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EDITORIAL

Exploring solutions for sustainable agriculture with "green" and "development" tags in Africa

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Following the UN sustainable development goals (SDGs), the 2030 agenda for sustainable development, which includes 17 sustainable development goals, was developed to shape a sustainable future for the world over the next 15 years[1]. It has offered a vision of a sustainable, more prosperous world where nobody is hungry, and people eat enough nutritious food, especially in Africa. Agriculture and food production are key to achieving the entire set of SDGs due to their fundamental role in societal and economic development. To produce enough nutritious food to feed the large and ever-growing human population in a sustainable manner is a major challenge facing all countries in the world. The challenge is however more daunting in Africa, especially sub-Saharan Africa. Agriculture and food systems account for more than a quarter of GDP, as well as for more than 40% of employment in many African countries[2]. To create, coordinate, and maintain "green" and "development" tags in African agriculture would require a fundamental shift in mobilizing the power of African food production system toward a sustainable agricultural intensification[3]. Without any doubt, Africa represents the ideal environment for implementing the SDGs by government policymakers, scientists and business, particularly from an agricultural and food production perspective.

Due to limited infrastructure, low adoption and use of technologies, and a flawed system of knowledge transfer by extension agents, Africa missed out on the Green Revolution of the last century. Compared with China, grain yield in sub-Saharan Africa is still less than 2 $t \cdot ha^{-1}$, which can hardly meet the food demand of its ever-increasing population[4]. Hunger is highly prevalent and still a major problem in many African countries. A more effective approach to food self-sufficiency in Africa is to develop a modern agricultural production system. Although this is still being explored, there are a few partially successful cases that have been noted internationally; these include the use of N_2 fixation technology as N-biofertilizer, improving cropping systems through legume introduction and optimized application of fertilizers. Compared to the food insecurity problem in Africa, China has had great success in producing enough food to feed its huge population. The difference lies in the fact that china has developed a successful approach to technology innovation and transfer through a common participatory model, which involves scientists, graduate students, farmers, government, business and other stakeholders. This special issue of *Frontiers of Agricultural Science and Engineering* focuses on sustainable agriculture in Africa, and comprises seven review and research articles, which cover a wide range of topics on adaptive technology innovation, knowledge transfer, bottom-up new technology application and extension, and the implications of China's experience for sustainable agriculture in Africa.

In terms of developing adoptable and adaptive technology, Jiao et al. (https://doi.org/10.15302/J-FASE-2020360) have proposed a scientist-farmer engagement to develop location-specific and innovative technologies for sustainable crop production based on analysis of Science and Technology Backyards model in China. In addition, some potential approaches to knowledge transfer through integration of resources from government, business,

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NGOs and knowledge hubs were also explored. Muhaba and Dakora (https://doi.org/10.15302/J-FASE-2020354) have also provided evidence for how development of an adaptive approach to improving groundnut productivity through promoting N_2 fixation in groundnut can increase yields with the addition of phosphorus fertilizer.

To translate knowledge into action by smallholder farmers for sustainable agriculture in Africa, Leta et al. (https://doi.org/10.15302/J-FASE-2020331) employed the "Integrated Soil Fertility Management Project", as pilot to stimulate multiparty participation in Ethiopian agricultural extension system (AES). They found that it was an effective way to increase grain yield, crop residue and farm household livelihood, and recommended that it should be integrated and institutionalized into the mainstream AES of Ethiopia. A study by Fofana et al. (https://doi.org/10.15302/J-FASE-2020358) investigated the value chain extension strategy of Sasakawa Africa Association through designing and disseminating innovative extension models that are delivering through on- and off-farm demonstrations and training on improved pre- and post-harvest agricultural technologies to equip extension agents and smallholders with the requisite new but adaptive knowledge and tools needed.

The Belt and Road initiative, which links China and Africa together, can help achieve the SDGs, and thus address the challenges of food security and socioeconomic needs of millions of smallholders in Africa. China's experience and successful agricultural extension practices should contribute to global food production, particularly when shared with smallholders in Africa for increased grain yield. Buerkert and Schlecht (https://doi.org/10.15302/J-FASE-2020341) have claimed the concept of sustainable agriculture intensification in sub-Saharan Africa and proposed Africa agriculture development may benefit from elements of the Chinese experience of agricultural innovation. In another study, Jiao et al. (https://doi.org/10.15302/J-FASE-2020359) compared the historical pattern of grain production and its drivers in Quzhou County on the North China Plain with Kenya, and found that grain production in Kenya could be increased if farmers developed a cycle of building soil fertility through fallow and cropping with manure and/or limited mineral fertilizer input under resource-poor conditions. A study by Meng et al. (https://doi.org/10.15302/J-FASE-2020353) also showed that early-warning systems for drought have great potential to improve crop productivity, nutrient and water use efficiency, as well as to control desertification in Morocco, Zambia, Egypt, Niger and Ethiopia. An evaluation of the ecological integrity of African farming systems based on the pressure-state-response model conducted by Wei et al. (https://doi.org/10.15302/J-FASE-2020320) showed that conservation of environmental ecology and food security must simultaneously receive greater and equal attention in African countries if food security is to be sustainably achieved in the context of climate change.

As the guest editors, we thank all authors and reviewers for their great contribution to this special issue on "Agriculture Green Development in Africa", and the editorial team for their great support. We hope that this will serve as a catalyst for a shared vision and solutions for addressing sustainable agriculture by simultaneously highlighting "green" and "development" in Africa, and help to build a prosperous Africa based on inclusive growth and sustainable development, toward achieving the SDGs worldwide.

References

1. United Nations. Transforming our world: the 2030 agenda for sustainable development. Working Papers, 2015
2. The World Bank. Development data and statistics. Available at The World Bank website on June 14, 2020
3. Shen J B, Zhu Q C, Jiao X Q, Ying H, Wang H L, Wen X, Xu W, Li T Y, Cong W F, Liu X J, Cui Z L, Oenema O, Davies W J, Zhang F S. Agriculture Green Development: a model for China and the world. *Frontiers of Agricultural Science and Engineering*, 2020, **7**(1): 5–13
4. Sanchez P A. En route to plentiful food production in Africa. *Nature Plants* , 2015, **1**(1): 14014–14014

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Dr. Xiaoqiang Jiao, Associate Professor of Department of Plant Nutrition, National Academy of Agriculture Green Development, College of Resources and Environmental Sciences, China Agricultural University. He has been engaged in research on systematic approach of technology innovation and knowledge transfer for sustainable farming system by Science and Technology Backyard (STB) model, in particular on transfer learnings of China's experience for sustainable Africa agriculture. He has published several peer-reviewed papers in international academic journals. He is currently the deputy coordinator of Sino-Africa STB project, supported by the Sino-Africa Friendship Scholarship of China Government, The World Bank, and Bill & Melinda Gates Foundation.