

Recent achievement of sustainable soil management in Sub-Saharan Africa

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Received: 7 May 2015 / Accepted: 8 May 2015 / Published online: 28 May 2015
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To many, the African continent is on the cusp of a rise in poverty and food insecurity. The often quoted widespread, inherently low fertility of soils in Africa is topped by a more widespread nutrient mining. The fundamental biophysical root cause for declining per capita food production in Sub-Saharan Africa is soil fertility depletion in smallholder farms. Although significant progress has been made in research in developing principles, methodologies and technologies for combating soil fertility depletion, soil infertility still remains the fundamental biophysical cause for the declining per capita food production in Sub-Saharan Africa. The inherent constraints in some soils have been exacerbated by their over-exploitation for agricultural production. Large areas of soils of high production potential in Sub-Saharan Africa have been degraded due to continuous cropping without replacement of nutrients exported by harvests. Increasing population pressure of up to 1200 persons per square kilometer have necessitated the cultivation of marginal lands that are prone to erosion and other

environmental degradation. In many cases, it is no longer feasible to use extended fallow periods to restore soil fertility. The shortened fallow periods are in many situations not able to regenerate soil productivity leading to non-sustainability of the production systems. For decades, the annual food production increase of 2 % does not match the yearly population growth rates of 3 %, rendering food insecurity more common and more regular. Furthermore, from the sixty-six nations worldwide that are currently unable to meet their population's food demands, the majority lies in Sub-Saharan Africa requiring greater food production in this region. Therefore, the African Union Assembly of Heads of State and Government coined 2014 to be the “Year of Agriculture and Food Security in Africa”. This was driven “to consolidate active commitments toward new priorities, strategies and targets for achieving results and impacts, with special focus on sustained, all Africa agriculture-led growth, propelled by stronger, private sector investment and public–private partnerships”. “Sustainable intensification” is recurrently proposed to meet this challenging pressure as it deals with increasing yields while concurrently decreasing the negative impacts on the environment.

There is consent that closing the yield gap in Sub-Saharan Africa is difficult to meet since there is no silver bullet solution, but rather a large portfolio of options is to be considered. To improve food and nutrition security, in a global crop modeling study,

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scientists identified eleven innovations including integrated soil fertility management and increased nitrogen use efficiency as the most promising ones to improve yields of cereals (maize, rice, wheat and millet) and reach food security by 2050. Decades of fertility research by national and international institutions in Africa have brought about some relief in several countries and with some (mainly wealthier) farmers, but could not yet bridge the entire yield gap everywhere. The latest research findings underline that new and updated standards can be offered to Sub-Saharan Africa farmers in managing nutrients irrespective of whether they are generated from organic or inorganic fertilizers. But all research efforts have not yet translated in noticeable success on farmers' fields. Even though fertilizing materials may not be the only solution for the many problems in the agricultural production sector, it is a solution for many different challenges including climate change mitigation. But when taking stock, one notices that the cupboard is still quite bare: fertilizer use worldwide in 2009 was on average about 122 kg ha⁻¹, but only between 8 and 11 kg ha⁻¹ in Sub-Saharan Africa. Furthermore, upfront investment for fertilizers is considered high by resource poor smallholders, whereas returns are uncertain. Also changing weather and market fluctuations can quickly make investments unprofitable. Yet, there is a consensus that it is impossible to ease food insecurity in Sub-Saharan Africa without fertilizing materials but that increasing the use efficiency of organic and inorganic, yield enhancing inputs is imperative. These facts justify this volume collating the most up-to-date science results on the use of organic and inorganic amendments in Sub-Saharan Africa. The updated standards summarized here should support land users, farmers, or extension workers to plan for increasing crop production while fully exploiting the (in)organic resources and protecting the environment through minimizing pollution, improving soil health, and reducing soil mining.

In the past 50 years Paul Vlek has been one of the front runners in fertilization research in Africa while concurrently advocating the need of sustainable intensification practices. He had a wealth of ideas which he followed with great lucidity and logic. He devoted most of his academic career to preventing action without thoughts. He was fully committed to detecting areas where knowledge is sketchy and to identify research where inquiry might be promising

and rewarding to meet the demands of the people in Sub-Saharan Africa. To reduce constant error and revision, avoid collecting a morass of data, he promoted systematic experimentation, driven by design and training of devoted field workers. He imparted that conducting fieldwork is not an unpleasant task and should not be only left to field staff, but is important to be familiar with. Fact-gathering is compulsory as is its consequent and intelligent processing to find order in a wealth of data as well as interpreting the findings. Fieldwork thus forms part of self-development. Also, keeping eyes firmly and only fixed on the ground is to be avoided as this leads to a partial view. To avoid theoretical speculation, he sought higher levels of abstraction as in this way more progress is to be expected. He encouraged reflection and knowledge before writing things down.

During his life time Paul Vlek earned an enviable reputation for commitment. In 2014 he was awarded for his life achievements with the GCHERA World Agriculture Prize as an outstanding personality in education, research and innovation in the agricultural and life sciences. This special issue of the journal of Nutrient Cycling in Agroecosystems is an additional honor to his long-standing work, also as long-time editor-in-chief of this journal, during which he has made an outstanding contribution to studying and disseminating nutrient cycling and management results.

This special issue summarizes latest advances in nutrient management practices for addressing food insecurity and increasing middle and long-term economic development in Sub-Saharan Africa. The different contributions provide updated guidance on managing the rate, source, placement, and timing of the application of plant nutrients and soil amendments. But this special issue goes beyond the historic reliance on technology by underlining the growing role of nutrient management and cycling in peri-urban production systems as are the financial and institutional conditions of fertilizer use, which are still insufficiently known and remain therefore untapped options for achieving the urgently needed production enhancement. When appropriate, the contributions combine a synthesis of previous knowledge of nutrient management for production increase with new knowledge, separate myths from reality and let facts guide future decision-making. Such decisions are urgently demanded and should lead to increased (national)

investments in agriculture. Investments should enable integrated soil nutrient management based on the latest agricultural knowledge that promote increasing nutrient efficiencies by better tailoring nutrient supply to crop demand, and making better-informed decisions for effective fertilizer use and management according to rainfall zones. This must be of interest to farmers, extension services, researchers and policy makers alike.

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