Bringing the Green Revolution to Resource-Poor Farmers of sub-Saharan Africa

by Rattan Lal

Soil and water resources of sub-Saharan Africa (SSA) are adequate to feed the present and projected population while improving the dietary intake and raising the standard of living. Furthermore, soil scientists, agronomists, and experts in other agricultural disciplines in SSA are excellent professionals. Several of these scientists received their education at prestigious universities in Africa, Europe, North America, and Australia. From the published literature in the recent past, it is also evident that some high quality research is being conducted by the scientific community in SSA, the results of which are enhancing production in Ghana, Uganda, and other countries in the region.

The scientific literature on the impact of land use and management on agronomic production in relation to properties and processes in soils of SSA, going back to the 1930s, is outstanding. For example, very useful research was done on: (i) soil structure, the impact of cover crops and grazing, and the effect of land use on water budget in East Africa in the 1930s and 1950s (Charles Pereira, Walter Russell, and Fred Wangati); (ii) organic matter and nitrogen dynamics in soils under shifting cultivation in West Africa also in the 1950s (Peter Nye and Dennis Greenland) in conjunction with the effects of deforestation on soil temperature and moisture regimes (R.K. Cunningham); (iii) soil erosion processes and techniques of their control in southern Africa, especially in Rhodesia/Zimbabwe in the 1950s–1960s (Norman Hudson); and (iv) methods of deforestation and land development, including the corridor system of land development and mulch farming techniques in central Africa or Congo in the 1950s (F. Jurion and J. Henry).

New scientific developments by the International Agricultural Research Centers (e.g., IITA, ICRISAT, ICRAF, and ILCA) were added to this excellent research knowledge since the 1970s. The research done at IITA and ICRISAT on soil and water conservation, watershed management, no-till farming, alley cropping, soil fertility management, tied-ridge system, etc., is especially pertinent to enhancing agronomic production. In this regard, the importance of the system approach proposed by Bede Okigbo of IITA was especially noteworthy since the recommended practices were based on a holistic approach to address specific issues of the diverse agroecoregions. There are numerous other examples, developed by knowledgeable and visionary African scientists, which are relevant to the sustainable use of soil resources of SSA.

Why Has the Green Revolution Bypassed SSA?

With such an excellent research base, why has the Green Revolution bypassed SSA?

One answer is that application of science and technology alone cannot solve all the problems. There are some other issues related to social, cultural, and political realms that must also be addressed. Technological miracles can happen only under the most conductive environments. The second answer is that the scientific know-how has not been used to address the practical problems. It can be argued that a principal constraint to an agrarian breakthrough has been the prominent lack of translation of the scientific knowledge into: (i) practical technology that farmers can use, (ii) a simple language that policy makers can understand and relate to, and (iii) an action program at the grassroots level (villages) that can make a difference. In short, the research was done without involving the principal beneficiary, the farmer. The audiences for the high quality research were the scientific community who read the peer-reviewed scientific journals rather than the resource-poor small landholders or policy makers of SSA who need this knowledge to solve practical problems of accelerated erosion, soil compaction, fertility decline, organic matter depletion, soil acidity, etc. The third answer is that institutions and infrastructure are too weak and cannot provide the technical support and the inputs required to enhance productivity.

Members Can Make a Difference

It is in this context that the membership of SSSA, especially soil scientists and agronomists based in SSA, can make a difference. There is an urgent need to translate the research data on properties and processes of soils of SSA into practical knowledge and the information communicated to policy makers and land managers in a simple and matter-of-fact language. The overall goal of an effective strategy is to: (i) develop an action plan with sharply focused priorities specifically identified on an ecoregional basis (e.g., water conservation and recycling in the Sahel, erosion control and soil structure management through mulch farming and no-tillage in the subhumid and humid regions, integrated nutrient management to create a positive nutrient balance, and soil organic matter improvement to enhance soil quality); (ii) involve farmers in the planning process and develop a demand-driven program that is farmer-centric rather than donor-centric; (iii) create a strong political will that gives a high priority to agricultural development; (iv) enhance respectability of the agricultural profession; and (v) improve management of the agricultural

programs so that limited resources are effectively utilized.

The action program developed must be relevant to the issues of importance to the farmers of SSA. Management of agricultural programs must reflect originality, dedication to serve the cause, and commitment to solving the practical problems. In this regard, program managers and administrators can make a difference by creating a work atmosphere that: (i) rewards originality, creativity, and productivity; (ii) minimizes bureaucracy by removing bottlenecks and facilitating operations; (iii) develops a trustworthy environment; (iv) enhances respectability of the soil science and agricultural professions; and (v) addresses sustainability of agricultural practices.

Revisiting 'Sustainability' in SSA

The question of "sustainability" must be revisited. In the context of SSA, it is extremely important to realize that the term "sustainable agriculture" is not synonymous with "low input," "organic," or "alternative agriculture" as is sometimes implied in North America and western Europe. With a negative nutrient balance at 20 to 30 kg/ha of NPK on a continental scale since time immemorial, there is no alternative to enhancing soil fertility except by using innovative techniques of integrated nutrient management including judicious use of chemical fertilizer along with biological nitrogen fixation, compost, manure, mulches, and other biosolids. Key interrelated issues of agricultural sustainability include: (i) poverty and lack of resources needed to invest in improved soil management, (ii) competing uses of limited resources (e.g., crop residue and animal dung), (iii) lack of institutional support and weak infrastructure, and (iv) lack of incentives to the farming community. The importance of these issues is also confounded by the soil degradation–climate change–environment dilemma, which demands a sincere involvement of the global community to address this global issue.

There is another important difference in the concept of sustainability. Resource-poor farmers in SSA, with perpetually low yields, are concerned with maximizing agronomic yields rather than optimizing returns, optimizing rather than minimizing the use of fertilizers and other off-farm input, obtaining an assured minimum yield in a bad year rather than maximum yield in a good year, and providing food for the family in the immediate future rather than long-term profitability over a longer time horizon.

There has been a lack or slow rate of adoption of improved soil management technology in SSA. The past experience has shown that the top-down approach is not effective in technology transfer. Furthermore, it is the combination of scientific technology with traditional knowledge through the participatory approach that is an appropriate strategy. Farmers of SSA, who have managed to survive under the most harsh environment, have done so at the strength of the traditional knowledge accumulated over the millennia. The scientific community can benefit from this wealth of knowledge.

Members of SSSA can help in creating "management tools" or "decision support systems" of recommended management practices for principle ecoregions and major soils. Such packages, based on a holistic approach, need to be tested and adapted under on-farm conditions. An example of such a package may be no-till farming involving use of crop residue mulch and incorporation of a leguminous cover crop in the rotation cycle. Mulch farming, in conjunction with application of compost/manure and a judicious use of fertilizer, may be the handle or an entry point to break the vicious cycle of poverty–soil degradation–low yield–more soil degradation. A combination of scientific technology and traditional knowledge may yet bring the Green Revolution to resource-poor farmers of SSA provided that they are involved in the decision-making process, social and political issues are appropriately addressed, and soils are not taken for granted.

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