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Editorial: Enhanced Nutrient Management in Agroecosystems

Tida Ge[1]*, *Mohammad Bagher Hassanpouraghdam*[2], *Sudarshan Dutta*[3] and *Xu Zhao*[4]

[1] State Key Laboratory for Managing Biotic and Chemical Threats to the Quality and Safety of Agro-products, Institute of Plant Virology, Ningbo University, Ningbo, China, [2] Department of Horticultural Science, Faculty of Agriculture, University of Maragheh, Maragheh, Iran, [3] African Plant Nutrition Institute (APNI), Benguérir, Morocco, [4] State Key Laboratory of Soil and Sustainable Agriculture, Changshu National Agro-Ecosystem Observation and Research Station, Institute of Soil Science, Chinese Academy of Sciences, Nanjing, China

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Editorial on the Research Topic

Enhanced Nutrient Management in Agroecosystems

The rapid increase in the application of chemical fertilizers over the past century has greatly benefited crop production. However, fertilizer over-consumption has led to many environmental problems, including excessive greenhouse gas emissions, water eutrophication, ammonia emissions, etc. (Ju et al., 2009; Darch et al., 2014). Managing the supply and utilization of nutrients to sustainably increase crop yields while minimizing impacts on other ecosystem services, such as clean water and air, biodiversity, and C sequestration, represents a significant challenge (Chadwick et al., 2015; Liu et al., 2022). Researchers have been making efforts to improve sustainable nutrient management strategies for decades, aiming at more efficient use of mineral fertilizers, increased recovery and recycling of waste nutrients, and better exploitation of the substantial inorganic and organic reserves of nutrients in the soil (Dungait et al., 2012; Owen et al., 2015; Ghimire et al., 2017; Atere et al., 2019; Luo et al., 2019; Kuzyakov et al., 2020; Wang et al., 2020). However, to prevent the mismanagement and the over-utilization of N, P, and C sources in agroecosystems significant changes are required in agroecosystem management.

This special issue aims to collect the novel approaches to measure, model, and efficiently manage nutrient cycling in agriculture. This will support of the development of sustainable and profitable farming systems that safeguard our future food security with minimal environmental impacts and contribute to the solution of the conflicts and trade-offs between the high productivity and environmental impact.

Five papers have been accepted from six submitted manuscripts. New findings from these papers broaden our understanding of the enhanced nutrient management in agroecosystems. Three papers conducted field experiments and recommended optimal practices for local farmers based on their regional issues. The other two papers are review articles, which studied the effect of organic materials such as rice husks and humic acids on soil properties and crop production. Furthermore, those studies recommend feasible practices for better economic and environmental benefits (Ulzen et al.) and present new approaches that ensure rainwater use efficiency (RUE) and nutrients supply as most farmers solely rely on rainfall in Africa. The combined application of rhizobia inoculant, P-fertilizer, and organic manure markedly increased harvest index (HI), P agronomic efficiency (P-AE), and RUE in soybean cropping systems. Treatments with the fertisoil (a commercially prepared compost from urban waste, rice husks, poultry manure, and shea butter waste) showed higher HI, P-AE, and RUE than cattle manure. Upadhyay et al. assessed the effect of fertilizer and cow by-products (blends of dung, ghee, curd, urine, and milk that are known) and irrigation on soil health and energy budget, and rice productivity in India. The suitable integration of fertilizers and cow by-products improved rice productivity, energy profitability, and soil quality under Indo-Gangetic

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Davey Jones,
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***Correspondence:**
Tida Ge
getida@nbu.edu.cn

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Plains. Tovihoudji et al. evaluated the growth, grain yield, and resource use efficiency of different drought-tolerant maize varieties under different N and P fertilizer options in Africa. The adequate supply of fertilizers through microdosing technology combined with the selected drought-tolerant variety considerably improved the growth and yield of maize with a high nutrient efficiency and can be an optimal alternative in the current context of declining soil fertility with climatic variability in sub-humid Benin. Runkle et al. proposed a modified field production system combining husk addition and conservation irrigation. This would take advantage of rice husks, an underutilized Si-rich by-product, and help attenuate the accumulation of toxic metal(loid)s, manage water usage and lower climate impacts. This review presented both the scientific basis and socio-technical considerations for rice production practices. Ampong et al. reviewed the literature on humic acids (HA) and showed that HA could positively affect soil physical, chemical, and biological characteristics. This review highlighted the relevance of HA on crop growth, plant hormone production, nutrient uptake and assimilation, yield, and protein synthesis. The effect of HA on soil properties and crops is influenced by the HA type, HA application rate, HA application mode, soil type, solubility, molecular size, and functional groups. This review also identified some knowledge gaps in HA studies, especially under field conditions.

Finally, the guest editors would like to express our sincere thanks to all authors who submitted their studies, irrespective of being accepted or not to this particular issue. We also appreciate all reviewers, responsible editors, and the Editor-in-Chief of John R. Porter from Frontiers in Agronomy for their continuous assistance in making this special issue success.

AUTHOR CONTRIBUTIONS

TG was an associate editor of the research topic and wrote the paper text. MH, SD, and XZ were associate editors of the research topic and edited the text. All authors contributed to the article and approved the submitted version.

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