UNIVERSITÀ DI PISA

2023 IEEE INTERNATIONAL WORKSHOP ON

METROLOGY FOR AGRICULTURE AND FORESTRY

NOVEMBER 6-8, 2023

PISA, ITALY

PROGRAM

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Welcome Message from the General Chairs

On behalf of the Organizing Committee, we cordially welcome you to the 2023 IEEE International Workshop on Metrology for the Agriculture and Forestry (*MetroAgriFor 2023*).

MetroAgriFor 2023 intends to create an active and stimulating forum where academics, researchers, and industry experts in measurement and data processing techniques for Agriculture, Forestry, and Food can meet and share new advances and research results.

Attention is paid, but not limited to, new technologies for agriculture and forestry environment monitoring, food quality monitoring, metrology-assisted production in agriculture, forestry and food industries, sensors and associated signal conditioning for agriculture and forestry, calibration methods for electronic test and measurement for environmental and food applications.

The first edition of *MetroAgriFor* was hosted by Polytechnic University of Marche, Italy, from an insightful and brilliant idea of Professor Enrico Primo Tomasini. He served as the first General Chair of this adventure.The subsequent editions of *MetroAgriFor* were organized in Italy by the Polytechnic University of Marche, the University of Naples "Federico II", the University of Trento, The University of Bolzano and by the University of Perugia.

This year, this sixth edition is hosted in Pisa, and it is organized at the "Centro Congressi Le Benedettine" with the patronage of the University of Pisa and Scuola Superiore Sant'Anna. We are really glad to welcome you to the historic and beautiful Pisa. Pisa is one of the most important cities in Tuscany and it is well-known in the world, because of its famous "Leaning Tower". Pisa was a world power during the Middle Ages when it was an important Sea Republic. It was the city of the mathematician Leonardo Fibonacci and, later, of Galileo Galilei who founded the experimental method. We think all this makes Pisa the ideal venue for the 2023 edition of MetroAgriFor and we hope that our attendees will enjoy the conference, the city and its surroundings!

The MetroAgriFor Technical Program consists of 157 oral and poster presentations scheduled over three days. Presentations are organized in 19 Special Sessions and a General Session. Special Sessions aim to create a focus on specific topics, where researchers can make knowledge, familiarize, exchange ideas, and build cooperation.

We received 182 extended abstracts from all over the world. Relevance, quality, significance, and novelty of the scientific contribution were the main attributes taken into consideration for acceptance and publication in the Proceedings. The Proceedings are going to be submitted for publication in the IEEEXplore Digital Library. We would like to thank all the reviewers who actively contributed to the selection and quality improvement of the presented works. Authors of all the above contributions are also welcome to submit an extended version to the Special Issues on the IEEE Transactions on AgriFood Electronics.

MetroAgriFor 2023 is honored to have experts in smart agriculture and forestry as Invited Speakers:

- Prof. José Enrique Fernández, Institute for natural resources and agrobiology (IRNAS, CSIC), Spain, will open the Workshop with a talk entitled "*Sceptic about digital agriculture? Watch this!*"
- Prof. John Steven Selker, Department of biological and ecological engineering, Oregon State University, United States, will open the second day of works with a talk about "*The Challenge of the Simple Within the Complexity of Hydrology*"
- Prof. Danilo Demarchi, Politecnico di Torino, Italy, will open the last day with a lecture entitled "*Let the Plants do the Talking: Smart Agriculture by the messages received from Plants and Soil*"

We are grateful to the Invited Speakers for joining the Workshop. During the Workshop, attendees have the possibility to follow three Tutorials:

- *UAV Applications for Digital Agriculture* by Dr. Alessandro Matese, National Research Council, Italy,
- *Opportunistic Use of Microwave Satellite Signals for Rainfall Measurement*, Prof. Filippo Giannetti, Department of information engineering, University of Pisa, Italy,
- *Internet of Things, Cloud and Artificial Intelligence in Digital Agriculture* by Prof. Stefano Chessa, Department of computer science, University of Pisa, Italy.

To recognize the most outstanding paper presented at the annual *IEEE International Workshop on Metrology for Agriculture and Forestry*, the Best Conference Paper Award will be assigned. Other awards will be assigned to the Best Paper presented by a Young Researcher, to the Best Paper Presented by a Woman to recognize the full engagement of women in all aspects of the Metrology in Agriculture and Forestry, and to the Best Paper presented as a Poster.

We sincerely want to thank all the sponsors and the patronages who made this event possible. The *2023 IEEE International Workshop on Metrology for Agriculture and Forestry* is about to begin. Metrologists, agriculture, forestry, food experts, and engineers, enjoy the Workshop!

November 2023

Giovanni Caruso, *University of Pisa, Italy*
Luca Sebastiani, *Scuola Sant'Anna, Italy*
***MetroAgriFor2023* General Chairs**

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IEEE MetroAgriFor 2023 Keynote Speakers
Plenary Session - Monday November 6 - H 11:00
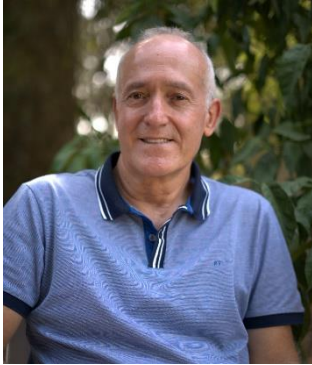
Sceptic about digital agriculture? Watch this!

José Enrique **Fernández**
Institute for Natural Resources and Agrobiology (IRNAS, CSIC), Spain

ABSTRACT

Digital agriculture is regarded as one of the most effective approaches to face current challenges in agriculture. Its potential success is based on the capacity of measuring what is going on in the field, and on identifying the natural variability within the farm or the orchard, such that precision agricultural techniques can be applied. In my research group, we work on sensoring, modelling and data processing approaches related to the management of water in agriculture. More precisely, we develop deficit irrigation strategies and methods to schedule irrigation from soil, plant and meteorological measurements. Most of our work is related to the use of plant-based variables and related systems to assess water stress, suitable for automatic and continuous monitoring under field conditions. This includes sap flow, trunk diameter variations and leaf turgor measurements. We evaluate the suitability of each variable to schedule irrigation through the identification of effective water stress indicators from the collected data, as well as from the development of applications to automatically process the data, some based on machine learning methods. In combination with remote imagery, our approaches allow for precision irrigation. We work in a context of Sustainable Intensive Agriculture, in which we try to ensure food safety and to achieve an optimum use of water at the same time that a fair profit to the grower is pursued. This includes an economic analysis of the derived approaches. Here I will give an overview of the work we do in my group and in combination with other groups, to illustrate the challenges and potential of digital agriculture for optimising irrigation.

SPEAKER BIOGRAPHY

José Enrique Fernández is a Research Professor at the Institute for Natural Resources and Agrobiology of Seville (IRNAS) a research institute belonging to the Spanish National Research Council (CSIC).

Dr Fernández is the head of the research group on Irrigation and Crop Ecophysiology. He is specialised in plant water relationships of crops typical of arid and semi-arid areas. Along his career he has focussed on the design of irrigation strategies for deficit irrigation, and in methods to schedule precision irrigation from plant-based measurements, suitable for digital agriculture. He has worked with a variety of herbaceous and woody crops, mainly olive.

In the last years he is interested in methods to optimise the agricultural use of water in a context Sustainable Intensive Agriculture, where food security is ensured at the same time that natural resources are preserved, biodiversity and landscaping are improved, a fair profit to the producers is guaranteed and the socio-economic conditions of rural environment are enhanced. Since 2014 he is the director of the IRNAS. From April 2015 to June 2018 he was Coordinator of Agriculture for the Spanish Agency of Evaluation and Prospective (ANEP). Since 2013 he is Editor in Chief of the scientific journal Agricultural Water Management.

Plenary Session - Tuesday November 7 - H 11:00

The Challenge of the Simple Within the Complexity of Hydrology

John Steven **Selker**
Oregon State University, USA

ABSTRACT

Nature follows very simple rules: conservation of energy, momentum, while finding the path of maximum entropy. I explore the challenge of keeping an eye on simplicity when faced with the unfathomable complexity of hydrological processes as they occur in the complex of geology, climate, and human culture. First, I will consider the melting of snow, and what we have missed there, perhaps by the complexity of phase change and atmospheric processes. Next I will consider evaporation from deep aquifers, wherein this extraordinarily complex problem if viewed through the lens of geology and climate, becomes a quite simple and general result when viewed from the process perspective. Finally, I will consider how we measure the dynamics of ecosystems. Here, the problem is somewhat inverted, in that the complexities of working in an aggressive natural setting demand simple solutions. Yet, to achieve system simplicity is perhaps the most demanding of all engineering undertakings. I will review the development paths for several recent innovations in environmental sensing and the lessons gained in bringing these to the community.

SPEAKER BIOGRAPHY

John Selker is an OSU Distinguished Professor of Biological and Ecological Engineering (College of Agricultural Sciences, 31 years) and co-Director of both The Center for Transformative Environmental Monitoring Programs (CTEMPs.org) and the Trans-African Hydro-Meteorological Observatory (TAHMO.org), and PI of the Openly Published Environmental Sensing Laboratory (currently employing 40 undergraduates - Open-Sensing.org). Selker has worked in >20 countries across 5 continents. Focus areas include environmental instrumentation, groundwater processes, and ecohydrology. Selker has published >230 peer-reviewed articles, is the president of the AGU Hydrology Section (7,000 members), and a raft of other things only academics worry about. He loves making things, like new environmental sensing systems and wooden bowls.

Let the Plants do the Talking: Smart Agriculture by the messages received from Plants and Soil

Danilo **Demarchi**
Politecnico di Torino, Italy

ABSTRACT

As analysed in the report recently issued by the United Nations (Intergovernmental Panel on Climate Change – IPCC Report 2021), the benefits that technology provides to a green and sustainable economy are highly appreciated and under intense research and development globally. Circuits and Systems (CAS), which are the base for any system, can bring the needed functionalities and performances for reaching eco-friendly, circular and practical solutions.

The IoT active connection in agriculture (as an example in Europe) are exponentially increasing, proving that Precision Agriculture is a very fast-growing research field, where more controlled quality production, water use optimisation, and a lower spreading of pesticides and fertilisers are some key issues, serving the improvement of food quality, but also helping the respect of agriculture for the environment.

For reaching these targets, electronics are the perfect tool for interfacing the data sources, extracting the data and processing them, and obtaining the needed information along the whole food chain: from the farmer, and the professional stakeholders to the consumers.

In the Keynote, an overview of electronics for precision agriculture will be presented, analysing the possible solutions that can bring important innovations, advancing the actual strategies based on remote or indirect measurements, by instead in-place measuring the plant and soil parameters (a.k.a. Let the Plants do The Talking), associated with more standard information derived from environmental conditions.

Application scenarios for crop monitoring, water control, information communication and decision support will be presented. In particular, will be analysed technologies for reaching the

needed levels of low power and low cost, and the efficient ones to be applied to AgriFood at the global scale, supporting also food security and sustainability.

SPEAKER BIOGRAPHY

Full Professor at Politecnico di Torino, Department of Electronics and Telecommunications.

Micro&Nano Electronics, Smart System Integration and IoTs for the AgriFood Value Chain and for BioMedical Devices.

Visiting Professor at EPFL Lausanne (2019) and at Tel Aviv University (2018-2021).

Visiting Scientist (2018) at MIT and Harvard Medical School for the project SISTER (Smart electronic IoT SysTEms for Rehabilitation sciences).

Author and co-author of 5 patents and more than 300 scientific publications in international journals and peer-reviewed conference proceedings.

Leading the MiNES (Micro&Nano Electronic Systems) Laboratory of Politecnico di Torino and coordinating the Italian Institute of Technology Microelectronics group at Politecnico di Torino (IIT@DET).

Founder and Editor in Chief of the IEEE Transactions on AgriFood Electronics - TAFE.

Founder and General-Co-Chair of the IEEE Conference on AgriFood Electronics - CAFE.

Founder and Vice-Chair of the IEEE CAS Special Interest Group on AgriFood Electronics.

2023-2024 Distinguished Lecturer for the IEEE CAS Society with the Lecture "Let the Plants Do the Talking: Smart Agriculture by the messages received from Plants and Soil".

Member of the IEEE Sensors Council and the BioCAS Technical Committee. Associate Editor of the IEEE Open Journal on Engineering in Medicine and Biology (OJ-EMB).

General Chair of IEEE BioCAS (Biomedical Circuits and Systems) Conference in 2017 in Torino and founder of IEEE FoodCAS Workshop (Circuits and Systems for the FoodChain).

TPC Co-Chair of IEEE ICECS 2019, IEEE BioCAS 2021 and IEEE BioCAS 2022 conferences. General Co-Chair of IEEE BioCAS 2023.

Organizer of the 3rd Seasonal School on AgriFood Electronics: Smart Technologies for a Sustainable Agriculture in Torino, September 2022.

Tutorial #1 - Monday November 6

UAV Applications for Digital Agriculture

Alessandro **Matese**

National Research Council – Institute of Bioeconomy, Italy

ABSTRACT

Digital technologies are valuable tools that may help farmers improve efficiency and make better decisions. The remote sensing sector and Unmanned Aerial Vehicles (UAV) has never been more capable of helping deliver on the promises of digital agriculture, thanks to recent developments in machine learning and artificial intelligence. But there are some problems and limitations that need to be fixed before these technologies can be used effectively and agriculture is being digitally transformed on a large scale. The aim of this tutorial is to present a framework of practical applications of such innovative solutions for extending the use of UAV in agriculture.

SPEAKER BIOGRAPHY

Senior Researcher at the National Research Council (CNR-ITALY) in Florence at the Institute of BioEconomy (IBE). Visiting Associate Professor at the Geosystems Research Institute (GRI) at Mississippi State University (MSU-USA). M.S. degree in Natural Sciences at the University of Florence (Italy), Department of Earth Sciences. PhD in Agriculture, Forest and Food Science, Doctoral School of Sciences and Innovative Technologies at the University of Turin, in 2014. His research interests are in remote sensing of agroecosystems, precision agriculture and forestry, unmanned aerial vehicles, multi-hyperspectral and thermal imaging, crop modeling, data fusion, machine learning and geostatistics. He is/was Principal Investigator (PI) in more than ten competitive research projects. Among his research projects, he serves as PI for a EU funded project from PRIMA-MED titled "DATI" which explores how to develop, implement and enhance irrigation efficiency using digital tools to create practical solution for small-scale farmers. Authored more than 80 peer-reviewed international journal articles.

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Tutorial #2 - Monday November 6

Opportunistic Use of Microwave Satellite Signals for Rainfall Measurement

Filippo **Giannetti**

University of Pisa, Italy

ABSTRACT

To date, quantitative precipitation estimation can be obtained by several observing systems, using different measurement principles, and yielding different time/space resolutions and accuracies. The simplest, cheapest and most widespread devices are tipping-bucket rain gauges (TBRGs). These are point devices with a small measuring area, yielding the accumulated rainfall (in mm) in a given amount of time at a given location. However, they provide quantized readings of the accumulated rainfall, are not suited for accurate estimates of rainfall intensity (in mm/h), are susceptible to mechanical problems, and their accuracy is affected by the wind. Furthermore, spatial maps of cumulated rainfall that are provided by networks of telemetered TBRG are usually characterized by spatially-inhomogeneous density. Other point-measurement instruments of the non-catching type, called disdrometers, yield better performance, but are still considered research devices and are much less common than rain gauges. On the other hand, satellite sensors, both active and passive, suffer from scarce time and space resolution, while ground-based weather radars, though providing better resolutions, are expensive, are not available in many regions of the globe, and are powerful sources of electromagnetic (e.m.) radiation which need the permission from competent authorities.

In the last decades, in addition to the techniques mentioned above, a promising low-cost technique emerged for effective and reliable rainfall estimates with high spatial and temporal resolutions. Such a new paradigm "opportunistically" relies on the wide availability of microwave (MW) signals generated by (pre-existing) communication systems, either terrestrial or satellite-based. These signals, termed "signals of opportunity", can be the MW backhaul links of the cell phone networks operating between 15 and 40 GHz (termed commercial microwave links, CMLs), or the downlinks of direct-to-home (DTH) satellite broadcasting services operating in Ku-band between 10 and 13 GHz (termed satellite microwave links, SMLs). As is well known, an e.m. wave that propagates in the atmosphere interacts with precipitation particles, in the

form of liquid and mixed-phase hydrometeors, and is attenuated due to both scattering and absorption phenomena. In particular, rainfall becomes a major source of attenuation at frequencies above 5 GHz. The basic idea underlying the opportunistic approach consists then in measuring, at the receiver site, the attenuation experienced by the MW signal through the rain, and, by resorting to appropriate empirical models, to analytically infer the rainfall intensity along the "wet" segment of the MW link. In particular, SML-based rain estimate turns out very a appealing way to complement conventional measurement techniques, thanks to the following features: low cost of commercial-grade receive equipment for satellite DTH broadcasts; ease of installation of new terminals wherever higher spatial density is required, especially in rural areas that are not adequately covered by CLMs.

The potentials of the opportunistic SML approach to rainfall measurement spurred the NEFOCAST (2016-2019) and the INSIDERAIN (2020-2022) projects, both funded by the Government of the Tuscany Region (Italy), and aimed at the development, test and validation of a network of SML-based sensors in rural enviroments. SMLs sensors are also employed in the framework of the H2020 project SCORE1, addressing water and climate-related hazards to increase climate resilience of European coastal cities.

SPEAKER BIOGRAPHY

Filippo Giannetti is a professor of telecommunications at the Department of Information Engineering of the University of Pisa, Italy. His main research interests concern digital signal processing, wireless communications, satellite systems, radiopropagation and rainfall measurement. He worked in several international projects (EU's FP7 and H2020, ESA) and authored more than 170 journal and conference papers. He is co-inventor of several patents, including an innovative technique for rainfall estimation based on opportunistic measurement of satellite signal strength. He is also member of the editorial board of EURASIP Journal on Wireless Communications and Networking.

Tutorial #3 - Monday November 6

Internet of Things, Cloud and Artificial Intelligence in Digital Agriculture

Stefano **Chessa**
University of Pisa, Italy

ABSTRACT

Internet of Things, Cloud and Artificial Intelligence are among the major information technologies that are driving the digitalization of many public and private sectors, and for this reason they are called "digital enablers". The adoption of these technologies however often leads to a change in established practices and opens up new, unexpected usage scenarios. The tutorial will first present in an intuitive and informal way the concepts of Internet of Things, cloud and Artificial Intelligence, and then it will discuss some use cases related to their adoption in digital agriculture.

SPEAKER BIOGRAPHY

Stefano Chessa is Full Professor at the Department of Computer Science of the University of Pisa. He is member of the Council of the Doctorate in Computer Science (since October 2013) and chair of the MSc curricula in Cybersecurity of the University of Pisa. He has worked in several national and European projects and he has been the scientific leader (for the University of Pisa) of the EU projects RUBICON and DOREMI. He is co-author of around 200 publications appeared on international, peer-reviewed journals, conferences and books chapters. His research interests are in the fields of smart environments, Internet of Things, pervasive computing and in their applications to digital agriculture, e-health, ambient assisted living, crowdsensing and participatory sensing.

IEEE MetroAgriFor 2023 Venue

IEEE MetroAgriFor 2023 will be held at **"Le Benedettine" Conference Center** of the University of Pisa. Le Benedettine Conference Center is an ancient Monastery held by nuns. It was built in 1393 on the south bank of the Arno river, in an area called "tegularia" in the late Middle Ages. During the centuries, the Monastery went through massive renovations. Nowadays, closed to the cult, it is completely restored and used as a venue for meetings and conferences by the University of Pisa. The Conference Venue is situated in the city centre and is walking distance from the main railway station.

ADDRESS

Piazza S. Paolo a Ripa D'Arno, 16
Pisa
Use the QRCode to open the location on *Google Maps*

IEEE MetroAgriFor 2023 Social Events

WELCOME PARTY
Monday November 6 - H 18:40

The Welcome Party will be held at **"Le Benedettine" Conference Center** on **Monday, November 6** - 18:40.

GALA DINNER
Tuesday November 7 - H 20:00

The Gala Dinner will be held will be held at the **Chiostro di Santa Caterina** on **Tuesday, November 7** - 20.00.

ADDRESS
Chiostro di Santa Caterina
Piazza Santa Caterina - Pisa

Use the QRCode to open the location on *Google Maps*

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Program Schedule - Monday, November 6

MONDAY - NOVEMBER 6			
10:15 - 11:00	Opening Ceremony - Welcome Addresses		
11:00 - 11:45	Plenary Session - Keynote Speaker - José Enrique Fernández Sceptic about digital agriculture? Watch this!		
	Room A	**Room B**	**Room C**
12:00 - 13:30	Session 1.1 Special Session #02 - Digital technologies and sustainable agriculture: meeting users' and societal needs	Session 1.2 Special Session #03 - Advances in Plant Phenotyping in Agriculture	Session 1.3 Special Session #05 - Artificial Intelligence, innovative data analysis and big data for agriculture and food applications
13:30 - 14:30	Lunch		
	Room A	**Room B**	**Room C**
14:30 - 16:00	Session 2.1 Special Session #19 - Advances on new sensors and models for more sustainable protected cultivations	Session 2.2 Special Session #14 - Advances in Agro-Hydrological Sensing and Modelling for Precision Irrigation	Session 2.3 Special Session #06 - Sensors and digital technologies for mapping and monitoring soil - PART I
16:00 - 16:30	Coffee Break		
16:30 - 18:00	Session 3.1 Special Session #15 - Bioinspired Engineering, Soft Robotics and Bio-hybrid Technologies as new Frontiers in Sustainable Agriculture and Environmental Management	Session 3.2 Special Session #08 - Measurements and modelling of mass and energy fluxes in agricultural and forest ecosystems	Session 3.3 Special Session #06 - Sensors and digital technologies for mapping and monitoring soil - PART II
18:00 - 18:40	Tutorial #1	Tutorial #2	Tutorial #3
18:40 - 20:00	Welcome Reception - Le Benedettine Conference Center		

Program Schedule - Tuesday, November 7

TUESDAY - NOVEMBER 7			
	Room A	**Room B**	**Room C**
09:00 - 10:30	Session 4.1 Special Session #07 - Measurements in olive for precision orchard management	Session 4.2 Special Session #12 - Vision Systems for Agri&Food Applications based on Embedded Processing	Session 4.3 Special Session #11 - Robotics for Agro-Forestry and Landscape Applications - PART I
10:30 - 11:00	Coffee Break		
11:00 - 11:45	Plenary Session - Keynote Speaker - John Steven Selker The Challenge of the Simple Within the Complexity of Hydrology		
	Room A	**Room B**	**Room C**
12:00 - 13:30	Session 5.1 Special Session #01 - Precision management of horticultural crops - PART I	Session 5.2 Special Session #10 - Sensing and Data Platforms: what is ahead of us - PART 1	Session 5.3 Special Session #11 - Robotics for Agro-Forestry and Landscape Applications - PART II
13:30 - 14:30	Lunch		
14:30 - 16:00	Session 6.1 Special Session #01 - Precision management of horticultural crops - PART II	Session 6.2 Special Session #10 - Sensing and Data Platforms: what is ahead of us - PART II	Session 6.3 Special Session #04 - Technologies and Strategies for Sustainable Livestock Farming - PART I
16:00 - 16:30	Coffee Break		
16:30 - 18:00	Sessoin 7.1 Special Session #13 - Optical sensors in Plant Pathology	Session 7.2 Special Session #17 - Earth Observation for agricultural water management under scarcity conditions in the Mediterranean area	Session 7.3 Special Session #04 - Technologies and Strategies for Sustainable Livestock Farming - PART II
20:00	Gala Dinner - Santa Caterina Cloister		

Program Schedule - Wednesday, November 8

WEDNESDAY - NOVEMBER 8				
	Room A	**Room B**	**Room C**	**Room F**
09:30 - 11:00	Session 8.1 Special Session #18 - Measurements in soil hydrological processes and properties	Session 8.2 Special Session #16 - Smart Systems for Operational Forest Monitoring, Automation and Analysis	Session 8.3 Special Session #20 - Metrology to support smart agricultural specialisations for monitoring and controlling pollutants in production environments	Session 8.4 General Session
11:00 - 11:30	Coffee Break			
11:30 - 12:15	Plenary Session - Keynote Speaker - Danilo Demarchi Let the Plants do the Talking: Smart Agriculture by the messages received from Plants and Soil			
12:15 - 13:00	Poster Session - Room D - E			
13:00 - 14:00	Lunch			
14:00 - 14:30	Closing and Award Ceremony			

Technical Program - Monday, November 6

09:00 - 18:00	*Le Benedettine Conference Center* **REGISTRATIONS**

10:15 - 11:00	*Room A - Le Benedettine Conference Center* **OPENING CEREMONY - WELCOME ADDRESSES**

11:00 - 11:45	*Room A - Le Benedettine Conference Center* **PLENARY SESSION - KEYNOTE SPEAKER** **Chair**: Luca Sebastiani, *Scuola Superiore Sant'Anna, Italy*

Sceptic about Digital Agriculture? Watch this!

José Enrique Fernández, *Institute for Natural Resources and Agrobiology of Seville, Spanish National Research Council*

12:00 - 13:30	*Room A - Le Benedettine Conference Center* **Session 1.1 - Digital technologies and sustainable agriculture: meeting users' and societal needs** **Chair:** Gianluca Brunori, *University of Pisa, Italy*

12:00 **The LandSupport Platform to Help Land Managers in the Mitigation of Degradation of Natural Resources**
Marialaura Bancheri, National Research Council, Italy
Giuliano Langella, University of Naples Federico II, Italy
Piero Manna, National Research Council, Italy
Florindo Antonio Mileti, University of Naples Federico II, Italy
Giuliano Ferraro, University of Naples Federico II, Italy
Luciana Minieri, University of Naples Federico II, Italy
Angelo Basile, National Research Council, Italy
Fabio Terribile, University of Naples Federico II, Italy

12:15 **Development of a Data Integration Architecture for Modern Sustainable Farming Systems: A Greenhouse Test Case**
Jorge A Sánchez-Molina, University of Almeria, Spain
Manuel Muñoz Rodriguez, University of Almeria, Spain
Ruben Avelino Gonzalez Morales, University of Almeria, Spain
Cynthia Lynn Giagnocavo, University of Almeria, Spain

12:30 **A Methodology for Process Modelling in Living Labs to Foster Agricultural Digitalisation**
Chiara Mannari, National Research Council, University of Pisa, Italy
F. Manlio Bacco, National Research Council, Italy
Alessio Ferrari, National Research Council, Italy
Livia Ortolani, University of Pisa, Italy
Maria Bonaria Lai, University of Pisa, Italy
Chiara Mignani, University of Pisa, Italy
Alina Silvi, University of Pisa, Italy
Alessio Malizia, University of Pisa, Italy, Molde University College, Norway
Gianluca Brunori, University of Pisa, Italy

12:45 **Co-Design and e-Governance Tools for Sustainable Land and Water Management in Rural Areas: The Experience Within the DESIRA H2020 Project**
Fabio Lepore, University of Pisa, Italy
Livia Ortolani, University of Pisa, Amigo Climate srl, Italy
Alessio Ferrari, National Research Council, Italy
Nicholas Fiorentini, National Research Council, University of Pisa, Italy
Chiara Mannari, National Research Council, University of Pisa, Italy
F. Manlio Bacco, National Research Council, Italy
Gianluca Brunori, University of Pisa, Italy

13:00 **Estimating evapotranspiration rate in greywater-irrigated pilot living green wall using sensor-derived temperature data from three different orientations**
Iqra Sarfraz, Scuola Superiore Sant'Anna, Italy
Anacleto Rizzo, IRIDRA, Italy
Fabio Masi, IRIDRA, Italy
Luca Sebastiani, Scuola Superiore Sant'Anna, Italy

12:00 - 13:30   *Room B - Le Benedettine Conference Center*
     Session 1.2 - Advances in Plant Phenotyping in Agriculture
     Chairs: Giuseppe Montanaro, *University of Basilicata, Italy*
     Francesco Cellini, *Metapontum Agrobios Research Center - ALSIA, Italy*

12:00 **Towards an Integrated Plant Phenotyping - Technology, Data, Community**
Roland Pieruschka, Forschungszentrum Jülich, Germany
Simone Gatzke, Forschungszentrum Jülich, Germany
Philipp von Gillhaussen, IPPN, Germany
Sven Fahrner, Forschungszentrum Jülich, Germany
Ulrich Schurr, Forschungszentrum Jülich, Germany

12:15 **Phenotyping Volatile Organic Compounds (VOCs) Emitted by Plants**
Assunta Russo, University of Naples Federico II, Italy
Maurilia Maria Monti, National Reaserch Council, Italy
Michelina Ruocco, National Reaserch Council, Italy
Francesco Loreto, National Research Council, University of Naples Federico II, Italy

12:30 **Application of Image-Based Phenotyping for Assessing Tolerance of Rice Varieties to Combined Water and Salt Stress**
Andi Isti Sakinah, Hasanuddin University, Indonesia
Yunus Musa, Hasanuddin University, Indonesia
Muh Farid, Hasanuddin University, Indonesia
Aris Hairmansis, National Research and Innovation Agency, Indonesia
Muhammad Fuad Anshori, Hasanuddin University, Indonesia
Marco Moriondo, National Reaserch Council, Italy
Marco Bindi, University of Florence, Italy
Riccardo Rossi, University of Florence, Italy

12:45 **Preliminary Image-Based Appraisal of Starch in One-Year-Old Grapevine Shoots**
Antonio Carlomagno, University of Basilicata, Italy
Antonella Zaccagnino, University of Basilicata, Italy
Giuseppe Montanaro, University of Basilicata, Italy
Laura Rustioni, University of Salento, Italy
Vitale Nuzzo, University of Basilicata, Italy

13:00 **Tomato Detection in Challenging Scenarios Using YOLO-Based Single Stage Detectors**
Angelo Cardellicchio, National Research Council, Italy
Vito Renò, National Research Council, Italy
Rosa Pia Devanna, National Research Council, Italy
Roberto Marani, National Research Council, Italy
Annalisa Milella, National Research Council, Italy

12:00 - 13:30   *Room C - Le Benedettine Conference Center*
Session 1.3 - Artificial Intelligence, innovative data analysis and big data for agriculture and food applications
Chairs: Marco Sozzi, *University of Padova, Italy*
Cristina Nuzzi, *University of Brescia,Italy*

12:00 **Satellite-Based Grapevine Phenological Stage Detection Through a Deep Supervised Machine Learning Approach**
Giacomo Blanco, LINKS Foundation, Italy
Federico Oldani, LINKS Foundation, Italy
Dario Salza, LINKS Foundation, Italy
Boris Basile, University of Naples Federico II, Italy
Claudio Rossi, LINKS Foundation, Italy

12:15	**An Intelligent Q&A Module for Tea Diseases and Pests Based on Automatic Knowledge Graph Construction**
Qiang Huang, Sichuan Agricultural University, China
Youzhi Tao, Sichuan Agricultural University, China
Shitao Ding, Sichuan Agricultural University, China
Yongbo Liu, Sichuan Academy of Agricultural Sciences, China
Francesco Marinello, University of Padova, Italy

12:30	**A Novel Automatic Method for Primary Roots Length Measurements in Arabidopsis Thaliana**
Ciro Allará, Free University of Bozen-Bolzano, Italy
Manuela Ciocca, Free University of Bozen-Bolzano, Italy
Mauro Maver, Free University of Bozen-Bolzano, Italy
Tanja Mimmo, Free University of Bozen-Bolzano, Italy
Luisa Petti, Free University of Bozen-Bolzano, Italy

12:45	**Automating Grape Thinning: Predicting Robotic Arm End-Effector Positions Using Depth Sensing Technology and Neural Networks**
Prawit Buayai, University of Yamanashi, Japan
Yin Suan Tan, University of Yamanashi, Japan
Muhammad Faris Bin Kamarudzaman, University of Yamanashi, Japan
Koji Makino, University of Yamanashi, Japan
Hiromitsu Nishizaki, University of Yamanashi, Japan
Xiaoyang Mao, University of Yamanashi, Japan

13:00	**Estimating Optimal Harvest Time and Yield in Tomatoes Using Deep Learning Techniques: A Preliminary Study**
Diego J. Gallardo Romero, University of Seville, Spain
Orly Enrique Apolo-Apolo, Ghent University, Belgium
Manuel Pérez-Ruiz, University of Seville, Spain

13:30 - 14:30	*Le Benedettine Conference Center*
LUNCH

14:30 - 16:00	*Room A - Le Benedettine Conference Center*
Session 2.1 - Advances on new sensors and models for more sustainable protected cultivations
Chair: Luca Incrocci, *University of Pisa, Italy*
Sonia Cacini, *Council for Agricultural Research and Economics (CREA), Italy*

14:30	**Hybridization of Vegetation Index With Agroclimatic Data to Improve Biomass Estimation in Tomato for Precision N Management**
Vito Cerasola, University of Bologna, Italy
Giuseppina Pennisi, University of Bologna, Italy

Francesco Orsini, University of Bologna, Italy
Stefano Bona, University of Padova, Italy
Giorgio Gianquinto, University of Bologna, Italy

14:45   Identification and Counting of Cucumber Downy Mildew Sporangia in Solar Greenhouses Based on the Improved YOLOV5
Dongyuan Shi, Shihezi University, China
Zhihuan Ding, Beijing Academy of Agriculture and Forestry, China
Xiaohui Chen, Beijing Academy of Agriculture and Forestry, China
Kaige Liu, Beijing Academy of Agriculture and Forestry, China
Xinting Yang, Beijing Academy of Agriculture and Forestry, China
Ming Diao, Shihezi University, China
Ming Li, Beijing Academy of Agriculture and Forestry, China

15:00   Experimental Analysis on Temperature Gradient and Environmental Parameters in a Greenhouse: A Case Study on Tomato Soilless Cultivation
Gianluca Caposciutti, University of Pisa, Italy
Bernardo Tellini, University of Pisa, Italy
Fatjon Cela, University of Pisa, Italy
Luca Incrocci, University of Pisa, Italy

15:15   Modeling Production and Energy Needs of a Vertical Farm
Andrea Baccioli, University of Pisa, Italy
Linda Capannoli, University of Pisa, Italy
Giuseppina Di Lorenzo, University of Pisa, Italy
Luca Incrocci, University of Pisa, Italy
Alberto Pardossi, University of Pisa, Italy
Aldo Bischi, University of Pisa, Italy

15:30   Greenhouse Climatic Sensing Through Agricultural Robots and Recurrent Neural Networks
Elia Brentarolli, University of Verona, Italy
Sara Migliorini, University of Verona, Italy
Davide Quaglia, University of Verona, Italy
Claudio Tomazzoli, University of Verona, Italy

14:30 - 16:00   *Room B - Le Benedettine Conference Center*
Session 2.2 - Advances in Agro-Hydrological Sensing and Modelling for Precision Irrigation
Chair: Àngela Puig-Sirera, *University of Pisa, Italy*

14:30   Plant Water Stress Derived Indexes From Water Potential and Diameter Fluctuations Measurements
María R. Conesa, CEBAS-CSIC, Spain
Wenceslao Conejero, CEBAS-CSIC, Spain
Juan Vera, CEBAS-CSIC, Spain

Ana Belén Mira-García, CEBAS-CSIC, Spain
María Carmen Ruiz-Sánchez, CEBAS-CSIC, Spain

14:45 **Appraising the Stem Water Potential of Citrus Orchards From UAV-Based Multispectral Imagery**
Giuseppe Longo Minnolo, University of Catania, Italy
Simona Consoli, University of Catania, Italy
Daniela Vanella, University of Catania, Italy
Serena Guarrera, University of Catania, Italy
Giuseppe Manetto, University of Catania, Italy
Emanuele Cerruto, University of Catania, Italy

15:00 **Capability of Hyperspectral and Thermal Data to Predict Gas Exchange and Chlorophyll Fluorescence Parameters in Broccoli**
Juan Miguel Ramírez-Cuesta, University of Catania, Italy
Diego S. Intrigliolo, CIDE- CSIC-UV-GVA, Spain
José Martínez Calvo, CIDE- CSIC-UV-GVA, Spain
Daniela Vanella, University of Catania, Italy
Joaquín Bolumar Bolumar, CIDE- CSIC-UV-GVA, Spain
Juan Gabriel Pérez Pérez, CDAS-IVIA, Spain

15:15 **Current State of Irrigation Decision Support Systems (IDSS) in Italy: Critical Insights**
Mino Sportelli, University of Pisa, Italy
Lorenzo Bonzi, University of Pisa, Italy
Gianluca Brunori, University of Pisa, Italy
Fatma Hamouda, University of Pisa, Italy
Àngela Puig-Sirera, University of Pisa, Italy
Salvatore Marasco, University of Pisa, Italy
Giovanni Rallo, University of Pisa, Italy

15:30 **Distributed FAO56 Agro-Hydrological Model for Irrigation Scheduling in Olives Orchards**
Matteo Ippolito, University of Palermo, Italy
Dario De Caro, University of Palermo, Italy
Fulvio Capodici, University of Palermo, Italy
Giuseppe Ciraolo, University of Palermo, Italy

14:30 - 16:00   *Room C - Le Benedettine Conference Center*
Session 2.3 - Sensors and digital technologies for mapping and monitoring soil - PART I
Chairs: Simone Priori, *University of Tuscia, Italy*
Roberto Barbetti, *CREA - Research Centre for Forestry and Wood, Italy*
Ulrike Werban, *UFZ Helmholtz Centre for Environmental Research*

14:30 **Prediction of Soil Organic Carbon in Arid Regions Using Hyperspectral Spectroscopy: UAE Case Study**

Abdel Rahman S. Alsaleh, Khalifa University, United Arab Emirates
Mariam Alcibahy, Khalifa University, United Arab Emirates
Abdelhamid Khaled Ads, Khalifa University, United Arab Emirates
Hamed Al Hashemi, UAE Space Agency, United Arab Emirates
Ali Al Hammadi, Khalifa University, United Arab Emirates
Lakmal Seneviratne, Khalifa University, United Arab Emirates
Maryam R. Al Shehhi, Khalifa University, United Arab Emirates

14:45 **Generating Variable Rate Application Maps Using Live Sensor Data, Soil and Crop Sensing**

Alexander Steiger, University of Rostock, Germany
Muhammad Qaswar, Ghent University, Belgium
Danyal Bustan, Ghent University, Belgium
Görres Grenzdörffer, University of Rostock, Germany
Ralf Bill, University of Rostock, Germany
Abdul M. Mouazen, Ghent University, Belgium

15:00 **Can Soil Organic Carbon in Long-Term Experiments Be Detected Using Vis-NIR Spectroscopy?**

Roberto Barbetti, CREA, Italy
Francesco Palazzi, CREA, Italy
PierMario Chiarabaglio, CREA, Italy
Carlos Lozano Fondon, CREA, Italy
Daniele Rizza, CREA, Italy
Alessandro Rocci, CREA, Italy
Carlo Grignani, University of Turin, Italy
Laura Zavattaro, University of Turin, Italy
Barbara Moretti, University of Turin, Italy
Maria Fantappiè, CREA, Italy
Stefano Monaco, CREA, Italy

15:15 **Enhancing Mediterranean Agriculture: Towards a Sensor Based Decision Support Tool for Efficient Irrigation Management in Smallholder Orchards**

Felix Thomas, Helmholtz Centre for Environmental Research, Germany
Juan Gabriel Pérez Pérez, Instituto Valenciano de Investigaciones Agrarias, Spain
Luis Bonet Pérez de León, Instituto Valenciano de Investigaciones Agrarias, Spain
Amparo Martínez-Gimeno, Instituto Valenciano de Investigaciones Agrarias, Spain
Juan Miguel Ramírez Cuesta, University of Catania, Italy
Daniela Vanella, University of Catania, Italy
Simona Consoli, University of Catania, Italy
Ulrike Werban, Helmholtz Centre for Environmental Research, Germany

15:30 **Coupling EMI and NIR Spectroscopy for Soil Mapping With Limited Number of Samples**

Simone Priori, University of Tuscia, Italy
Monica Zanini, University of Tuscia, Italy
Luca Meini, SO.IN.G srl, Italy

Stefano Cecchi, SO.IN.G srl, Italy
Annalisa Morelli, SO.IN.G srl, Italy

16:00 - 16:30	*Le Benedettine Conference Center* **COFFEE BREAK**

16:30 - 18:00	*Room A - Le Benedettine Conference Center* **Session 3.1 - Bioinspired Engineering, Soft Robotics and Bio-hybrid** **Technologies as new Frontiers in Sustainable Agriculture and** **Environmental Management** **Chairs:** Emanuela Del Dottore, *Istituto Italiano di Tecnologia, Italy* Donato Romano, *Scuola Superiore Sant'Anna, Italy*

16:30   **Towards a Bioinspired Soft Robotic Gripper for Gentle Manipulation of Mushrooms**
Niccolo Pagliarani, The BioRobotics Institute, Scuola Superiore Sant'Anna, Italy
Giacomo Picardi, Instituto de Ciencias del Mar, Spain
Radan Pathan, The BioRobotics Institute, Scuola Superiore Sant'Anna, Italy
Andrea Uccello, Teagasc Food Research Centre, Ireland
Helen Grogan, Teagasc Food Research Centre, Ireland
Matteo Cianchetti, The BioRobotics Institute, Scuola Superiore Sant'Anna, Italy

16:45   **Image-Based Approach for Fungal Network Analysis: Reconstructing Connectivity With Occluded Information**
Oscar Sten, Istituto Italiano di Tecnologia, University of Trento, Italy
Emanuela Del Dottore, Istituto Italiano di Tecnologia, Italy
Nicola Pugno, University of Trento, Italy, Queen Mary University of London, UK
Barbara Mazzolai, Istituto Italiano di Tecnologia, Italy

17:00   **A Bioinspired Multifunctional Soft Gripper With Embedded Sensing Ability: A Potential Way for Sustainable Agricultural Harvesting**
Mohsen Annabestani, Italian Institute of Technology, Italy
Behnam Kamare, Italian Institute of Technology, Italy
Majid Shabani, Italian Institute of Technology, Italy
Samuel Videira Magalhaes, Italian Institute of Technology, Italy
Alessio Mondini, Italian Institute of Technology, Italy
Barbara Mazzolai, Italian Institute of Technology, Italy

17:15   **Development of an Autonomous Fish-Inspired Robotic Platform for Aquaculture Inspection and Management**
Gianluca Manduca, Scuola Superiore Sant'Anna, Italy
Luca Padovani, Sapienza University of Rome, Italy
Edoardo Carosio, Scuola Superiore Sant'Anna, Italy
Giorgio Graziani, Sapienza University of Rome, Italy
Cesare Stefanini, Scuola Superiore Sant'Anna, Italy
Donato Romano, Scuola Superiore Sant'Anna, Italy

17:30 **Lightweight Soft Sensor for Droplets on Plant Leaves and Other Surfaces**
Fabian Meder, Istituto Italiano di Tecnologia, Italy
Serena Armiento, Istituto Italiano di Tecnologia, Italy
Barbara Mazzolai, Istituto Italiano di Tecnologia, Italy

16:30 - 18:00	*Room B - Le Benedettine Conference Center*
	Session 3.2 - Measurements and modelling of mass and energy fluxes in agricultural and forest ecosystems
	Chairs: Damiano Zanotelli, *Free Universtity of Bolzano-Bozen, Italy*
	Marco Moriondo, *National Research Council, Italy*
	Francesco Reyes*, University of Modena and Reggio Emilia, Italy*

16:30 **GRASSVISTOCK: Modeling Water Fluxes in Agro-Pastoral Systems**
Luisa Leolini, University of Florence, Italy
Marco Moriondo, National Research Council, Italy
Lorenzo Brilli, National Research Council, Italy
Marta Galvagno, ARPA-VDA, Italy
Marco Bindi, University of Florence, Italy
Giovanni Argenti, University of Florence, Italy
Davide Cammarano, Aarhus University, Denmark
Edoardo Bellini, University of Florence, Italy
Camilla Dibari, University of Florence, Italy
Georg Wohlfahrt, University of Innsbruck, Austria
Iris Feigenwinter, ETH Zürich, Switzerland
Aldo Dal Prà, National Research Council, Italy
Daniela Dalmonech, National Research Council, Italy
Alessio Collalti, National Research Council, Italy
Elisa Cioccolo, University of Viterbo, Italy
Edoardo Cremonese, ARPA VDA, Italy
Gianluca Filippa, ARPA-VDA, Italy
Nicolina Staglianò, University of Florence, Italy
Sergi Costafreda-Aumedes, National Research Council, Italy

16:45 **A Simple Framework to Calibrate a Soil Water Balance Model With Sentinel-1 and Sentinel-2 Observations Over Irrigated Fields**
Martina Natali, CIMA Research Foundation, Italy
Sara Modanesi, National Research Council, Italy
Christian Massari, National Research Council, Italy
Luca Brocca, National Research Council, Italy
Gabriëlle De Lannoy, KU Leuven, Belgium
Andrea Maino, University of Ferrara, Italy
Fabio Mantovani, University of Ferrara, Italy

17:00 **Meteorological Drivers of Vineyard Water Vapour Loss and Water Use Efficiency During Dry Days**

Flávio Bastos Campos, Free University of Bolzano-Bozen, Italy
Torben O. Callesen, Free University of Bolzano-Bozen, Italy
Giorgio Alberti, Free University of Bolzano-Bozen, Italy
Leonardo Montagnani, Free University of Bolzano-Bozen, Italy
Massimo Tagliavini, Free University of Bolzano-Bozen, Italy
Damiano Zanotelli, Free University of Bolzano-Bozen, Italy

17:15   **Simulating Soil Greenhouse Gases Emissions With the ARMOSA Model: Calibration With Continuous Field Measures of CO2 and N2O Soil Fluxes From the AGRESTIC Project**
Mara Gabbrielli, Università degli Studi di Milano, Italy
Marco Botta, Università degli Studi di Milano, Italy
Marco Perfetto, Università degli Studi di Milano, Italy
Iride Volpi, AEDIT srl, Italy
Diego Guidotti, AEDIT srl, Italy
Cristiano Tozzini, Scuola Superiore Sant'Anna di Pisa, Italy
Pierluigi Meriggi, Horta srl, Italy
Alessia Perego, Università degli Studi di Milano, Italy
Marco Acutis, Università degli Studi di Milano, Italy
Giorgio Ragaglini, Università degli Studi di Milano, Italy

17:30   **Characterization of Microclimate and Turbulent Fluxes at a Mediterranean Kiwi Orchard Covered With Hail-Protection Net**
Nadia Vendrame, University of Trento, Italy
Francesco Reyes, University of Modena and Reggio Emilia, Italy
Bartolomeo Dichio, University of Basilicata, Italy
Cristos Xiloyannis, University of Basilicata, Italy
Andrea Pitacco, University of Padova, Italy

16:30 - 18:00   *Room C - Le Benedettine Conference Center*
Session 3.3 - Sensors and digital technologies for mapping and monitoring soil - PART II
Chairs: Simone Priori, *University of Tuscia, Italy*
Roberto Barbetti, *CREA - Research Centre for Forestry and Wood, Italy*
Ulrike Werban, *UFZ Helmholtz Centre for Environmental Research*

16:30   **Using an Portable Gas Analayzer to Monitoring Soil Respiration in Mediterranean Garrigues With Extensive Livestock System**
Raffaello Spina, University of Tuscia, Italy
Riccardo Primi, University of Tuscia, Italy
Bruno Ronchi, University of Tuscia, Italy
Paolo Viola, University of Tuscia, Italy
Pier Paolo Danieli, University of Tuscia, Italy
Giampiero Grossi, University of Tuscia, Italy
Simone Priori, University of Tuscia, Italy
Andrea Vitali, University of Tuscia, Italy

16:45   **Digital Soil Mapping for Precision Agriculture Using Multitemporal Sentinel-2 Images of Bare Ground**
Monica Zanini, University of Tuscia, Italy
Simone Priori, University of Tuscia, Italy
Matteo Petito, IBF-Agronica, Italy
Silvia Cantalamessa, University of Padova, Italy

17:00   **Low-Cost Sensors for Soil Moisture Measurement: Modeling and Characterization**
Irene Cappelli, University of Siena, Italy
Lorenzo Parri, University of Siena, Italy
Benedetta Bichi, University of Siena, Italy
Marco Mugnaini, University of Siena, Italy
Valerio Vignoli, University of Siena, Italy
Ada Fort, University of Siena, Italy

17:15   **On the Combined Use of Static and Mobile Cosmic-Ray Neutron Sensors for Monitoring Spatio-Temporal Variability of Soil Water Content in Cropped Fields**
Luca Morselli, Finapp Srl, Italy
Stefano Gianessi, Finapp Srl, Italy
Riccardo Mazzoleni, University of Bologna, Italy
Barbara Biasuzzi, Finapp Srl, Italy
Enrico Gazzola, Finapp Srl, Italy
Marcello Lunardon, University of Padova, Italy
Gabriele Baroni, University of Bologna, Italy
Luca Stevanato, Finapp Srl, Italy

17:30   **Comparative Performance of Machine Learning Algorithms for Forest Cover Classification Using ASI - PRISMA Hyperspectral Data**
Eros Caputi, University of Tuscia, Italy
Gabriele Delogu, University of Tuscia, Italy
Alessio Patriarca, University of Tuscia, Italy
Miriam Perretta, Università di Napoli Federico II, Italy
Lorenzo Gatti, University of Tuscia, Italy
Lorenzo Boccia, Università di Napoli Federico II, Italy
Maria Nicolina Ripa, University of Tuscia, Italy

18:00 - 18:40   *Room A - Le Benedettine Conference Center*
TUTORIAL SESSION #1
Chair: Giacomo Palai, *University of Pisa, Italy*

UAV Applications for Digital Agriculture

Alessandro Matese, *National Research Council, Italy*

18:00 - 18:40	*Room B - Le Benedettine Conference Center*
	TUTORIAL SESSION #2
	Chair: Alessio Giovannelli, *National Research Council, Italy*

Opportunistic Use of Microwave Satellite Signals for Rainfall Measurement

Filippo Giannetti, *University of Pisa, Italy*

18:00 - 18:40	*Room C - Le Benedettine Conference Center*
	TUTORIAL SESSION #3
	Chair: Carlo Bibbiani, *University of Pisa, Italy*

Internet of Things, Cloud and Artificial Intelligence in Digital Agriculture

Stefano Chessa, *University of Pisa, Italy*

18:40 - 20:00	*Le Benedettine Conference Center*
	WELCOME PARTY

Technical Program - Tuesday, November 7

| 09:00 - 10:30 | *Room A - Le Benedettine Conference Center*
Session 4.1 - Measurements in olive for precision orchard management
Chairs: Enrico Maria Lodolini, *Università Politecnica delle Marche, Italy*
José Enrique Fernández, *Institute for natural resources and agrobiology, Spain* |

09:00 **Dynamic Characterization of an Olive Tree by Vibration Testing**
Alessandro Annessi, Università Politecnica delle Marche, Italy
Francesco Belluccini, Università Politecnica delle Marche, Italy
Veronica Giorgi, Università Politecnica delle Marche, Italy
Enrico Maria Lodolini, Università Politecnica delle Marche, Italy
Milena Martarelli, Università Politecnica delle Marche, Italy
Paolo Castellini, Università Politecnica delle Marche, Italy
Davide Neri, Università Politecnica delle Marche, Italy

09:15 **Plant2Web. A Modular Platform for Remote Data Retrieval and Visualization**
Rafael Romero, IRNAS-CSIC, Spain

09:30 **Mapping of Olive Trees Using Sentinel-2 and Sentinel-1 Images: An Evaluation of Pixel-Based Analyses**
Giuliano Ramat, National Research Council, Italy
Giacomo Fontanelli, National Research Council, Italy
Fabrizio Baroni, National Research Council, Italy
Alessandro Lapini, National Research Council, Italy
Simonetta Paloscia, National Research Council, Italy
Simone Pettinato, National Research Council, Italy
Simone Pilia, National Research Council, Italy
Emanuele Santi, National Research Council, Italy
Leonardo Santurri, National Research Council, Italy
Najet Souissi, National Research Council, Italy

09:45 **Preliminary Observations on the Use of Microtensiometers to Continuously Measure Water Potential in a Mature Olive Orchard**
Matteo Zucchini, Marche Polytechnic University, Italy, University of California, USA
Paula Guzman-Delgado, University of California, USA
Emly Adeline Santos, University of California, USA
Taylor Synstelien, University of California, USA
Giulia Marino, University of California, USA

10:00 **Continuous Monitoring of Olive Fruit Growth by Proximal Sensor: Case Study of the Daily Rain Effect**
Arash Khosravi, Università Politecnica delle Marche, Italy
Matteo Zucchini, Università Politecnica delle Marche, Italy
Adriano Mancini, Università Politecnica delle Marche, Italy
Enrico Maria Lodolini, Università Politecnica delle Marche, Italy
Davide Neri, Università Politecnica delle Marche, Italy

09:00 - 10:30   *Room B - Le Benedettine Conference Center*
Session 4.2 - Vision Systems for Agri&Food Applications based on Embedded Processing
Chairs: Cristina Nuzzi*, University of Brescia, Italy*
Simone Pasinetti*, University of Brescia, Italy*
Eduard Gregorio López, *University of Lleida, Spain*

09:00 **STEWIE: eSTimating grapE Berries Number and Radius From Images Using a Weakly supervIsed nEural Network**
Davide Botturi, University of Brescia, Italy
Alessandro Gnutti, University of Brescia, Italy
Cristina Nuzzi, University of Brescia, Italy
Bernardo Lanza, University of Brescia, Italy
Simone Pasinetti, University of Brescia, Italy

09:15 **Image-Based Sensor for On-Tree Automatic Color Tracking in Pomegranate Orchards**
Jaime Giménez-Gallego, Technical University of Cartagena, Spain
Jesus Martinez del Rincon, Queen's University Belfast, United Kingdom
Pedro J. Blaya-Ros, Technical University of Cartagena, Spain
Juan D. González-Teruel, Technical University of Cartagena, Spain
Manuel Jimenez, Technical University of Cartagena, Spain
Roque Torres, Technical University of Cartagena, Spain

09:30 **Image-Based Measurement of Grape Inflorescence Length for Automatic Inflorescence Trimming**
Shunsuke Fujisawa, University of Yamanashi, Japan
Muhammad Faris Kamarudzaman, University of Yamanashi, Japan
Prawit Buayai, University of Yamanashi, Japan
Koji Makino, University of Yamanashi, Japan
Hiromitsu Nishizaki, University of Yamanashi, Japan
Xiaoyang Mao, University of Yamanashi, Japan

09:45 **Estimation of Non-Invasive Grape Ripeness and Sweetness From Images Captured by a General-Purpose Camera**
Chee Siang Leow, University of Yamanashi, Japan
Ryosuke Shimazu, University of Yamanashi, Japan

Tomoki Kitagawa, University of Yamanashi, Japan
Hideaki Yajima, University of Yamanashi, Japan
Prawit Buayai, University of Yamanashi, Japan
Koji Makino, University of Yamanashi, Japan
Xiaoyang Mao, University of Yamanashi, Japan
Hiromitsu Nishizaki, University of Yamanashi, Japan

10:00   **Video-Based Fruit Detection and Tracking for Apple Counting and Mapping**
Jordi Gené-Mola, Institute of AgriFood Research and Technology, Spain
Marc Felip-Pomés, University of Lleida, Spain
Francesc Net-Barnés, Computer Vision Center, Spain
Ramon Morros, Universitat Politècnica de Catalunya, Spain
Juan C. Miranda, University of Lleida, Spain
Jaume Arno, University of Lleida, Spain
Luís Asín, Institute of AgriFood Research and Technology, Spain
Jaume Lordan, Institute of AgriFood Research and Technology, Spain
Javier Ruiz-Hidalgo, Universitat Politècnica de Catalunya, Spain
Eduard Gregorio López, University of Lleida, Spain

09:00 - 10:30   *Room C - Le Benedettine Conference Center*
Session 4.3 - Robotics for Agro-Forestry and Landscape Applications - PART I
Chairs: Marco Fontanelli, *University of Pisa, Italy*
Dario Mengoli, *University of Bologna, Italy*
Gabriele Costante, *University of Perugia, Italy*

09:00   **Enhancing Weakly Supervised Yield Estimation Through Learn-To-Pay-Attention Module**
Alessandro R. Denarda, University of Perugia, Italy
Francesco Crocetti, University of Perugia, Italy
Gabriele Costante, University of Perugia, Italy
Paolo Valigi, University of Perugia, Italy
Mario Luca Fravolini, University of Perugia, Italy

09:15   **A Glance at the Behaviour of a Tracked Mobile Robot on Different Agricultural Surfaces**
Antonio Leanza, Politecnico di Bari, Italy
Rocco Galati, Politecnico di Bari, Italy
Giulio Reina, Politecnico di Bari, Italy

09:30   **Overcoming Limitations of IoT Installations: Active Sensing UGV for Agricultural Digital Twins**
Miguel Pincheira, Fondazione Bruno Kessler, OpenIoT Unit, Italy
Farhad Shamsfakhr, Fondazione Bruno Kessler, OpenIoT Unit, Italy
Jhonny Hueller, Fondazione Bruno Kessler, OpenIoT Unit, Italy
Massimo Vecchio, Fondazione Bruno Kessler, OpenIoT Unit, Italy

09:45 **Adaptive Sliding Mode Control With Artificial Potential Field for Ground Robots in Precision Agriculture**
Mauro Mancini, Politecnico di Torino, Italy
Enza Incoronata Trombetta, Politecnico di Torino, Italy
Davide Carminati, Politecnico di Torino, Italy
Elisa Capello, Politecnico di Torino, Italy

10:00 **A Lightweight and Affordable Method for Canopy Porosity Estimation for Precision Spraying**
Dario Mengoli, University of Bologna, Italy
Gianmarco Bortolotti, University of Bologna, Italy
Michele Bartolomei, University of Bologna, Italy
Gianluca Allegro, University of Bologna, Italy
Ilaria Filippetti, University of Bologna, Italy
Luigi Manfrini, University of Bologna, Italy

10:30 - 11:00   *Le Benedettine Conference Center*
COFFEE BREAK

11:00 - 11:45   *Room A - Le Benedettine Conference Center*
PLENARY SESSION - KEYNOTE SPEAKER
Chair: Giovanni Rallo, *University of Pisa, Italy*

The Challenge of the Simple Within the Complexity of Hydrology

John Steven Selker, *Oregon State University, USA*

12:00 - 13:30   *Room A - Le Benedettine Conference Center*
Session 5.1 - Precision management of horticultural crops - PART I
Chairs: Luigi Manfrini, *University of Bologna, Italy*
Gianmarco Bortolotti, *University of Bologna, Italy*

12:00 **Mixing Supervised and Unsupervised Learning Algorithms to Solve Human Perception Subjectivity in Internal Fruit Quality Assessment**
Mirko Piani, University of Bologna, Italy
Gianmarco Bortolotti, University of Bologna, Italy
Dario Mengoli, University of Bologna, Italy
Niccolò Raule, University of Bologna, Italy
Francesco Spinelli, University of Bologna, Italy
Luigi Manfrini, University of Bologna, Italy

12:15 **Plot-Specific Drought Stress Simulation in Vineyards Using a Microclimatic Monitoring System in Combination With a Radiation and Water Balance Model**
Rikard Graß, Helmholtz Centre for Environmental Research GmbH, Germany
Hannah Boedeker, Helmholtz Centre for Environmental Research GmbH, Germany
Marco Hofmann, Hochschule Geisenheim University, Germany
Martin Schieck, Leipzig University, Germany
Silvia Krug (Mid Sweden University, Sweden & IMMS GmbH, Germany)
Tino Hutschenreuther, IMMS, Germany
Hannes Mollenhauer, IMMS, Germany

12:30 **Fruit Water Stress Index: Case Study on Applying Jones' Equation in Apple**
Arash Khosravi, Università Politecnica Delle Marche, Italy
Nikolaos Tsoulias, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany
Manuela Zude-Sasse, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany

12:45 **Machine Learning Regressor for the Prediction of the SPAD Value of Indoor Basil With RGB Monitoring**
Matteo Landolfo, University of Bologna, Italy
Fabio Perotti, University of Bologna, Italy
Gaia Moretti, University of Bologna, Italy
Giuseppina Pennisi, University of Bologna, Italy
Francesco Orsini, University of Bologna, Italy

13:00 **Development of a Consumer-Grade Scanning Platform for Fruit Thermal and Position Data Collection**
Gianmarco Bortolotti, University of Bologna, Italy
Mirko Piani, University of Bologna, Italy
Dario Mengoli, University of Bologna, Italy
Cristiano Franceschini, University of Bologna, Italy
Nicolò Omodei, University of Bologna, Italy
Simone Rossi, University of Bologna, Italy
Luigi Manfrini, University of Bologna, Italy

12:00 - 13:15   *Room B - Le Benedettine Conference Center*
Session 5.2 - Sensing and Data Platforms: what is ahead of us - PART I
Chairs: Cristina M. Pinotti, *University of Perugia, Italy*
Lars Wolf, *TU Braunschweig, Germany*

12:00 **Preliminary Results for Halyomorpha Halys Monitoring Relying on a Custom Dataset**
Francesco Betti Sorbelli, University of Perugia, Italy
Lorenzo Palazzetti, University of Florence, Italy
Cristina M. Pinotti, University of Perugia, Italy

12:15 **Remote Sensing and Machine Learning for Riparian Vegetation Detection and Classification**

Nicholas Fiorentini, National Research Council, Italy
F. Manlio Bacco, National Research Council, Italy
Alessio Ferrari, National Research Council, Italy
Massimo Rovai, University of Pisa, Italy
Gianluca Brunori, University of Pisa, Italy

12:30   CZU Data Platform: Initial Study
Michal Stočes, Czech University of Life Sciences Prague, Czech Republic
Vojtěch Novák, Czech University of Life Sciences Prague, Czech Republic
Petr Cihelka, Czech University of Life Sciences Prague, Czech Republic
Milos Ulman, Czech University of Life Sciences Prague, Czech Republic
Martin Havranek, Czech University of Life Sciences Prague, Czech Republic
Lukáš Kovář, Czech University of Life Sciences Prague, Czech Republic
Jiří Vaněk, Czech University of Life Sciences Prague, Czech Republic
Pavel Šimek, Czech University of Life Sciences Prague, Czech Republic

12:45   A Drone-Based Automated Halyomorpha Halys Scouting: A Case Study on Orchard Monitoring
Francesco Betti Sorbelli, University of Perugia, Italy
Lorenzo Palazzetti, University of Florence, Italy
Cristina M. Pinotti, University of Perugia, Italy

12:00 - 13:30	*Room C - Le Benedettine Conference Center* **Session 5.3 - Robotics for Agro-Forestry and Landscape Applications - PART II** **Chairs:** Marco Fontanelli, *University of Pisa, Italy* Dario Mengoli, *University of Bologna, Italy* Gabriele Costante, *University of Perugia, Italy*

12:00   Generalization of Reinforcement Learning Through Artificial Potential Fields for Agricultural UGVs
Petre Ricioppo, Politecnico di Torino, Italy
Davide Celestini, Politecnico di Torino, Italy
Elisa Capello, Politecnico di Torino, Italy

12:15   On-Line Real-Time Trunk Detection, Counting and Sizing to Enable Precision Agriculture Tasks on a Single-Plant Basis
Dario Mengoli, University of Bologna, Italy
Simone Rossi, University of Bologna, Italy
Gianmarco Bortolotti, University of Bologna, Italy
Nicolò Omodei, University of Bologna, Italy
Mirko Piani, University of Bologna, Italy
Luigi Manfrini, University of Bologna, Italy

12:30   Field Campaign and Experimental Design for Robot Performance Evaluation (ACRE 2023)

Sofia Matilde Luglio, University of Pisa, Italy
Mino Sportelli, University of Pisa, Italy
Christian Frasconi, University of Pisa, Italy
Marco Fontanelli, University of Pisa, Italy
Matteo Matteucci, Politecnico di Milano, Italy
Giulio Fontana, Politecnico di Milano, Italy
Enrico Piazza, Politecnico di Milano, Italy
Davide Facchinetti, University of Milan, Italy

12:45 **Measuring the Operative Performance of Autonomous Mowers on Slopes**
Marco Fontanelli, University of Pisa, Italy
Nicola Del Chiaro, University of Pisa, Italy
Lorenzo Gagliardi, University of Pisa, Italy
Christian Frasconi, University of Pisa, Italy
Michele Raffaelli, University of Pisa, Italy
Andrea Peruzzi, University of Pisa, Italy
Giuliano Sciusco, University of Pisa, Italy
Sofia Matilde Luglio, University of Pisa, Italy

13:00 **Comparison of Autonomous Mowers Energy Consumption and Working Capacity on a Bermudagrass Turf at Different Cutting Heights**
Giuliano Sciusco, University of Pisa, Italy
Lisa Caturegli, University of Pisa, Italy
Sofia Matilde Luglio, University of Pisa, Italy
Marco Fontanelli, University of Pisa, Italy
Marco Volterrani, University of Pisa, Italy
Simone Magni, University of Pisa, Italy
Mino Sportelli, University of Pisa, Italy

13:30 - 14:30	*Le Benedettine Conference Center* **LUNCH**

14:30 - 16:00	*Room A - Le Benedettine Conference Center* **Session 6.1 - Precision management of horticultural crops - PART II** **Chairs:** Luigi Manfrini, *University of Bologna, Italy* Gianmarco Bortolotti, *University of Bologna, Italy*

14:30 **Exploring the Potential of Electrical Impedance Spectroscopy for Predicting Internal Browning in Apples**
Sundus Riaz, Free University of Bolzano, Laimburg Research Centre, Italy
Pietro Ibba, Free University of Bolzano, Italy
Nadja Sadar, Laimburg Research Centre, Italy
Ahmed Rasheed, Free University of Bolzano, Italy
Paolo Lugli, Free University of Bolzano, Italy

Angelo Zanella, Free University of Bolzano, Laimburg Research Centre, Italy
Luisa Petti, Free University of Bolzano, Italy

14:45   **Disease Early Warning and Intelligent Climate Control in the Chinese Solar Greenhouse**
Ran Liu, National Engineering Research Center for Information Technology in Agriculture, China
Ming Li, National Engineering Research Center for Information Technology in Agriculture, China
José Luis Guzmán, University of Almería, Spain
Xinting Yang, National Engineering Research Center for Information Technology in Agriculture, China
Chunhao Zhang, University of Almería, Spain
Juan D. Gil, University of Almería, Spain

15:00   **Evaluation of Fruit Temperature on Cherries by Means of Thermal Point Clouds**
Marco Bignardi, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany
Nikolaos Tsoulias, Geisenheim University, Germany
Luigi Manfrini, University of Bologna, Italy
Manuela Zude-Sasse, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany

15:15   **Apple Fruit Surface Temperature Prediction Using Weather Data-Driven Machine Learning Models**
Nelson Goosman, Washington State University, USA
Basavaraj Amogi, Washington State University, USA
Lav Khot, Washington State University, USA

15:30   **Hyperspectral Imaging-Based Monitoring of Apple Fruit in Storage and Shelf Life**
Arman Arefi, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany
Manuela Zude-Sasse, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany

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14:30 - 16:00   *Room B - Le Benedettine Conference Center*
Session 6.2 - Sensing and Data Platforms: what is ahead of us - PART II
Chairs: Cristina M. Pinotti, *University of Perugia, Italy*
Lars Wolf, *TU Braunschweig, Germany*

14:30   **Towards Detecting Brown Marmorated Stink Bug Using Stationary Cameras**
David Niederprüm, Technische Universität Braunschweig, Germany
Shashank Jhansale Anil Kumar, Technische Universität Braunschweig, Germany
Lars C Wolf, Technische Universität Braunschweig, Germany

14:45   **Uncertainty Model for NDVI Estimation From Multispectral Camera Measurements**
Fatemeh Khalesi, University of Sannio, Italy
Pasquale Daponte, University of Sannio, Italy
Luca De Vito, University of Sannio, Italy
Francesco Picariello, University of Sannio, Italy
Ioan Tudosa, University of Sannio, Italy

15:00 **Evaluation of Wireless Technologies for an Embedded Camera-Based Pest Monitoring System**
Leonard J Zurek, Tyndall National Institute, University College Cork, Ireland
Amin Kargar, Tyndall National Institute, University College Cork, Ireland
Brendan O'Flynn, Tyndall National Institute, University College Cork, Ireland
David Niederprüm, Technische Universität Braunschweig, Germany
Lars C Wolf, Technische Universität Braunschweig, Germany
Dimitrios Zorbas, Nazarbayev University, Kazakhstan

15:15 **Enhancing Machine Learning Training Performance in Smart Agriculture Datasets Using a Mobile App**
Temirlan Zarymkanov, Nazarbayev University, Kazakhstan
Amin Kargar, Tyndall National Institute, University College Cork, Ireland
Cristina M. Pinotti, University of Perugia, Italy
Brendan O'Flynn, Tyndall National Institute, University College Cork, Ireland
Dimitrios Zorbas, Nazarbayev University, Kazakhstan

15:30 **A Model for Simulation of Developmental Instars of Halyomorpha Halys**
Catalin Lazar, National Agricultural Research and Development Institute, Romania
Dan Popescu, University Politehnica of Bucharest, Romania
Lara Maistrello, University of Modena and Reggio Emilia, Italy
Elena Costi, University of Modena and Reggio Emilia, Italy
Loretta Ichim, University Politehnica of Bucharest, Romania
Emil Igor Georgescu, National Agricultural Research and Development Institute, Romania

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14:30 - 16:00   *Room C - Le Benedettine Conference Center*
Session 6.3 - Technologies and Strategies for Sustainable Livestock Farming - PART I
Chairs: Giuseppe Conte, *University of Pisa, Italy*
Marco Bovo, *University of Bologna,Italy*

14:30 **Ankom DaisyII Modifications to Stabilise the Rotation Speed**
Salvatore Barbera, University of Turin, Italy
Chiara Sarnataro, University of Udine, Italy
Sabah Mabrouki, University of Turin, Italy
Sara Glorio Patrucco, University of Turin, Italy
Hatzumi Kaihara, University of Turin, Italy
Sonia Tassone, University of Turin, Italy

14:45 **Automated Method for Measuring Body Size Parameters of Live Pigs Based on Non-Rigid Registration of Point Clouds**
Zicheng Gao, China Agricultural University, China
Jie Lei, China Agricultural University, China
Jianhuan Wu, China Agricultural University, China
Jialong Zhang, China Agricultural University, China
Alexey Ruchay, Chelyabinsk State University, Russia

Andrea Pezzuolo, University of Padova, Italy
Hao Guo, China Agricultural University, China

15:00 **Insights From an Oxygen Integrated Monitoring and Control System in Land-Based Aquaculture**
Carlo Bibbiani, Università di Pisa, Italy
Riccardo Tonasso, Cosa - Società Agricola, Italy
Marco Gentili, Cosa - Società Agricola, Italy
Baldassare Fronte, Università di Pisa, Italy
Lorenzo Rossi, Università di Pisa, Italy

15:15 **Modelling the Spatial Distribution of THI in a Cattle Barn From Data of a Smart Monitoring System**
Carlos Alejandro Perez Garcia, University of Bologna, Italy
Marco Bovo, University of Bologna, Italy
Alberto Barbaresi, University of Bologna, Italy
Patrizia Tassinari, University of Bologna, Italy
Daniele Torreggiani, University of Bologna, Italy
Stefano Benni, University of Bologna, Italy

15:30 **Laser Methane Smart Detector for Measuring the Reduction of Emissions in Dairy Cows: A Pilot Study**
Elena Senatore, University of Pisa, Italy
Giulia Foggi, University of Pisa, Italy
Alina Silvi, University of Pisa, Italy
Alberto Mantino, University of Pisa, Italy
Giuseppe Conte, University of Pisa, Italy
Marcello Mele, University of Pisa, Italy

16:00 - 16:30 *Le Benedettine Conference Center*
COFFEE BREAK

16:30 - 18:00 *Room A - Le Benedettine Conference Center*
Session 7.1 - Optical sensors in Plant Pathology
Chairs: Lorenzo Cotrozzi, *University of Pisa, Italy*
René HJ Heim, *University of Goettingen, Germany*

16:30 **Hyperspectral Detection and Monitoring of Eggplant Verticillium Wilt in Field Conditions**
Ivan Fiaccadori, University of Pisa, Italy
Cosimo Bettiol, University of Pisa, Italy
Gian Piero Ricci, University of Pisa, Italy
Lorenzo D'Asaro, University of Pisa, Italy
Giuseppe Quaratiello, University of Pisa, Italy

Samuele Risoli, University School for Advanced Studies - IUSS Pavia, Italy
Athos Pedrelli, University of Pisa, Italy
Claudia Pisuttu, University of Pisa, Italy
Lorenzo Cotrozzi, University of Pisa, Italy

16:45 **Hyperspectral Imaging to Oversee the Status of Baby Leaf Vegetable Crops: The Agrofiliere Project Results**
Catello Pane, Council for Agricultural Research and Economics, Italy
Nicola Nicastro, Council for Agricultural Research and Economics, Italy
Gelsomina Manganiello, University of Naples Federico II, Italy
Francesco Carotenuto, University of Naples Federico II, Italy
Federico Pallottino, Council for Agricultural Research and Economics, Italy
Corrado Costa, Council for Agricultural Research and Economics, Italy

17:00 **Hyperspectral Signatures and Betalain Indicator for Beet Mosaic Virus Infection in Sugar Beet**
Nathan Okole, Institut Für Zuckerrübenforschung, Germany
Facundo R Ispizua Yamati, Institut Für Zuckerrübenforschung, Germany
Roxana Hossain, Institut Für Zuckerrübenforschung, Germany
Mark Varrelmann, Institut Für Zuckerrübenforschung, Germany
Anne-Katrin Mahlein, Institut Für Zuckerrübenforschung, Germany
René HJ Heim, Institut Für Zuckerrübenforschung, Germany

17:15 **An Experimental Setup for the Study of Plasmopara Viticola on Vine Leaves by Fluorescence**
Manuel Greco, Roma Tre University, Italy
Mariagrazia Leccisi, Roma Tre University, Italy
Giuseppe Schirripa Spagnolo, Roma Tre University, Italy
Fabio Leccese, Roma Tre University, Italy

17:30 **Detection of Fusarium Head Blight of Wheat From Hyperspectral Images**
Luca Tuzzi, University of Milano-Bicocca, Italy
Ilaria Busi, University of Milano-Bicocca, Italy
Roberto Garzonio, University of Milano-Bicocca, Italy
Lorenzo Cotrozzi, University of Pisa, Italy
Samuele Risoli, University of Pisa, Italy
Giuseppe Quaratiello, University of Pisa, Italy
Roberto Colombo, University of Milano-Bicocca, Italy
Sergio Cogliati, University of Milano-Bicocca, Italy
Laura Sironi, University of Milano-Bicocca, Italy

16:30 - 18:00   *Room B - Le Benedettine Conference Center*
Session 7.2 - Earth Observation for agricultural water management under scarcity conditions in the Mediterranean area
Chair: Giulio Castelli, *University of Florence, Italy*

16:30 **Implementation of Integrated Technologies for Hydrological Modeling in Mediterranean Viticulture: The SOSVITE Project**
Riccardo Rossi, University of Florence, Italy
Camilla Dibari, University of Florence, Italy
Gloria Padovan, University of Florence, Italy
Nicolina Staglianò, University of Florence, Italy
Anna Rita Balingit, University of Florence, Italy
Marco Bindi, University of Florence, Italy
Sergi Costafreda-Aumedes, National Research Council, Italy
Marta Chiesi, National Research Council, Italy
Fabio Maselli, National Research Council, Italy
Marco Moriondo, National Research Council, Italy

16:45 **Remote Sensing Techniques for Soil Humidity Monitoring in Drought Areas: Case Study of the Wadi Hallouf/Oum Zessar Watershed (Tunisia)**
Amal Hachani, National Research Council, Italy, IRA, Tunisia
Giuliano Ramat, National Research Council, Italy
Simonetta Paloscia, National Research Council, Italy
Emanuele Santi, National Research Council, Italy
Fabrizio Baroni, National Research Council, Italy
Giacomo Fontanelli, National Research Council, Italy
Alessandro Lapini, National Research Council, Italy
Simone Pettinato, National Research Council, Italy
Simone Pilia, National Research Council, Italy
Leonardo Santurri, National Research Council, Italy

17:00 **PRIMA MAGO Project: Open-Source Applications Based on Copernicus Data for Agricultural Water Management**
Laurent Pouget, CETAQUA, Spain
Albert Serra, CETAQUA, Spain
Francisco Nuñez, CETAQUA, Spain
Miquel Sarrias, CETAQUA, Spain
Samir Yacoubi, INRGREF, Tunisia
Ignacio Gil, AGBAR Agriculture, Spain
Marta Pérez, AGBAR Agriculture, Spain

17:15 **Remote Sensing Measurements for Efficient Crop Irrigation Management**
Irene Terlizzi, University of Padova, Italy
Federico Toson, University of Padova, Italy
Sebastiano Chiodini, University of Padova, Italy
Carlo Bettanini, University of Padova, Italy
Giacomo Colombatti, University of Padova, Italy
Francesco Morbidini, University of Padova, Italy
Carmelo Maucieri, University of Padova, Italy
Maurizio Borin, University of Padova, Italy

17:30 **Improving Irrigation Scheduling at Farm Level by Using High Quality Weather Forecasts**
Anna Pelosi, University of Salerno, Italy

Oscar Rosario Belfiore, University of Naples Federico II, Italy
Angeloluigi Aprile, University of Naples Federico II, Italy
Paolo Villani, University of Salerno, Italy
Guido D'Urso, University of Naples Federico II, Italy
Giovanni Battista Chirico, University of Naples Federico II, Italy

16:30 - 18:00	*Room C - Le Benedettine Conference Center*
	Session 7.3 - Technologies and Strategies for Sustainable Livestock Farming - PART II
	Chairs: Andrea Pezzuolo, *University of Padova,Italy*
	Alberto Barbaresi, *University of Bologna,Italy*

16:30 **An Integrated Renewable Energy Plant With Smart Monitoring System for Sustainable Farming**
Stefano Benni, University of Bologna, Italy
Francesco Tinti, University of Bologna, Italy
Marco Bovo, University of Bologna, Italy
Alberto Barbaresi, University of Bologna, Italy
Daniele Torreggiani, University of Bologna, Italy
Patrizia Tassinari, University of Bologna, Italy

16:45 **Algorithms for the Identification of Yield Anomalies in Cattle Dataset Collected by Automatic Milking Systems**
Mattia Ceccarelli, University of Bologna, Italy
Miki Agrusti, University of Bologna, Italy
Claudia Giannone, University of Bologna, Italy
Marco Bovo, University of Bologna, Italy
Alberto Barbaresi, University of Bologna, Italy
Enrica Santolini, University of Bologna, Italy
Stefano Benni, University of Bologna, Italy
Daniele Torreggiani, University of Bologna, Italy
Patrizia Tassinari, University of Bologna, Italy

17:00 **A Valuable Strategy for Chicken Welfare Management: A Review for Chicken Live Weight Monitoring**
Jing Xie, University of Almeria, Spain
Ming Li, National Engineering Research Center for Information Technology in Agriculture, China
Chunxu Wan, Beijing Vocational College of Agriculture, China

17:15 **A Mechanisability Index to Evaluate the Potential of Alpine Pastures and Meadows in North-East of Italy**
Daniele Pinna, University of Padova, Italy
Andrea Pezzuolo, University of Padova, Italy
Stefano Macolino, University of Padova, Italy
Cristina Pornaro, University of Padova, Italy

Alessia Cogato, University of Padova, Italy
Francesco Marinello, University of Padova, Italy

17:30 **Cattle Face Recognition Using Deep Transfer Learning Techniques**
Alexey Ruchay, Chelyabinsk State University, Russia
Ilya Akulshin, Chelyabinsk State University, Russia
Vladimir Kolpakov, Federal Research Centre of Biological Systems, Russia
Kinispay Dzhulamanov, Federal Research Centre of Biological Systems, Russia
Hao Guo, China Agricultural University, China
Andrea Pezzuolo, University of Padova, Italy

20:00	*Chiosto di Santa Caterina - Santa Caterina Cloister* *Piazza Santa Caterina - Pisa* **GALA DINNER**

Technical Program - Wednesday, November 8

09:00 - 12:00	*Le Benedettine Conference Center* **REGISTRATIONS**

09:30 - 11:00	*Room A - Le Benedettine Conference Center* **Session 8.1 - Measurements in soil hydrological processes and properties** **Chairs:** Vincenzo Alagna, *University of Palermo, Italy* Leonor Rodriguez Sinobas, *Universidad Politecnica de Madrid, Spain* Dario Autovino, *University of Palermo, Italy*

09:30 **Effect of Rainfall Intensity on the Mechanical Biases of Tipping Bucket Rainfall Measurements**
Daniel Alberto Segovia-Cardozo, Universidad Politécnica de Madrid, Spain
Carlota Bernal Basurco, Universidad Politécnica de Madrid, Spain
Leonor Rodriguez Sinobas, Universidad Politécnica de Madrid, Spain

09:45 **A New BEST Algorithm for Determining Soil Saturated Hydrodynamic Parameters Without Measuring Soil Water Content**
Dario Autovino, University of Palermo, Italy
Raphael Angulo-Jaramillo, Université Lyon, France
Vincenzo Alagna, University of Palermo, Italy
Simone Di Prima, University of Basilicata, Italy
Massimo Iovino, University of Palermo, Italy
Laurent Lassabatere, Université Lyon, France
Jianbin Lai, Chinese Academy of Sciences, China
Vincenzo Bagarello, University of Palermo, Italy

10:00 **Hydrological Response of a Volcanic Medium as a Potential Substrate for Green Roofs**
Cristina Bondì, University of Palermo, Italy
Vincenzo Alagna, University of Palermo, Italy
Massimo Iovino, University of Palermo, Italy

10:15 **Estimating Soil Water Repellency From Infiltration Experiments Conducted With Ethanol and Water**
Gaetano Caltabellotta, University of Palermo, Italy
Vincenzo Bagarello, University of Palermo, Italy
Massimo Iovino, University of Palermo, Italy

10:30 **Estimating the Saturated Soil Hydraulic Conductivity in a Farm Constructed Wetland From the Borehole Permeameter Infiltration Method**
Vincenzo Alagna, University of Palermo, Italy
Dario Autovino, University of Palermo, Italy
Massimo Iovino, University of Palermo, Italy
Attilio Toscano, University of Bologna, Italy

09:30 - 11:00   *Room B - Le Benedettine Conference Center*
Session 8.2 - Smart Systems for Operational Forest Monitoring, Automation and Analysis
Chairs: Giovanni Carabin, *Free University of Bozen-Bolzano, Italy*
Flor Álvarez-Taboada, *Universidad de León, Spain*

09:30 **Cutting Systems Evaluation for a Tree-Pruning Robot**
Giovanni Carabin, Free University of Bozen-Bolzano, Italy
Stefan Leitner, Free University of Bozen-Bolzano, Italy
Fabrizio Mazzetto, Free University of Bozen-Bolzano, Italy
Renato Vidoni, Free University of Bozen-Bolzano, Italy
Marco Bietresato, University of Udine, Italy

09:45 **Stem Sensors for Tree Health/Vitality: Perspectives to Quantify the Synchronization of Environmental Patterns and Plant Response Dynamics**
Alessio Giovannelli, National Research Council, Italy
Negar Rezaie, National Research Council, Italy
Claudia Cocozza, University of Florence, Italy

10:00 **A Pilot Study to Classify Salt Treated Poplar Plants Using Machine Learning Algorithms**
Bushra Jalil, Scuola Superiore Sant'Anna, Italy
Iqra Sarfraz, Scuola Superiore Sant'Anna, Italy
Lorenzo Della Maggiora, Scuola Superiore Sant'Anna, Italy
Alessandra Francini, Scuola Superiore Sant'Anna, Italy
Luca Valcarenghi, Scuola Superiore Sant'Anna, Italy
Luca Sebastiani, Scuola Superiore Sant'Anna, Italy

10:15 **Is Handheld Mobile Scanner Data Operational for the Evaluation of Field Performance of Poplar Clones?**
Rodrigo Arevalo, Universidad de León, Spain
Carlos Cabo Gómez, Universidad de Ovideo, Spain
Joaquín Garnica López, Bosques y Ríos, Spain
Fernando Castedo Dorado, Universidad de León, Spain
Carlos Álvarez Cuevas, GARNICA Valencia de Don Juan, Spain
Flor Álvarez-Taboada, Universidad de León, Spain

10:30 **Development and Application of an Automated System for Early Detection of Stress and Damage in Poplar Clone Plantations Using Eco-Physiological Sensors and IoT**
Isabel Cristina Grisales Sánchez, Universidad de León, Spain
Rodrigo Arthus Bacovich, IDAF SL Córdoba, Spain
Joaquín Garnica López, Bosques y Ríos, Spain
Carlos Álvarez Cuevas, GARNICA Valencia de Don Juan, Spain
Claudia Cocozza, University of Florence, Italy
Flor Álvarez-Taboada, Universidad de León, Spain

09:30 - 11:00 *Room C - Le Benedettine Conference Center*
Session 8.3 - Metrology to support smart agricultural specialisations for monitoring and controlling pollutants in production environments
Chair: Simone Pascuzzi, *University of Bari Aldo Moro, Italy*

09:30 **Chemical Risk Assessment in Agriculture: A New Methodological Approach**
Marco Bietresato, University of Udine, Italy
Rino Gubiani, University of Udine, Italy
Nicola Zucchiatti, University of Udine, Italy

09:45 **Use of the Logistic Function to Model Cumulative Volumes of Spray Nozzles**
Emanuele Cerruto, University of Catania, Italy
Juan Miguel Ramírez-Cuesta, University of Catania, Italy
Salvatore Privitera, University of Catania, Italy
Simone Pascuzzi, University of Bari Aldo Moro, Italy
Giuseppe Manetto, University of Catania, Italy

10:00 **Autonomous Navigation Simulation of an Agricultural Robot During Soil Fertilization in Open Fields**
Francesco Paciolla, Polytechnic of Bari, Italy
Nicola Pace, E80Group, Italy
Gianluca Barile, Procmatech srl, Italy
Pietro Patimisco, University of Bari Aldo Moro, Italy
Simone Pascuzzi, University of Bari Aldo Moro, Italy

10:15 **Nozzle Characterisation to Support Aerosol Spray Drift Measurement in a Semi-Controlled Environment**
Lorenzo Becce, Free University of Bozen-Bolzano, Italy
Giovanna Mazzi, Ca' Foscari University of Venice, Italy
Ayesha Ali, Free University of Bozen-Bolzano, Italy
Mara Bortolini, Ca' Foscari University of Venice, Italy
Andrea Gambaro, Ca' Foscari University of Venice, Italy
Fabrizio Mazzetto, Free University of Bozen-Bolzano, Italy

10:30 **Enhancing Spray Drift Deposition Analysis: Towards Real-Time Estimation Through Resistive Measurements and Optical Tracers**

Ayesha Ali, Free University of Bozen-Bolzano, Italy
Antonio Altana, Free University of Bozen-Bolzano, Italy
Lorenzo Becce, Free University of Bozen-Bolzano, Italy
Paolo Lugli, Free University of Bozen-Bolzano, Italy
Luisa Petti, Free University of Bozen-Bolzano, Italy
Fabrizio Mazzetto, Free University of Bozen-Bolzano, Italy

09:30 - 11:00	*Room F - Le Benedettine Conference Center*
	Session 8.4 - General Session
	Chair: Luigi Manfrini, *University of Bologna, Italy*

09:30   **Early Prediction of Honeybee Hive Winter Survivability Using Multi-Modal Sensor Data**
Yi Zhu, INRS-EMT, Canada
Mahsa Abdollahi, INRS-EMT, Canada
Ségolène Maucourt, Laval University, Canada
Nico Coallier, Nectar Technologies Inc, Canada
Heitor R Guimarães, INRS-EMT, Canada
Pierre Giovenazzo, Laval University, Canada
Tiago Falk, INRS-EMT, Canada

09:45   **Adapting Self-Supervised Features for Background Speech Detection in Beehive Audio Recordings**
Heitor R Guimarães, INRS-EMT, Canada
Mahsa Abdollahi, INRS-EMT, Canada
Yi Zhu, INRS-EMT, Canada
Ségolène Maucourt, Laval University, Canada
Nico Coallier, Nectar Technologies Inc, Canada
Pierre Giovenazzo, Laval University, Canada
Tiago Falk, INRS-EMT, Canada

10:00   **Detection of Biodiversity Indicators for Regenerative Agriculture Compliance**
Mohua Haldar, Accenture, India
Priyanka Pandey, Accenture, India
Manali Shyam, Accenture, India
Bharathi Venkat, Accenture, India
Bhushan Gurmukhdas Jagyasi, Accenture, India

10:15   **Combined Approach for Hillslope Hydrogeological Assessment, in Rainfall-Induced Shallow Landslides Prone Area**
Valerio Vivaldi, University of Pavia, Italy
Patrizio Torrese, University of Pavia, Italy
Massimiliano Bordoni, University of Pavia, Italy
Claudia Meisina, University of Pavia, Italy

10:30   **Wavelet Coherence Analysis to Assess Cross-Correlation of Mediterranean Vegetation and Drought Condition at Local Scale**
Martina Perez, Sapienza University of Rome, Italy
Danilo Lombardi, Sapienza University of Rome, Italy
Marcello Vitale, Sapienza University of Rome, Italy

11:00 - 11:30   *Le Benedettine Conference Center*
COFFEE BREAK

11:30 - 12:15   *Room A - Le Benedettine Conference Center*
PLENARY SESSION - KEYNOTE SPEAKER
Chair: Giovanni Caruso, *University of Pisa, Italy*

Let the Plants do the Talking:
Smart Agriculture by the messages received from Plants and Soil

Danilo Demarchi, *Politecnico di Torino, Italy*

12:15 - 13:00   *Room D - Room E - Le Benedettine Conference Center*
POSTER SESSION
Chair: Alessandra Francini, *Scuola Superiore Sant'Anna, Italy*

PS01   **Measuring Fruit Quality Traits in Olive Through RGB Imaging and Artificial Neural Networks: Opportunities and Limitations**
Giuseppe Montanaro, University of Basilicata, Italy
Angelo Petrozza, Centro Ricerche Metapontum Agrobios ALSIA, Italy
Laura Rustioni, University of Salento, Italy
Francesco Cellini, Metapontum Agrobios Research Center - ALSIA, Italy
Antonio Carlomagno, University of Basilicata, Italy
Vitale Nuzzo, University of Basilicata, Italy

PS02   **Measure of Spray Deposition in a "Tendone" Vineyard Produced by an Air Blast Sprayer Machine**
Simone Pascuzzi, University of Bari Aldo Moro, Italy
Giuseppe Manetto, University of Catania, Italy
Fabrizio Mazzetto, Free University of Bolzano-Bozen, Italy
Emanuele Cerruto, University of Catania, Italy

PS03   **Data Integration of Sentinel-1 and Sentinel-2 for Evaluating Vegetation Biomass and Water Status**
Simone Pilia, National Research Council, Italy
Giacomo Fontanelli, National Research Council, Italy

Leonardo Santurri, National Research Council, Italy
Giuliano Ramat, National Research Council, Italy
Fabrizio Baroni, National Research Council, Italy
Emanuele Santi, National Research Council, Italy
Alessandro Lapini, National Research Council, Italy
Simone Pettinato, National Research Council, Italy
Simonetta Paloscia, National Research Council, Italy

PS04   **Predictive Model for the Growth Rate of Tomatoes in Saline Substrate Cultivation**

Alexander Kocian, University of Pisa, Italy
Paolo Milazzo, University of Pisa, Italy
Antonella Castagna, University of Pisa, Italy
Annamaria Ranieri, University of Pisa, Italy
José A Hernández, CEBAS-CSIC, Spain
Pedro D Vivancos, CEBAS-CSIC, Spain
Gregorio B Espín, CEBAS-CSIC, Spain
Karim B Hamed, CBBC, Tunisia
Aida Selmi, CBBC, Tunisia
Nesrine Kalboussi, CERTE, Tunisia
Stefano Chessa, University of Pisa, Italy

PS05   **On the Automatic Detection and Monitoring of Leaves and Grapes Using In-Field Optical Cameras**

Giacomo Blanco, LINKS Foundation, Italy
Federico Oldani, LINKS Foundation, Italy
Dario Salza, LINKS Foundation, Italy
Claudio Rossi, LINKS Foundation, Italy

PS06   **Carbon and Water Fluxes of a Laurisilva Cloud Forest in Anaga Biosphere Reserve (Tenerife, Canary Islands)**

Axel Ritter, University of La Laguna, Spain
Carlos M. Regalado, Instituto Canario de Investigaciones Agrarias, Spain
María León-González, University of La Laguna, Spain

PS07   **Effects of Drought Stress on the Water Relations of Sweet Cherry Trees**

Pedro J. Blaya-Ros, Technical University of Cartagena, Spain
Víctor Blanco, Washington State University, USA
Roque Torres-Sánchez, Technical University of Cartagena, Spain
Jaime Giménez-Gallego, Technical University of Cartagena, Spain
Manuel Jimenez, Technical University of Cartagena, Spain
Rafael Domingo, Technical University of Cartagena, Spain

PS08   **Measuring Energy Use in Controlled Environment Agriculture**

Alessandro Franco, University of Pisa, Italy
Lorenzo Miserocchi, University of Pisa, Italy

PS09   **The Contribution of the European Project Probefield to In-Field Use of Proximal Soil Sensors**

Romina Lorenzetti, National Research Council, Italy
Fabio Castaldi, National Research Council, Italy

Carlos Lozano Fondon, CREA, Italy
Luboš Borůvka, Czech University of Life Sciences, Czech Republic
Konrad Metzger, Agroscope, Switzerland
Eyal Ben-Dor, Tel Aviv University, Israel)
Fenny van Egmond, Wageningen Environmental Research, The Netherlands
Roberto Barbetti, CREA, Italy
Maria Fantappiè, CREA, Italy
Guillaume Debaene, Institute of Soil Science and Plant Cultivation, Poland
Katja Klumpp, INRAE, France)
Frank Liebisch, Agroscope, Switzerland
Asa Gholizadeh, Czech University of Life Sciences, Czech Republic
Bo Stenberg, Swedish University of Agricultural Sciences, Sweden
Maria Knadel, Aarhus University, Denmark

PS10   Analysis of the Feasibility of a Low-Cost DAQ for EM-38 Detection and Mapping

Fatma Hamouda, University of Pisa, Italy
Lorenzo Bonzi, University of Pisa, Italy
Àngela Puig-Sirera, University of Pisa, Italy
Damiano Remorini, University of Pisa, Italy
Andrea Sbrana, University of Pisa, Italy
Mino Sportelli, University of Pisa, Italy
Giovanni Rallo, University of Pisa, Italy
Filippo Giannetti, University of Pisa, Italy
Vincenzo Lottici, University of Pisa, Italy
Rosario G. Garroppo, University of Pisa, Italy
Salvo Marcuccio, University of Pisa, Italy

PS11   Predictive Measurements of Pigmentation Index and Polyphenols in Olive Fruits Using a Colorimetric Approach

Carmen Fidalgo Illesca, Scuola Superiore Sant'Anna, Italy
Elena Vichi, Scuola Superiore Sant'Anna, Italy
Dario Torresi, Scuola Superiore Sant'Anna, Italy
Letizia Tozzini, Scuola Superiore Sant'Anna, Italy
Andrea Raffaelli, Scuola Superiore Sant'Anna, Italy
Alessandra Francini, Scuola Superiore Sant'Anna, Italy
Luca Sebastiani, Scuola Superiore Sant'Anna, Italy

PS12   Designing and Implementing a Multifunctional Network of Urban Green Infrastructures

Ernesto Marcheggiani, Università Politecnica delle Marche, Italy
Mattia Balestra, Università Politecnica delle Marche, Italy
MD Abdul Mueed Choudhury, Università Politecnica delle Marche, Italy
Francesco Paci, Università Politecnica delle Marche, Italy
Nicole Hofmann, Università Politecnica delle Marche, Italy
Adriano Mancini, Università Politecnica delle Marche, Italy
Andrea Galli, Università Politecnica delle Marche, Italy
Davide Neri, Università Politecnica delle Marche, Italy
Stefano Chiappini, Università Politecnica delle Marche, Italy

PS13   **Time Series Analysis of Olive Orchard Coverage in the Rural Landscape: A Case Study of the Cartoceto Municipality**

Stefano Chiappini, Università Politecnica delle Marche, Italy
Mattia Balestra, Università Politecnica delle Marche, Italy
Andrea Galli, Università Politecnica delle Marche, Italy
Eva Savina Malinverni, Università Politecnica delle Marche, Italy
Arash Khosravi, Università Politecnica delle Marche, Italy
Davide Neri, Università Politecnica delle Marche, Italy
Ernesto Marcheggiani, Università Politecnica delle Marche, Italy

PS14   **Sensor Networks for Indexing Disease Severity on Rose Plants in a Low-Tech Mediterranean Greenhouse Conditions**

Silvia Traversari, National Research Council, Italy
Catello Pane, CREA, Italy
Piero Battista, National Research Council, Italy
Bernardo Rapi, National Research Council, Italy
Maurizio Romani, National Research Council, Italy
Beatrice Nesi, CREA, Italy
Daniele Massa, CREA, Italy
Sonia Cacini, CREA, Italy

PS15   **First Step Towards Embedded Vision System for Pruning Wood Estimation**

Bernardo Lanza, University of Brescia, Italy
Cristina Nuzzi, University of Brescia, Italy
Davide Botturi, University of Brescia, Italy
Simone Pasinetti, University of Brescia, Italy

PS16   **Revolutionizing Precision Agriculture: Exploring a Novel Biodegradable Substrate for Advanced Electronic Sensors**

Elena Palmieri, National Research Council, Italy
Francesco Maita, National Research Council, Italy
Alessandra Pellegrino, National Research Council, Italy
Giovanni Avola, National Research Council, Italy
Miriam Distefano, National Research Council, Italy
Luca Maiolo, National Research Council, Italy

PS17   **Preliminary evaluation of gas-exchange parameters as drought tolerance indicators for phenotyping durum wheat genotypes**

Liberata Gualtieri, National Research Council, Italy
Maurilia Maria Monti, National Research Council, Italy
Michelina Ruocco, National Research Council, Italy
Donatella Danzi, ALSIA Metapontum Agrobios Research Centre, Italy
Angelo Petrozza, ALSIA Metapontum Agrobios Research Centre, Italy
Stephan Summerer, ALSIA Metapontum Agrobios Research Centre, Italy
Domenico Pignone, ALSIA Metapontum Agrobios Research Centre, Italy
Francesco Loreto, CNR, University of Naples Federico II, Italy
Federico Brilli, National Research Council, Italy

PS18   **Mapping Irrigated Crops Through Sentinel 2 Satellite Images: Evidences From Southern Italy**

Raffaella Matarrese, National Research Council, Italy
Ivan Portoghese, National Research Council, Italy
Laura Mirra, National Research Council, Italy
Giacomo Giannoccaro, University of Bari, Italy
Pietro Sciusco, Planetek, Italy
Vincenzo Barbieri, Planetek, Italy

PS19   **Bio-Inspired Complete Coverage Path Planner for Precision Agriculture in Dynamic Environments**

Davide Celestini, Politecnico di Torino, Italy
Stefano Primatesta, Politecnico di Torino, Italy
Elisa Capello, Politecnico di Torino, Italy

PS20   **Image-To-Image Translation for Satellite and UAV Remote Sensing: A Use Case for Cercospora Leaf Spot Monitoring on Sugar Beet**

Facundo R Ispizua Yamati, Institute of Sugar Beet Research, Germany
Maurice Günder, Universität Bonn, Germany
Weronika Gajda, Utrecht University, Netherlands
Anne-Katrin Mahlein, Institute of Sugar Beet Research, Germany
René HJ Heim, Institute of Sugar Beet Research, Germany

PS21   **Design and Stability Analysis of an Agricultural Sprayer UAS Integrated With an Anti-Sloshing Tank**

Pietro Surico, Politecnico di Torino, Italy
Nicoletta Bloise, Politecnico di Torino, Italy
Stefano Primatesta, Politecnico di Torino, Italy
Giorgio Guglieri, Politecnico di Torino, Italy

PS22   **Platform to Decision-Making in Sustainable Tourism and Landscape Protection Based on Signal Detection**

Vojtěch Novák, Czech University of Life Sciences Prague, Czech Republic
Michal Stočes, Czech University of Life Sciences Prague, Czech Republic
Lukáš Kovář, Czech University of Life Sciences Prague, Czech Republic
Milos Ulman, Czech University of Life Sciences Prague, Czech Republic
Jan Jarolímek, Czech University of Life Sciences Prague, Czech Republic
Jan Masner, Czech University of Life Sciences Prague, Czech Republic
Karel Kubata, Czech University of Life Sciences Prague, Czech Republic
Eva Kánská, Czech University of Life Sciences Prague, Czech Republic

PS23   **Grapevine Bunch Digital Twin Analysis to Detect Alternative Traits for Bunch Morphology Classification**

Alessandro Zanchin, University of Padova, Italy
Mahshid Kalantari, University of Padova, Italy
Uxue Encinas, University of Padova, Italy
Marco Sozzi, University of Padova, Italy
Lorenzo Guerrini, University of Padova, Italy
Francesco Marinello, University of Padova, Italy

PS24   **Design of Crop Growth Analysis Platform With Image and Time Series Analysis**
Seung Woo Kum, Korea Electronics Technology Institute, Korea
Seungtaek Oh, Korea Electronics Technology Institute, Korea
Youngkee Kim, Korea Electronics Technology Institute, Korea
Jaewon Moon, Korea Electronics Technology Institute, Korea
Alejandro Barrera Carvajal, CT Engineering Group, Spain
Francisco Andres Perez, CT Engineering Group, Spain

PS25   **Augmented Reality for the Management of Microclimate Variability in Greenhouses**
Elio Romano, CREA, Italy
Carlo Bisaglia, CREA, Italy
Andrea Lazzari, CREA, Italy
Alex Filisetti, CREA, Italy
Elia Premoli, CREA, Italy
Massimo Brambilla, CREA, Italy

PS26   **Comparison of Landsat and Sentinel-2 Surface Reflectance Data and Derived Vegetation Indexes: Application in a Rainfed Vineyard**
Àngela Puig-Sirera, University of Pisa, Italy
Giovanni Rallo, University of Pisa, Italy
Diego S. Intrigliolo, CIDE-CSIC, Spain
Salvatore Marasco, University of Pisa, Italy
Marco Carrara, University of Pisa, Italy
Juan Miguel Ramírez-Cuesta, University of Catania, Italy

PS27   **A Modular Platform to Build Task-Specific IoT Network Solutions for Agriculture and Forestry**
Silvia Krug, Mid Sweden University, Sweden, IMMS GmbH, Germany
Marco Goetze, IMMS GmbH, Germany
Sören Schneider, IMMS GmbH, Germany
Tino Hutschenreuther, IMMS GmbH, Germany

PS28   **Enhancing Precision Agriculture Through Cyber-Physical Systems: A Functional Monitoring Platform as a Decision Support Tool**
Eduardo Suraci Picchiotti, Free University of Bolzano-Bozen, Italy
Soufiane Krik, Free University of Bolzano-Bozen, Italy
Pietro Ibba, Free University of Bolzano-Bozen, Italy
Pietro Tosato, Fondazione Bruno Kessler, Italy
Antonio Altana, Free University of Bolzano-Bozen, Italy
Matteo Valt, Fondazione Bruno Kessler, Italy
Andrea Gaiardo, Fondazione Bruno Kessler, Italy
Luisa Petti, Free University of Bolzano-Bozen, Italy

PS29   **Monitoring Olive Tree Water Status by Unmanned Aerial Vehicles (UAVs) and Trunk Dendrometers**
Giovanni Caruso, University of Pisa, Italy
Giacomo Palai, University of Pisa, Italy
Riccardo Gucci, University of Pisa, Italy

PS30 **Enabling High-Quality Compost for a Smart Domestic Production**
Giovanna Turvani, Politecnico di Torino, Italy
Melania Fiore, Politecnico di Torino, Italy
David O. Rodriguez-Duarte, Politecnico di Torino, Italy
Francesca Demichelis, Politecnico di Torino, Italy
Tonia Tommasi, Politecnico di Torino, Italy
Francesca Vipiana, Politecnico di Torino, Italy
Fabrizio Riente, Politecnico di Torino, Italy

PS31 **Calibration and Validation of a Model for the Prediction of Biomass and Nutrient Uptake of a Tomato (Cv. Pisanello) Grown in a Greenhouse Soilless Cultivation System**
Giulia Carmassi, University of Pisa, Italy
Susanna Cialli, Sant'Anna School of Advanced Studies, Italy
Fatjon Cela, University of Pisa, Italy
Luca Incrocci, University of Pisa, Italy

PS32 **Foliar Hyperspectral Identification of Butternut Canker Infection in Pure and Hybridized Butternut (Juglans Cinerea)**
Elisabeth Joll, Purdue University, USA
Aziz Ebrahimi, Purdue University, USA
Anna Conrad, USDA, USA
Doug Jacobs, Purdue University, USA
John J Couture, Purdue University, USA

13:00 - 14:00 *Le Benedettine Conference Center*
LUNCH

14:00 - 14:30 *Room A - Le Benedettine Conference Center*
CLOSING AND AWARD CEREMONY