



**ECPA**  
BOLOGNA 2023

**14<sup>th</sup> European Conference  
on Precision Agriculture**

# PRECISION AGRICULTURE '23

*Edited by: John V. Stafford*



Wageningen Academic  
Publishers



# Precision agriculture '23



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edited by:  
**John V. Stafford**

Papers presented at the 14<sup>th</sup> European Conference on Precision Agriculture  
Bologna, Italy  
2-6 July 2023



**Wageningen Academic  
P u b l i s h e r s**

**EAN: 9789086863938**  
**e-EAN: 9789086869473**  
**ISBN: 978-90-8686-393-8**  
**e-ISBN: 978-90-8686-947-3**  
**DOI: 10.3920/978-90-8686-947-3**

**First published, 2023**

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The Netherlands, 2023**

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6700 AE Wageningen  
The Netherlands  
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## Preface

Precision Agriculture has for some time been considered 'mainstream', aspects of it being practised across a very wide range of crops and over many countries. Continuing research in the many associated disciplines is still very necessary and the increasing number of papers being submitted to 'Precision Agriculture' is clear evidence of the attention being given to the concept by the research community: Agriculture faces increasing challenges in areas such as food security: environmental protection, water availability and resistance to agrochemicals. Precision agriculture can certainly be part of the solution to these challenges. So this 14<sup>th</sup> conference is again timely and the papers published in these Proceedings should form an important permanent record. PA research is increasing the world over and a good cross-section of results from that research is presented here. Bologna in Italy will, I am sure, be an excellent location for the conference but, long after it is over, these Proceedings will be pulled down from the bookshelf to reference papers – and also bring back happy memories of a successful conference.

The conferences have gained a good reputation because of the standard of the Proceedings. A strict approach has been taken to paper acceptance. Each draft paper has been assessed by two members of the Scientific Committee and by myself as Editor. Revised papers have been subjected to rigorous editorial processing so that the papers presented here approach the quality of papers in refereed journals. I would like to record my grateful appreciation to the members of the Scientific Committee who, amidst the busy schedule of research careers, have freely given their time and professional judgement to assess the conference papers.

John V. Stafford

*Editor*

Amphill, UK.

April 2023





## Foreword

When we attended the European Conference on Precision Agriculture - ECPA 2019 - at SupAgro in Montpellier, France, it became evident through the remarks of several participants that the ECPA conference had never been organised in Italy. It was a situation that needed to change. In 2021, amid the full-blown COVID-19 pandemic, the Hungarian Society of Precision Agriculture organised the 13<sup>th</sup> ECPA in Budapest, Hungary. Despite the immense challenges faced by our predecessors, which we experienced firsthand, we believed that proposing Bologna as the location for the next conference would be a courageous move, signalling our determination to emerge from the ongoing health crisis on a high note.

When the ECPA Program Committee received our proposal, they agreed that 14ECPA would be organised in Bologna, Italy. We wanted to organise a conference that would enable people worldwide to gather in Bologna, listen to captivating presentations in conference rooms, and engage in meaningful interactions in common areas, and so we enthusiastically embraced the idea. After enduring months of virtual meetings, we were eager to promise an in-person event, confident that it was possible and greatly desired. In retrospect, our choice may have seemed audacious rather than brave. Despite uncertainties and numerous challenges, we are immensely proud to have fulfilled our promise.

We express our sincere gratitude to all the authors who have made it possible, submitting an impressive number of 380 abstracts. While this large volume presented a challenge in terms of selection, as we had to ensure the conference's viability, it also reassured us of the strong appeal of the conference among our colleagues. The overwhelming response from the research community has been an essential motivating factor that fuelled our dedication over the past two years in organising this event.

The 14<sup>th</sup> European Conference on Precision Agriculture theme was 'Unleashing the Potential of Precision Agriculture.' We trust that this gathering will leave an indelible mark on everyone in attendance, fostering the development of new ideas and the creation of solutions that empower farmers to implement agricultural management practices utilising tools that collect, process, and analyse data about time, space, and individual factors. The pursuit of enhanced efficiency, productivity, quality, profitability, and sustainability in agricultural production is more critical than ever, and the effective use of data and information integration for decision-making based on estimated variations are pivotal to achieving these goals.

The ECPA committee's requirement to produce an edited proceedings book for distribution at the conference posed a truly challenging task, placing everyone involved under significant time constraints. To cope with this challenge, we hired a proven team: Dr John V. Stafford, an experienced Editor of the Proceedings Book, and Wageningen Academic Publishers, through Mike Jacobs, a reputable publishing company. This choice proved successful, enabling us to meet all deadlines and accomplish our assigned mission.

We extend our heartfelt gratitude to John Stafford for his excellent work in evaluating the suitability of the initial proposals and leading the team of Scientific Assessors responsible for reviewing the full manuscripts. The list of assessors is published in this book, and we express our sincerest appreciation for their invaluable and selfless contributions. Their assessments ensured the scientific quality of the oral communications presented at the conference and published in this book. We are confident that this book will serve as a valuable reference for researchers, practitioners, technical advisors, and farmers, driving the advance of knowledge in the field of precision agriculture.

As a result, we are able to present an exciting conference, comprising 139 oral presentations of scientific works, all of which are compiled in this edited book, along with a collection of over 100 poster presentations. It is our hope that these contributions will generate further scientific knowledge in the field of precision agriculture.

We acknowledge and appreciate the support of the International Society of Precision Agriculture (ISPA) in spreading the word among its members through newsletters and social media. The first idea to organise the conference was supported by the encouragement provided by James Lowenberg-DeBoer, the ISPA Past-President, and supported by the President, John Fulton, and the Secretary, Brenda Ortiz. It was a pleasure to meet the ISPA Board in Minneapolis during the 15th International Conference on Precision Agriculture and in online meetings, and we are grateful for the guidance and advice provided throughout the process.

Our deepest thanks go to all members of the Organizing Committee, the colleagues at the Department of Agricultural and Food Science at the Alma Mater Studiorum-Università di Bologna, and Francesco Marinello, as a member of the ECPA committee, for their invaluable assistance and advice during the last two years, and their support in organising the sessions and enriching the program, including the engaging field demonstration at the Experimental Farm of the University of Bologna.

We wish to thank Claudio Vercellone and Elisabetta Iogna from Avenue Media, the company running the conference secretariat and supporting the organisation of various management and logistical aspects of the conference. Their professionalism and dedication have been invaluable in ensuring a smooth and well-coordinated event.

Finally, we extend a heartfelt thanks to all the conference attendees. Their presence and active participation will be the driving force behind the success of this event. We are honoured to have you join us in experiencing insightful oral communications and engaging poster presentations at the Savoia Hotel Regency conference venue. As attendees are the key actors in every meeting, we eagerly anticipate the opportunity to interact with them during the event, with the hope that it will be both memorable and valuable for all.

We take a moment to acknowledge that, as we write this, the city of Bologna and a large area in the Emilia-Romagna region have been struck by devastating floods, causing significant damage to both the local population and the agricultural sector. Our thoughts and support go out to those affected by this natural disaster, and we remain committed to contributing to the recovery and resilience of the region's agricultural community. These are moments in which one truly grasps the immense value of agriculture as a fundamental pillar of society, providing sustenance, resilience, and hope in the face of adversity.

As the conference approaches, we await the announcement of the organisers for the 15<sup>th</sup> European Conference on Precision Agriculture. The anticipation of discovering the candidates is intriguing, and we extend our best wishes to them as they undertake the important task of continuing the tradition of successful ECPA conferences in Europe.

Maurizio Canavari, Giuliano Vitali, Michele Mattetti

*Conference Chairs*

*May 23, 2023*

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