

Lecture Notes in Civil Engineering

Edmund Lorencowicz
Bruno Huyghebaert
Jacek Uziak *Editors*

Farm Machinery and Processes Management in Sustainable Agriculture

XII International Scientific Symposium
2024

 Springer

Editors

Edmund Lorencowicz
Faculty of Production Engineering
University of Life Sciences
Lublin, Poland

Bruno Huyghebaert
Walloon Agricultural Research Centre
Gembloux, Belgium

Jacek Uziak
College of Management and Enterprise
Wałbrzych, Poland

ISSN 2366-2557

ISSN 2366-2565 (electronic)

Lecture Notes in Civil Engineering

ISBN 978-3-031-70954-8

ISBN 978-3-031-70955-5 (eBook)

<https://doi.org/10.1007/978-3-031-70955-5>

© The Editor(s) (if applicable) and The Author(s), under exclusive license
to Springer Nature Switzerland AG 2024

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

If disposing of this product, please recycle the paper.



Preface

The International Scientific Symposium “Farm Machinery and Processes Management in Sustainable Agriculture”—FMPMSA 2024 was held for the twelfth time. Thirty years have passed since the first meeting of researchers and experts attracted to development in technical processes in agriculture. The idea was born in 1994, when the International Seminar “Rational Mechanization of Family Farms” was organized at the Agricultural University of Lublin. It was attended by 30 local scientists and only one from abroad—Switzerland.

The current thematic formula was developed gradually. In 2006, the main organizer—the Department of Machine Operation and Production Processes Management from Faculty of Production Engineering, University of Life Sciences in Lublin, started cooperation with Walloon Agricultural Research Center CRA-W from Gembloux in Belgium. This enhanced the international reach of the symposium and also identified new areas of interest. The title of the symposium was changed to include the issues of sustainable agriculture. The following years have allowed to establish new and expand already existing international contacts. Symposia were held not only in Lublin, but also in other centers—in 2008 and 2015 at CRA-W in Gembloux in Belgium and in 2022 at the University of Bari Aldo Moro in Italy.

Over the last thirty years, the understanding of the concept of “sustainable development” has changed significantly. That change, in the context of agriculture and its processes, has been reflected in papers presented at subsequent symposia.

Main activities related to sustainable agriculture have been traditionally reduced to the negative impact on the environment. However, social and economic aspects are also very important. The development of sustainable agriculture should have a positive impact on the development of local societies and the level of income. That involves not only a direct impact on farmers and their families, but also on the environment and rural areas infrastructure.

Additional topics included in the themes of the symposia have been Agriculture 4.0 (or Farming 4.0) with Precision Agriculture (PA). Integrating digital technology into agriculture has become the most influential trend in the sector. With the possibility of farmers applying water, fertilizers, and pesticides only in the required quantities and in very specific target areas, plus technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology should allow the farms to be more profitable, efficient, safe, and environmentally friendly.

This year’s twelfth symposium was held in Lublin, at the University of Life Sciences. Over 80 people from 16 countries registered for the symposium. The topics of the presented papers included issues related to the sustainability of processes and technology in the agri-food economy. Traditionally, an away session was also organized—this time in one of the most modern beverage-can factories in Europe—Ball Packaging Europe Lublin Sp. z o. o.

This publication is a compilation of selected articles presented at the Symposium and then subjected to a verification and review process. After approval and correction, they were qualified for publication. Published articles are arranged alphabetically by the first author.

Detailed information about the presented papers and publications from the period of 1994–2024 can be found at www.up.lublin.pl/fmpmsa.

Edmund Lorencowicz
Jacek Uziak
Bruno Huyghebaert

Organization

Scientific Committee

Chairmen

Edmund Lorencowicz	University of Life Sciences in Lublin, Poland
Bruno Huyghebaert	CRA-W Gembloux, Belgium

Members

Alex Folami Adisa	Federal University of Agriculture, Abeokuta, Nigeria
Arlindo Almeida	Polytechnic Institute of Bragança, Portugal
Atanas Zdravkov Atanasov	"Angel Kanchev" University of Ruse, Bulgaria
Fatima Baptista	University of Évora & MED– Mediterranean Institute for Agriculture, Environment and Development, Portugal
Volodymyr Bulgakov	University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine
Philippe Burny	Walloon Agricultural Research Centre & Gembloux Agro-Bio Tech, University of Liege, Gembloux, Belgium
Karl-Heinz Dammer	ATB Leibnitz-Institut für Agrartechnik und Bioökonomie, Potsdam, Germany
Ester Foppa Pedretti	Marche Polytechnic University, Ancona, Italy
Fran Gjoka	Agricultural University of Tirana, Albania
Sławomir Kocira	University of Life Sciences in Lublin/Poland & University of South Bohemia in České Budějovice, Czechia
Milan Koszel	University of Life Sciences in Lublin, Poland
Artur Kraszkiewicz	University of Life Sciences in Lublin, Poland
José Rafael Marques da Silva	University of Évora, Portugal
Radko Mihaylov	Technical University of Varna, Bulgaria
Paula A. Misiewicz	Harper Adams University, UK
Gerhard Moitzi	BOKU-University of Natural Resources and Life Sciences, Vienna, Austria
Janusz Nowak	University of Life Sciences in Lublin, Poland

Jüri Olt	Estonian University of Life Sciences, Tartu, Estonia
Taskin Oztas	Atatürk University, Erzurum, Turkey
Athanassios Papageorgiou	Technological Educational Institute of Peloponnese, Kalamata, Greece
Stanisław Parafiniuk	University of Life Sciences in Lublin, Poland
Simone Pascuzzi	University of Bari Aldo Moro, Italy
Fabienne Rabier	CRA-W Gembloux, Belgium
Francesco Santoro	University of Bari Aldo Moro, Italy
Giacomo Scarascia-Mugnozza	Polytechnic of Bari, Italy
Yves Schenkel	CRA-W Gembloux, Belgium
Enkeleda Shkurta	National Environmental Agency & Polytechnic University of Tirana, Albania
Alaa Subr	College of Agricultural Engineering Sciences, University of Baghdad, Iraq
Hop Tho Hi Min	Gembloux Agro-Bio Tech, University of Liege, Belgium
Jacek Uziak	College of Management and Enterprise, Wałbrzych, Poland
Viktor Vojnich	University of Szeged, Hungary
Jens Karl Wegener	JKI Institute for Application Techniques in Plant Protection, Braunschweig, Germany

Contents

PATAT'UP: Towards a Low-Input Potato	1
<i>Feriel Ben Abdallah, Florine Decruyenaere, Charlotte Bataille, Vincent César, Fabienne Rabier, and Vincent Berthet</i>	
An Image Processing Algorithm to Address the Problem of Stains Merge on Water Sensitive Papers and Its Impact on the Evaluation of Spray Quality Indicators	11
<i>Ameer H. Al-Ahmadi, Alaa Subr, Stanisław Parafiniuk, and Marek Milanowski</i>	
Monitoring and Evaluation of the Moisture Retention of Leached Chernozem Under Different Types of Tillage	23
<i>Atanas Z. Atanasov, Plamena D. Nikolova, and Boris I. Evstatiev</i>	
Measurement of Soil Density	37
<i>Asparuh Atanasov, Svilen Stoyanov, and Stefan Tenev</i>	
Information Processing Systems to Support Integrated Crop Protection	46
<i>Marcin Baran, Kamila Roik, and Anna Tratwal</i>	
PRIOR'eau, a Tool for Spatializing the Detection of Plant Protection Products in Walloon Water Resources for Prevention Purposes	52
<i>Guillaume Bergiers, Bastien Durenne, Bernard Weickmans, and Bruno Huyghebaert</i>	
Effectiveness of Biocoatings for Ammonia Emission from Manure	62
<i>Rolandas Bleizgys, Vilma Naujokienė, Arvydas Povilaitis, Juozas Pekarskas, and Ieva Knoknerienė</i>	
Assessment of the Suitability of Selected Apple Cultivars for Production of Cloudy Juice	69
<i>Agata Blicharz-Kania and Anna Pecyna</i>	
A Romanian Standpoint on Minimum Tillage Soil System and Prospects for an Sustainable Agriculture: A Review	77
<i>Cătălin Bogdan, Ovidiu Ranta, Alexandru Bogdan Ghețe, Ovidiu Marian, and Irimie Gheorghe Claudiu Andraș</i>	

Theory of Operation of a Safety Finger Coupling Applied in the Drive of a Screw Conveyor for Bulk Agricultural Materials	87
<i>Volodymyr Bulgakov, Simone Pascuzzi, Jilri Olt, Arlindo Almeida, Oleksandra Trokhaniak, Janusz Nowak, Yevhen Ihnatiev, Zbigniew Kiernicki, Francesco Paciolla, and Giacomo Scarascia Mugnozza</i>	
Investigation of the Parameters of a Conveyor for Transportation of Bulk Agricultural Materials with a Bladed Working Body	98
<i>Volodymyr Bulgakov, Simone Pascuzzi, Oleksandra Trokhaniak, Adolfs Rucins, Janusz Nowak, Mykola Klendii, Alessia Farella, and Tommaso Quartarella</i>	
A System for Precise Diagnosis of Diseases, Pests and Fertilization Needs in Horticultural Production	107
<i>Michał Cupiał, Bogdan Kulig, Mirosław Maziarka, Anna Szelaq-Sikora, and Aneta Oleksy-Gębczyk</i>	
Automatic Classification of Farmer's Weather Station Siting Based on Geodata	116
<i>Sébastien Dandrifosse, Alban Jago, Valéry Michaud, Jean Pierre Huart, Viviane Planchon, and Damien Rosillon</i>	
Evaluating Heavy Metal Contamination in the Rehova Cu-Mine Area for Sustainable Soil Management	131
<i>Arta Dollani, Enkeleda Shkurta, Fatbardh Sallaku, and Seit Shallari</i>	
Agricultural Unmanned Ground Vehicle (UGV): A Brief Overview	137
<i>Alessia Farella, Francesco Paciolla, Tommaso Quartarella, and Simone Pascuzzi</i>	
Concentration of Pollutants in the Air of a Cattle Farm	147
<i>Mateusz Gancarz, Maciej Wilk, Sebastian Jaguszewski, Katarzyna Karpińska, and Bożena Nowakowicz-Dębek</i>	
Impact of Soil Erosion on Environmental and Agricultural Sustainability in Bovilla Watershed (Tirana, Albania)	153
<i>Fran Gjoka, Valmir Baloshi, and Elvin Toromani</i>	
Soil Compaction and Maize Yield in Various Plowing Systems from a Sustainability Perspective	159
<i>Fran Gjoka, Enkeleda Shkurta, and Elian Kasa</i>	

Evaluation of Engine Oil Degradation: Enhancing Cost-Efficiency in Vehicle Fleet Maintenance	165
<i>Wojciech Gołębiowski, Artur Wolak, and Grzegorz Zajac</i>	
The Course of Changes in the Starch Index of Apples Calculated Using Selected Optical Instruments	179
<i>Tomasz Guz and Małgorzata Szczepanik</i>	
The Market for Renting Tractors and Agricultural Machinery as an Element of Sustainable Agriculture	190
<i>Sławomir Juściński</i>	
The Effect of Digestate on the Antioxidant Properties of Hemp Leaves (<i>Cannabis sativa</i> L)	203
<i>Magdalena Kachel, Milan Koszel, and Karolina Sokal</i>	
Air Dust Monitoring on a Farm Keeping Cold-Blooded Horses	211
<i>Katarzyna Karpińska, Joanna Barłowska, Mateusz Ossowski, Lukasz Wlazło, Bożena Nowakowicz-Dębek, and Piotr Maksym</i>	
The Use of Drones in Agriculture: Perspectives and Limitations	219
<i>Paweł Karpiński</i>	
Opportunity Cost (Cost of Lost Profits) as an Element of Decision-Making Analysis in Prosumer Energy	229
<i>Artur Kraszkiewicz</i>	
Analysis of Water Intended for Drinking in Terms of the Content of Nitrogen Compounds (Ammonium Nitrogen, Nitrates (III) and (V))	240
<i>Luiza Kubisiak-Banaszkiewicz, Wioletta Żukiewicz-Sobczak, Agnieszka Starek-Wójcicka, and Paweł Sobczak</i>	
Comparison of Three Spot-Spraying Machines to Control Dock (<i>Rumex obtusifolius</i> L.) on Grassland	246
<i>Quentin Limbourg, Jérôme Gennen, and Fabienne Rabier</i>	
On the Path to Sustainability: Seeking New Competences to Face Challenges of Implementing Sustainable Processes. Polish Chemical Industry Case Study	254
<i>Aleksandra Lis, Aneta Oleksy-Gębczyk, Anna Szelağ-Sikora, and Katarzyna Kowalska-Jarnot</i>	
Threats to Road Safety by Agricultural Tractors	262
<i>Edmund Lorencowicz and Jacek Uziak</i>	

Use of Fruit Pomace in the Production of Selected Cosmetics	270
<i>Patrycja Łusiak, Paweł Sobczak, Jacek Mazur, Monika Wójcik, and Adrianna Romańska</i>	
Innovations in Corn Planting: A Comparison of Strip-Till, No-Till, and Traditional Technologies in the Context of Climate Adaptation and Sustainable Development	277
<i>Katarzyna Łyp-Wrońska, Krystian Nowak, and Agnieszka Dudziak</i>	
Assessment of Slagging and Fouling Indicators for Ashes from Vine Shoots Regent Cultivar	284
<i>Grzegorz Maj, Kamila Klimek, and Magdalena Kaptan</i>	
ESG: Carbon and Biodiversity a Problem or an Opportunity for Smart Agriculture?	295
<i>José Rafael Marques da Silva</i>	
Consumption of Plant Protection Products as an Indicator of Agriculture Intensity – A Case Study of Low Risk Active Substances	300
<i>Ewa Matyjaszczyk</i>	
Field Traffic-Induced Compaction Effects on Physical Soil Properties, Plant Vegetation Index and Crop Yield on a Chernozem Soil	308
<i>Gerhard Moitzi, Paul Riedl, Matthias Konzett, Thomas Weninger, Gernot Bodner, and Helmut Wagentristsl</i>	
Influence of Worldview Factors on Food Consumers' Purchasing Decisions	323
<i>Aneta Oleksy-Gębczyk, Anna Szeląg-Sikora, Katarzyna Kowalska-Jarnot, Aleksandra Lis, Jakub Sikora, and Michał Cupiał</i>	
Development of a Battery Swapping and Charging Unit in Servicing Station for Farming Robot: A Review	333
<i>Jüri Olt, Yevhen Ihnatiev, Tormi Lillerand, and Indrek Virro</i>	
Performance Evaluation of Hybrid-Electric Architectures for Agricultural Tractors	346
<i>Francesco Paciolla, Pietro Patimisco, Alessia Farella, Tommaso Quartarella, and Simone Pascuzzi</i>	
Quality Evaluation of the Operation of the XAG R 150 Autonomous Sprayer in Currant Cultivation	357
<i>Stanisław Parafiniuk, Łukasz Kopiński, Jacek Ogrodniczek, Paweł Karpiński, Fabienne Rabier, and Alaa Subr</i>	

Improved Design of the Working Body of a Flexible Sectional Screw Conveyor	367
<i>Simone Pascuzzi, Volodymyr Bulgakov, Valerii Adamchuk, Oleksandra Trokhaniak, Janusz Nowak, Adolfs Rucins, Zinoviy Ruzhilo, and Francesco Paciolla</i>	
UVC Rays Devices Mounted on Autonomous Terrestrial Rovers: A Brief Overview	378
<i>Tommaso Quartarella, Alessia Farella, Francesco Paciolla, and Simone Pascuzzi</i>	
Impact of the Integration of Mechanical Weeding on Sugar Beet Crop and Weed Control in a 4-Year Rotation	387
<i>Fabienne Rabier, François Henriet, Stanislaw Parafiniuk, Elena Pitchugina, and Quentin Limbourg</i>	
Possibility of Combined Control of Leaf Miners and Cereal Leaf Beetles in Winter Wheat Crops	398
<i>Kamila Roik, Anna Tratwal, and Marcin Baran</i>	
The Impact of the Use of Nanoparticles and Pulsed Electric Field on Oilseeds	404
<i>Karolina Sokal and Magdalena Kachel</i>	
Development of Poultry Meat Production and Consumption Levels in the Light of Environmental Sustainability Goals	411
<i>Anna Szelaż-Sikora, Aneta Oleksy-Gębczyk, Katarzyna Kowalska-Jarnot, Jakub Sikora, and Joanna Stuglik</i>	
Effect of Fertilization with Digestate on Crop Yields: A Review	419
<i>Małgorzata Szwed, Milan Koszel, and Artur Przywara</i>	
The Role of Monitoring and Signaling in Integrated Crop Protection	426
<i>Anna Tratwal, Marcin Baran, and Kamila Roik</i>	
Pollen Concentration Data of <i>Xanthium</i> spp. Between 2014 and 2019 in Hungary	432
<i>Viktor József Vojnich and Donát Magyar</i>	
Assessment of the Effectiveness of Selected Disinfectants Against Biological Agents Identified on the Hands of Cattle Breeders	440
<i>Maciej Wilk, Mateusz Gancarz, Sebastian Jaguszewski, Mateusz Ossowski, Łukasz Wlazło, Katarzyna Karpińska, and Bożena Nowakowicz-Dębek</i>	

The Necessity of Sustainable Agriculture from the Perspective of the Importance and Risks of Agriculture for a Country: A Comparative Research 448
Yue Wu, Balázs Pál, and Katalin Takács-György

Noise Effect of Tractors Purchased “Second Hand” upon the Agricultural Workers 462
Ivan Zahariev and Atanas Atanasov

Reasons for not Using the Energy Potential of Residual Biomass Generated During the Contour Pruning of Oil-Bearing Roses as Heating Fuel 477
Ivan Zahariev and Atanas Atanasov

Monitoring Quality Parameters of Wood Pellets Available on the Polish Market 488
Grzegorz Zajac, Andrzej Kuranc, and Joanna Szyszlak-Bargłowicz

Author Index 497