic optimization of Colombian greenhouses: simulation and evaluation of a radiant floor heating system powered by photovoltaic energy

Rodrigo Gil Castañeda
Universidad Nacional de Colombia, Calle 7 A Bis A 72 92, Casa 34, Bogotá 110821, Colombia

11:45-12:00

OS18-04

A sensitivity analysis on the value of the stomatal resistance to study the microclimate inside a plant factory using CFD

Wito Plas
University of Gent, Sint-Pietersnieuwstraat 41, 9000 Gent, Belgium

12:00-12:15

OS18-05

Analysis natural ventilation of rooftop greenhouse in urban area using Computational Fluid Dynamics

Yunwoo Cho
Seoul National University, Bdlg 200, Unit 3210, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea

12:15-12:30

OS18-06

Exploring the geocooling potential of agricultural greenhouses in desert climates: The case of southern Morocco

Zouhair Charqui
African Sustainable Agriculture Research Institute - Mohammed VI Polytechnic University (ASARI-UM6P), Laayoune, Morocco

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ORAL SESSION 19 - Tuesday 24 (11:00-12:30 h)

Topic 4: Fertigation, water and growing medium / *4.5. Microalgae cultivation in photobioreactors. – 4.6. Aquaponics and aeroponic production.*

Chair: Oliver Körner (*Leibniz-Institute of Vegetable and Ornamental Crops (IGZ), Grossbeeren, Germany*)

11:00-11:15

OS19-01

Optimizing resource-friendly nutrient management in de coupled aquaponics: a study on nutrient regimes and lettuce production

Faiqa Atique
IGZ - Leibniz Institute of Vegetable, and Ornamental Crops e.V., Theodor-Echtermeyer-Weg 1, 14979 Grobeeren, Germany.

11:15-11:30

OS19-02

Aeroponic cultivation and light optimization in *Artemisia annua*: a sustainable approach to enhance secondary metabolite production

Teresa Piovano
Viale Giuseppe Fanin 46, Università degli studi di Bologna - Distal, 40129 BolognaBO, Italy.

11:30-11:45

OS19-03

Hydroponics-aquaculture-solar energy optimization approach: a real-time decision support system for sustainable agriculture

Helena Vitoshkin
Agricultural Research Organization (ARO), Volcani Center, P.O.Box 6, 68 Derch Hamacabim, Rishon-le'zion 5025001, Israel.

11:45-12:00

OS19-04

Environmental analysis of high-tech decoupled aquaponics for rainbow trout and greenhouse tomato production

Maria Ravani
SASRER Lab, Hellenic Agricultural Organization-DIMITRA, Thermi - Thessaloniki, 57001 Thessaloniki, Greece.

12:00-12:15

OS19-05

Greening Horticulture: multi-omics integration of greenhouse-grown lettuce response to develop effective microalgae-based biostimulants

Michele Ciriello
Universidad de Napoles Federico II, Corso 25 Archi, 86070 Montaquila (IS), Italy.

12:15-12:30

OS19-06

Resource-efficient plant growth: mixed planting and microbial interactions in de coupled aquaponics

Faiqa Atique
IGZ - Leibniz Institute of Vegetable, and Ornamental Crops e.V., Theodor-Echtermeyer-Weg 1, 14979 Grobeeren, Germany.

ORAL SESSION 20 - Tuesday 24 (11:00-12:30 h)

Topic 5: Light in Horticulture */ 5.4. Plant factory with artificial lighting (PFAL).*

Chair: Murat Kacira (*Biosystems Engineering Department, University of Arizona, Tucson Arizona 85721, United States of America*)

11:00-11:15

OS20-01

Analysis of the uniformity of the photosynthetic photon flux density (PPFD) and spectral quality of LED fixtures for mini plant factories

Efrén Fitz-Rodríguez
Universidad Autónoma Chapingo, Ing. Mecánica Agrícola/Posgrado IAUIA, km 38.5 Carretera México-Texcoco S/N, Texcoco, Edo. de México C.P. 56230, Mexico.

11:15-11:30

OS20-02

Ozone gas exposure increases health-promoting bioactive compound content in red leaf lettuce (*Lactuca sativa* L.) in a plant facility with artificial light

Eiji Goto
Graduate School of Horticulture, Chiba University, 648 Matsudo, Matsudo, Chiba 271-8510, Japan.

11:30-11:45

OS20-03

Precise regulation of selenium content and species vegetables cultivated in plant factory

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), 12#, Zhongguancun South Street, Haidian District, Beijing City, 100081, China.

11:45-12:00

OS20-04

Optimization of the light quality for plant factory production of pakchoi

Qingming Li
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences, No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

12:00-12:15

OS20-05

StrawGRO: a dynamic strawberry growth model for plant factory

Rongmei Fu
Zhejiang University, No. 866, Yuhangtang Road, Sandun Town, Hangzhou, Zhejiang, 310058, China.

12:15-12:30

OS20-06

Estimation of temperature and air-conditioning load before and after demand response in a plant factory

Takashi Ishii
Central Research Institute of, Electric Power Industry, 1646 Abiko, Abiko-shi, Chiba-ken, Japan.

ORAL SESSION 21 - Tuesday 24 (11:00-12:30 h)

Topic 3: Crop production in controlled environment horticulture */ 3.1. Crop management.*

Chair: Raul I. Cabrera (*Dept. of Plant Biology, Rutgers University, USA*)

OS21-06

Developing Single Truss Tomato Systems (STTPS): role of light intensity and planting density

Zixin Yao
Wageningen University, Droevendaalsesteeg 1 , 6708PB WAGENINGEN, Netherlands.

11:15-11:30

OS21-02

Development of a cultivation system to increase productivity per greenhouse area

Jingu Kim
National Institute of Horticultural and Herbal Science, 1425 Jinham-ro, Haman-myeon, Haman-gun, Republic of Korea.

11:30-11:45

OS21-03

Utilizing controlled environment agriculture to enhance the yield and flavor of strawberries

Nick Cooley
Michigan State University, 1066 Bogue Street, Room A288 PSSB, East Lansing, United States of America.

11:45-12:00

OS21-04

Overcoming the challenges of growing woody perennial horticultural crops indoors

Nick Gould
Plant and Food Research, 412 No 1 Road, RD2, Te Puke 3182, New Zealand.

12:00-12:15

OS21-05

In-situ vermicomposting-biochar integration enhances soil quality and cucumber metabolism under brackish water irrigation

Yune Cao
Ningxia University, Helan Mountain road, Yinchuan, Ningxia, China.

POSTER SESSION 04 - Tuesday 24 (12:30-13:00 h)

Topic 3: Crop production in controlled environment horticulture

PS04-01

Application of biostimulant inhibit incident of intumescence in tomato (*Solanum lycopersicum* L.) seedlings

Arachaporn Sripawatakul
Graduate School of Horticulture , Chiba University, 648 Matsudo, Matsudo 271-8510, Japan.

PS04-03

Photosynthesis and photoprotection in top leaves respond faster to irradiance ffuctuations than bottom leaves in a tomato canopy

Bingjie Shao
Wageningen University Research WUR, Haarweg 1, 6709PH Wageningen, Netherlands.

PS04-04

Plant stem occlusion inpainting with deep reinforcement learning

Fang Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

PS04-05

Evaluation of a 3D imaging process for crop structure phenotyping in strawberry plant

Jinwoo Lee
Kyunpook National University, CALS 4 408, 80, Daehak-ro, Buk-gu, Daegu, Republic of Korea.

PS04-06

Evaluation of reference evapotranspiration models based on different types of greenhouses

Jeongmin Yun
Jeonbuk National University , 567 Baekje-daero, Deokjin-gu, Jeonju, Republic of Korea.

PS04-07

The effect of the seedling growing period of autumn cabbage on chlorosis resistance

Kurumi Torigoe
Okayama University. 102 Fregrance M1, 1-14-30-6, Tsushimafukui, kita-ku, Okayama 700-0080, Japan.

PS04-08

Effects of nano amorphous calcium phosphate (nACP) on chives growth on vertical crop system (VCS) inside a greenhouse

Miguel Guzmán
Dpto. Agronomy, Universidad de Almería, Crtra. Sacramento s/n, 04120 Almería, Spain.

PS04-09

PEPC-mediated C4 carboxylation as the primary carbon fixation strategy in CAM photosynthesis of *Phalaenopsis*

Nam Hyun Im
Seoul National University, 1, Gwanak-ro, Gwanak-gu, Seoul, Republic of Korea.

PS04-10

SlMLO4, a plasma membrane-localized susceptibility gene, interacts with SNARE proteins SlGOSR1-2 and SlVAMP to modulate tomato resistance to powdery mildew (*Oidium neolycopersici*)

Xiaomin Wang
Ningxia University, No. 489 Helan Mountain West Road, Xixia District, Yinchuan City, Ningxia, China.

PS04-11

Structural quantification of sweet basils (*Ocimum basilicum* L.) using 3D design software and procedural modeling

Taewon Moon
Smart Farm Research Center, Korea Institute of Science and Technology, Gangneung 25451, Gangwon-do, Republic of Korea.

PS04-12

Estimation of individual leaf photosynthetic characteristics based on time variation of chlorophyll fluorescence

Tomohiro Jishi
Central Research Institute of Electric Power Industry (CRIEPI), 1646 Abiko, Abiko-shi, Chiba-ken 270-1194, Japan.

PS04-13

Diploid potato breeding in controlled - environment plant factories: accelerating the breeding process

Wei Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Sichuan, China.

PS04-14

Adaptation analysis of the transpiration model for east-west row cultivation in winter in Chinese solar greenhouses in northeast China

Xinlan Luo
Shenyang Agricultural University, Shenyang, China.

PS04-15

Development of a leaf optical properties measurement device

Yuta Ohashi
Institute for Rural Engineering, NARO, Tsukuba, Ibaraki 305-8609, Japan.

PS04-16

RNA-seq analysis for the mechanism of root development under low temperature condition in the high-yielding strawberry cultivar 'Benihoppe'

Yuya Mochizuki
College of Agriculture, Ibaraki University, 3-21-1, Amimachi, Chuo, Inashiki gun, Ibaraki 300-0393, Japan.

PS4-17

Investigation on the occurrence of sweet cherry diseases in China and provision of control recommendations

Lui Mei
Beijing Academy of Agricultural and Forestry Sciences, Beijing 100097, Beijing, China.

KEYNOTE SPEAKER 4 - Tuesday 24 (15:00-15:30 h)

Topic 4: Fertigation, water and growing medium

Chair: Diego Luis Valera-Martínez (*University of Almería - Dept. Engineering, Almería, Spain*)

KN4

Unveiling the biostimulant potential of plant-derived protein hydrolysates: mechanisms, efficacy, and field validation

Stefania De Pascale
Department of Agriculture, University of Naples Federico II, Italy.

POSTER SESSION 05 - Tuesday 24 (15:30-16:00 h)

Topics 1-6: Technologies and Management for Sustainable Greenhouses

PS05-01

Influence of reflective plastic mulch on agronomic parameters and photosynthetic activity of a pepper (*Capsicum annum* L.) crop

Diego L. Valera
Dpto. Ingeniería, Universidad de Almería, Ctra Sacramento s/n, 04120 Almería, Spain

PS05-02

Manipulating seedlings morphology by adjusting red and blue LED light in indoor cultivation systems

Afsaneh Nematpour
University of Bologna, Viale Giuseppe Fanin 44, 40127 Bologna, Italy

PS05-03

Multi-criteria methodology for selecting an exhaust fan for a greenhouse

Eugueni Romantchik
Universidad Autónoma Chapingo, Km. 38.5 Carretera México Texcoco Chaping, 56230 México, Mexico

PS05-04

Study on application effect of air intake system in desert greenhouse

Fang Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), No. 36 Lazi East Street, Tianfu New District, Chengdu City, China

PS05-05

Effect of blue and far-red light ratios in white LEDs on the growth and flowering in strawberry "*Seolhyang*"

Geon Hyeong Kim
Jeonbuk National University, Baekje-daero 567, Deokjin-gu Jeonju, Jeollabuk-do, Republic of Korea

PS05-06

Effects of supplemental LED light on growth and Spilanthol content in Acmella oleracea

Giuseppina Pennisi
University of Bologna, Viale Giuseppe Fanin 44, 40127 Bologna, Italy

PS05-07

Influence of UVa light on the profile of cannabinoids in indoor cultivated *Cannabis sativa*

Gregorio Grassi
University of Bologna, viale Giuseppe Fanin 44, Bologna, Italy

PS05-08

Comparative evaluation of red lettuce cultivation at different levels of UV-radiation

Ioannis Lycoskoufis
Department of Agriculture, University of Peloponnese, Antikalamos, 24100 Kalamata, Greece

PS05-09

Development of an Image-Based AI system for predicting petal angle in tomato flower buds

Koichi Yoshi
National Agriculture and Food Research Organization (NARO), 1-31-1 Kannondai, Tsukuba, Japan

PS05-10

Influence of the pH buffering capacity of composts containing different compositions of *Rugulopteryx okamurae* on saturated extract vs. saturated paste: adaptation of Costello and Sullivan's methodology by titration with dilute sulfuric acid

Mª del Carmen Salas
Departamento de Agronomia, Universidad de Almeria, 04120 Almeria, Spain.

PS05-11

Transition to LED lamps reduces yield but not quality of cucumber varieties grown in wintertime in Norway

Michel Verheul
Norwegian Institute of Bioeconomy Research, NIBIO Særheim, Section Horticulture, Postvegen 213, 4353 Klepp-St., Norway

PS05-12

Potential nutritional and antioxidant activity of other organs in the dragon fruit plant

Miguel Guzmán
Dpto. Agronomy, Universidad de Almería, Crtra. Sacramento s/n, 04120 Almería, Spain

PS05-13

Applying machine learning for the classification of environmental conditions using plant electrical signals

Moon-Sun Yeom
Chungbuk National University, 28644 Cheongju, Republic of Korea

PS05-14

Applications of supplementary light in rapid propagation of rice

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), 12#, Zhongguancun South Street, Haidian District, Beijing City, 100081, China.

PS05-15

Study on application effects of air intake system in desert greenhouse

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), 12#, Zhongguancun South Street, Haidian District, Beijing City, 100081, China.

PS05-16

Smart lighting reduces electricity cost while maintaining yield in pepper production

Xiuming Hao
Harrow Research and Development Centre, Agriculture and Agri-Food Canada, 2585 County Road 20, Harrow, ONT, N0R 1G0, Canada.

ORAL SESSION 22 - Tuesday 24 (16:00-17:30 h)

Topic 1: Greenhouse Environment and Climate Control */ 1.4. Modelling greenhouse environment.*

Chair: Irineo Lopez Cruz (*Postgrado en Ingeniería Agrícola, Universidad Autónoma Chapingo, Chapingo, Mexico*)

16:00-16:15

OS22-01

Quantification of limiting transpiration as affected by vapor deficit in a cucumber crop

Caterina Carpineti
Wageningen UR, Weidelust 3, 2804KB Gouda, Netherlands.

16:15-16:30

OS22-02

Nonlinear Artificial Neural Network model predictive control of greenhouse

Murat Kacira
Dept. of Biosystems Engineering, 1177 East 4th Street, Room 403, Shantz Building, 38, Tucson, AZ 85721-0038, United States of America.

16:30-16:45

OS22-03

KASSIM: a versatile app for education and research

Gert-Jan Swinkels
Wageningen University and Research Centre, Droevendaalsesteeg 1, 6708 Pb, Wageningen, Netherlands.

16:45-17:00

OS22-04

Development of Time Series Prediction Model for Greenhouse Environment based on Physics-Informed Neural Networks

Hyo-Hyeog Jeong
Department of Rural Systems Engineering, Seoul National University, 1, Gwanak-ro, Gwanak-gu, 08826 Seoul Seoul, Republic of Korea.

17:00-17:15

OS22-05

Heating and Harvesting Cycles in Stochastic Greenhouse Control

Simon van Mourik
Wageningen University, Droevendaalsesteeg 1, 6708PB Wageningen, Netherlands.

17:15-17:30

OS22-06

Optimizing hybrid heating operations in greenhouses: a proposal and evaluation of air-source heat pumps and fossil fuel-based systems.

Takaya Ishimori
Waseda University, 1-6-1, Nishiwaseda, Shinjuku-ku, Tokyo, Japan.

ORAL SESSION 23 - Tuesday 24 (16:00-17:30 h)

Topic 4: Fertigation, water and growing medium */ 4.2. Greenhouse crops nutrition.*

Chair: Nikolaos Katsoulas (*University of Thessaly, Department of Agriculture Crop Production and Rural Environment, Volos, Greece*)

16:00-16:15

OS23-01

X-ray Fluorescence (XFM) Microscopy Uncovers the Distinct Distribution of Micronutrients in Tomato Fruits and Leaves Subjected to Salinity and Calcium Solution

Abdullah Al Hosni
Oman Botanic Garden, Seeb, Muscat, P.O. Box: 808, Postal code 808, Oman.

16:15-16:30

OS23-02

Phosphorous Restriction Influences Ornamental Quality of Containerized Echinacea in Soilless Substrates

Garrett Owen
The Ohio State University, Department of Horticulture and Crop Science, 334 Howlett Hall, 2001 Fyffe Court, Columbus, OH 43210, United States of America.

16:30-16:45

OS23-03

Enhancing avocado seedling quality in nursery environments through the combined use of seaweed extracts and silicon applications

Hermann Restrepo-Diaz
Universidad Nacional de Colombia, Carrera 30 No 45-03 Edificio 500 Of. 229, Bogota, Colombia.

16:45-17:00

OS23-04

Rose responses to nitrogen supply confounded by collateral effects on rootzone pH and micronutrient availability

Raul I Cabrera
Rutgers University, Department of Plant Biology, 121 Northville Road, Bridgeton, New Jersey 08302, United States of America.

17:00-17:15

OS23-05

Amelioration of copper-induced phytotoxicity by silicon is crop dependent

Rosa Raudales
University of Connecticut, 1376 Storrs Rd, Unit 4067, Storrs, CT 06269, United States of America.

17:15-17:30

OS23-06

Study on carbon and nitrogen parameters promoting early flowering of rice under controlled environment

Wei Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

ORAL SESSION 24 - Tuesday 24 (16:00-17:30 h)

Topic 5: Light in Horticulture. */ 5.1. Covering materials. – 5.2. Lighting technology. – 5.3. Effect of light on plant growth.*

Chair: Xiuming Hao (*Harrow Research and Development Centre, Agriculture and Agri-Food Canada, Harrow, ONT, N0R 1G0, Canada.*)

16:00-16:15

OS24-01

Evaluation of supplemental greenhouse lighting spectrums on flower yield and quality of *Cannabis sativa*

Cristian Collado
North Carolina State University, 5304 Kaplan Dr, Raleigh, NC 27606, United States of America.

16:15-16:30

OS24-02

Enhancing crop performance: investigating spectrum-shifting greenhouse roofs for improved illumination

Chun-Ting Cho
Delft University of Technology. Mekelweg 15, 2629 JB, Delft, Netherlands.

16:30-16:45

OS24-03

Blue-tiful tomatoes: unraveling the effects of blue light fraction and blue intensity on plant growth and development

Ingeborg Schouten
Wageningen University Research WUR, Droevendaalsesteeg 1, Gebouw 107, 6708 PB Wageningen, Netherlands.

16:45-17:00

OS24-04

Basil evapotranspiration under different greenhouse light transmission covers

Laura Cammarisano
University of California Davis, One Shields Avenue Davis, CA 95616, United States of America..

17:00-17:15

OS24-05

Effects of the light spectrum on the flowering of okra Abelmoschus Esculentus

Yao Hervé Yao
University of Toulouse, LAPLACE, UMR 5213, 118 route de Narbonne, 31062 Toulouse, France.

17:15-17:30

OS24-06

Effect of difference between day and night temperature (DIF) treatment on growth of fruit vegetable seedling and after transplanting in plant factory with artificial lighting

Young-Ho Kim
Kangwon National University, 56, Fuman-ro, Chuncheon-si, Kangwon-do, Room 402, Building 713, 24285 (82) 033 Chuncheon-si, Kangwon-do, Republic of Korea.

ORAL SESSION 25 - Tuesday 24 (16:00-17:00 h)

Topic 2: Mechanization, Digitization, Sensing and Robotics / *2.1. Artificial Intelligence (AI) and automation in indoor production systems. – 2.2. Digital twins.*

Chair: Gene A. Giacomelli (*University of Arizona, Controlled Environment Agric., Tucson, United States of America*)

16:00-16:15

OS25-01

Yield variation and required sample size estimation for yield prediction in large-scale greenhouse horticulture

Kota Shimomoto
Institute of Agricultural Machinery, NARO, 1-31-1, Kannondai, Tsukuba, Japan.

16:15-16:30

OS25-02

Enhancing cucumber harvesting in polytunnel cultivation through machine vision: evaluation of an improved YOLOv8 algorithm for fruit detection and classification in two different pruning methods

Gaia Moretti
Alma Mater Studiorum, Department of Agricultural and Food Science, Viale Fanin 44, Bologna, Italy.

16:30-16:45

OS25-03

Semantics for greenhouse construction, robotics and digital twins

Jack Verhoosel
TNO Data Science, Soesterberg, Maastricht University, Institute of Data Science, Netherlands.

16:45-17:00

OS25-04

Data-driven horticulture: autonomous control of substrate, crop and climate by intelligent algorithms based on sensor data

Anja Dieleman
Wageningen UR Greenhouse Horticulture, PO Box 644, 6700 AP Wageningen, Netherlands.

POSTER SESSION 06 - Tuesday 24 (17:30-18:00 h)
Topic 4: Fertigation, water and growing medium

PS06-02
Use of new biobased fertilisers made from organic wastes of vegetable crops
Carolina C. Martínez Gaitán
Centro Tecnológico Tecnova, Parque Tecnológico de Almería PITA, Avenida de la Innovación, 23, 04131 Almería El Alquian, Spain.

PS06-03
Nitrate availability impacts on nitrogen use efficiency, productivity, photosynthetic activity and nutritional quality of Chinese broccoli (*Brassica oleracea*)
Jie He
National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, 637616 Singapore, Singapore.

PS06-04
Measuring N, P, K individually in hydroponic solution using UV-Vis spectroscopy
Michael Zankel
University of Arizona, 1177 E. 4th Street, Tucson, AZ 85721-0038, United States of America.

PS06-05
Vertical crop of chard under the greenhouse. effect of different concentrations of the steiner universal nutrient solution
Miguel Guzmán
Dpto. Agronomy, Almería University, CeiA3, CIAIMBITAL, Crtra. Sacramento sn, 04120 Almería, Spain.

PS06-06
Nutrient changes in recirculating drainage solution of sweet pepper plants grown in stone wool and coconut coir substrates
Mi-Young Roh
Protected Horticulture Research Institute, NIHHS, RDA, Haman 52054, Republic of Korea.

PS06-07
Effect of different mixtures of desalinated seawater and conventional water on production and certain post-harvest quality parameters of tomato fruit from a substrate cultivation
Patricia Marín-Membrive
Universidad de Almería, 04120 Cañada San Urbano, Almería, Spain.

PS06-08
Effect of different mixtures of desalinated sea water and conventional water on the morphological characteristics of a tomato crop in substrate
Patricia Marín-Membrive
Universidad de Almería, 04120 Cañada San Urbano, Almería, Spain.

PS06-09
Fertilizer placement on substrate nutrient distribution, root growth and yield of roses
Raul I. Cabrera
Rutgers University, Department of Plant Biology, 121 Northville Road, Bridgeton, New Jersey 08302, United States of America.

PS06-10
Monitoring sap flow dynamics in tomato peduncles: insights into fruit development and stress-induced fruit losses
Helena Clauw
Ghent University, Coupure Links 653, 9000 Gent, Belgium.

PS06-11
Application of simple methods and tools of irrigating a commercial greenhouse cucumber crop on the Granada coast
Santiago Bonachela Castaño

Universidad de Almería, Campus la Cañada de San Urbano, 04120 Almería, Spain.

PS06-12

Desert solar greenhouse with continuous water recovery and freshwater production

Wei Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Sichuan, China.

PS06-13

The responses of sucrose metabolism and carbon translocation in tomato seedlings under different light spectra

Wei Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Sichuan, China.

PS06-14

An automatic irrigation system based on hourly cumulative evapotranspiration improves cabbage growth and reduces agricultural water usage

YongJae Lee
Chungnam National University, Daejeon 34134, Republic of Korea.

PS06-15

Role of effective microorganisms in improving water and salt stress response in *Capsicum annuum* L

Vito Aurelio Cerasola
Alma Mater Studiorum University of Bologna, Bologna, Italy.

ORAL SESSION 26 - Tuesday 24 (18:00-19:00 h)

Topic 1: Greenhouse Environment and Climate Control */ 1.4. Modelling greenhouse environment.*

Chair: David Katzin (*Wageningen University and Research, Greenhouse Horticulture and Flower Bulbs, Wageningen, The Netherlands*)

18:00-18:15

OS26-01

Energy demand estimation for tomato greenhouses in Mediterranean climate using energy balance modelling

Lahoucine Gourdo
Thermodynamics and Energetics Laboratory, Ibn Zohr University, B.P 8106. Hay Dakhla, 80000 Agadir, Morocco.

18:15-18:30

OS26-02

Evaluation of more efficient greenhouse cultivation practices using a generic dynamic model modelling tool

Etienne Chantoiseau
Institut Agro Rennes-Angers, UP EPHor, 2 rue Andre Le Nôtre, 49045 ANGERS Cedex 01, France.

18:30-18:45

OS26-03

A full-scale climate model of the Chinese solar greenhouse

Weituo Sun
Intelligent Equipment Research Center, BAAFS, Beijing, 100097, China.

18:45-19:00

OS26-04

Construction and application of heat dissipation model for Chinese solar greenhouses at typical climate zones in China

Yi Zhang
Institute of Environment and Sustainable Development in Agriculture (IEDA), Chinese Academy of Agricultural Sciences (CAAS), No 12, Zhong-Guan-Cun South Street, Haidian District, Beijing, 100081, China.

ORAL SESSION 27 - Tuesday 24 (18:00-19:15 h)

Topic 4: Fertigation, water and growing medium */ 4.3. Sensing plant water status and stress response.*

Chair: Uttara Samarakoon (*Ohio State University ATI, 132B Halterman Hall, Wooster, United States of America*)

18:00-18:15

OS27-01

The efficiency of H-WEF wastewater on the production of *Brassica rapa* var. *chinensis* 'Li Ren Choi' using GREENBOX technology

Ankit Kumar Singh
7Department of Cooperative Extension, University of Maine, Orono, ME, United States of America.

18:15-18:30

OS27-02

Modelling the water and nitrogen dynamics in an open field cauliflower-leek rotation

Eddie Schrevens
Katholieke Universiteit Leuven, Biosystems Department, MeBioS (lok. 01.234), Celestijnenlaan 200e - bus 2411, 3001 Heverlee, Belgium.

18:30-18:45

OS27-03

Brassinosteroids, plant growth-promoting bacteria, and their combinations have the potential to enhance the growth and yield of Lactuca sativa L. under soilless cultivation conditions

Hermann Restrepo-Diaz
Universidad Nacional de Colombia, Carrera 30 No 45-03 Edificio 500 Of. 229, Bogotá, Colombia.

18:45-19:00

OS27-04

Mapping oomycetes in a commercial hydroponic greenhouse

Rosa Raudales
University of Connecticut, 1376 Storrs Rd, Unit 4067, Storrs, CT 06269, United States of America.

ORAL SESSION 28 - Tuesday 24 (18:00-19:15 h)

Topic 5: Light in Horticulture / *5.3. Effect of light on plant growth.*

Chair: Efrén Fitz-Rodríguez (*Universidad Autónoma Chapingo, Ing. Mecánica Agrícola/Posgrado IAUIA, Mexico*)

18:00-18:15

OS28-01

Impact of light intensity and far-red radiation on biomass and secondary metabolites production in hydroponically grown *Brassicaceae* microgreens

Riccardo Prandi
University of Bologna, Via Mondo 10, 40127 Bologna BO, Italy.

18:15-18:30

OS28-02

Optimizing strawberry (*Fragaria* × *ananassa*) production through abaxial leaf photosynthetic enhancement via targeted supplemental lighting

Fang Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

18:30-18:45

OS28-03

Optimizing pak choi growth and quality: prolonged photoperiod outperformed increased light intensity at the same daily light integral

Kartika Restu Susilo
Wageningen University Research WUR, Radix, building number 107, Droevendaalsesteeg 1, 6708PB Wageningen, Netherlands.

18:45-19:00

OS28-04

Evaluating nighttime application of different light qualities from low intensity LEDs and biorational products to suppress downy mildew on impatiens

River Dean
Department of Plant, Soil and Microbial Sciences, Michigan State University, 622 Wilson Road, 140 PBL, East Lansing, MI 48824-1312, United States of America.

19:00-19:15

OS28-05

Perfect Timing: effects of diurnal changes, circadian rhythm, and light availability on the changes of glucosinolates in rocket salad

Supasan Loketsatian
School of Agriculture, Policy Development, University of Reading, Whiteknights, RG6 6EU Reading, United Kingdom.

ORAL SESSION 29 - Tuesday 24 (18:00-19:00 h)

Topic 2: Mechanization, Digitization, Sensing and Robotics / *2.4. Precision horticulture and engineering. – 2.5. Robotics and sensing in greenhouses.*

Chair: Alvaro Fuentes (*Jeonbuk National University, Jeonbuk, Republic of Korea*)

18:00-18:15

OS29-01

Visual-SLAM for mobile robots in greenhouses using hiearchical localization and GLOMAP

Fernando Cañadas Aránega
University of Almería, Carretera Sacramento, sn, 04120 La Cañada de San Urbano, Almería, Spain.

18:15-18:30

OS29-02

LoRa-based sensor and control node for automated spatial environment management by multiple actuators in smart greenhouses

Hongbin Jin
Chungnam National University, 99, Daehak-ro, Yuseong-gu, Daejeon, Room 2115, E10-2, 34139 Daejeon, Republic of Korea.

18:30-18:45

OS29-03

Optimization of fine dust control in peach sorting stations for sustainable agricultural work environments

Hyo Jae Seo
Dept. of Rural Construction Engineering, Jeonbuk National University, 567, Baekje-daero, Deokjingu, 54896 Jeonju-si, Republic of Korea.

18:45-19:00

OS29-04

Development and demonstration of a groundwater source heat pump for decarbonizing greenhouse heating

Masahisa Ishii
Institute for Rural Engineering, NARO, 2-1-6 Kannondai, Tsukuba, Ibaraki 305-8609, Japan.

PROGRAM

WEDNESDAY

25 JUNE

Wednesday June 25, 2025

Time	Wednesday 25-06-2025			
8:00-8:30	Welcome – Registration 8:00-18:00			
8:30-9:00	**Topic 5: Light in Horticulture (A)** – *Keynote speaker:* Feije de Zwart			
9:00-9:30	**Coffee Break – *Paraninfo* Hall**			
9:30-10:00 10:00-10:30	**OS-30 (A)** ***5.3. Effect of light*** OS30-01: Evelien Rosiers OS30-02: Leo F.M. Marcelis OS30-03: Yunke Chen OS30-04: Xin Yuan	**OS-31 (B)** ***6.5. Sustainable greenhouses*** OS31-01: Chung Geon Lee OS31-02: Feije De Zwart OS31-03: Masahisa Ishii OS31-04: Steffi Pot	**OS-32 (C)** ***3.2. Fruit quality*** ***3.3. Plant genomics*** ***3.4. Modelling plants*** OS32-01: Ziye Zhu OS32-02: Fang Wang OS32-04: Woo-Joo Choi	**OS-33 (D)** ***2.4. Precision horticulture and engineering*** OS33-01: Harin Jang OS33-02: Jiwon Ryu OS33-03: Minhyun Kim OS33-04: Takashi Okayasu
10:30-11:00	**Coffee Break – *Paraninfo* Hall**			
11:00-11:30 11:30-12:00 12:00-12:30	**OS-34 (A)** ***5.2. Lighting technology*** ***5.6. Vertical Farming*** OS34-01: Jeong-hwa Cho OS34-02: Matteo Landolfo OS34-03: Minhee Han OS34-04: Zicheng Zhan OS34-05: Vivek Jadhav OS34-06: M. Huysmans	**OS-35 (B)** ***6.5. Sustainable greenhouses*** OS35-01: Frank Kempkes OS35-02: Il-Hwan Seo OS35-03: Isabella Righini OS35-04: N. Garcia Victoria OS35-05: Ryota Tsuchiya OS35-06: Takashi Miki	**OS-36 (C)** ***1.2. CFD*** OS36-01: Jorge Flores OS36-02: Luyang Kang OS36-03: Takeshi Kuroyanagi	**OS-37 (D)** ***4.1. Fertigation management*** OS37-01: M. Urrestarazu Gavilán OS37-02: O. Davide Palmitessa OS37-03: Qichang Yang OS37-04: Raul I Cabrera OS37-05: R. Gil Castañeda OS37-06: C. Galindo-Rodriguez
12:30-13:00	***Poster presentations – Session 7* (Hall *Ciencias Salud* E)** PS07-01: Ankit Singh PS07-02: Bozidar Benko PS07-03: Sayuri Teramoto PS07-04: Da-Seul Choi	PS07-05: Elisa Cioccolo PS07-06: HyeongEun Choi PS07-07: Mª del Carmen Salas PS07-08: Mª del Carmen Salas	PS07-09: Miguel Guzmán PS07-10: Min-Jeong Ha PS07-11: P. Marín-Membrive PS07-12: P. Marín-Membrive	PS07-13: Qichang Yang PS07-14: Qichang Yang PS07-15: Qingming Li
13:00-15:00	**Lunch – Restaurant of the University of Almería (F)**			
15:00-15:30	**Topic 6: Sustainable greenhouse production** – *Keynote speaker:* Fátima Baptista			
15:30-16:00	***Poster presentations – Session 8* (Hall *Ciencias Salud* E)** PS08-01: Feng Zhang PS08-02: I. Chatzigeorgiou PS08-03: Jeong Kil Koo PS08-04: Lin Ouyang PS08-05: Phenchan Whijitara	PS08-06: Riccardo Prandi PS08-07: Satu Engström PS08-08: Seungwon Seok PS08-09: Shoko Hikosaka PS08-10: Sissel Torre	PS08-11: Taro Fukuyama PS08-12: Tuomo Laine PS08-13: U.M.J. Arachchilage PS08-14: Wei Wang PS08-15: Yaliang Xu	PS08-16: Zheng Wang PS08-17: Zhouping Sun PS08-18: Laura Cammarisano
16:00-16:30 16:30-17:00 17:00-17:30	**OS-38 (A)** ***5.2. Lighting technology*** ***5.4. Plant factory*** OS38-01: Fulin Xia OS38-02: Luyu Shuai OS38-03: Michel Verheul OS38-04: Shumao Wang OS38-05: Xiuming Hao OS38-06: Yuqi Zhang	**OS-39 (B)** ***6.1. Circularity*** ***6.3. LCA*** ***6.5. Sustainability*** ***6.6. Resilience*** OS39-01: Ariane Grisey OS39-02: Marianne Belley OS39-03: Oliver Körner OS39-04: Xiaoming Wei	**OS-40 (C)** ***2.4. Precision horticulture and engineering*** OS40-01: Helena Vitoshkin OS40-02: Hui Wang OS40-03: Junyoung Park OS40-04: Seonghwan Lee	**OS-41 (D)** ***5.3. Effect of light on plant growth*** OS41-01: Ep Heuvelink OS41-02: Fabio Perotti OS41-03: M. Moosavi-Nezhad OS41-04: Mojtaba Delshad OS41-05: Ningyi Zhang OS41-06: Naoya Fukuda
17:30-18:00	***Poster presentations – Session 9 / Coffee Break*** PS09-01: Matteo Landolfo PS09-02: Bateer Baiyin PS09-03: Eunjung Choi PS09-04: F. Fuentes-Peñailillo	PS09-05: Gil Carron PS09-06: Goun Im PS09-07: Henry Gonzalez PS09-08: H. Esmaeli Sooderjani	PS09-09: Il-Beom Yang PS09-10: Jae Min Yu PS09-11: Jeongmin Park PS09-12: M.J. González Fernández	PS09-13: Maria Ravani PS09-14: Qichang Yang PS09-15: Reia Tomita PS09-16: Soonjae Hyeon PS09-17: Weonil Hong
18:00-18:30 18:30-19:00 19:00-19:15	***Business Meeting of ISHS Divisions* (A)**			

Oral presentations: Wednesday June 25, 2025

KEYNOTE LECTURE 5 - Wednesday 25 (8:30-9:00 h)
Topic 5: Light in Horticulture – Topic 1: Greenhouse Environment and Climate Control.

Chair: F.D. Molina-Aiz (*University of Almería - Dept. Engineering, CIAMBITAL, Almería, Spain*)

KN5
Light and energy in controlled environment agriculture systems
Feije de Zwart
Greenhouse Horticulture & Flower Bulbs. Wageningen University & Research, Wageningen, The Netherlands.

ORAL SESSION 30 - Wednesday 25 (9:30-10:30 h)
Topic 5: Light in Horticulture */ 5.3. Effect of light on plant growth.*

Chair: Laura Cammarisano (*Department of Plant Sciences, University of California, Davis, United States*)

9:30-9:45
OS30-01
Increasing crop yield of tomato, cucumber and leafy vegetable cultivation by adding controlled artificial far red light
Evelien Rosiers
Proefstation voor de Groenteteelt, Duffelsesteenweg 101, 2860 Sint-Katelijne-Waver, Belgium.

9:45-10:00
OS30-02
Increasing the red fraction in LED supplemental light enhances yield without affecting the quality of greenhouse-grown lettuce (*Lactuca sativa* L.)
Leo F.M. Marcelis
Horticulture and Product Physiology, Wageningen University, Droevendaalsesteeg 1, 6708PB Wageningen, Netherlands.

10:00-10:15
OS30-03
Investigating the effects of green light on whole-plant water use efficiency
Yunke Chen
Wageningen University Research WUR, Droevendaalsesteeg 1, Gebouw 107, 6708 PB Wageningen, Netherlands.

10:15-10:30
OS30-04
Tomato plant growth under multiple light/dark cycles
Xin Yuan
Wageningen University Research WUR, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands.

ORAL SESSION 31 - Wednesday 25 (9:30-10:30 h)

Topic 6: Sustainable greenhouse production */ 6.5. Sustainable greenhouse systems and environmentally friendly technologies.*

Chair: Diego Luis Valera-Martínez (*University of Almería - Dept. Engineering, Almería, Spain*)

9:30-9:45

OS31-01

Analysis of heating performance in a strawberry greenhouse using PVT (photovoltaic and thermal) panels and an air-to-air heat pump

Chung Geon Lee
Rural development administration, 310 Nongsaengmyeong-ro, Deokjin-gu, Jeonju-si, Jeonbuk-do, Republic of Korea.

9:45-10:00

OS31-02

Optimizing the energy supply mix of carbon neutral greenhouses

Feije De Zwart
Wageningen UR, Greenhouse Horticulture, Bornsesteeg 65, P.O. Box 16, 6700 AA Wageningen, Netherlands.

10:00-10:15

OS31-03

Development and demonstration of a net zero energy greenhouse (ZEG)

Masahisa Ishii
Institute for Rural Engineering, NARO (National Agriculture and Food Research Organization (NARO), 2-1-6 Kannondai, Tsukuba, Ibaraki 305-8609, Japan.

10:15-10:30

OS31-04

Towards climate-neutral and energy-efficient greenhouse horticulture: Innovations and insights from the ENERGLIK project

Steffi Pot
Research Centre Hoogstraten, Voort 71, 2328 Meerle, Belgium.

ORAL SESSION 32 - Wednesday 25 (9:30-10:30 h)

Topic 3: Crop production in controlled environment horticulture. */ 3.2. Fruit quality in greenhouse horticulture. – 3.3. Plant genomics and breeding. – 3.4. Modelling plants physiology.*

Chair: Yasunaga Iwasaki (*Meiji University, Faculty of Agriculture, Kawasaki city, Japan*)

9:30-9:45

OS32-01

Integrating crop growth model and visual signals for intelligent climate control

Ziye Zhu
Agricultural Biosystems Engineering Group, Wageningen University Research, Postbus 17, 6700AA Wageningen, Netherlands.

9:45-10:00

OS32-02

Thidiazuron enhances strawberry shoot multiplication by regulating hormone signal transduction pathways

Fang Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

10:00-10:15

OS32-03

Prediction of strawberry growth changes based on multi-dimensional growth and environmental data

Woo-Joo Choi
Joenbuk National University , Jeonju-si, Deokjin-gu, Jeonbuk-do, Republic of Korea.

ORAL SESSION 33 - Wednesday 25 (9:30-10:30 h)

Topic 2: Mechanization, Digitization, Sensing and Robotics. */ 2.4. Precision horticulture and engineering.*

Chair: Ken-ichiro Yasuba (*Okayama University, Okayama, Japan*)

9:30-9:45

OS33-01

Prediction of sugar content and firmness in the growth stage of peaches using hyperspectral technology

Harin Jang
Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea.

9:45-10:00

OS33-02

Application of hyperspectral imaging in bruise detection of horticultural products based on artificial neural networks

Jiwon Ryu
Seoul National University, Rm 2210, Building 200, Gwanak-ro 1, Seoul, Seoul, Republic of Korea.

10:00-10:15

OS33-03

Monitoring of gochujang fermentation based on hyperspectral imaging technique

Minhyun Kim
Seoul National University, 1, Gwanak-ro, Gwanak-gu, Seoul, Republic of, Seoul, Republic of Korea.

10:15-10:30

OS33-04

Application of plant phenotyping to realize data-driven greenhouse horticulture

Takashi Okayasu
Kyushu University, 744 Motooka, Nishi-ku, Fukuoka 819-0395, Japan.

ORAL SESSION 34 - Wednesday 25 (11:00-12:30 h)

Topic 5: Light in Horticulture */ 5.2. Lighting technology. – 5.6. Vertical Farming.*

Chair: Kami Baghalian (*Anglia Ruskin University, ARU-Writtle, Chelmsford, United Kingdom*)

11:00-11:15

OS34-01

Numerical evaluation of air distribution systems according to vertical farm scale for improving uniformity

Jeong-hwa Cho
Korea Institute of Machinery Materials, 156 Gajeongbuk-ro, Yuseong-gu, Daejeon, Republic of Korea.

11:15-11:30

OS34-02

Multispectral assessment of tipburn in lettuce under dynamic lighting and airflow in vertical farming

Matteo Landolfo
University of Bologna, Viale Giuseppe Fanin, 40-50, 40127, Bologna, Italy.

11:30-11:45

OS34-03

Seedling growth and light acclimation after transplating cucumber grown under different spectral qualities

Minhee Han
Protected Horticulture Research Institute, 1425, Jinham-ro, Haman-gun, Republic of Korea.

11:45-12:00

OS34-04

Automated and precise single strawberry plant height measurement in vertical farms using mask R-CNN and binocular vision

Zicheng Zhan
College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou, Zhejiang, 310058, China.

12:00-12:15

OS34-05

Improving vertical farming sustainability through dynamic modulation of blue and red-light intensity

Vivek Jadhav
University of Bologna, DISTAL, Viale Giuseppe Fanin 44-46, 40127, Bologna, Italy.

12:15-12:30

OS34-06

Reduced light use efficiency under a cost-reducing lighting strategy in tomato greenhouses

Marlies Huysmans
Research Centre Hoogstraten, Voort 71, 2328 Meerle, Belgium.

ORAL SESSION 35 - Wednesday 25 (11:00-12:30 h)

Topic 6: Sustainable greenhouse production */ 6.5. Sustainable greenhouse systems and environmentally friendly technologies.*

Chair: Ariane Grisey (*Centre Technique Interprofessionnel des Fruits et Légumes - CTIFL, Saint Remy de Provence, France*)

11:00-11:15

OS35-01

Greenhouse 2030, towards an emission free cultivation

Frank Kempkes
Wageningen University Research WUR, Violierenweg 1, 26656 mv Bleiswijk, Netherlands.

11:15-11:30

OS35-02

Optimizing renewable energy and water management in greenhouse complexes on reclaimed land

Il-Hwan Seo
Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, Jeonju-si, Jeollabuk-do, 54896 Republic of Korea.

11:30-11:45

OS35-03

CO_2 of the future? Assessing the potential of direct air capture for greenhouse horticulture

Isabella Righini
Wageningen University Research, PO Box 644, 6700 AP, Netherlands.

11:45-12:00

OS35-04

Towards a climate neutral cultivation of *Anthurium*: A 2-year cultivation demo in the 2SaveEnergy greenhouse

Nieves Garcia Victoria
Wageningen UR Greenhouse Horticulture, Violierenweg 1, 2665 MV Bleijswijk, Netherlands.

12:00-12:15

OS35-05

Estimating time-series energy consumption of combustion-type air heater in greenhouse using readily measurable variables

Ryota Tsuchiya
Institute for Rural Engineering, NARO, 2-1-6 Kannondai, Tsukuba 305-8609, Japan.

12:15-12:30

OS35-06

Demonstration test on supplying heat to a greenhouse using a water source heat pump system that uses running water from an irrigation canal as a heat source

Takashi Miki
Institute for Rural Engineering, NARO, 2-1-6 Kannondai, Tsukuba, Japan.

ORAL SESSION 36 - Wednesday 25 (11:00-12:15 h)

Topic 1: Greenhouse Environment and Climate Control */ 1.2. Computational Fluid Dynamics (CFD) in controlled environment horticulture.*

Chair: Hicham Fatnassi (*INRAE PACA Research Center, Avignon, France*)

11:00-11:15

OS36-01

Numerical and experimental evaluation of a greenhouse for the ex-vitro hardening of banana seed plant material: optimization of microclimatic conditions

Jorge Flores
Posgrado en Hidrociencias, Colegio de Postgraduados. Carr, Mex-Tex. , Km. 36.5 Texcoco. 56264, Mexico state, Mexico.

11:15-11:30

OS36-02

Comparison of numerical crop models used in climate control for greenhouses and plant factories

Luyang Kang
Biotechnology Institute, Xianghu Laboratory, Hangzhou, Zhejiang, 311231, China.

11:30-11:45

OS36-04

Preliminary simulation of computational fluid dynamics using a plant model reproducing each leaf

Takeshi Kuroyanagi
Western Region Agricultural Research Center, NARO, 1-3-1 Sen-yu, 765-8508 Zentsuji Kagawa, Japan.

ORAL SESSION 37 - Wednesday 25 (11:00-12:30 h)

Topic 4: Fertigation, water and growing medium */ 4.1. Fertigation management.*

Chair: Paul Fisher (*Environmental Horticulture Dept., University of Florida, USA*)

11:00-11:15

OS37-01

Load Cell Array: A scalable low-cost weight-based irrigation and real-time transpiration experimental system

Miguel Urrestarazu Gavilán
Universidad de Almería, Departamento de Agronomía, La Cañada de San Urbano, 4120 Almeria, Spain.

11:15-11:30

OS37-02

Nutrient solution uptake dynamics of a landrace of *Cucumis melo* L. in a closed-cycle nutrient film technique system

Onofrio Davide Palmitessa
Department of Soil, Plant and Food Sciences, Via Amendola, 165A, Bari, Italy.

11:30-11:45

OS37-03

Effects of the irrigation strategies of accumulated solar radiation on cucumber yield and quality under different soil textures in greenhouse

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), 12#, Zhongguancun South Street, Haidian District, Beijing City, 100081, China.

11:45-12:00

OS37-04

Irrigation management and container shape effects on growth, yield and cannabinoid content of hemp

Raul I Cabrera
Rutgers University, Department of Plant Biology, 121 Northville Road, Bridgeton, New Jersey 08302, United States of America.

12:00-12:15

OS37-05

Insights into fertigation in systems with organic substrates: lessons learned in the High Andean Tropics

Rodrigo Gil Castañeda
Universidad Nacional de Colombia, Calle 7 A Bis A 72 92, Casa 34, Bogotá 110821, Colombia.

12:15-12:30

OS37-06

Comparison of *cucubita pepo* crop on substrate with and without recirculation

Carlos Galindo-Rodriguez
Universidad de Almería, 04120 Cañada San Urbano, Almería, Spain

POSTER SESSION 07 - Wednesday 25 (12:30-13:00 h)
Topic 4: Fertigation, water and growing medium

PS07-01
A novel low-cost 3D-printed sensor system for real-time water quality monitoring in controlled environment agriculture and space applications.
Ankit Singh
University of Maine, 15 Oak Street, Suite 302, Springvale ME 04083, United States of America.

PS07-02
Optical properties of nanoparticle-coated glasses affect lamb's lettuce morphology and yield
Bozidar Benko
Faculty of Agriculture, Department of Vegetable Crops, Svetosimunska 25, Zagreb 10000, Croatia.

PS07-03
Enhancing aquaponics productivity through planting media inoculation and microbial biodiversity
Sayuri Teramoto
University of the Ryukyus, 1 Senbaru, Nishihara, Okinawa 9030213, Japan.

PS07-04
Mixture design-based optimization of red, green, and blue led ratios and seedling quality evaluation in leafy vegetables
Da-Seul Choi
Chungbuk National University, 1, Chungdae-ro, Seowon-gu, Cheongju-si, Republic of Korea

PS07-05
Zucchini seedlings benefit from the partial replacement of peat with compost derived from organic waste
Elisa Cioccolo
Universidad de la Tuscia, via zuccari 148, 01100 Viterbo Viterbo, Italy

PS07-06
Effect of electrical conductivity level changes in nutrient solution for overgrowth suppression of cucumber seedlings
HyeongEun Choi
Gyeongsang National University, 501 Jinju-daero, 455-324, 52828 Gyeongsangnam-do Jinju-si, Republic of Korea.

PS07-07
Compost tea from vegetable waste from horticultural crops as a source of nutrients in biofertigation
Mª del Carmen Salas
Departamento de Agronomia, Universidad de Almeria, 04120 Almeria, Spain

PS07-08
Compost of *Rugulopteryx okamurae* for use as a substrate in seedling production
Mª del Carmen Salas
Departamento de Agronomia, Universidad de Almeria, 04120 Almeria, Spain

PS07-09
Effect of amorphous calcium phosphate (nACP) nanopriming on lettuce germination
Miguel Guzmán
Dpto. Agronomy, Universidad de Almería, Crtra. Sacramento s/n, 04120 Almería, Spain

PS07-10
Relative humidity of the root-zone air layer affects the root development and growth of lettuce seedlings
Min-Jeong Ha
Chungbuk National University, Chungdae-ro 1, Cheongju-si, Chungcheongbuk-do, Republic of Korea.

PS07-11

Study of the evolution of the concentration of ions in leachate of a crop on substrate with recirculation

Patricia Marín-Membrive
Universidad de Almería, 04120 Cañada San Urbano, Almería, Spain

PS07-12

Use of chlorine dioxide as a disinfectant of recirculated water from drainage in a hydroponic crop

Patricia Marín-Membrive
Universidad de Almería, 04120 Cañada San Urbano, Almería, Spain

PS07-13

Nutrient flow as eustress in hydroponics: root growth promotion through phytohormone regulation and signal transduction

Qichang Yang
Institute of Urban Agriculture, No. 36 Lazi, Chengdu, Sichuan, 610000, China

PS07-14

High-proportion blue light irradiation at the end-of-production stage promotes the biosynthesis and recycling of ascorbate in lettuces

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), 12#, Zhongguancun South Street, Haidian District, Beijing City, 100081, China

PS07-15

Narrowband blue LEDs with different peak wavelengths can similarly promote plant elongation

Qingming Li
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences, No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

KEYNOTE LECTURE 6 - Wednesday 25 (15:00-15:30 h)

Topic 6: Sustainable greenhouse production

Chair: Diego Luis Valera-Martínez (*University of Almería - Dept. Engineering, Almería, Spain*)

KN6

Sustainable greenhouse production

Fátima Baptista
Mediterranean Institute for Agriculture, Environment and Development (MED) & CHANGE; Agricultural Engineering Department, University of Évora, Portugal.

POSTER SESSION 08 - Wednesday 25 23 (15:30-16:00 h)

Topic 5: Light in Horticulture

PS08-01

Exploration on temperature variation for E-W and N-S rows cultivation inside a Chinese solar greenhouse

Feng Zhang
Shenyang Agricultural University, No.120 Dongling Road, Shenhe District, Shenyang, China.

PS08-02

Pansies under the spotlight: light-driven enhancements in yield, quality, and energy use efficiency of edible flowers (*Viola* × *wittrockiana*)

Ioanna Chatzigeorgiou
SASRER Lab, Hellenic Agricultural Organization-DIMITRA, 57001 Central Macedonia Thermi, Thessalonik, Greece.

PS08-03

Effects of supplemental lighting and solid CO_2 generator on the growth, fruit quality, and yield of '*Kuemsil*' strawberry

Jeong Kil Koo
Gyeongsang National University, 501 Jinju-daero, 455-324, 52828 Gyeongsangnam-do Jinju-si, Republic of Korea.

PS08-04

Higher light intensity supplemented with far-red light enhanced growth and flowering of rosa *'Queen of Sweden*'

Lin Ouyang
Institute of Urban Agriculture, Chinese Academy of Agricultural, China.

PS08-05

Yield and quality of *Centella asiatica* cultivated in a greenhouse via supplemental lighting

Phenchan Whijitara
Department of Agriculture, Ministry of Agriculture and Cooperatives, Thailand.

PS08-06

Light management for dwarf tomato production in vertical farm: effect of different light spectra on growth, yield, and lighting energy use efficiency

Riccardo Prandi
Department of Agricultural and Food Science, Alma Mater Studiorum University of Bologna, Viale Giuseppe Fanin 44, Bologna, Italy.

PS08-07

Transition from HPS to LED lighting affects plant energy metabolism and photosynthesis

Satu Engström
Natural Resources Institute Finland, Piikkiö, Finland.

PS08-08

Analysis of winter sunshine hour deficiency status in korea and its effects on greenhouse horticultural crops

Seungwon Seok
Jeonbuk National University, 567, Baekje-daero, Deokjin-gu, 54898, Jeonju-si, Jeonbuk State, Republic of Korea.

PS08-09

Diurnal rhythm of tomato transpiration rates under controlled environments

Shoko Hikosaka
Chiba University, 648 Matsudo, Matsudo city 271-8510, Japan.

PS08-10

Optimizing light conditions for cucumber: From growth chambers to greenhouses

Sissel Torre
Norwegian University of Life Sciences, P.O. Box 5003. NO-1432 Ås, Norway.

PS08-11

Chalcone synthase expression regulated the polyphenol biosynthesis depended on blue light in *Catharanthus roseus*

Taro Fukuyama
Tamagawa University, 6-1-1 Tamagawagakuen, Machida , 194-8610, Japan.

PS08-12

Light-adapted flash-induced chlorophyll fluorometry to monitor physiological limitations in controlled environment agriculture

Tuomo Laine
Natural Resources Institute Finland Luke, Toivonlinnantie 518, FI-21500 Piikkiö, Toivonlinnantie 518, Finland.

PS08-13

Effect of controlled RGB LED light ratios on growth, leaf coloration, and chlorophyll fluorescence in two cultivars of coleus (*Plectranthus scutellarioides*)

Udani Manodya Jayathissa Arachchilage
Jeju National University, Department of Horticulture, 212 Floriculture Laboratory, 63243 Jeju Jeju-si, Republic of Korea.

PS08-14

The effects of different LED light quality ratios on the growth of lentinula edodes fruiting bodies

Wei Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Sichuan, China.

PS08-15

UV-A supplement improved growth, antioxidant capacity, and anthocyanin accumulation in purple lettuce (*Lactuca sativa* L.)

Yaliang Xu
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences, No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

PS08-16

The interaction between nitrogen supply and light quality on growth, resource allocation and metabolic processes in lettuce (*Lactuca sativa* L.)

Zheng Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences, No. 36 Lazidong Street, Tianfu New District, Chengdu, Sichuan, 610213, China.

PS08-17

Crop shading simulation of east and west row cultivation in winter solar greenhouse

Zhouping Sun
College of Horticulture, Shenyang Agricultural University, Shenyang 110866, China.

PS08-18

Impact of light intensity and electrical conductivity on the growth and quality of Lettuce in indoor vertical farming systems

Laura Cammarisano
University of California Davis, One Shields Avenue Davis, CA 95616, United States of America.

ORAL SESSION 38 - Wednesday 25 (16:00-17:30 h)

Topic 5: Light in Horticulture */ 5.2. Lighting technology. – 5.4. Plant factory with artificial lighting (PFAL).*

Chair: Cristian Collado (*North Carolina State University, Raleigh, United States of America*)

16:00-16:15

OS38-01

Energy consumption analysis of plant factories: impacts of climatic conditions and control strategies

Fulin Xia
Zhejiang University, No. 866, Yuhangtang Road, Sandun Town, Hangzhou, Zhejiang, 310058, China.

16:15-16:30

OS38-02

A multimodal large language model based strawberry disease management agent for plant factory production

Luyu Shuai
Zhejiang University, Hangzhou, China.

16:30-16:45

OS38-03

Optimisation of tomato production in a closed greenhouse system in Norway

Michel Verheul
Norwegian Institute of Bioeconomy Research, NIBIO Særheim, Section Horticulture, Postvegen 213, 4353 Klepp-St., Norway.

16:45-17:00

OS38-04

Assessment of shoot biomass and leaf area of lettuce via 3D point cloud techniques in plant factories

Shumao Wang
Biotechnology Institute, Xianghu Laboratory, Hangzhou, Zhejiang, 311231, China.

17:00-17:15

OS38-05

Continuous lighting to reduce electricity cost and greenhouse gas emissions in greenhouse cucumber production

Xiuming Hao
Harrow Research and Development Centre, Agriculture and Agri-Food Canada, 2585 County Road 20, Harrow, ONT, N0R 1G0, Canada.

17:15-17:30

OS38-06

Developing speed breeding protocols for spring wheat in plant factory with artificial light

Yuqi Zhang
Institute of Environment and Sustainable Development in Agriculture (IEDA), Chinese Academy of Agricultural Sciences, Zhongguancun South Street 12, Beijing, China.

ORAL SESSION 39 - Wednesday 25 (16:00-17:00 h)

Topic 6: Sustainable greenhouse production */6.1. Circular bioeconomy in controlled environments. – 6.3. Life cycle assessment (LCA) in greenhouse production. – 6.5. Sustainable greenhouse systems and environmentally friendly technologies. – 6.6. Vulnerability and resilience of protected crops against Climate Change.*

Chair: Frank Kempkes (*Wageningen University and Research - WUR, Bleiswijk, The Netherlands*)

16:00-16:15

OS39-01

Improving environmental impacts of tomatoes and cucumbers in greenhouses

Ariane Grisey
Centre Technique Interprofessionnel des Fruits et Légumes (CTIFL), Route Mollèges, 13210 Saint Remy de Provence, France.

16:15-16:30

OS39-02

Pilot-scale optimization of anaerobic digestion of tomato and cucumber plant residues: Advancing a Circular Agricultural Management Strategy

Marianne Belley
University of Laval, 2400 Chemin Sainte-Foy, 123, Quebec G1V 4G6, Canada.

16:30-16:45

OS39-03

Optimised site-specific production system planning for future climates using IPCC scenarios

Oliver Körner
Leibniz-Institute of Vegetable, and Ornamental Crops IGZ, Theodor-Echtermeyer-Weg 1, 14979 Grossbeeren, Germany.

16:45-17:00

OS39-04

Developing status and future trends of China's intelligent greenhouse horticulture

Xiaoming Wei
National Engineering Research Center for Information Technology in Agriculture, Shuguang Garden Middle Road, Haidian, Beijing, China.

ORAL SESSION 40 - Wednesday 25 (16:00-17:00 h)

Topic 2: Mechanization, Digitization, Sensing and Robotics / *2.4. Precision horticulture and engineering.*

Chair: F.D. Molina-Aiz (*University of Almería - Dept. Engineering, CIAMBITAL, Almería, Spain*)

16:00-16:15

OS40-01

Spectral splitting Agrivoltaics: Plants grown under dynamic shading with filtered sunlight

Helena Vitoshkin
Volcani Center, Derech-Hmakabim 68, Rishon-Le, Israel.

16:15-16:30

OS40-02

A friendly warning tool for supporting grape disease infection risk and control strategy in China

Hui Wang
Beijing Academy of Agricultural and Forestry Sciences, Beijing 100097, Beijing, China.

16:30-16:45

OS40-03

Monitoring Graft Union Establishment Using Bioimpedance Spectroscopy

Junyoung Park
Department of Biosystems Engineering, Seoul National University, Seoul,08826, 2. Integrated Major in Global Smart Farm, Seoul National University, Seoul,08826, Republic of Korea.

16:45-17:00

OS40-04

Development of 3D phenotypic analysis technology for precision monitoring of strawberries

Seonghwan Lee
College of Agriculture and Life Sciences, Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, Jeonju-si, 54896 Jeonbuk State, Republic of Korea.

ORAL SESSION 41 - Wednesday 25 (16:00-17:30)

Topic 5: Light in Horticulture */ 5.3. Effect of light on plant growth.*

Chair: Francesco Orsini (*Università di Bologna, Bologna, Italy*)

16:00-16:15

OS41-01

Partially substituting top-light with intracanopy light increases yield more at higher LED light intensities

Ep Heuvelink
Horticulture and Product Physiology, Wageningen University, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands.

16:15-16:30

OS41-02

Balancing biomass and resource use efficiency: the untapped potential of end-of-day far-red light in *Cannabis* cultivation

Fabio Perotti
Università di Bologna, Viale Giuseppe Fanin 46, Bologna, Italy.

16:30-16:45

OS41-03

Enhancing strawberry propagation systems through photoperiod, spectrum, and intracanopy lighting

Moein Moosavi-Nezhad
Department of Horticulture, North Carolina State University, Raleigh, United States of America.

16:45-17:00

OS41-04

Changing red and blue lighting mode in greenhouse lettuce production: enhancing growth and regulating nitrate content

Mojtaba Delshad
Department of Horticultural Science, Faculty of Agriculture, College of Agriculture, Natural Resources, University of Tehran, 31587-77871 Karaj, Iran.

17:00-17:15

OS41-05

Quantifying lettuce growth and yield in the vertical farm using a functional-structural plant model

Ningyi Zhang
Nanjing Agricultural University, 210095, Nanjing, China.

17:15-17:30

OS41-06

Rapid enhancement of chlorogenic acid in leaf lettuce plants grown under greenhouse condition via short-term continuous blue LED lighting with high CO_2 and low air temperature treatment

Naoya Fukuda
Faculty of Life and Environmental Sciences, University of Tsukuba, Tennodai 1-1-1, Tsukuba city, Japan.

POSTER SESSION 09 - Wednesday 25 (17:30-18:00 h)

Topic 5: Light in Horticulture - Topic 6: Sustainable greenhouse production

PS09-01

The use of bumblebees as potential pollinating agents in vertical farming

Matteo Landolfo
DiSTAL, Science University of Bologna, Viale Fanin 42, Bologna, Italy.

PS09-02

Effects of nutrient solution flow on root morphology and growth of lettuce in hydroponics at plant factory

Bateer Baiyin
Institute of Urban Agriculture, Institute of Urban Agriculture, No. 36 Lazi, Chengdu, China.

PS09-03

Artificial intelligence-based prediction of environmental factors in building-integrated rooftop greenhouses using building energy simulation analysis

Eunjung Choi
Korea Institute of Machinery Materials, 156 Gajeongbuk-Ro, Yuseong-Gu, 3103 Daejeon, Republic of Korea.

PS09-04

Development of a semi-automatic control system for vertical farming units using low-cost wireless sensor networks

Fernando Fuentes-Peñailillo
Vicerrectoría Académica, Universidad de Talca, Chile.

PS09-05

Optimization of cultivation conditions for basil in vertical farming set-up

Gil Carron
Agroscope, Route des Eterpys 18, 1964 Conthey, Switzerland.

PS09-06

Effects of Daily Light Integral (DLI) and Vapor Pressure Deficit (VPD) control on the initial growth and vegetative development of strawberry '*Kuemsil*' in an artificial light vertical farm

Goun Im
Jeonbuk National University, Baekje-daero 567, Deokjin-gu Jeonju, Jeollabuk-do, Republic of Korea.

PS09-07

Sequential anaerobic-aerobic bioreactors remediate agrochemicals when producing ornamental crops using recycled irrigation water

Henry Gonzalez
Michigan State University, 1066 Bogue St, East Lansing, Michigan 48824, United States of America.

PS09-08

A modelling study on the trade-off of lighting strategy and energy use in Vertical Farming

Homa Esmaeli Sooderjani
Wageningen University Research, Agricultural Biosystems Engineering Group, Wageningen, Netherlands.

PS09-09

Development of nutrient solution for coriander in vertical farms

Il-Beom Yang
Chungbuk National University, 1, Chungdae-ro, Seowon-gu, Cheongju-si, Chungcheongbuk-do, Republic of Korea.

PS09-10

Policy trends and for heat pumps application in horticulture industry for renewable energy application

Jae Min Yu
Gyeongsang National University, 52828 Jinju, Republic of Korea.

PS09-11

Far-red light promotes flowering and stem elongation of petunia in a closed-type plant factory system with sole-source light-emitting diodes

Jeongmin Park
Jeju National University, Department of Horticulture, 212 Floriculture Laboratory, 63243 Jeju Jeju-si, Republic of Korea.

PS09-12

Nutritional strategies in lemon (*Citrus Limon* l.) for climate change challenges

Maria José González Fernández
Centro Tecnológico Tecnova, Parque Tecnológico Almería PITA, Av. Innovación, 23, El Alquián, 04131, Spain.

PS09-13

Environmental impact assessment of tomato seedling production in a greenhouse nursery: Insights for sustainable practices

Maria Ravani
SASRER Lab, ELGO-DIMITRA, Thermi Thessaloniki, Thessaloniki, Greece.

PS09-14

Far-red light and high light intensity promote rice speed flowering in plant factory

Qichang Yang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Sichuan, China.

PS09-15

Highly efficient cultivation of dwarf rice plants in a plant factory with artificial lighting

Reia Tomita
Tamagawa University, 6-1-1 Tamagawagakuen, Machida, Japan.

PS09-16

Comparison of seedling quality of cucumber seedlings and growth and production after transplanting according to differences in seedling production systems

Soonjae Hyeon
Kangwon National Universty, Chuncheon, Republic of Korea.

PS09-17

Supplemental UV-A or deep blue LED radiation using linear guide rails improves energy efficiency based on bioactive compounds of red lettuce in vertical farms

Weonil Hong
Chungbuk National University, 1 Chungdae-ro, Seowon-gu, Cheongju-si, Chungcheongbuk-do, Republic of Korea.

PROGRAM

THURSDAY

26 JUNE

Thursday June 26, 2025

Time	Thursday 26-06-2025
8:00-8:30	Registration 8:00-12:00
8:30-9:00	**Technical sessions - Almería Horticulture (A)** *Invited speaker: Roberto García Torrente*
9:00-9:30	**Coffee Break – *Paraninfo* Hall**
9:30-10:00	**TS-1** (***Paraninfo - A***) – Oral sessions for scientists and engineers TS01-01: Athanasios Sapounas TS01-02: Kenneth Tran TS01-03: Pierre-Emmanuel Bournet TS01-04: Silke Hemming
10:00-10:30	
10:30-11:00	**Coffee Break – *Paraninfo* Hall**
11:00-11:30	**TS-2** (***Paraninfo - A***) – Oral sessions for scientists and engineers TS02-01: Alvaro Fuentes TS02-02: Cecilia Berrueta TS02-03: Dimitrios Savvas TS02-04: Harlene Hatterman-Valenti TS02-05: Francisco Domingo Molina Aiz TS02-06: Tae In Ahn
11:30-12:00	
12:00-12:30	
12:30-13:00	***Poster presentations – Session 10*** **(E)** PS10-01: Ado Van Assche PS10-02: Ankit Singh PS10-03: Ariane Grisey PS10-04: Bong Salazar PS10-05: D.T.P. Nguyen PS10-06: Georgios Ntinas PS10-07: Jie Peng PS10-08: L. Rossdeutsch PS10-10: M. Carmen Salas PS10-11: M.J. González PS10-12: M. Takahashi PS10-13: P. Rebolledo Gonzalez PS10-14: Solhee Kim PS10-15: Vi. Cioncoloni PS10-16: Wei Wang PS10-18: X. Zhang-Schneider
13:00-15:00	**Lunch – Restaurant of the University of Almería (F)**
15:00-15:30	***Farewell Speech - Closing ceremony*** **(A)** ISHS Young Minds Award Presentation of the next GreenSys2027 in Wageningen Final remarks by the Organizing Committee
15:30-16:00	
16:00-16:30	
16:30-17:00	***Technical Tours*** *- Visit to the University of Almería Experimental Farm UAL-ANECOOP* *- Visit to commercial (Agricola Vasan S.L.) and experimental (IFAPA Centro La Mojonera) greenhouses in Almería*
17:00-17:30	
18:30-19:00	
19:00-19:30	
19:30-20:00	
20:00-20:30	
20:30-21:00	
21:00-21:30	

Oral presentations: Thursday June 26, 2025

KEYNOTE LECTURE 7 Thursday 26 (8:30-9:00 h)
Topics 1-6. Advanced technologies and management for sustainable greenhouse systems

Chair: F.D. Molina-Aiz (*University of Almería - Dept. Engineering, CIAMBITAL, Almería, Spain*)

8:30-9:00

KN7

60 years of innovation for more sustainable agriculture in Almería

Roberto García Torrente
Director of Sustainability and Agri-Food Development at Grupo Cajamar. Almería, Spain.

TECHNICAL SESSION 01 Thursday 26 (9:30-10:30 h)
Topic 1: Greenhouse Environment and Climate Control
Topic 2: Mechanization, Digitization, Sensing and Robotics

Chair: Esteban José Baeza-Romero (COEXPHAL, R&D Department, La Mojonera, Almería, Spain)

9:30-9:45

TS01-01

Integrating extreme weather events into greenhouse climate simulations

Athanasios Sapounas
TNO, Digital Built Environment, Molengraaffsingel 8, 2629 JD Delft, Netherlands.

9:45-10:00

TS01-02

Comparative analysis of advanced AI/data-driven and expert-driven climate control in greenhouse cherry tomato

Kenneth Tran
Koidra Inc, 1201 3rd Ave, Suite 2200, Seattle, WA 98101, United States of America.

10:00-10:15

TS01-03

Impact of insect-proof nets on local climate conditions, pest spread and yield in an unheated tunnel greenhouse with a cucumber crop

Pierre-Emmanuel Bournet
L'Institut Agro 2, rue Le Nôtre, 49045 Angers, France.

10:15-10:30

TS01-04

Quantifying the contribution of autonomous greenhouse control algorithms to net profit, crop yield and sustainability indicators

Silke Hemming
Wageningen University & Research, Business Unit Greenhouse Horticulture, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands.

TECHNICAL SESSION 02 Thursday 26 (11:00-12:30 h)
Topic 2: Mechanization, Digitization, Sensing and Robotics
Topic 4: Fertigation, water and growing medium.
Topic 6: Sustainable greenhouse production.

Chair: Fátima Baptista (*Mediterranean Institute for Agriculture, Environment and Development (MED) & CHANGE; Agricultural Engineering Department, University of Évora, Portugal*)

11:00-11:15

TS02-01

AI-driven autonomous crop monitoring with multivariable data integration

Alvaro Fuentes
Jeonbuk National University, Republic of Korea.

11:15-11:30

TS02-02

FertiRIEGO: decision support system to calculate irrigation and nutrient requirements for greenhouse tomato

Cecilia Berrueta
INIA Uruguay, Cno. Al Terrible, Salto 50000, Uruguay.

11:30-11:45

TS02-03

Alternative options for the application of ion selective electrodes to optimize plant nutrition in a closed-loop soilless tomato crop

Dimitrios Savvas
Agricultural University of Athens, Laboratory of Vegetable Production, Iera Odos 75, 11855 Athens, Greece.

11:45-12:00

TS02-04

High tunnels extend the growing season for warm season vegetable crops in North Dakota, USA

Harlene Hatterman-Valenti
North Dakota State University, Dept 7670, PO Box 605, Fargo ND 58106-6050, United States of America.

12:00-12:15

TS02-05

Reduction of cover whitewashing of Mediterranean solar greenhouses using soil mulching with white marble gravel and the increase in the natural ventilation surface

Francisco Domingo Molina Aiz
University of Almería – Department of Engineering, CIAMBITAL, Ctra. Sacramento s/n, 04120 Almería, Spain.

12:15-12:30

TS02-06

Precision hydroponic management system based on real-time sensing of crop transpiration and nutrient compositions for closed-loop tomato cultivation

Tae In Ahn
Seoul National University, Department of Plant Science, Seoul, Republic of Korea.

POSTER SESSION 10 - Thursday 26 (12:30-13:00 h)
Topic 6: Sustainable greenhouse production

PS10-01
The use of condensation water of a cogeneration installation in hydroponic greenhouse bell pepper cultivation
Ado Van Assche
Research station for vegetable production, Duffelsesteenweg 101, 2860 Sint Katelijne Waver, Belgium.

PS10-02
Harnessing Greenhouse Technology: Opportunities and Challenges in the Northeast Agricultural Landscape
Ankit Singh
University of Maine15 Oak Street, Suite 302, Springvale ME 04083, United States of America.

PS10-03
Re-Greenhouse project: a renewable energy Decision Tool
Ariane Grisey
Centre Technique Interprofessionnel des Fruits et Légumes (CTIFL), Route Mollèges, 13210 Saint Remy de Provence, France.

PS10-05
Integrating Life Cycle Assessment and Life Cycle Costing for Sustainable Optimization in Plant Factories with Artificial Lighting
Duyen T.P. Nguyen
Center for Environment, Health and Field Science, Chiba University, 6-2-1 Kashiwanoha, Kashiwa 2770882, Japan.

PS10-06
Assessing the environmental impact of greenhouse tomato production with treated wastewater irrigation: a Life Cycle Perspective
Georgios Ntinas
SASRER Lab, Hellenic Agricultural Organization-DIMITRA, 57001, Thermi-Thessaloniki, Greece.

PS10-07
Cutting-edge technologies in plant factories to increase economic viability and environmental sustainability
Jie Peng
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences, No. 36 Lazi East Street, Tianfu New District, Chengdu City, China.

PS10-08
Energy-Efficient Cucumber Cultivation: Reducing Consumption and Chemical Residues While Managing Crop Performance
Landry Rossdeutsch
Centre Technique Interprofessionnel des Fruits et Légumes - CTIFL de Carquefou - ZI Belle Étoile - Antarès 35 allée des Sapins 44 483 Carquefou, France.

PS10-10
Degradability of the clips, material used as a crop support during the composting process: Effect on the final quality of the compost
Mª del Carmen Salas
Departamento de Agronomia, Universidad de Almeria, 04120 Almeria, Spain.

PS10-11
Development and application study of new ingredients from sustainable by-product revalorisation processes
Maria José González Fernández
Centro Tecnológico Tecnova, Parque Tecnológico Almería PITA, Av. Innovación, 23, El Alquián, 04131, Spain.

PS10-12
Effect of UV-A irradiation to increase the content of rice seed protein in the plant factory with artificial lighting
Masaaki Takahashi
National Agriculture and Food Research Organization (NARO), 1-31-1 Kannondai, Tsukuba City, Ibaraki 305-0856, Japan.

PS10-13

Sustainable Production of Leafy Vegetables Grown in an NFT System in Unheated Greenhouses and Vertical Farming with Controlled Environment

Pabla Rebolledo Gonzalez
University of Almería, Doctorate in Greenhouse Technology and Industrial and Environmental Engineering, International Doctoral School, Almería, Spain.

PS10-14

Environmental Implications of Soil and Hydroponic Tomato Production Systems in Smart Greenhouses: A Life Cycle Assessment Approach for Carbon Reduction Strategies

Solhee Kim
Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, 54896 Jeollabuk State Jeonju, Republic of Korea.

PS10-15

Exploring the potential productivity of container farming for urban applications

Virginia Cioncoloni
University of Bologna, Department of Agricultural and Food Science, Viale Fanin 44, Bologna, Italy.

PS10-16

Progress of facility agriculture in Gobi and desert areas

Wei Wang
Institute of Urban Agriculture, Chinese Academy of Agricultural Sciences (CAAS), Sichuan, China.

PS10-18

Modelling and simulating the environmental effects of biogas-waste scenarios used in greenhouse crop production

Xingjiang Zhang-Schneider
Leibniz-Institute of Vegetable and Ornamental Crops (IGZ), Theodor-Echtermeyer-Weg 1, 14979 Grossbeeren, Germany.

Presenting authors Index