

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

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Deliverable 5.7. Open field days

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D5.7 – Open field days

Abstract

The objective of this deliverable is to collect the Open field days 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 open days held in each country. A total of 16 Open field days were held, divided into 5 Open field days in Spain and in Tunisia, 4 in Italy and 2 in Turkey. The Open field days were attended by growers, technical advisors, agricultural vocational training students, technology companies, researchers, computer scientists, agritech start-ups, and agronomy students.

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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.

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1.1 Summary of the deliverable

The objective of this deliverable is to collect the Open field days 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 open days held in each project participating country.

The target for this deliverable was to hold at least eight Open Field Days, two per country. The outcomes of this deliverable have been largely met, with a total of 15 Open Field Days held. During these days, the viability and potential of iGUESS-MED was presented and demonstrated, and its adoption was promoted.

The audience for the Open Field Days was broad and diverse, including growers, technical advisors, agricultural students, technology companies, researchers, computer scientists, agritech start-ups and agricultural vocational training students.

2 Open field days held in Spain



2.1 Visit by La Caña's Technical Advisors to the experimental trials.

Date: 21/12/2021

Location: Research Center of the Cajamar Foundation, Almería, Spain

Type of audience: Technical Advisors

Number of attendees: 15

Highlights: The Cajamar Group Foundation and La Caña organised an open field day to visit the experimental trials of the iGUESS-MED project at the Cajamar Foundation Research Centre. During this event, Juan José Magán and M^a Dolores Fernández, from the Cajamar Foundation, explained the experimental trials for the calibration and validation of the VegSyst (fertilisation) and PrHo (irrigation) models (Task 2.3). During this visit, La Caña's technical advisors were informed in detail about the trials, treatments, measurements, etc., and were shown the sensors installed in the greenhouses.

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Figure 1: Open field day on 21/12/2021 at the Cajamar Foundation Research Center.

2.2 Visit to the experimental trials during the celebration of World Water Day 2022

Date: 22/03/2022

Location: Research Center of the Cajamar Foundation, Almería, Spain

Type of audience: Growers, Technical Advisors, Agricultural vocational training students, technology companies

Number of attendees: 83

Highlights: The Cajamar Foundation and Cajamar Innova organised an open field day to celebrate World Water Day. The event was aimed at Growers, Technical Advisors, agricultural vocational training students and technology companies.

The aim of the event was to promote the importance of water in agriculture and the challenges it faces, as well as to encourage entrepreneurship in this field. A guided tour was conducted of the research projects of the Cajamar Foundation and the technological innovations of the startups incubated by Cajamar Innova, which are related to water.

This 'Open Field Day' included a visit to the experimental trials of the iGUESS-MED project at the Research Center of the Cajamar Foundation. After a brief explanation of the iGUESS-MED project, the experimental trials to calibrate and validate the irrigation and fertilisation models were explained (Task 2.3).

Link: [Jornada de puertas abiertas Cajamar Innova-Estación Experimental \(plataformatierra.es\)](https://plataformatierra.es/jornada-de-puertas-abiertas-cajamar-innova-estacion-experimental)

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Figure 2: Open field day on 22/03/2022 at the Cajamar Foundation Research Center. World Water Day 2022.

2.3 Greenhouse Day at Datagri 2022

Date: 11/11/2022

Location: Research Center of the Cajamar Foundation, Almería, Spain

Type of audience: Growers, Technical Advisors, Students, technology companies

Number of attendees: 400

Highlights: The 5th Datagri Forum for the promotion of digital transformation in the agri-food sector was celebrated in El Ejido, Almeria on 10th and 11th November 2022. The event was divided into two main days: the Forum Day, which included presentations of technological projects, and the Greenhouse Day, organized by the Cajamar Foundation Research Centre, where the latest innovations were showcased. A tour of the facilities was organized, during which the more than 400 attendees of Greenhouse Day were informed about various projects. During this visit, the iGUESS-MED project was presented, as well as the main results achieved.

Link: <https://twitter.com/ForoDatAgri/status/1591068485572231171?t=KW6B8xAEp2DZvDMXP3YISw&s=08>
[La actividad de investigación y transferencia de la Estación Experimental Cajamar \(plataformatierra.es\)](https://www.plataformatierra.es)



Figure 3: Greenhouse Day at Datagri 2022 carried out in the Research Center of Cajamar Foundation (11/11/2022).

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2.4 51st Seminar of Horticultural Technicians and Specialists

Date: 16/11/2022

Location: Research Center of the Cajamar Foundation, Almería, Spain

Type of audience: Researchers, Technical Advisors, Students

Number of attendees: 70

Highlights: The 51st Seminar of Horticultural Technicians and Specialists, co-organised by the Spanish Ministry of Agriculture, Fisheries and Food, the IFAPA and the Cajamar, was held in Almeria from 14 to 18 November 2022. The seminar was attended by horticultural technicians and specialists from all over Spain to discuss the latest developments in R+D+i in horticultural crops. On 16 November, the participants visited the research centre of the Cajamar Foundation, where the iGUESS-MED project was presented.



Figure 4: Visit of the participants of the 51st Seminar of Horticultural Technicians and Specialists (16/11/2022).

2.5 Visit to the Pilot Farm trial of the iGUESS-MED DSS

Date: 17/05/2023

Location: Anecoop farm, Almería, Spain

Type of audience: Agricultural vocational training students

Number of attendees: 51

Highlights: An open field day was organized by University of Almería, with the collaboration of Cajamar Foundation, to visit the pilot farm where the iGUESS-MED DSS was tested. The event was aimed at the students of the Escuela Agraria Vicar, the largest Agricultural vocational training centre in Almeria.

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After a brief explanation of the iGUESS-MED project by M^a Dolores Fernández, from Cajamar Foundation, the irrigation and fertilization models were introduced by M^a Dolores Fernández (Cajamar Foundation) and Marisa Gallardo (University of Almería), respectively. Later, there were several short explanations by other researchers involved in the project. During this visit the sensors installed in the greenhouse were shown by Dr. Francisco Padilla. Explanations to the students about how the irrigation and nutrients were managed following the iGUESS-MED DSS recommendations in a tomato soil crop were made by Dr. Santiago Bonachela and Francisco Sánchez, and by Dr. Teresa Peña, respectively.

Link: <https://drive.google.com/file/d/1920M5ITh6KcCV8lnFQvyXrU1pHBlj9gZ/view?usp=sharing>



Figure 5: Open field day on 17/05/2023 at the Anecoop farm, Almería (Spain).

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3 Open field days held in Tunisia



3.1 Infoday on Technology innovations (Sensors, IoT, and Artificial Intelligence) in Greenhouse Farming.

Date: 31/05/2022

Location: Sousse-Chott Mariem, Tunisia

Type of audience: Stakeholders, farmers, advisors, Agritech start-ups, computer scientists, teachers, and researchers

Number of attendees: 40

Highlights: The CRRHAB Team explained the operation of the sensors during the visit of the iGUESS-MED trial at the CRRHAB Research Center. After the visit, the participants discussed the current state, problems and prospects of using these technologies in greenhouse crops in Tunisia.

Participants in Tunisia believe that the adoption of IoT in smart agriculture may face significant challenges, including initial costs, lack of knowledge, and the rigid mentality of traditional farmers. It is important to note that small farmers, who are often over-indebted and precarious, may struggle to understand the need for modernization to achieve profitability objectives aligned with the vision of sustainable development. Therefore, it is crucial to provide them with the necessary support and training to ensure a smooth transition towards a more sustainable and profitable future. Some individuals who are interested in data processing for decision-making may feel that their expertise is undervalued when subjective evaluations are excluded in favour of intelligent algorithmic systems.



Figure 6: Visit of trial at the CRRHAB Research Center in Tunisia on 31/05/2022.

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3.2 Organization of a visit of a team from CIHEAM Bari-Italy to the CRRHAB trial

Date: 02/06/2022

Location: Sousse ChottMariem/Tunisia

Type of audience: Students, professors and experts

Number of attendees: 27

Highlights: In the framework of the WES (Water and Environment Support) project, a team from CIHEAM Bari-Italy (students, professors, and experts) visited the Chott Mariem experimental site, where they were informed by Mohsen Mansour and Imed Ben Issa about the objectives and methodology of the iGUESS-MED project and were shown the different sensors installed, particularly those for irrigation management.



Figure 7. A team from CIHEAM Bari (Italy) visiting the CRRHAB trial.

3.3 Organization of a visit of Trainers from different agricultural training centers to the CRRHAB trial

Date: 16/06/2022

Location: Sousse-Chott Mariem/Tunisia

Type of audience: Trainers from different agricultural training centers

Number of attendees: 8

Highlights: Mohsen Mansour explained to visitors how crop water requirements are determined and demonstrated to them measuring equipment (soil, climate) that enables irrigation management of the greenhouse crops.

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Figure 8: Demonstration of soil and climate measurement equipment and sensors by Mohsen Mansour to trainers.

3.4 Decision Support System for irrigation, fertigation, and pest management in greenhouses

Date: 10/03/2023

Location: Monastir/Tunisia

Type of audience: stakeholders, farmers, technicians, engineers

Number of attendees: 44

Highlights:

An open field day was co-organized at the socio-economic partner of the project (technical center for protected and geothermal crops; DSS validation test) by the CRRHAB and Agrimatco, international distributor of agricultural inputs and sponsor of the project iGUESS-MED (donations of tomato plants for all project trials). Asma Laarif introduced the project and its objectives to the participants, Imed Ben Issa explained the functionality of the sensors and their use, and Thameur Bouslama showed the participants the integrated control components used in this trial. The Agrimatco representative highlighted the importance of using grafted plants to reduce fungal diseases and presented the qualities of the PAIPAI variety used in the trial. The participants noted the general condition and phytosanitary state of the crop which were very satisfactory, and they were interested in the reduction of pesticides used.



Figure 9: Information and open field day co-organized by Agrimatco and CRRHAB to inform stakeholders about iGUESS-MED DSS.

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3.5 Organization of two open field days for agronomy students in iGUESS-MED trial in Monastir

Date: 13/02/2024 and 16/02/2024

Location: Monastir/Tunisia

Type of audience: Agronomy Students, trainers, and engineers

Number of attendees: 37

Highlights: CRRHAB organized two open field days in the regional station of the Technical Center for Protected and Geothermal Agriculture in Monastir; the iGUESS-MED socioeconomic partner. We received two groups of agronomy students (20 and 17 students) accompanied by teachers and trainers. Students learned about sensors, pest management, and iGUESS-MED DSS. The events were animated by Asma Laarif, Mohsen Mansour, and Thameur Bouslama.



Figure 10: Open field days for agronomy students in iGUESS-MED trial in Monastir.

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4 Open field days held in Italy



4.1 Visit to the Farm trials of iGUESS-MED project 2021.

Date: 03/12/2021

Location: CREA, Pontecagnano (SA), Italy

Type of audience: University students of the Faculty of Agriculture. University of Naples (UNINA).

Number of attendees: 30

Highlights: An open field day was organized by CREA (Research Centre for Vegetable and Ornamental Crops Council for Agricultural Research and Economics), to visit the trials at the experimental farm where the iGUESS-MED DSS was tested. The event was aimed at the university students of the of the Faculty of Agriculture (University of Naples), one of the most important faculties of Agriculture in Italy.

After introduction explanation of the iGUESS-MED project by Dr. Alejandra Navarro Garcia, coordinator of iGUESSMED, and a presentation about the diseases preventive models designed and developed during the first years of iGUESSMED introduced by Catello Pane (iGUESS-MED staff) both reasercher from CREA (Research Centre for Vegetable and Ornamental Crops) of Pontecagnano (SA). During the visit to the greenhouse trials where OPI climate station with the environmental sensors installed and the disease infections were developed were shown by Dr. Catello Pane. Explanations to the students about how the irrigation and nutrients were managed following the iGUESS-MED DSS recommendations in a tomato soilless crop were made by Dr. Alejandra Navarro Garcia and by Dr. Accursio Venezia, respectively.

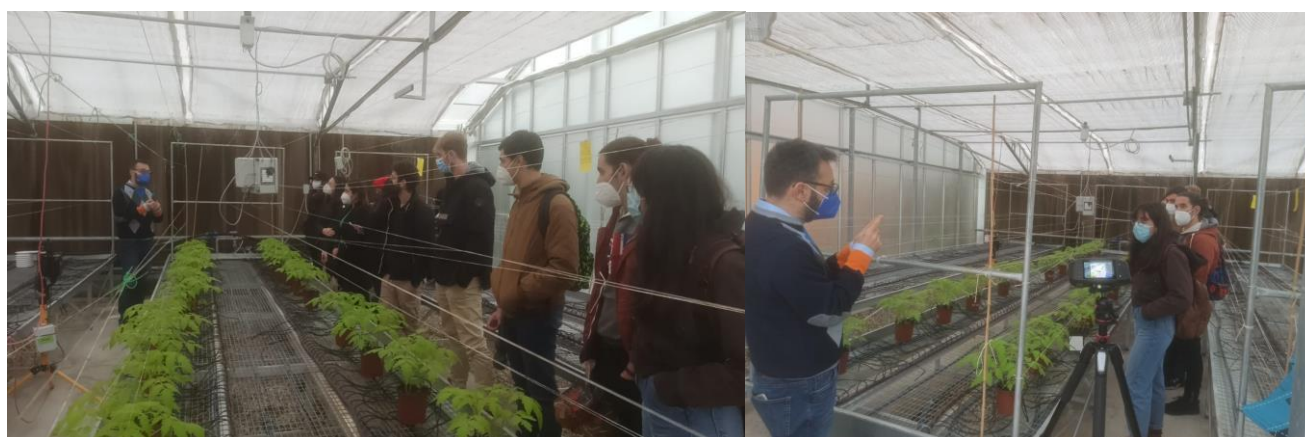


Figure 11: Visit to the trials in the greenhouses of CREA, Pontecagnano (SA) on 03/12/2021.

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4.2 Visit to the Farm trials of iGUESS-MED project 2022.

Date: 14/04/2022

Location: CREA, Pontecagnano (SA), Italy

Type of audience: Agricultural professional education students.

Number of attendees: 20

Highlights: An open field day was organized by CREA (Research Centre for Vegetable and Ornamental Crops Council for Agricultural Research and Economics), to visit the trials at the experimental farm where the iGUESS-MED DSS was tested. The event was aimed at the the students of the “Istituto Agrario ISS Makrakomis (Greece)” visiting commercial vegetables farms and research centers in southern Italy.

After a brief presentation about CREA by Dr. Gianluca Francese, an introduction explanation of the iGUESS-MED project was made by Dr. Alejandra Navarro Garcia, coordinator of iGUESSMED, and later iGUESS-MED models and DSS were introduced by Dr. Catello Pane (iGUESS-MED staff), both reasercher from CREA (Research Centre for Vegetable and Ornamental Crops) of Pontecagnano (SA). During the visit to the greenhouse trials where OPI climate station with the environmental sensors installed, soilless tomato trial for the management of the irrigation and nutrients following the recommendations of the iGUESS-MED DSS was shown by Dr. Catello Pane.

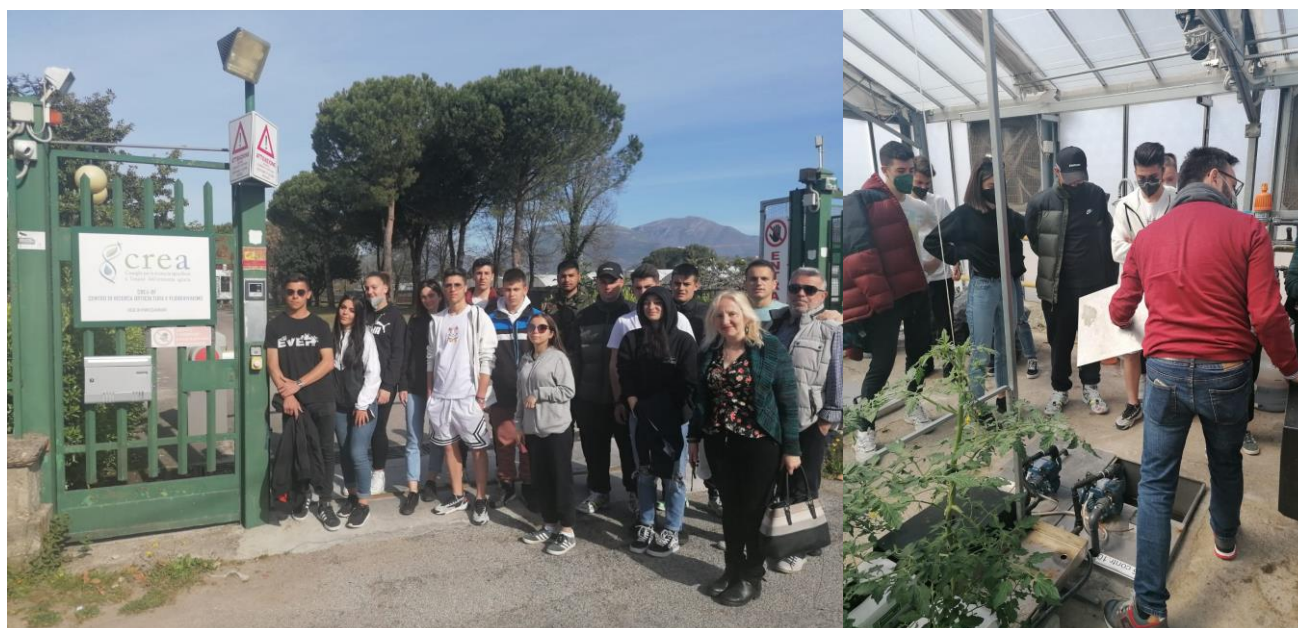


Figure 12: Visit to the trials in the greenhouses of CREA, Pontecagnano (SA) on 14/04/2022.

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4.3 Open day to the experimental greenhouse trials of iGUESS-MED project conducted in spring 2022 at the DAFE-UNIPI.

Date: 1/07/2022

Location: DAFE, University of Pisa (PI), Italy

Type of audience: Growers, stakeholders, agronomists, and master's degree students.

Number of attendees: 26

Highlights: An open field day was organized by DAFE-UNIPI (Department of Agriculture, Food and Environment of the University of Pisa) in collaboration of BIOPLANET and EVJA partner, to show the iGUESS-MED experiment, carried out to validate the Simulhydro DSS, and to illustrate the new strategies for pest biological control in greenhouse tomato crop.

Prof. Luca Incrocci introduced briefly the main goals of the iGUESS-MED project and he explained the main results of the experiment on greenhouse soilless tomato (cv Pisanello, an old landrace tomato variety) performed to validate of the Simulhydro, PrHO, and VEGSYS models. During the visit to the greenhouse, the OPI-EVJA climate control unit with its sensors (air temperature, leaf wetting, substrate moisture sensor) was illustrated using a tablet to show the climate data recorded in the greenhouse and the output of the models.

Afterward, Dr. Valeria Zeni illustrated the techniques for biological and chemical control of the main tomato pests, explaining the biology of the main antagonistic insects and mites proposed by Bioplanet partner.



Figure 13: Visit of the experimental trials on tomato for the validation of Simulhydro, Vegsys and PrHo on 1/07/2022.

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4.4 Open day to the farm “Il Molino” at Bagno a Ripoli in June 2024.

Date: 10/06/2024

Location: Farm “Il Mulino S.A.S. Società Agricola”, Bagno a Ripoli (FI), Italy.

Type of audience: Growers, stakeholders, agronomists,

Number of attendees: 20

Highlights: On 10th June 2024 an open day was held at the farm "il Molino" in Bagno a Ripoli, near Florence, in collaboration with the Cia (Confederazione Italiana Agricoltori), the Georgofili Academy, Bioplanet and EVJA.

After a brief explanation of the objectives of the iGUESS-MED project, Prof. Luca Incrocci illustrated the functionalities of the OPI-EVJA climate station. In particular, he demonstrated the leaf wetness and soil moisture sensors useful to reduce the fungicide use and optimize water use in the greenhouse. Dr Valeria Zeni spoke about the main antagonistic insects advised by Bioplanet for biological control of tomato pests, tested within the activities of the iGUESS-MED project.



Figure 14: Open day event in a commercial greenhouse farm to illustrate the results of the iGUESS-Med project on

10/06/2024

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5 Open field days held in Turkey



5.1 Information on the Use of Technology in Greenhouse Tomato Cultivation

Date: 08/12/2023

Location: Antalya, Turkey

Type of audience: Agricultural professional education students, Agricultural vocational training students.

Number of attendees: 15

Highlights: As part of the iGUESS-MED project, we organised the first open field day for students and academic staff. During this event, the participants visited a commercial greenhouse where the trial was conducted, and Dr. Gulcin Ece Aslan gave a detailed explanation of the objectives, scope, and implemented practices of the iGUESS-MED project.

Participants had the opportunity to observe and evaluate tomato plants grown using under both controlled irrigation and fertigation practices in the commercial greenhouse, as well as those grown by the farmer using traditional methods.



Figure 15: First open field day event as part of iGUESS-MED project on 08/12/2023.

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5.2 Introduction of Models Used for Irrigation and Fertilization, and Presentation of the Decision Support System

Date: 08/03/2024

Location: Antalya, Turkye

Type of audience: Agricultural Engineering students, growers

Number of attendees: 24

Highlights: The second open field day in Turkey was organized after the workshop held on March 8, 2024 as part of the iGUESS-MED project. Agricultural engineering students and farmers participated in this event. During the event, Dr. Dursun Buyuktas and Dr. Cihan Karaca provided detailed information about the decision support system developed in the iGUESS-MED project, as well as the models developed for irrigation and fertigation on which this decision support system is based.

In addition, an introduction to the sensors used to obtain the necessary data for the models was presented.



Figure 16: Second open field day event as part of iGUESS-MED project on 08/03/2024.

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6 Conclusions



The viability and potential of iGUESS-MED DSS has been demonstrated and its adoption promoted in 16 Open Field Days, thanks to the efforts of all the consortium members in all the project participating countries. The target for this deliverable was to hold at least eight Open Field Days, so all the KPIs proposed in the project have been met and achieved.

The Open Field Days increased the visibility of the project among growers, technical advisors, agricultural vocational training students, technology companies, researchers, computer scientists, agritech start-ups, and agronomy students.

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