

The Importance of Researches on Climate-Smart Agriculture for 5C Dimension of Global Soil Security: An Overview of GSS2023

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The 4th Global Soil Security Conference 2023 (GSS2023) was held in Seoul from June 26 to 29, 2023 with the theme of “Beyond The Soil (BTS) for Global Soil Security”. Soils are the fundamental resources for living organisms including human beings in our Earth. The functions of soils to support life are defined as food security, water security, energy security, ecosystem service, biodiversity protection, and climate change mitigation (CEC, 2006). However, the soil functions have been threatened by soil degradation that include erosion, acidification, nutrient and organic matter depletion, pollution, and salinization due to improper uses and management of soils for mass production and consumption of food and energy (Pierzynski and Brajendra, 2017). Therefore, securing soils is imperative for maintaining and enhancing soil functions for life on Earth.

For global soil security, a multi-dimensional framework is required for the participation of soil scientists, policy maker, and the public in developing and implementing soil security strategies. The five dimensions of soil security are “capability (optimal capacity of the soil to perform the functions)”, “condition (the current state of the soil)”, “capital (monetary value of the soil)”, “connectivity (social relationship)”, and “codification (soil policy)” (McBratney et al., 2014). In GSS2023, to address and discuss all of the 5C dimensions of soil security, 34 invited scientists and more than 200 volunteered participants gave presentation on topics of “soil security and policy”, “soil security and food security”, “soil security and ecosystem services”, “soil security and climate change”, “soil security and biodiversity”, and “soil security and water and environmental security”.



The concept of 5C dimension was deeply addressed and its importance for soil security and function was highlighted to advance the concept of 5C dimension of global soil security. The “capability” and “condition” focusing on the traditional monitoring and management of physical-chemical-biological properties of soils and their implications for food and environmental security were still the most frequently addressed issues. However, modeling and digital soil mapping of “capability” and “condition” were also presented and this is a notable advance from the past GSS conferences. It was also notable that the importance of soil security not only for food quantity but also for food quality such as micronutrients for human health was highlighted, which might trigger relevant researches on more sophisticated soil nutrient management for high-quality food production (Miller and Welch, 2013). The direct implication of soil security for human health was also emphasized on the importance of soil microbiome because two-thirds of medicine used for humans are derived from soil microbe but only 1% of soil microbiota is cultured outside soils (East, 2013).

Climate change is the most urgent threat we faced. Numerous studies addressed the mutual relationship between soil security and climate changes with special emphasis on sustainable food production under climate change and soil management for climate change mitigation including soil carbon sequestration. In this context, soil organic matter management for sustainable rice (*Oryza sativa* L.) production in waterlogged paddy systems was questioned because incorporation of organic inputs to improve soil quality should increase methane (CH₄) emission (Yoon et al., 2022; Baek et al., 2023; Lee et al., 2023). Therefore, a strategy to produce high-quality rice in paddy while mitigating CH₄ emission needs to be developed, and this effort should make a progress on “connectivity” and “codification” dimension of soil security. Due to the global agreement on the urgency of fighting against climate change, international carbon trade markets are emerging and national policies to support carbon farming are being implemented. Despite the importance of carbon market, in this GSS2023, carbon market in relation with climate-smart agriculture was addressed only for USA. Therefore, more international efforts are required to advance “capital” dimension for soil security particularly in the field of climate change mitigation.

In this GSS2023, we found advances in modeling and digital soil mapping of “capability” and “condition” and the linkage of soil security to human health. However, progresses on the topic of “capital”, “connectivity”, and “codification” are still slow. Despite this, in this conference, we noticed a big opportunity to develop these three dimensions through researches on climate-smart agriculture which aims sustainable food production, climate change mitigation, and farmers’ income increase that should be supported by government and the public. Therefore, we encourage extensive studies on climate-smart agriculture in relation with food production and climate change mitigation as well as carbon farming and welcome submission of high-quality studies for publication in the Korean Journal of Soil Science and Fertilizer.

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