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Editorial

Improving Functioning of Soil–Plant Systems Using the Application of Sustainable and Intelligent Methods

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We are privileged to serve as Guest Editors for this Special Issue (SI), "Improving Functioning of Soil–Plant Systems Using the Application of Sustainable and Intelligent Methods", in the international journal *Agronomy*. We are grateful to the Editorial Board, the staff of this journal, and the publisher for the support.

This Special Issue focuses on revealing how the intricate relationships between soil and plants govern water and nutrient dynamics in ecosystems, with far-reaching implications for society, the economy, and the environment. Soil quality in the rhizosphere, where plant roots thrive, profoundly influences plant growth and the overall soil–plant system. Unfortunately, suboptimal agricultural practices put this vital system at risk. Sustainable and intelligent agriculture has emerged as a solution, offering innovative approaches to soil remediation and crop modeling. However, its practical implementation and the development of cost-effective biomaterials for long-term field use require further exploration. Hence, adopting sustainable practices and intelligent measurements is crucial for effective soil–plant management.

The purpose of this SI is to review the latest developments in soil–plant systems as well as their sustainable management and intelligent measurements for solving problems in agriculture. This SI contains 11 published manuscripts covering various methods of sustainable management, intelligent agriculture, and agricultural production. The following is a brief summary of each paper published in this SI.

Zhang et al. [1] introduce an evaluation method for the spraying coverage region of plant protection UAVs. Their study sought to enhance the real-time assessment of droplet distribution during aerial spraying, thus optimizing the efficacy of plant protection operations. This innovation holds promise for improving crop yield by ensuring the precise application of protective agents.

Różewicz et al. [2] focused on sustainable waste management by utilizing apple pomace as an organic resource. Their research explores the potential of apple pomace as a soil conditioner and its impact on crop yield, demonstrating the environmental benefits of converting waste into valuable resources.

Sala et al. [3] delve into the realm of precision agriculture by proposing models to estimate wheat production using various data sources. Their work underscores the importance of accessible and accurate methods for assessing crop nutrition and vegetation status to enable sustainable and informed decision-making in agriculture.

Gao et al. [4] employed machine learning and swarm intelligence search algorithms to develop a fertilization decision model for maize, rice, and soybean. By optimizing fertilization strategies, this model aims to reduce agricultural costs and non-point-source pollution and enhance crop yields, contributing to both economic and environmental sustainability.

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Khalid et al. [5] explored the potential of vermicomposting, specifically employing two earthworm species for efficient solid waste management. Their research demonstrates the effectiveness of using a combination of earthworm species for composting and its positive impact on crop production.

Zhou et al. [6] tackled the challenge of nitrogen management in agriculture, emphasizing the importance of long-term sustainable practices. By substituting inorganic nitrogen with organic nitrogen, their study aimed to increase maize yields while minimizing nitrogen-containing gas emissions, offering a balanced approach to crop production.

Jing et al. [7] delve into the environmental concern of microplastics in soil. Their study investigates the effects of microplastics on the physical properties of soil during wetting–drying cycles. These findings highlight the need for comprehensive assessments of the impact of microplastics on soil health.

Li et al. [8] present an innovative approach to estimate soil hydraulic parameters using hybrid algorithms. This precision method offers valuable insights into soil characteristics, enabling informed decisions in agriculture and resource management.

Gupta et al. [9] review the application of urease and nitrification inhibitors as strategies to optimize nitrogen management. Their work provides a comprehensive understanding of these technologies and their potential to revolutionize agricultural practices, reducing nitrogen loss while enhancing crop yield.

Liu et al. [10] investigated the influence of interlayer soil on water infiltration characteristics in heavy saline–alkali soil. Their research sheds light on strategies to enhance water infiltration in challenging soil conditions, which is essential for sustainable agriculture.

He et al. [11] focused on flood irrigation in arid regions, exploring its impact on soil salinity and cotton sowing timing. Their findings highlight the significance of optimal sowing timing for cotton crops, particularly in regions where flood irrigation is employed.

Collectively, these diverse studies emphasize the ongoing pursuit of innovative solutions in agriculture and soil science. From real-time UAV evaluations to precision fertilization models and sustainable waste management, these research efforts provide a glimpse into the multifaceted world of modern agriculture. As we continue to confront environmental challenges and seek ways to feed a growing global population, these studies underscore the importance of interdisciplinary collaboration and cutting-edge research in shaping the future of agriculture.

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