**Session Proposal**

# Session Title

Sustainable Phosphorus use in Agroecosystems: New Approaches to Optimizing Nutrient Management and Ecosystem Functionality

# Session Organizers

*Primary contact:*

* Klaus Jarosch, Agroscope, Agroecolgoy and Environment, Zurich, Switzerland, klaus.jarosch@agroscope.admin.ch

Co-organizers:

* Hao Chen, Sun Yat-sen University, School of Agriculture and Biotechnology, Shenzhen, China. *chenh626@mail.sysu.edu.cn*
* Owen Fenton, Teagasc, Environmental research Centre, Wexford, Ireland, owen.fenton@teagasc.ie
* Wenxuan Shi, Teagasc, Environmental research Centre, Wexford, Ireland,

wenxuan.shi@teagasc.ie

# Session Description

Phosphorus (P) is an essential nutrient for crop production, crucial for plant growth and food security. Both oversupply and undersupply of phosphorus pose significant challenges in agroecosystems. While excess phosphorus can lead to environmental issues such as nutrient runoff and water pollution, a lack of phosphorus limits crop yields and food production, particularly in regions with limited fertilizer access.

This session will bring together researchers from diverse fields to explore innovative approaches for the sustainable management of phosphorus. We invite contributions to showcase new concepts, analytical tools, management strategies, and approaches aimed at balancing phosphorus use to enhance agricultural productivity while minimizing environmental impact.

Attendees will gain insights into the latest research and developments in phosphorus management, with a focus on data-driven analysis and the creation of decision support tools. These tools are designed to optimize phosphorus use in agroecosystems, ensuring long-term sustainability. By presenting cutting-edge strategies, the session aims to foster collaboration and promote solutions that benefit both crop productivity and ecosystem functionality.

# Format

This will be a classical scientific conference session. Depending on the size, we will invite 1-2 keynote speakers. After that oral presentations will follow. After that, the poster presentation session will follow.

# Proposed Speakers

We intend to ask the following researches either for a keynote talk or a submission for a abstract to our session

* Professor Yu Wang, Nanjing Institute of Soil Science, Chinese Academy of Sciences (CAS). He primary research focuses on soil phosphorus cycling and its agricultural and ecological environmental effects, with particular emphasis on phosphorus cycling and transformation processes in agricultural and natural ecosystems, the impacts of land use practices on soil organic matter stability and nutrient availability. These investigations advance the understanding of biogeochemical interactions governing phosphorus bioavailability, establishing theoretical foundations for sustainable agricultural development and ecological restoration.
* Prof Richard McDowell, AgResearch New Zealand and University of Lincoln, contribution. Leading expert in the field of phosphorus characterization and losses in agricultural landscapes at field to global scales, with H-Index of 73, > 19,000 citations. Recent publications in Nature Food and Nature Communications on soil phosphorus stocks, global reserves and water quality)
* Professor Enqing Hou, South China Botanical Garden, Chinese Academy of Sciences (CAS). He primarily investigates the carbon, nitrogen, and phosphorus cycles in forest and grassland ecosystems, as well as the responses of soil microbial community structure and function to global change. By integrating multi-scale field experiments with model simulations, his research has revealed the critical role of microbial-mediated phosphorus mobilization pathways in subtropical forest ecosystems.
* Assistant Professor Julian Helfenstein, Wageningen University. Focuses on finding solutions for healthy agricultural soils at different spatial scales. He works with farm management and soil monitoring data at the European scale to determine how farm management impacts soil health across different geographic regions, with a special focus on phosphorus. Recent publication is a review on understanding soil phosphorus cycling for sustainable development.
* Professor Leo Condron, Lincoln University. He investigates the impacts of land use and management practices on phosphorus and organic matter dynamics in grassland and forest soils, soil chronosequence biogeochemistry, and relationships between soil microbial diversity and function. This body of research has contributed to significantly advancing understanding of the importance of biological processes in determining the bioavailability and utilisation of phosphorus in soil-plant system.
* Professor Xinqiang Liang, Zhejiang University. He investigates agricultural non-point source pollution control, focusing on nutrient cycling (nitrogen and phosphorus), soil-water interface processes, and conservation agriculture (CA). He utilized synchrotron radiation X-ray absorption near-edge structure spectroscopy (XANES) technology to study the morphological characteristics of phosphorus in conservation tillage soil and revealed the molecular mechanism of the enhanced bioavailability of soil phosphorus.
* Professor Keke Yi, Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences CAAS. He focuses on molecular mechanisms of phosphorus efficiency in agroecosystems, genetic regulation of crop phosphorus use efficiency, and soil-root-microbe interactions enhancing phosphorus uptake. These findings offer theoretical frameworks and practical solutions for addressing China's critical agricultural challenge of phosphorus resource limitation, demonstrating enhanced fertilizer utilization through root-microbe engineering approaches.
* Professor Xionghan Feng, Huazhong Agricultural University. He investigates the chemical processes of phosphorus soil and its efficient utilization. He coordinated the National Key R&D Program project ‘Phosphorus Transformation Processes and Mechanisms in Major Chinese Soils’ (2017–2020), establishing a comprehensive phosphorus turnover database encompassing acidic soils in southern China and calcareous soils in northern regions. This work developed technical pathways for yield-sustaining phosphorus management, demonstrating that reduced phosphorus fertilizer application by 20% maintains crop productivity under varying agroecological conditions.
* Professor Gu Feng, China Agricultural University. His specializes in rhizosphere ecology, focusing on plant-microbe interactions, arbuscular mycorrhizal (AM) fungi-mediated nutrient cycling, and saline soil agriculture. His research reveals synergistic mechanisms between AM fungi and phosphate-solubilizing bacteria in enhancing phosphorus availability, demonstrated via isotope tracing and molecular techniques.
* Professor Tida Ge, Ningbo University. He focuses on soil microbial ecology, soil-borne disease control, and biogeochemical cycles. His work emphasizes soil health, carbon-nitrogen cycling, and rhizosphere microbial dynamics to enhance agricultural sustainability. Notable achievements include optimizing viral extraction methods in red soils, elucidating microbial roles in carbon sequestration.
* Professor Lin Zhang, China Agricultural University. He specializes in rhizosphere ecology and plant-microbe interactions, particularly focusing on arbuscular mycorrhizal (AM) fungi-mediated phosphorus utilization. His research explores the synergistic mechanisms between AM fungi and phosphate-solubilizing bacteria to enhance soil phosphorus availability and plant nutrient efficiency.
* Dr. Lihong Xue, Jiangsu Academy of Agricultural Sciences. She focuses on specializes in agricultural non-point source pollution control, focusing on nutrient management, soil health, and sustainable farming practices. Her work emphasizes optimizing fertilization techniques to enhance crop yields while reducing nitrogen and phosphorus losses in paddies. She and her team achieved "near-zero phosphorus emissions" in agricultural systems through the integrated application of smart irrigation-drainage technologies, ecological ditch networks, and precision fertilization strategies.
* Professor Guanglong Liu, Huazhong Agricultural University. He investigates the development and application of new materials for phosphorus recovery, and the mechanisms of eutrophication and cyanobacterial blooms. He has developed innovative phosphate-removal adsorbents, such as resin-based iron oxide composites, and proposed strategies to mitigate phosphorus release from sediments. His research employs advanced techniques like Fourier-transform ion cyclotron resonance mass spectrometry (FT-ICR MS) to analyze organic phosphorus transformation and photochemical mineralization in water bodies, revealing molecular-scale dynamics driving algal blooms.