

INNOVATIVE GREENHOUSE SUPPORT SYSTEM IN THE MEDITERRANEAN REGION: EFFICIENT FERTIGATION AND PEST MANAGEMENT THROUGH IOT BASED CLIMATE CONTROL — IGUESSMED

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Deliverable 5.6 WORKSHOPS

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Deliverable leader: CRRHAB

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Abstract

As part of the activities of Task 5.2: Demo and dissemination of iGUESS-MED support system performance, face-to-face or online workshops were organized by the project partners. The objectives of the first workshops were to train and inform the different stakeholders of the greenhouse tomato production sector on the project concept, its objectives and the methods and approaches to obtain the iGUESS-MED decision support system (DSS). The last workshops allowed the project partner' teams to present to the stakeholders the results of the iGUESS-MED project and the positive impact of using the DSS on the irrigation, fertilization and phytosanitary management, as well to modify climate conditions with the climate checker advice, in the greenhouse tomato crops of the Mediterranean basin. The workshops gave the opportunity to the people collaborating on the project to share their knowledge and experiences on smart and precise agriculture with the various stakeholders about greenhouse vegetable production, to exchange ideas on the current state of the sector and the prospects for decision-making tools to improve farmer profitability and reduce the effects of chemical inputs on the environment and human health.

The deliverable 5.6 presents the eight workshops (two per country) organized by the partners of the iGUESS-MED project. Growers, technical advisors, agronomy students, technology companies, researchers, computer scientists, agritech start-ups, and agricultural development organizations attended these workshops.

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1 Introduction



The iGUESS-MED project aims to develop a Decision Support System (DSS) able to effectively manage fertigation and prevent plant diseases and pests in tomato crops grown in soil and soilless in commercial greenhouses of the Mediterranean region. This innovative greenhouse DSS will be developed to (i) help greenhouse farmers to improve the management of fertigation in areas with low (saline) quality waters (ii) to reduce the use of chemicals by a sustainable and integrated pest and disease control and (iii) to improve the climatic efficiency in the existent greenhouse by low-cost climate actions. The DSS will allow obtaining healthier and higher quality productions and higher yields, while will reduce the use of water and the losses of nutrients and chemicals to the environment. iGUESS-MED will be able to manage efficient fertigation, to forecast diseases and pests, and to improve the climatic efficiency in tomato greenhouses, using only climate data acquisition and basic information on cropping system. The DSS will provide feedbacks and alerts about crop needs and real time recommendations to the farmers through friendly portable real time data visualization tools as PC, tablets or smartphones. To achieve this objective, new models for calculating crop evapotranspiration will be performed by integrating sensor data from plant, soil and climate, and forecasting models for assessing disease and pest risks will be developed by using the Integrated Pest Management.

The project consortium (research centers, SMEs and end-users of EU and non-EU countries belonging to the Mediterranean basin) will collaborate from the beginning to make the DSS marketable involving, end-users and stakeholders to validate the system in own greenhouses, reducing gaps between research, application developers and farmers. The application of DSS will benefit the workers and the consumers, providing better working conditions, crop healthiness and reduction of environmental impact.

1.1 Summary of the deliverable

The objective of this deliverable is to collect the Workshops held in the project. This deliverable is a part of Task 5.2 Demo and dissemination of iGUESS-MED support system performance. The aim of this task was to demonstrate the innovations, technical requirements and results achieved by the iGUESS-MED project to interested end users and stakeholders in the field.

The deliverable is divided into four chapters, each one covering the Workshops held in each project participating country. The target for this deliverable was to hold at least eight Workshops, two per country. The outcomes of this deliverable have been met. During these days, the viability and potential of iGUESS-MED was presented and demonstrated (objectives and the methodology undertaken), and its adoption was promoted by the dissemination of the results obtained.

The audience for the Workshops was broad and diverse, including farmers, trainers, agritechs, students, technology companies, researchers, and agricultural development agents.

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2 Workshops held in Spain

2.1 Tools for the sustainable management of irrigation and fertilisation of tomato crops in greenhouses (Almeria, November 2022).

Date: 16/11/2022

Location: Online, Spain

Type of audience: Technical Advisors, students, researchers

Number of attendees: 97

Highlights:

The Cajamar Foundation, with the collaboration of the University of Almeria (UAL), organised a webinar to present the main results obtained with the experimental trials carried out in Almeria, Spain.

This webinar consisted of a brief presentation of the iGUESS-MED project and three talks to present the main results obtained in the experimental trials carried out in Almeria.

The results of the experimental trials on plant nutrition and fertilization were shown in the talk entitled "Recommendations of nutrient solution composition in greenhouse tomato using the VegSyst-DSS tool" presented by Prof. Marisa Gallardo (UAL). The calibration, validation and use of the irrigation model in greenhouse soil-grown tomato was presented by Prof. Santiago Bonachela (UAL). Finally, M^a Dolores Fernández (CAJAMAR) presented the response of the soil-grown tomato crop to different irrigation management and water qualities.



The screenshot shows a webinar interface with a central presentation slide. The slide title is "La integración de:" and it lists three bullet points:

- Modelos previamente desarrollados para invernadero (gestión de plagas y enfermedades, fertirrigación, riego y control climático) en un único DSS.
- Sensores (clima, suelo y planta) y una herramienta portátil de visualización de datos en tiempo real como una tablet o un teléfono inteligente.
- Tecnologías de la Comunicación (IoT).

Below the text, there is a diagram showing the integration of the VegSyst-DSS tool (with sub-components CALFERT, Pflw, SIMULHYDRO, and DRI) with a greenhouse and a smartphone displaying real-time data. The webinar interface also shows a list of participants on the right and a Cajamar logo at the bottom of the slide.

Figure 1: Screenshot the webinar carried out on 16/11/2022 in Almeria, Spain.

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2.2 Presentation of the PRIMA iGUESS-MED project for the optimisation of irrigation and fertilisation of the greenhouse tomato crops (Almeria, March 2024).

Date: 12/03/2024

Location: Almería, Spain

Type of audience: Technical Advisors, students, farmers, researchers

Number of attendees: 149

Highlights:

The Cajamar Foundation, with the collaboration of the iGUESS-MED partners, organised a workshop to present the main results of the project. This dissemination event had an online and face-to-face format.

After the presentation of the iGUESS-MED project by Alejandra Navarro of CREA (CREA), the coordinator of the project, Davide Parisi of EVJA showed the prototype of the Decision Support System (DSS) for recommending irrigation and fertigation of tomato crops in Mediterranean greenhouses. The results of the commercial evaluation of iGUESS-MED DSS carried out in demo-pilot commercial greenhouses in Spain (Anecoop Farm, Almería) and Italy (Anterminelli Farm, Toscana), were then presented by Marisa Gallardo (UAL) and Luca Incrocci (UNIFI), in a tomato crop grown in soil and soilless, respectively. In both greenhouses, the amount of water and fertiliser applied to the crop was reduced when the tomato crop was irrigated and fertilised using the iGUESS-MED DSS recommendations.

Participants were interested in some aspects of the iGUESS-MED DSS, such as the climate and soil sensors used, the cost of this product once a commercial version will be available, etc.



Figure 2: Picture of the attendees at the workshop held on 12/03/2024 in Almeria, Spain.

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Figure 3: Pictures of the speakers at the workshop held on 12/03/2024 in Almeria, Spain.

The CAJAMAR Foundation and the University of Almería (UAL) participated in four workshops where they had the opportunity to disseminate the results of iGUESS-MED and increase the visibility of the project. A selective list of the events where iGUESS-MED results were presented can be found in the table below.

Table 1. A selective list of events where iGUESS-MED's outcomes were presented by CAJAMAR and UAL.

Date	Event	Partner
17/06/2021	The digitalisation of the agri-food sector. Webinar organized by Cajamar in collaboration with the Master's Degree in Digital Agriculture and Agri-Food Innovation of the University of Seville (Spain)	CAJAMAR
18/01/2022	Support tools for irrigation and fertigation scheduling. Webinar organized by Cajamar Foundation	CAJAMAR - UAL
15/03/2022	Innovation applied to the agri-food sector. Workshop organized by Meditomato PRIMA Project consortium.	CAJAMAR
25/3/2022	New research strategies in hydraulic engineering and plant production.	UAL

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In addition to organizing their own workshops and participating in others, CAJAMAR Foundation, with the collaboration of the iGUESS-MED partners, organised a JOINT WORKSHOP, on 12 March 2024, together to another PRIMA project Safe-H2O-Farm (Innovative farm strategies that integrate sustainable N fertilization, water management and pest control to reduce water and soil pollution and salinization in the Mediterranean.). In this workshop titled “Fertigation in tomato greenhouses across the Mediterranean basin: the contribution of PRIMA projects iGUESS-MED & Safe-H2O-Farm” both projects were presented by the coordinators: Dr. Alejandra Navarro Garcia (iGUESS-MED) and Dr. Michela Farneselli (Safe-H2O-Farm) with the online participation of PRIMA P.O., Dr. Marco Orlando and Prof. Ali Rhouma. The UAL (Dr. Francisco Padilla) and the Akdeniz University (Dr. Cihan Karaca), as partners who are involved in both projects, explained the similarities and differences of the activities carried out and what was learnt from iGUESS-MED and could help and improve Safe-H2O-Farm. This dissemination event had an online and face-to-face format. This dissemination event had an online and face-to-face format.



Figure 4: Pictures of the speakers at the workshop “Fertigation in tomato greenhouses across the Mediterranean basin: the contribution of PRIMA projects iGUESS-MED & Safe-H2O-Farm” held on 12/03/2024 in Almeria, Spain (online-presence format).

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3 Workshops carried out in ITALY

3.1 Workshop of iGUESS-MED project held at CREA (Pontecagnano, July 2023)

Date: 12/07/2023

Location: CREA (Research Centre for Vegetable and Ornamental Crops Council for Agricultural Research and Economics), Pontecagnano-Faiano (SA), Italy

Type of audience: Agronomists, technician, researchers, and Phd students

Number of attendees: 50 in presence, 20 online

Highlights:

On the morning of July 12th, from 09:30 a.m. till 13:30 p.m., a Workshop was organized by CREA (Research Centre for Vegetable and Ornamental Crops Council for Agricultural Research and Economics) as coordinator of IGUESS-MED project.

All the project partners, two members of the advisory board, Prof. Antonio Elia (UNIFG- Italy) and Dr. Maria Fernanda Ortuño Gallud (CEBAS-CSIC- SPAIN), and also researchers, Phd students, agronomist and agri-food sector technicians participated to this workshop.

We were glad to have an online connection to Prof. Ali Rhouma (PRIMA Project Officer) and to Dr. Stefano Vaccari (CREA General Management). All presentations were made in English due to the different nationalities of the attendees, and because it is the official language of the project.



Figure 5: Participants in person and online at the workshop organized by CREA in Pontecagnano (SA), Italy.

After the welcome greeting from Dr. Stefano Vaccari (General Director of CREA) Dr. Daniele Massa (Director of CREA-OF) and Prof. Ali Rhouma (Project Officer of PRIMA Foundation), Dr. Alejandra Navarro Garcia, coordinator of IGUESS-MED, presented the project to the attendees, highlighting the selection and funds, consortium, objectives, challenges, and results.

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Figure 6: Welcome to the iGUESS-MED Workshop hosted by Dr. Stefano Vaccari (General Director of CREA), Dr. Daniele Massa (Director of CREA-OF), and Prof. Ali Rhouma (Project Officer PRIMA Foundation).



Figure 7: iGUESS-MED Presentation by Dr. Alejandra Navarro Garcia (CREA - iGUESS-MED coordinator).

The workshop focussed on the three core aspects of the project: the main final product (Decision support system), its environmental and socio-economic impact assessment, and the future exploitation of the project results.

The first aspect was presented by Dr. Antonio Affinito, and Dr. Emanuele Varriale (EVJA), who explained how is, and how works the Decision Support System (DSS) prototype and the IoT-data management platform, and how was implemented in the commercial greenhouses.



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Figure 8: Dr. Antonio Affinito and Dr. Emanuele Varriale (EVJA) presenting the DSS prototype and IoT-data management platform designed and developed with iGUESS-MED.

Secondly, Prof. Fabio Bartolini (UNIFE) and Dr. Sara Sturiale (UNIFI) presented the life cycle sustainability assessment (LCSA) considering the four study cases of the project (one by project country: Italy, Spain, Tunisia, and Turkey) and the environmental and socio-economic impact assessment of this innovative technology in the MED greenhouses.







Figure 9: Prof. Fabio Bartolini (UNIFE) and Dr. Sara Sturiale (UNIFI) presenting the environmental and socio-economic impact assessment, and Life cycle sustainability assessment (LCSA) of iGUESS-MED DSS.

Finally, Dr. Aliona Lupu (Iniziativa Cube S.r.l., subcontracted by CREA in iGUESS-MED) gave a small seminar of how exploit the project results and how made an efficient business planning, speaking about market analysis, generation of new value proposition portfolio, business plan and business modelling.






Figure 10: Dr. Aliona Lupu (Iniziativa Cube S.r.l. subcontracting of CREA) explaining the exploitation of project results and the business planning.

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IL PROGETTO iGUESS-MED - Innovative Greenhouse Support System in the Mediterranean Region: efficient fertigation and pest management through IoT based climate control

Patronages






Mercoledì 12 Luglio 2023
 AULA MAGNA • CREA-Centro di ricerca Orticoltura e Florovivaismo (OF)
 Via Cavalleggeri 25 • Pontecagnano-Faiano (SA)


<p>9:30 Welcome Dr. Stefano Vaccari (General Director of CREA) Dr. Daniele Massa (Director of CREA-OF) Prof. Ali Rhouma (Project Officer PRIMA Foundation) Dr. Maurizio Camillo (Presidente ODAF Provincia di Salerno)</p> <p>10:00 iGUESS-MED Presentation (Introduction, objectives, results, and challenge). Dr. Alejandra Navarro Garcia (CREA-OF - iGUESS-MED coordinator)</p> <p>10:30 Decision Support System (DSS) prototype and IoT-data management platform (how is, how works, implementation in commercial greenhouses). Dr. Antonio Affinito, Dr. Davide Parisi, and Dr. Emanuele Varriale (EVJA)</p> <p>11:15 COFFEE BREAK</p> <p>12:00 Environmental and socio-economic impact assessment. Life cycle sustainability assessment (LCSA) Prof. Fabio Bartolini (UNIFE) and Dr. Sara Sturiale (UNIPI)</p> <p>12:45 Exploitation of project results and business planning (Market analysis, generation of new value proposition portfolio, business plan and business modelling). Dr. Alejandra Navarro Garcia (CREA-OF - iGUESS-MED coordinator) and Dr. Aliona Lupu (Iniziativa Cube)</p> <p>13:15 LUNCH</p>	<p>14:30 TRAINING SESSIONS – WORKSHOP • Presentazione e manuali d'uso dei protocolli e software coinvolti nel DSS iGUESSMED</p> <p>14:30 Protocolli dedicati per prevedere l'insorgenza di patologie e parassiti, aumentando i livelli di controllo biologico nelle coltivazioni di pomodoro delle serre mediterranee Dr. Catello Pane (CREA-OF), Dr. Marco Mosti, (BIOPLANET), Dr. Valeria Zeni (UNIPI), Prof. Asma Laarif and Dr. Thameur Bouslama (CRRHAB)</p> <p>16:00 COFFEE BREAK</p> <p>16:30 Gestione efficiente della fertirrigazione nelle coltivazioni di pomodoro IN SUOLO delle serre mediterranee attraverso il software VEGSYST (nutrizione) e PrHo (Irrigazione) Dr. Maria Dolores Fernández (CAJAMAR) – Porf. Marisa Gallardo (UAL)</p> <p>17:15 Gestione efficiente della fertirrigazione nelle coltivazioni di pomodoro IN FUORI SUOLO nelle serre mediterranee attraverso il software SIMULHYDRO Prof. Luca Incrocci (UNIPI) and Dr. Daniele Massa (CREA-OF)</p> <p>18:00 Semplici interventi per migliorare il clima nella serra mediterranea Dr. Esteban Baeza (FUTURE FARM Solutions) and Prof. Luca Incrocci (UNIPI)</p> <p>18.45 Discussione e Chiusura dei lavori</p>
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Il convegno si svolgerà in modalità mista, con la presenza nella sala di un numero massimo di 60 iscritti. La partecipazione è gratuita previa compilazione della [scheda di registrazione](#) da inviare entro e non oltre il 30 giugno 2023 a cui seguirà conferma. Saranno attribuiti i crediti formativi per gli iscritti ODAF che parteciperanno all'iniziativa. Gli interventi della mattina saranno in inglese, quelli del pomeriggio in italiano.

Comitato Organizzatore
 CREA-OF: Alejandra Navarro Garcia, Catello Pane, Crescenzo Vitolo, Daniele Massa, Fabio Scotto di Covella
 Università degli Studi di Pisa: Luca Incrocci, Sara Sturiale



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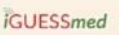
















Figure 11: Leaflets designed for the workshop, published on line and distributed to participants (CREA, 2023)

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3.2 Workshop held at the Association of Producer Organizations “C.S.C. Lazio” (Lazio, July 2024).

Date: 05/07/2024

Location: Association of Producer Organizations “C.S.C.” at Fondi (province of Latina, Lazio, Italy).

Type of audience: Growers, stakeholders, agronomists,

Number of attendees: 40 in presence; 15 on-line.

Highlights:

On the morning of 5th July 2024, a workshop was held at the Association of Producer Organisations “C.S.C. Lazio” at Fondi (province of Latina, Lazio, Italy), in collaboration with EVJA, University of Pisa and CREA. The main goals of the workshop were been to disseminate the results of two projects on the optimization of greenhouse tomato cultivation.



8:30 - Registrazione partecipanti

9:15 - Saluti istituzionali
Guido La Rocca, Presidente AOP CSC Lazio
Giuseppe Colla, Direttore CIA-Ses Azienda Agraria DS dell'Università della Tuscia
Daniele Massa, Direttore CREA Orticoltura e Florovivaismo

9:40 - Romano Pecchia, Direttore AOP CSC Lazio "Stato attuale e prospettive future del pomodoro nell'areale pontino e piano di Fondi"

10:00 - Giuseppe Colla, Mariateresa Candarelli, Francesco Latini, Università della Tuscia, Roberto Mariotti, Arsiel "Nutrizione e biostimolazione del pomodoro"

10:20 - Piero Santelli, Toro Ag "Gestione pilotata de'Irrigazione del pomodoro mediante sistema Tempus"

10:40 - Andrea Minuto, Gloria Strigina, CeRSAA "La difesa fitopatologica del pomodoro"

11:00 - Coffe break

11:30 - Alejandra Navarro Garcia, CREA Orticoltura e Florovivaismo "Il Progetto iGUESS-MED"

11:40 - Simone Scarpa, EVJA "DSS per ottimizzare il sistema suolo-pianta-atmosfera per le aricole in coltura protetta"

12:00 - Luca Incecci, Università di Pisa "Sviluppo e validazione di modelli di supporto decisionale per la gestione delle colture fuori suolo"

12:20 - Valeria Zeni, Università di Pisa e Stefano Foschi, Bioplanet "Il controllo biologico degli insetti dannosi del pomodoro: risultati del progetto iGUESS-MED"

12:40 - Question time

13:00 - Light lunch

14:30 - Corso di formazione sull'utilizzo del Sistema di Supporto Decisionale EVJA (riservato ai partecipanti in presenza)

17:00 - Conclusioni

Figure 12: Leaflets designed for the workshop, published on line and distributed to participants (UNIPI, 2024)

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The main results of the iGUESS-MED project were illustrated from 11:00 to 13:30. The coordinator of iGUESS-MED, Dr. Alejandra Navarro Garcia, provided a brief overview of the main objectives, results and challenge of the iGUESS-MED project. This was followed by a presentation by Dr. Simone Scarpa (Evja), Professor Luca Incrocci (UNIFI), and Dr Valeria Zeni (UNIFI) provided, respectively, an overview of the functionalities of the OPI-EVJA climate station, the Simulhydro model, and the protocols developed for the biological pest control.

The workshop was attended by 40 people in person and 15 online: many of them were agronomists, growers, and stakeholders.



Figure 13: Presentation of the main results of iGUESS-MED project by Dr Alejandra Navarro Garcia (CREA), Dr Simone Scarpa (EVJA), Prof. Luca Incrocci (UNIFI), and Dr Valeria Zeni (UNIFI).

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4 Workshops held in Turkey

4.1. Management of irrigation and fertilization in tomato greenhouses in the framework of the iGUESS-MED project (Antalya, August 2023)

Date: 10/08/2023

Location: Batı Akdeniz Agricultural Research Institute, Serik/ Antalya Turkey

Type of audience: Scientific community (higher education, research), students

Number of attendees: 65

Highlights:

The workshop organized within the framework of the iGUESS-MED project was held at the Batı Akdeniz Agricultural Research Institute, with the participation of researchers, academics, and students from different universities. During the workshop, Dr. Abdullah Ünlü, Director of the Batı Akdeniz Agricultural Research Institute, Project Leader Dr. Dursun Büyüктаş, and Project Researcher.

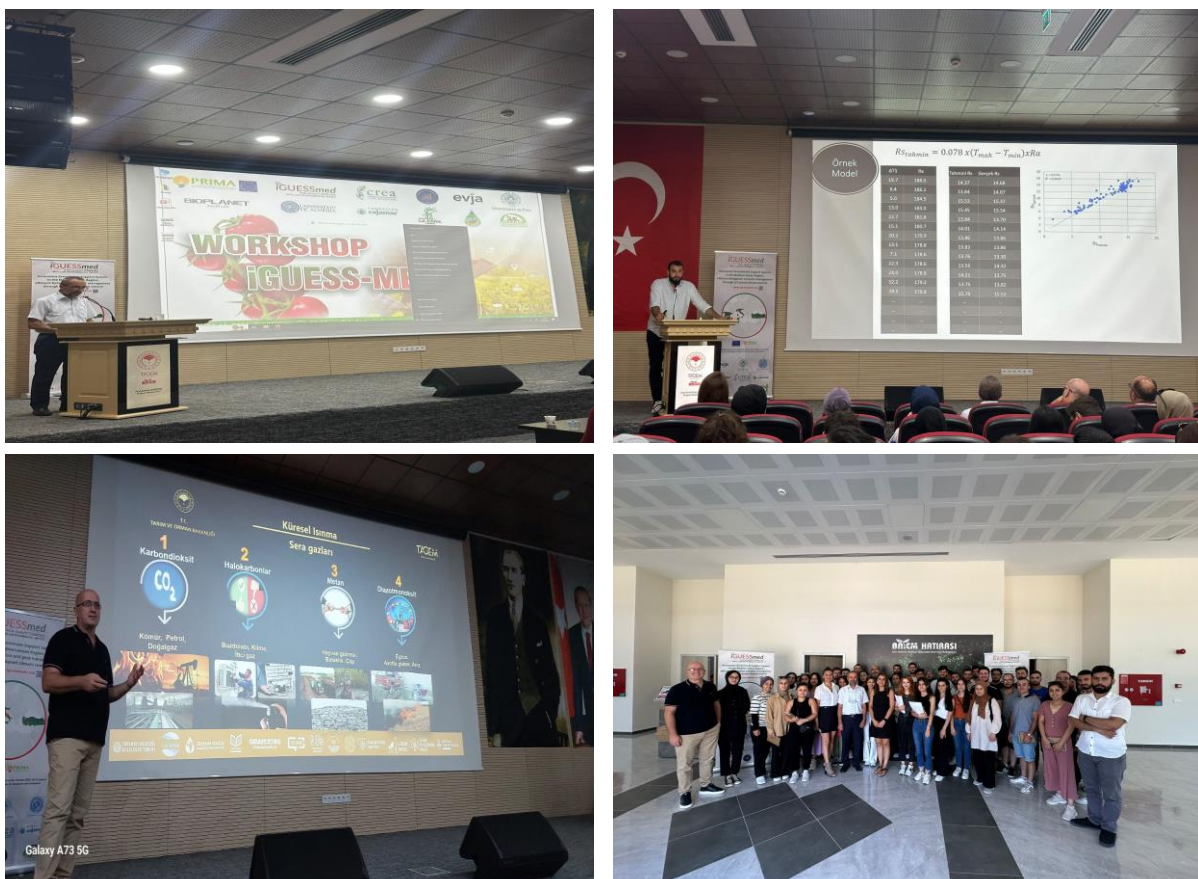


Figure 14: Speakers and attendees of the workshop at the Batı Akdeniz Agricultural Research Institute.

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Dr. Ahmet Kurunç gave their opening speeches. Dr. Gülçin Ece Aslan then gave a presentation on the Prima iGUESS-MED project, while Dr. Cihan Karaca gave a presentation on the introduction of OPI system and how works the iGUESS-MED DSS. Finally, Dr. Köksal Aydınşakir presented on the effects of climate change and global warming on agricultural production in the Mediterranean region.



The banner features logos of various partners: PRIMA, iGUESSmed, crea, evja, UNIVERSITÀ DI PISA, BIOPLANET, UNIVERSIDAD DE ALMERIA, FUNDACIÓN cajamar, and CERIAS. The central text reads "WORKSHOP iGUESS-MED" in large, bold letters. Below the text, it specifies the date and time: "AUGUST 10, 2023 THURSDAY 09:00" and the location: "Batı Akdeniz Agricultural Research Institute Serik, Antalya / TÜRKİYE". The background shows a person using a tablet in a field with various agricultural icons overlaid.

We are pleased to invite you to attend the Workshop of "iGUESSmed-Innovative Greenhouse Support System in the Mediterranean Region for Efficient Fertigation and Pest Management throught on IoT-Based Climate Control" project on August 10, 2023, at the Batı Akdeniz Agricultural Research Institute.

Prof. Dr. Dursun BÜYÜKTAŞ
Project Leader

WORKSHOP PROGRAM

09:00 - 09:30	Registration	10:30 - 11:00	Coffee Break
09:30 - 10:00	Welcome and Introduction Dr. Abdullah ÜNLÜ, Institute Director, Batı Akdeniz Agricultural Research Institute Prof. Mustafa ERKAN, Dean, Agricultural Faculty of Akdeniz University Prof. Dursun BÜYÜKTAŞ, Project Leader Agricultural Faculty of Akdeniz University Prof. Ahmet KURUNÇ, Project Researcher Agricultural Faculty of Akdeniz University	11:00 - 11:30	Impact of Global Warming and Climate Change on Agricultural Irrigation in Mediterranean Region Assoc. Prof. Köksal AYDINŞAKIR
10:00 - 10:30	iGUESS-MED Presentation Asst. Prof. Gülçin Ece ASLAN, Project Researcher	11:30 - 12:00	Application of OPI and Decision Support System (DSS) Prototype Asst. Prof. Cihan KARACA, Project Researcher
		12:00 - 13:30	Lunch
		13:30 - 17:00	Visit to Research Greenhouses in Batı Akdeniz Agricultural Research Institute

Figure 15: Leaflets designed for the workshop, published on line and distributed to participants (Akdeniz University, 2023)

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3.2. Introduction of the DSS developed within the iGUESS-MED project and evaluation of preliminary results (Antalya, March 2024)

Date: 08/03/2024

Location: Antalya/ Türkiye

Type of audience: Scientific community (higher education, research), students

Number of attendees: 123

Highlights:

A workshop was organized by the iGUESS-MED project team at Akdeniz University to present the preliminary results of the project. This workshop was attended by a total of 123 participants, including academic staff and students from the Faculty of Agriculture.

Following the opening speech by Dr. Demir Özdemir, Vice Dean of the Faculty of Agriculture, Dr. Hamide Gübbük, Chair of the Faculty of Agriculture R&D Commission, and Project Leader Dr. Dursun Büyüктаş delivered their speeches.

Dr. Gülçin Ece Aslan presented an overview of the iGUESS-MED project, including its objectives, main goals, and work packages, introducing the project to the participants. Subsequently, Dr. Cihan Karaca shared the preliminary results of the application of the decision support system (DSS) developed within the project for irrigation and fertigation in commercial greenhouses. According to the project's preliminary results, the DSS notably reduced the amount of irrigation water applied, increased the effective use of fertilizers by the plants, and consequently led to a significant increase in overall yield.

Additionally, during the workshop, a presentation titled "The Status of Greenhouse Cultivation in Mediterranean Countries and the Present and Future of Tomato Cultivation " was delivered by the Dr. Sinan Zengin who is responsible for R&D of Antalya Tarım.

Finally, Dr. Özer Çalış, Faculty Member of the Department of Plant Protection at Akdeniz University's Faculty of Agriculture, presented on "Major Diseases in Tomato Production."

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UNIVERSITÀ DI PISA



MARCH 08, 2024 FRIDAY

09:00

Agricultural Faculty of Akdeniz University

Antalya / TÜRKİYE

We are pleased to invite you to attend the Workshop of "iGUESS-MED-Innovative Greenhouse Support System in the Mediterranean Region: Efficient Fertigation and Pest Management through IoT Based Climate Control" project on March 08, 2024, at the Agricultural Faculty of Akdeniz University.

Prof. Dr. Dursun BÜYÜKTAŞ
Project Leader

WORKSHOP PROGRAM

09:00-09:30	➤ Registration	10:35- 10:50	➤ Validation of Decision Support System and Assessment of Preliminary Results Assoc. Prof. Dr. Cihan KARACA, Project Researcher
09:30 - 10:00	➤ Welcome and Introduction Prof. Dr. Mustafa ERKAN, Dean, Agricultural Faculty of Akdeniz University Assoc. Prof. Dr. Demir ÖZDEMİR, Vice Dean, Agricultural Faculty of Akdeniz University Prof. Dr. Hamide GÜBBÜK, Chair of R&D Commission, Agricultural Faculty of Akdeniz University Prof. Dr. Dursun BÜYÜKTAŞ, Project Leader	10:50-11:00	➤ Coffee Break
10:20-10:35	➤ iGUESS-MED Presentation Asst. Prof. Dr. Gülçin Ece ASLAN, Project Researcher	11:00-11:30	➤ The Status of Greenhouse Cultivation in Mediterranean Countries and the Present and Future of Tomato Cultivation Dr. Sinan ZENGİN, Responsible for R&D, Antalya Tarım
		11:30- 12:00	➤ Major Diseases in Tomato Production Assoc. Prof. Dr. Özer ÇALIŞ
		12:00-13.30	➤ Lunch
		13:30-17:00	➤ Visit to Commercial Greenhouse in Serik

Figure 16: Leaflets designed for the workshop, published on line and distributed to participants (Akdeniz University, 2024)

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Figure 17: Second workshop carried out on March 2024 at Akdeniz University.

5 Workshops held in Tunisia

5.1 Technology innovations (Sensors, IoT, and AI) in greenhouse farming and presentation of iGUESS-MED project (Chott Mariem, May 2022)

Date: 31/05/2022

Location: Sousse-Chott Mariem/Tunisia

Type of audience: Stakeholders, farmers, advisors, Agritech startups, computer scientists, teachers, and researchers

Number of attendees: 40

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Highlights:

On May 31, a Workshop was organized by CRRHAB (Regional Research Center on Horticulture and Organic Agriculture). The CRRHAB invited farmers, advisors, Agritech startups, computer scientists, teachers, researchers and decision makers to participate in this workshop.

يوم اعلامي حول استخدام التقنيات الحديثة في الزراعات المحمية
بالمركز الجهوي للبحوث في البستنة والفلاحة البيولوجية بشطط مريم
31 ماي 2022
البرنامج

التسجيل	09.00-08.30
تقديم المشروع: السيدة أسماء العريف-معلقة المشروع	09.30-09.00
تقديم تطبيقات وتقنيات المشروع • المقاربة المتكاملة : السيد تاجر بوسلامة • تقدير المعايير العالمية للتبات في البيت المحمي : السيد محسن منصور • البات تسيير ضوابط الري : السيد احمد بن هبسي • دراسة وتقييم الخوالب الاقتصادية والبيئية للمشروع : السيد الحسين الجادر	10.30-09.30
زيارة ميدانية لتجربة المشروع بمحطة التجارب بشطط مريم	11.30-10.30
استراحة	12.00-11.30
مناقشة تحديات وسبل تطوير وتحديث قطاع الزراعة المحمية	13.00-12.00

Centre Régional des Recherches en Horticulture et Agriculture Biologique
BP 57 Chet Mariem, 4047 - Tél: 73 327 543 - Fax: 73 327 070

High Quality Tomatoes with Low Environmental Impact

Innovative Greenhouse Support System in the Mediterranean Region: efficient fertigation and pest management through IoT based climate control

www.iguessmed.com

Innovative Greenhouse Support System in the Mediterranean Region: Efficient Fertigation and Pest Management Through IoT based Climate Control

A. Laarif, I. Ben Aissa, M. Mansour, H. Jedder, T. Bouslama

iGUESS-MED est un projet de recherche financé par PRIMA (Partnership for Research and Innovation in the Mediterranean Area), d'une durée de 4 ans (2020-2024). Il implique 9 partenaires, unités publiques et privées de 4 pays du bassin méditerranéen: Italie (CREA, EVJA, UNIPA, BIOPLANET), Espagne (UAL, CAJAMAR, LA-CAÑA), Turquie (Université d'Abderrahmane) et Tunisie (CRRHAB). Le DSS sera validé au Centre Technique de Cultures Protégées et Géothermiques (CTCPG) et à la société Zana Fresh.

DÉFIS

- *Augmentation tangible et solide de la durabilité et de la compétitivité des serres méditerranéennes moyennant une technologie innovante et peu coûteuse.
- *Développement d'un outil d'analyse agro-climatique intelligent permettant de prendre les meilleures décisions pour la gestion des cultures sous-serre (irrigation, fertigation, protection de la culture...)
- *Nouvelle génération de Système d'aide à la décision (DSS), qui intègre les technologies de l'Internet des Objets (IoT), du Big Data et de l'Intelligence Artificielle dans une seule plateforme cloud.

OBJECTIF GLOBAL

Soutenir la transition vers des serres horticoles méditerranéennes innovantes, durables et compétitives par le développement, la validation et le transfert d'un Système D'aide à la Décision (DSS) pionnier pour les serres du bassin méditerranéen

LIVRABLES

- *Modèles de gestion intégrée des insectes et des maladies de la tomate respectueux de l'environnement et de la santé humaine.
- *Modèles d'irrigation et de fertilisation pour la culture de tomates en sol et hors-sol.
- *Modèle climatique de serres MED plus efficaces et utilisables toute l'année
- *Articles et événements scientifiques.

UTILISATEURS

Producteurs de tomate sous serres chauffées ou froides en sol et hors sol.

Système innovant d'aide à la décision pour la serrière méditerranéenne; Fertigation et lutte phytosanitaire efficaces grâce à un contrôle climatique basé sur l'Internet des objets

Schéma de fonctionnement du DSS iGUESSmed

IMPACTS ATTENDUS

- Pour le consommateur:** Des tomates de haute qualité quantitative et qualitative
- Pour l'agriculture:** Réduction des coûts et des intrants, utilisation des ressources disponibles, amélioration de la productivité et de la compétitivité de la serrière
- Pour l'environnement:** Utilisation raisonnée des produits chimiques et de l'eau, valorisation des eaux de qualité réduite...
- Pour la recherche:** Développement de méthodes de gestion de la fertigation et des bioressources, échange d'informations et d'expériences, formation dans les nouvelles technologies.

Figure 18: Leaflet distributed to participants, explaining the iGUESS-MED project with the workshop program (CRRHAB, 2022)

Prof Asma Laarif presented the iGUESS-MED project. Dr Thameur Bouslama showed the Integrated pest management protocols in greenhouses. Dr Mohsen Mansour explained how to estimate the water needs of the plant in the greenhouse. Mr Imed Ben Issa explained to attendees the irrigation management mechanisms. Finally, Dr Houcine Jedder presented economic and environmental impacts of the project.

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Figure 19: Picture of the speakers at the workshop held in CRRHAB, Tunisia.

The CRRHAB team explained the operation of the sensors and the cultivation management by visiting the iGUESS-MED trial in the CRRHAB experimental station.

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Figure 20: Visit of the trial in CRRHAB experimental station and explanation to workshop participants of how the different sensors work

After the visit, the participants discussed the current state of the use of these technologies in greenhouse crops in Tunisia, the problems, and the prospects. Participants believe that in Tunisia, the adoption of IoT in smart agriculture faces daunting challenges; initial cost, lack of knowledge, rigid mentality of the classic farmer. Small farmers, over-indebted, precarious, and little concerned with global environmental issues, have difficulty assimilating the need for modernization in favor of profitability objectives aligned with the vision of sustainable development. Those who are interested, do not like to be little involved in the processing of data for their decision-making, they begin to feel dispossessed of their expertise with the reduced part of subjectivity in the service of intelligent algorithmic systems.

5.2 Technology innovations in Greenhouse Farming and results of iGUESS-MED project (Chott Mariem, June 2024)

Date: 20/06/2024

Location: Chott Mariem, Sousse / Tunisia

Type of audience: Stakeholders, farmers, advisors, Agritech startup, decision-makers, teachers, and researchers

Number of attendees: 44

Highlights:

The CRRHAB organised a second workshop to present the results of the iGUESS-MED project and discuss the advantages of using DDS and protocols of integrated pest management in the greenhouses.

The CRRHAB invited actors from 22 public institutions and private companies involved in agriculture sector. Stakeholders, decision-makers, farmers, advisors, agritech startups, teachers, and researchers honored us with their participation.



Figure 21: Poster of the workshop organization published in the website of IRESA

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Prof. Asma Laarif, PI of the CRRHAB team presented an oral communication about the use of the Internet of Things (IoT), data analysis and integrated pest management protocols in tomato greenhouses. Dr Thameur Bouslama illustrated simulation models to predict the occurrence of different stages of insects and their role in integrated pest management. Dr. Mohsen Mansour and Mr. Imed Ben Aissa presented the IoT and DSS and precisely the role of sensors in both. Dr Houcine Jedder demonstrated economic and environmental profitability of protected tomato cultivation. Mr. Bechir Ben Brika, owner of an agritech Start-up told us about his experience in smart agriculture in Tunisia.

The participants were very convinced and impressed by the results obtained by the consortium regarding the reduction in use of chemical pesticides, fertilizers and water. Then, participants discussed the difficulties and the prospects of the use of modern technologies, DSS and IoT for the sustainability of the protected crops sector in the Mediterranean basin.

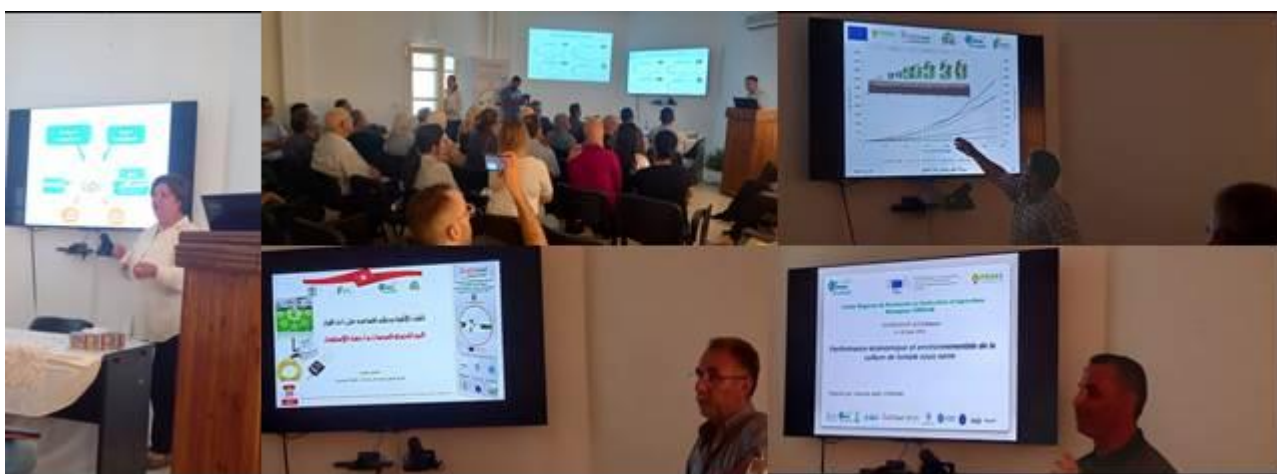


Figure 22: CRRHAB researchers presenting the activities and results of iGUESS-MED project

6 Conclusions



The iGUESS-MED project is part of the evolution of agriculture which introduces technologies in greenhouses such as Internet of Things (IoT), wireless sensor networks, remote monitoring to sustain and make more efficient the greenhouse production.

Eight workshops were organised in Spain, Italy, Turkey and Tunisia. These workshops were the occasions to present the iGUESS-MED project progress and results to a large audience composed of farmers, students, technicians, trainers, decision makers and researchers.

These workshops were generally, found successful by all participants and they were considered a very useful activity in this period when water scarcity is intense and excessive use of chemicals is worrying.

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