

2022 IEEE Workshop on Metrology for Agriculture and Forestry (MetroAgriFor 2022)

**Perugia, Italy
3-5 November 2022**



**IEEE Catalog Number: CFP22U22-POD
ISBN: 978-1-6654-6999-9**

**Copyright © 2022 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP22U22-POD
ISBN (Print-On-Demand):	978-1-6654-6999-9
ISBN (Online):	978-1-6654-6998-2

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

WORKSHOP PROGRAM

Thursday, November 3

Session 1.1 - ICT application in the energy, industrial and biorefineries chains based on wood and lignocellulosic biomass

Room: San Pietro Abbey - Aula Magna

Chair: Giuseppe Toscano, *Università Politecnica delle Marche, Italy*

- 1 Performance evaluation of a benchtop wood pellet length analyser based on visual imaging**
Giuseppe Toscano (Università Politecnica delle Marche), Chiara Masci (Metacortex srl), Rino Goller (Metacortex srl), Sara Di Stefano (Università Politecnica delle Marche), Michele Naspi (Università Politecnica delle Marche) and Thomas Gasperini (Università Politecnica delle Marche)
- 7 Assessment of energy content of industrial woodchip based on prediction models of moisture content using portable NIR spectrophotometer**
Elena Leoni (Università Politecnica delle Marche), Manuela Mancini (Università Politecnica delle Marche), Sara Fabrizi (Università Politecnica delle Marche), Carmine de Francesco (Università Politecnica delle Marche), Gianni Picchi (CNR-IBE (Sesto Fiorentino)) and Giuseppe Toscano (Università Politecnica delle Marche)
- 12 An innovative retrofitting solution for the reduction of particulate matter in small sized pellet stoves**
Valentina Coccia (University of Perugia CIRIAF/CRB), Franco Cotana (University of Perugia CIRIAF/CRB), Ramoon Barros Lovate Temporim (University of Perugia CIRIAF/CRB) and Leandro Lunghi (University of Perugia CIRIAF/CRB)
- 17 Wood pellet bulk density determination by machine vision deep learning technique**
Giuseppe Toscano (Department of Agricultural, Food and Environmental Sciences (D3A), Università Politecnica delle Marche (UNIVPM)), Roberto Pierdicca (Department of Civil, Building and Architectural Engineering (DICEA), Università Politecnica delle Marche (UNIVPM)), Thomas Gasperini (Department of Agricultural, Food and Environmental Sciences (D3A), Università Politecnica delle Marche (UNIVPM)), Andrea Felicetti (Department of Information Engineering (DII), Università Politecnica delle Marche (UNIVPM)), Giorgio Rossini (Department of Agricultural, Food and Environmental Sciences (D3A), Università Politecnica delle Marche (UNIVPM)) and Mattia Balestra (Department of Agricultural, Food and Environmental Sciences (D3A), Università Politecnica delle Marche (UNIVPM))
- 22 Energy characterization of wood briquettes and possible use in automated domestic heating systems**
Alessio Mencarelli (Università degli Studi di Padova), Raffaele Cavalli (Università degli Studi di Padova) and Rosa Greco (Università degli Studi di Padova)

Session 1.2 - Gaseous emissions in livestock production: advances in measurement and modelling from barn to the field

Room: San Pietro Abbey - Aula Riviste

Chairs: Stefania Pindozi, *University of Naples Federico II, Italy*

Elio Dinuccio, University of Turin, Italy

- 28 Monitoring and Analysis of the Gaseous Emissions Collected in a Livestock Farm**
Enrica Santolini (DISTAL - ALMA MATER STUDIORUM UNIVERSITA' DI BOLOGNA), Marco Bovo (DISTAL - ALMA MATER STUDIORUM UNIVERSITA' DI BOLOGNA), Alberto Barbaresi (DISTAL - ALMA MATER STUDIORUM UNIVERSITA' DI BOLOGNA), Miki Agrusti (DISTAL - ALMA MATER STUDIORUM UNIVERSITA' DI BOLOGNA), Patrizia Tassinari (DISTAL - ALMA MATER STUDIORUM UNIVERSITA' DI BOLOGNA), Andrea Pezzuolo (University of Padova) and Daniele Torreggiani (DISTAL - ALMA MATER STUDIORUM UNIVERSITA' DI BOLOGNA)

- 33 **Development and evaluation of an in vitro procedure to assess enteric methane production**
Flavia Dela Pierre (DISAFA, Department of Agricultural, Forest and Food Sciences, University of Turin), Martina Friuli (DISAFA, Department of Agricultural, Forest and Food Sciences, University of Turin), Luca Rollé (DISAFA, Department of Agricultural, Forest and Food Sciences, University of Turin), Riccardo Fortina (DISAFA, Department of Agricultural, Forest and Food Sciences, University of Turin), Sonia Tassone (DISAFA, Department of Agricultural, Forest and Food Sciences, University of Turin) and Elio Dinuccio (DISAFA, Department of Agricultural, Forest and Food Sciences, University of Turin)
- 38 **Treatment of dairy cattle slurry for biogas production and nitrogen recovery**
Ester Scotto di Perta (University of Naples Federico II), Raffaele Grieco (University of Naples Federico II), Stefano Papirio (University of Naples Federico II), Giovanni Esposito (University of Naples Federico II), Elena Cervelli (University of Naples Federico II) and Stefania Pindozi (University of Naples Federico II)
- 43 **Biochar covering to mitigate the ammonia emissions from the manure storage tank: Effect of the pyrolysis temperature**
Ester Scotto di Perta (University of Naples Federico II), Paola Giudicianni (Institute of Sciences and Technologies for Sustainable Energy and Mobility - C.N.R, Naples, Italy), Corinna Maria Grottola (Institute of Sciences and Technologies for Sustainable Energy and Mobility - C.N.R, Naples, Italy), Antonio Mautone (University of Naples Federico II), Elena Cervelli (University of Naples Federico II), Raffaele Ragucci (Institute of Sciences and Technologies for Sustainable Energy and Mobility - C.N.R, Naples, Italy) and Stefania Pindozi (University of Naples Federico II)

Session 1.3 - New advancements and integrations of observation systems for monitoring hydrological processes and for supporting the sustainable management of agro-forest systems

Room: San Pietro Abbey - Aula Periodici

Chairs: Gabriele Baroni, *University of Bologna, Italy*

Arianna Facchi, *Università degli Studi di Milano, Italy*

Christian Massari, *National Research Council, Italy*

Andrea Merlone, *Istituto Nazionale di Ricerca Metrologica, Italy*

- 48 **Comparison of cosmic-ray neutron sensing and gamma-ray spectrometry for non-invasive soil moisture estimation over a large cropped field**
Stefano Gianessi (Department of Agricultural and Food Sciences (DISTAL) Alma Mater Studiorum – University of Bologna), Matteo Polo (FINAPP s.r.l.), Luca Stevanato (FINAPP s.r.l.), Marcello Lunardon (Department of Physics and Astronomy University of Padova) and Gabriele Baroni (Department of Agricultural and Food Sciences (DISTAL) University of Bologna).
- 53 **Comparison between a rigid and flexible border irrigation scheduling: a pilot case study in Northern Italy**
Fabiola Gangi (Università di Milano), Claudio Gandolfi (Università di Milano) and Daniele Masseroni (Università di Milano)
- 58 **Improving Cosmic-Ray Neutron Sensing with Neutron Spectrometry**
Andrea Cirillo (Politecnico di Milano), Marco Caresana (Politecnico di Milano), Giacomo Paolo Manessi (Else Nuclear S.r.L.) and Massimiliano Clemenza (Istituto Nazionale di Fisica Nucleare - Sezione Milano Bicocca)
- 64 **Use of satellite-based phenometrics, geophysical soil data and a semi-distributed agro-hydrological model for variable-rate irrigation management in a maize farm in northern Italy**
Alice Mayer (University of Milano), Bianca Ortuani (University of Milano), Margherita De Peppo (National Research Council), Francesco Nutini (National Research Council), Alberto Crema (National Research Council), Giorgio Ragaglini (University of Milano) and Arianna Facchi (University of Milano)
- 70 **A customizable and user friendly R package to process big data from the Tree Talker system**
Jerzy Piotr Kabala (University of Campania "Luigi Vanvitelli"), Francesco Niccoli (University of Campania "Luigi Vanvitelli") and Giovanna Battipaglia (University of Campania "Luigi Vanvitelli")
-

Friday, November 4

Session 2.1 - General Session

Room: San Pietro Abbey - Aula Magna

Chair: Pietro Goglio, *University of Perugia, Italy*

- 75 **A smart sensing system for the drying process of figs**
Marco Carratù (University of Salerno), Daniele Buonocore (University of Salerno), Giuseppe Ciavolino (University of Salerno), Domenico Di Caro (University of Salerno), Consolatina Liguori (University of Salerno) and Antonio Pietrosanto (University of Salerno)
- 80 **Data-Driven Model Predictive Control for Skid-Steering Unmanned Ground Vehicles**
Lorenzo Gentilini (University of Bologna), Dario Mengoli (University of Bologna), Simone Rossi (University of Bologna) and Lorenzo Marconi (University of Bologna)
- 86 **On-line real-time fruit size estimation using a depth-camera sensor**
Dario Mengoli (University of Bologna), Gianmarco Bortolotti (DISTAL - Alma Mater Studiorum - Università di Bologna), Mirko Piani (DISTAL - Alma Mater Studiorum - Università di Bologna) and Luigi Manfrini (DISTAL - Alma Mater Studiorum - Università di Bologna)
- 91 **Assessment of Ultra Wide Band device for monitoring chicken behaviour reared free-range**
Alice Cartoni Mancinelli (Dpt. Scienze Agrarie Alimentari e Ambientali - Università degli studi di Perugia Perugia), Diletta Chiatelli (Dpt. Scienze Agrarie Alimentari e Ambientali - Università degli studi di Perugia Perugia), Luca Roselli (Università degli studi di Perugia), Gianmaria Bernacchia (Luna Geber Engineering srl – Spin-off Università degli studi di Perugia), Costanza Nicconi (Luna Geber Engineering srl – Spin-off Università degli studi di Perugia), Jacopo Torroni (Luna Geber Engineering srl – Spin-off Università degli studi di Perugia) and Cesare Castellini (Dpt. Scienze Agrarie Alimentari e Ambientali - Università degli studi di Perugia Perugia)
- 94 **UAV in precision agriculture: a preliminary assessment of uncertainty for vegetation health index**
Pasquale Daponte (University of Sannio), Luca De Vito (University of Sannio), Fatemeh Khalesi (University of Sannio), Francesco Picariello (University of Sannio), Ioan Tudosa (University of Sannio)
-

Session 2.2 - Digital technologies in agricultural, livestock and food-processing facilities

Room: San Pietro Abbey - Aula Riviste

Chairs: Andrea Pezzuolo, *University of Padova, Italy*

Carlo Bibbiani, *University of Pisa, Italy*

Alberto Barbaresi, *University of Bologna, Italy*

- 100 **Potentials for Technological Advancement in Anaerobic Digestion Plants: a Multicriteria Analysis**
Giovanni Ferrari (University of Padova), Guo Hao (China Agricultural University), Marco Sozzi (University of Padova), Zihao Zheng (Guangzhou University), Francesco Marinello (University of Padova) and Andrea Pezzuolo (University of Padova)
- 106 **Sensorization of an electric dryer for *Bombyx mori* (L.) silken cocoons desiccation**
Domenico Giora (University of Padova - Department of Land, Environment, Agriculture and Forestry), Alberto Assirelli (CREA-Council for Agricultural Research and Economics Research Center for Engineering and Agro-Food Processing), Silvia Cappellozza (CREA-Council for Agricultural Research and Economics Sericulture Laboratory of Padua), Alessio Saviane (CREA-Council for Agricultural Research and Economics Sericulture Laboratory of Padua), Francesco Marinello (University of Padova - Department of Land, Environment, Agriculture and Forestry) and Luigi Sartori (University of Padova - Department of Land, Environment, Agriculture and Forestry)
- 111 **Validation campaign of a smart dynamic scale for measuring live-fish biomass in aquaculture**
Lorenzo Rossi (Department of Veterinary Sciences - University of Pisa), Carlo Bibbiani (Department of Veterinary Sciences - University of Pisa), Baldassare Fronte (Department of Veterinary Sciences - University of Pisa), Eugenio Damiano (MEGA Materials s.r.l.) and Alberto Di Lieto (Department of Physics - University of Pisa)

- 116 **Simulations in agricultural buildings: a machine learning approach to forecast seasonal energy need**
Mattia Ceccarelli (University of Bologna), Alberto Barbaresi (University of Bologna), Giulia Menichetti (Harvard Medical School), Enrica Santolini (University of Bologna), Marco Bovo (DICAM Department - University of Bologna), Patrizia Tassinari (University of Bologna), Francesco Barreca (University of Reggio Calabria) and Daniele Torreggiani (University of Bologna)

Session 2.3 - Artificial intelligence, innovative data analysis and big data for agriculture and food applications

Room: San Pietro Abbey - Aula Periodici

Chairs: Marco Sozzi, *University of Padova, Italy*

Riccardo Dainelli, *National Research Council, Italy*

- 121 **Geostatistical analysis of downy mildew (*Plasmopara viticola*) symptoms on grapevines leaves**
Marco Sozzi (University of Padova), Alessandro Zanchin (University of Padova), Giovanni Ferrari (University of Padova), Alessia Cogato (University of Udine), Luigi Sartori (University of Padova) and Francesco Marinello (University of Padova)
- 126 **Variational Autoencoder for Early Stress Detection in Smart Agriculture: A Pilot Study**
Alberto Zancanaro (University of Padova), Giulia Cisotto (University of Padova), Dagmawi Tegegn (University of Milan-Bicocca), Leonardo Badia (University of Padova), Sara Lucia Manzoni (University of Milan-Bicocca), Ivan Reguzzoni (SeleTech Engineering Srl), Edoardo Lotti (SeleTech Engineering Srl) and Italo Zoppis (University of Milan-Bicocca)
- 131 **On the impact of the stem electrical impedance in neural network algorithms for plant monitoring applications**
Mattia Barezzi (Politecnico di Torino), Federico Cum (Politecnico di Torino), Umberto Garlando (Politecnico di Torino), Maurizio Martina (Politecnico di Torino) and Danilo Demarchi (Politecnico di Torino)
- 136 **Preliminary spray nozzle characterization activities through shadowgraphy at the AgroForestry Innovation Lab (AFI-Lab)**
Lorenzo Becce (Free University of Bolzano-Bozen), Saba Amin (Free University of Bolzano-Bozen), Giovanni Carabin (Free University of Bolzano-Bozen) and Fabrizio Mazzetto (Free University of Bolzano-Bozen)
- 141 **Clustering of Remotely Sensed Time Series using Functional Principal Component Analysis to Monitor Crops**
Luca Coviello (University of Trento, DISI), Francesco Maria Martini (Università Politecnica delle Marche, D3A), Lorenzo Cesaretti (CREA, Centro di ricerca Foreste e Legno Arezzo), Simone Pesaresi (Università Politecnica delle Marche, D3A), Francesco Solfanelli (Università Politecnica delle Marche, D3A) and Adriano Mancini (Università Politecnica delle Marche, DII)

Session 3.1 - Platforms for integrated analyses of agro-ecosystems

Room: San Pietro Abbey - Aula Magna

Chair: Francesca Todisco, *University of Perugia, Italy*

- 146 **The Nitrate fate tool for the assessment of the groundwater vulnerability within the geospatial decision support system LandSupport**
Mariialaura Bancheri (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR), Giuliano Langella (Department of Agriculture, University of Napoli Federico II, Portici, Naples, Italy), Piero Manna (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy), Nadia Orefice (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy), Antonietta Agrillo (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy), Giuliano Ferraro (CRISP Research Center, Department of Agriculture, University of Napoli Federico II, Portici, Naples, Italy), Alessia Perego (University of Milano, Department of Plant Production, Milano, Italy) and Angelo Basile (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy)
- 150 **Preliminary results of a novel approach to assess the fundamental sway frequency of trees**
Francesco Zanotto (Università degli studi di Padova), Luca Marchi (Università degli studi di Padova) and Stefano Grigolato (Università degli studi di Padova)
- 155 **Enhancement of Vision-Based 3D Reconstruction Systems Using Radar for Smart Farming**
Lukas Meyer (Friedrich-Alexander-Universität Erlangen Nürnberg), Jonas Gedschold (TU Ilmenau), Tim-Erich Wegner (TU Ilmenau), Giovanni Del Galdo (TU Ilmenau) and Adam Kalisz (Friedrich-Alexander-Universität Erlangen Nürnberg)

- 160 Assessing the potential for forest residue classification and distribution over clear felled areas using UAVs and Machine Learning: a preliminary case study in South Africa**
Alberto Udali (Dipartimento TESAF, Università di Padova), Bruce Talbot (Department of Forest and Wood Science-Faculty of Agrisciences Stellenbosch University), Stefano Puliti (Division of Forest and Forest Resources - Norwegian Institute for Bioeconomy Research (NIBIO)), Jacob Crous (Sappi Forests, Shaw Research Centre), Emanuele Lingua (Dipartimento TESAF, Università di Padova) and Stefano Grigolato (Dipartimento TESAF, Università di Padova)
- 164 Cost-effective tracing techniques for the rapid characterization of spray deposition and drift through electrical conductivity and fluorescence**
Antonio Altana (Faculty of science and technology Free University of Bozen), Lorenzo Becce (Competence Centre for Plant Health Free University of Bozen), Enrico Avancini (Faculty of science and technology Free University of Bozen), Paolo Lugli (Free University of Bozen), Luisa Petti (Faculty of science and technology & Competence Centre for Plant Health Free University of Bozen) and Fabrizio Mazzetto (Faculty of science and technology & Competence Centre for Plant Health Free University of Bozen)
- 169 Sugarcane responses to elevated ozone**
Barbara Baesso Moura (Institute of Research on Terrestrial Ecosystems (IRET) National Research Council of Italy (CNR)), Yasutomo Hoshika (Institute of Research on Terrestrial Ecosystems (IRET) National Research Council of Italy (CNR)), Rafael Vasconcelos Ribeiro (Department of Plant Biology, Institute of Biology University of Campinas (UNICAMP) Campinas, Brazil) and Elena Paoletti (Institute of Research on Terrestrial Ecosystems (IRET) National Research Council of Italy (CNR))

Session 3.2 - Precision horticulture

Room: San Pietro Abbey - Aula Riviste

Chairs: Luigi Manfrini, *Università di Bologna, Italy*

Gianmarco Bortolotti, *University of Bologna, Italy*

- 174 Effect of cell size on mechanics of strawberry fruit tissue**
Mariialaura Bancheri (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR), Giuliano Langella (Department of Agriculture, University of Napoli Federico II, Portici, Naples, Italy), Piero Manna (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy), Nadia Orefice (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy), Antonietta Agrillo (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy), Giuliano Ferraro (CRISP Research Center, Department of Agriculture, University of Napoli Federico II, Portici, Naples, Italy), Alessia Perego (University of Milano, Department of Plant Production, Milano, Italy) and Angelo Basile (Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), CNR, Portici, NA, Italy)
- 180 A computer vision system for in-field fruit quality evaluation: preliminary results on peach fruit**
Gianmarco Bortolotti (DISTAL - Alma Mater Studiorum - Università di Bologna), Dario Mengoli (DEI - Alma Mater Studiorum - Università di Bologna), Mirko Piani (DISTAL - Alma Mater Studiorum - Università di Bologna), Luca Corelli Grappadelli (DISTAL - Alma Mater Studiorum - Università di Bologna) and Luigi Manfrini (DISTAL - Alma Mater Studiorum - Università di Bologna)
- 186 Reliable image processing algorithm for sunburn management in green apples**
Basavaraj Amogi (Washington State University), Rakesh Ranjan (The Conservation Fund, Freshwater Institute) and Lav Khot (Washington State University)
- 191 Quantification of Modern Apple Orchard Effects on Meteorological Variables**
Karisma Yumnam (Department of Biological Systems Engineering, Washington State University, Prosser, Washington, United States), Matthew D. Cann (AgWeatherNet, Washington State University, Prosser, Washington, United States), Lav R. Khot (Department of Biological Systems Engineering, Washington State University Prosser, Washington, United States), David J. Brown (METER Group, Pullman, Washington, United States), Joseph Boomgard-Zagrodnik (AgWeatherNet, Washington State University, Prosser, Washington, United States) and Lee Kalcsits (Department of Horticulture, Washington State University, Pullman, Washington, United states)
- 197 Fourier analysis of LiDAR scanned 3D point cloud data for surface reconstruction and fruit size estimation**
Nicolas Tapia Zapata (Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)), Kowshik Kumar Saha (Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)), Nikos Tsoulas (Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)) and Manuela Zude-Sasse (Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB))

- 203 **Aerial-RGB imagery based 3D canopy reconstruction and mapping of grapevines for precision management**
Giacomo Tolomelli (University of Bologna), Gajanan Suryakant Kothawade (Washington State University), Abhilash Kumar Chandel (Virginia Tech), Luigi Manfrini (University of Bologna), Pete Jacoby (Washington State University) and Lav R. Khot (Washington State University)
-

Session 3.3 - Contactless measurements, edge computing and computer vision for agriculture, forestry and zootechnics

Room: San Pietro Abbey - Aula Periodici

Chair: Loris Francesco Termitte, *Idea-Re S.r.l.*

- 208 **Introducing on-the-go sensing rover for vines canopy abiotic stressors detection**
Simone Pasinetti (University of Brescia), Mauro Maesano (University of Tuscia), Elena Brunori (University of Tuscia), Federico Valerio Moresi (University of Tuscia), Alessandra Bernardini (University of Tuscia), Paolo Cirenei (Bedurin SrL) and Rita Biasi (University of Tuscia)
- 213 **Innovation in olive-growing by Proximal sensing LiDAR for tree volume estimation**
Stefano Chiappini (Department of Agricultural, Food, and Environmental Sciences Marche Polytechnic University Ancona, Italy), Veronica Giorgi (Department of Agricultural, Food, and Environmental Sciences Marche Polytechnic University Ancona, Italy), Davide Neri (Department of Agricultural, Food, and Environmental Sciences Marche Polytechnic University Ancona, Italy), Andrea Galli (Department of Agricultural, Food, and Environmental Sciences Marche Polytechnic University Ancona, Italy), Ernesto Marcheggiani (KU Leuven), Eva Savina Malinverni (Department of Construction, Civil Engineering and Architecture Marche Polytechnic University), Roberto Pierdicca (Department of Construction, Civil Engineering and Architecture Marche Polytechnic University) and Mattia Balestra (Department of Agricultural, Food, and Environmental Sciences Marche Polytechnic University Ancona, Italy)
- 218 **Assessment of the geometrical characteristics of hazelnut intensive orchard by an Unmanned Aerial Vehicle (UAV)**
Alessandra Vinci (Department of Agricultural, Food and Environmental Sciences - University of Perugia), Chiara Traini (Department of Agricultural, Food and Environmental Sciences - University of Perugia), Daniela Farinelli (Department of Agricultural, Food and Environmental Sciences - University of Perugia) and Raffaella Brigante (Independent Researcher)
- 223 **Non-invasive measurements for characterization of *Hermetia Illucens* (BSF) life cycle in rearing plant**
Massimiliano Proietti (Idea-re S.r.l.), Andrea Marini (Idea-re S.r.l. Perugia, Italy), Alberto Garinei (Department of Engineering Sciences, Guglielmo Marconi University, Rome Italy Idea-Re S.r.l. Perugia, Italy), Gianluca Rossi (Department of Engineering Università degli Studi di Perugia), Federico Bianchi (Idea-re S.r.l. Perugia, Italy), Marcello Marconi (Department of Engineering Sciences, Guglielmo Marconi University, Rome Italy Idea-Re S.r.l. Perugia, Italy), Silvia Discepolo (Dipartimento di Ingegneria Industriale e Scienze Matematica (DIISM), Università Politecnica delle Marche Ancona, Italy), Maria Teresa Calcagni (Dipartimento di Ingegneria Industriale e Scienze Matematica (DIISM), Università Politecnica delle Marche Ancona, Italy), Paolo Castellini (Dipartimento di Ingegneria Industriale e Scienze Matematica (DIISM), Università Politecnica delle Marche Ancona, Italy), Milena Martarelli (Dipartimento di Ingegneria Industriale e Scienze Matematica (DIISM), Università Politecnica delle Marche Ancona, Italy), Giacomo Zeni (BugsLife S.r.l., Bevagna (PG), Italy) and Stefano Speciali (Idea-re S.r.l. Perugia, Italy)
- 229 **A Discrimination of Healthy and Rotten Hazelnuts Using a THz Imaging Scanner**
Manuel Greco (Dipartimento di Scienze - Università degli Studi "Roma Tre"), Emilio Giovenale (ENEA, Fusion and Nuclear Dept.), Fabio Leccese (Università degli Studi "Roma Tre") and Andrea Doria (ENEA, Fusion and Nuclear Dept.)
- 234 **Development of a monitoring system to assess honeybee colony health**
Massimiliano Micheli (University of Brescia), Simone Pasinetti (University of Brescia), Matteo Lancini (University of Brescia) and Gabriele Coffetti (University of Brescia)
-

Saturday, November 5

Session 4.1 - Navigation, georeferenced spatial data acquisition and analysis in precision agriculture

Room: San Pietro Abbey - Aula Magna

Chairs: Andrea Masiero, *University of Florence, Italy*

Fabio Radicioni, *University of Perugia, Italy*

Aurelio Stoppini, *University of Perugia, Italy*

239 How important is UAVs RTK accuracy for the identification of certain vine diseases?

Fabio Zottele (Fondazione Edmund Mach), Paolo Crocetta (Green Fly) and Valerio Baiocchi (Sapienza University of Rome)

244 Towards the use of low-cost GNSS receivers for permanent networks in precision agriculture

Paolo Dabove (Politecnico di Torino) and Vincenzo Di Pietra (Politecnico di Torino)

249 Thermal camera geometric self-calibration supported by RTK measurements

Erica Parisi (University of Florence), Irene Cortesi (University of Florence), Andrea Masiero (University of Florence), Francesco Mugnai (University of Florence) and Grazia Tucci (University of Florence)

255 A low-cost multi-GNSS PPP-RTK solution for precision agriculture: a preliminary test

Umberto Robustelli (Department of Engineering, University of Naples Parthenope), Matteo Cutugno (Department of Civil, Architectural and Environmental Engineering, University of Naples Federico II) and Giovanni Pugliano (Department of Civil, Architectural and Environmental Engineering, University of Naples Federico II)

260 Multi-constellation Network RTK for Automatic Guidance in Precision Agriculture

Fabio Radicioni (Engineering Dept. University of Perugia), Aurelio Stoppini (Engineering Dept. University of Perugia), Grazia Tosi (Engineering Dept. University of Perugia) and Laura Marconi (Engineering Dept. University of Perugia)

Session 4.2 - Measurement of soil water erosion at different spatial scales

Room: San Pietro Abbey - Aula Riviste

Chairs: Lorenzo Vergni, *University of Perugia, Italy*

Vincenzo Pampalone, *University of Palermo, Italy*

Giovanni Francesco Ricci, *University of Bari, Italy*

266 Effects of different forest recovery management on runoff and soil erosion in an area affected by Vaia storm

Andrea Andreoli (Faculty of Science and Technology, Free University of Bozen-Bolzano), Alessio Rozzoni (Faculty of Science and Technology, Free University of Bozen-Bolzano), Enrico Tomelleri (Faculty of Science and Technology, Free University of Bozen-Bolzano) and Francesco Comiti (Faculty of Science and Technology, Free University of Bozen-Bolzano)

271 Measuring the USLE soil erodibility factor in the unit plots of Sparacia (southern Italy) experimental area

Vincenzo Bagarello (University of Palermo), Vito Ferro (University of Palermo) and Vincenzo Pampalone (University of Palermo)

277 Monitoring suspended sediment transport in two mountainous river basins: the Carapelle and the Celone (Apulia, Italy)

Giovanni Francesco Ricci (University of Bari), Anna Maria De Girolamo (Water Research Institute, National Research Council, Bari, Italy) and Francesco Gentile (University of Bari)

282 Evaluation of the GPM IMERG half-hourly final precipitation product in the quantification of rainfall erosivity in central Italy

Lorenzo Vergni (Department of Agricultural Food and Environmental Sciences), Andrea Parisi (Department of Agricultural Food and Environmental Sciences) and Francesca Todisco (Department of Agricultural Food and Environmental Sciences)

287 Theoretical advancements on a recently proposed method to measure rainfall energy

Francesco Giuseppe Carollo (University of Palermo), Vito Ferro (University of Palermo), Vincenzo Palmeri (University of Palermo), Vincenzo Pampalone (University of Palermo) and Alessio Nicosia (University of Palermo)

292 **Viticulture and Cultural Landscapes: remote sensing and Earth surface processes modelling to promote sustainable agricultural practices**

Eugenio Straffelini (Università degli Studi di Padova, Land, Environment, Agriculture and Forestry, University of Padova) and Paolo Tarolli (Università degli Studi di Padova, Land, Environment, Agriculture and Forestry, University of Padova)

Session 4.3 - Measurements for risk management in agriculture

Room: San Pietro Abbey - Aula Periodici

Chairs: Alberto Garinei, *Università degli Studi Guglielmo Marconi, Italy*
Simone Severini, *Tuscia University, Italy*

298 **How can data monitoring and crop modelling support agricultural risk management solutions in climate change scenarios?**

Samuele Trestini (Università degli Studi di Padova), Francesco Morari (Università degli Studi di Padova), Francesco Pirotti (Università degli Studi di Padova), Daniela Anastasija Epstein (Georg-August-University Göttingen, Germany) and Simone Severini (Università degli Studi della Tuscia)

303 **Benefits of using production factors in assessing farm risk: a simulation on the role of irrigation data**

Luigi Biagini (Università degli Studi della Tuscia), Cinzia Zinnanti (Università degli Studi della Tuscia) and Simone Severini (Università degli Studi della Tuscia)

307 **Snow water equivalent (SWE) measurements for better management of water resources to reduce drought risk**

Andrea Mangeruca (Arcadiasit s.r.l.), Gianluca Ferrari (Radarmeteo s.r.l.), Alberto Garinei (Department of Engineering Sciences, Guglielmo Marconi University, Idea-Re s.r.l.), Lucia Cisco (Hypermeteo s.r.l.), Maurizio Sozzi (Arcadiasit s.r.l.), Marcello Marconi (Department of Engineering Sciences, Guglielmo Marconi University, Idea-Re s.r.l.), Massimo Crespi (Radarmeteo s.r.l.), Andrea Chini (Radarmeteo s.r.l.), Emanuele Piccioni (Idea-Re s.r.l.), Davide Bavera (Arcadiasit s.r.l.) and Giorgio Frigerio (Arcadiasit s.r.l.)

313 **(Extreme) Weather index-based insurances: data, models, and other aspects we need to think about**

Marco Tappi (Università degli Studi di Foggia) and Fabio Gaetano Santeramo (Università degli Studi di Foggia)

Poster Session

Room: San Pietro Abbey

Chair: Lorenzo Vergni, *University of Perugia, Italy*

318 **The efficiency of Digestate as Inoculum for in vitro Digestibility of Feeds**

Sara Glorio Patrucco (DISAFA - Dep. of Agricultural, Forestry and Food Science), Riccardo Fortina (DISAFA - Dep. of Agricultural, Forestry and Food Science), Elio Dinuccchio (DISAFA - Dep. of Agricultural, Forestry and Food Science), Flavia Dela Pierre (DISAFA - Dep. of Agricultural, Forestry and Food Science) and Sonia Tassone (DISAFA - Dep. of Agricultural, Forestry and Food Science)

323 **Analytical Evaluation of Age of Information in Networks of Correlated Sources**

Laura Crosara (University of Padova), Alberto Zancanaro (University of Padova), Giulia Cisotto (University of Milano-Bicocca), Nicola Laurenti (University of Padova) and Leonardo Badia (University of Padova)

329 **Theoretical prediction of rainfall intensity for a small rainfall simulator**

Martina Agosta (University of Palermo), Vincenzo Bagarello (University of Palermo), Gaetano Caltabellotta (University of Palermo), Francesco Giuseppe Carollo (University of Palermo), Girolamo Vaccaro (University of Palermo) and Vincenzo Pampalone (University of Palermo)

334 **An Integrated Multi-Sensor System for Remote Bee Health Monitoring**

Francesco Bellino (Politecnico di Torino), Giovanna Turvani (Politecnico di Torino), Umberto Garlando (Politecnico di Torino) and Fabrizio Riente (Politecnico di Torino)

339 **Construction of statistical shape model of real cattle and its application to body measurement**

Xinying Luo (China Agricultural University), Yihu Hu (China Agricultural University), Zicheng Gao (China Agricultural University), Battsetseg Damjin (Research and development center of food, agriculture and light industry), Hao Guo (China Agricultural University), Alexey Ruchay (Federal Research Centre of Biological Systems and Agro-technologies of the Russian Academy of Sciences) and Andrea Pezzuolo (University of Padova)

- 344 **Ion Mobility Spectrometry for Rapid HEMP Potency Testing - spectrometric testing of technical hemp**
Richard Marko (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies), Martin Sabo (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies), Katarina Valkovicova (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies), Zuzana Gaborcikova (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies), Rastislav Kavon (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies), Matus Miklovic (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies), Marek Janec (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies), Peter Nemcek (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies) and Filip Chalas (Slovak University of Technology in Bratislava Faculty of Informatics and Information Technologies)
- 350 **Primary Production Prediction from Aerial Spectrographic Survey**
Giovanni Carabin (Free University of Bozen), Lorenzo Becce (Free University of Bozen), Andreas Mandler (Free University of Bozen) and Fabrizio Mazzetto (Free University of Bozen/Bolzano)
- 356 **Evaluation of remotely-sensed evapotranspiration datasets at different spatial and temporal scales at forest and grassland sites in Italy**
Domenico De Santis (National Research Council), Concetta D'Amato (University of Trento), Paulina Bartkowiak (Eurac Research), Shima Azimi (University of Trento), Mariapina Castelli (Eurac Research), Riccardo Rigon (University of Trento) and Christian Massari (National Research Council)
- 362 **How water affects growing plants: an experimental set-up based on 2D vision and on-the-edge sensing**
Simone Pasinetti (University of Brescia), Cristina Nuzzi (University of Brescia), Davide Botturi (University of Brescia), Gabriele Coffetti (University of Brescia), Sara Mangili (University of Brescia) and Manuel Collina (University of Brescia)
- 368 **Evaluation of the physiological and spectral responses of grapevines (*Vitis vinifera* L.) under different durations of drought stress under high temperature conditions**
Alessia Cogato (University of Udine), Marco Sozzi (University of Padova), Franco Meggio (University of Padova), Francesco Marinello (University of Padova), Shaikh Jewan (University of Nottingham) and Vinay Pagay (University of Adelaide)