Improving soil fertility management in Sub-Saharan Africa

There are more than 60 million smallholder farmers in Sub-Saharan Africa (SSA). Declining soil fertility is a fundamental impediment to agricultural growth and a major reason for slow growth in food production in SSA. In Africa, as a result of soil degradation, irrigated lands may be, on average, 7 percent below their potential productivity, rain-fed crop lands 14 percent below their potential and rangelands 45 percent below potential. Compared to parts of North America, Europe and of Asia, most SSA soils are naturally not very fertile. Low in a number of chemical constituents such as phosphorus, sulphur, magnesium and zinc, low amounts of soil organic matter (SOM) combined with poor land cover have resulted in poor soil structure, limited rooting depth and susceptibility to accelerated erosion. However, similar soils in other parts of the world have been made highly productive by using appropriate management techniques.

There are two main approaches to improved soil fertility management. One is to attempt to meet plant requirements with purchased mineral fertilizers. The second relies on biological processes to optimize nutrient recycling, with little reliance on external chemical fertilizers, but maximizing the efficiency of their use. The more sustainable middle path borrows the best features from both and is referred to as Integrated Nutrition Management (INM). INM combines mineral fertilizers with organic resources, thus increasing fertilizer use efficiency, reducing the risks of acidification and providing a more balanced supply of nutrients.

Why are promising techniques not adopted?

Many well-meaning schemes proposed by donors and NGOs to promote better management practices have come to nothing as they had not factored in the client’s need for a profitable practice. Also, the substantial gaps between the outcomes under research conditions and under farmer conditions has been another reason for non-adoption. Under virtually any scenario, the issue comes down to achieving a "fit" between the farmer’s circumstances, the incentives offered for adoption and the factors constraining his capacity to do so.

This study identifies the main reasons for lack of adoption as follows.

**Lack of knowledge**: Smallholder farmers, often with poor roads and communications
infrastructure, lack access to information because of sporadic extension contacts, a weak network of farm input stockists (who provide information along with their sales), limited cooperative membership, and illiteracy. Thus, lack of knowledge about fertilizer prices or likely crop prices also contributes to their inability to articulate demand for fertilizers at the time when orders have to be placed, a year in advance of harvest. This lack of information also often translates into an underestimation or overestimation of needs, resulting in a below-optimum dosage or financial losses from holding large stocks. The research system developing technical solutions wrongly assume that the farmers have the knowledge to take up the recommendations and make them work.

**Limited resources:** Farmers may know about how to use a technique profitably, but may be unable to raise sufficient funds to invest in it, because of lack of access to credit, or lack of cash arising from late payment for crops. They may simply lack the time needed to implement it, as a result of labor constraints. Or, they may not have enough land to do all that they want to do on their farms, or may have insecure tenures that preclude longer-term investments.

**Inability to bear risk:** Farmers may have both the knowledge and available resources, but be unwilling or unable to incur the risks of crop losses from adverse weather, pests and diseases, or failure of the technology, or income losses from adverse market developments. For example, the risks associated with using fertilizer is the rainfall factor. Fertilizer applied without subsequent adequate rainfall may actually damage the crop by burning the seeds. In less extreme cases, the lack of water may limit, with varying degrees of severity, the yield of the crop, with the more fundamental nutrient - water - dominating the nutrients in the fertilizer. Even though these events may occur only with a certain frequency (calculable by statisticians, but known to farmers only in an imprecise way), for many farmers on the edge of survival, it is hard to risk adding in any way to the losses they may incur.

**Limits on profitability arising from technical factors:** For example, fertilizer use may not be financially viable because soils are too poor to use it effectively; there is an inadequate response from lower grade crop varieties or poor seeds; or farmers are unable to apply the comprehensive package of complementary practices needed to get the most out of the fertilizer.

**Limits on profitability arising from economic factors:** The recommended technique may not be profitable enough because of: the high costs of getting fertilizer to the fields (including unavailability in small enough packages); inadequate prices or late payments for crops; unavailability of other purchased inputs; or, as in the case of some soil conservation techniques, the externalities make only community solutions viable. Also, macroeconomic policies play an important role here. The most important policy instruments relate to exchange rates, subsidies, liberalization of policies for inputs and outputs, and agricultural research and extension.

**Unavailability of techniques or inputs:** Many researchers contend that basic problems of availability, for example, "getting the right fertilizer to the right place at the right time" are as important as price-response interactions in determining fertilizer use. Thus, the fertilizer may not be available within any reasonable radius (equivalent to a price that is "infinitely high"); the correct formulation of fertilizer may be unavailable; or the critical elements of a package such
as improved plant materials may be unavailable.

**Some experiences**

*Kenya*: From 1969 to 1973, in a program assisted by the FAO, about 900 on-farm fertilizer trials were carried out at research stations all over the country. A central discovery was that very little knowledge was available on which to base fertilizer recommendations. In 1985, the Fertilizer Use Recommendation Project, funded by GTZ and the EEC decentralized fertilizer research by production zone and type of farming, covering in two phases over ten years seventy-one representative sites in thirty-two districts. Fertilizer use recommendations were made that took into account both physical and economic variables. In other words, recommendations were designed to be optimal for farmers, rather than to merely maximize crop production. The results were distributed to agricultural extension agents throughout the country. The recommendations are being verified by an ongoing Fertilizer Extension Project.

*Malawi*: While the emphasis of the joint CIMMYT/Rockefeller research project is on addressing soil nutrient constraints with improved mineral fertilizer packages, it incorporates intensive on-farm research and extension activities. New fertilizer blends were tested on farms for yield effect and profitability, and included the active involvement of both the extension service and farmers. The research team also worked with a local fertilizer company to develop new, more practical, fertilizer blends to address regional deficiencies.

*Mali*: The Equipe Systemes de Production et Gestation de Ressources Naturelles (ESPGRN) of the Institut d’Economie Rurale has developed a research and implementation process that has been successful in promoting the increased use of organic and mineral fertilization technologies that take account of farmers’ income, land, and labor constraints.

*Ethiopia*: The National Fertilizer Project started in 1995 has the central goal of increasing fertilizer supplies by ensuring that a viable private sector comes into being, is built up, and becomes sustainable. Its proposals include promotion of fertilizer use by selecting, on a competitive basis, traders to operate in the more remote areas; and identifying and solving problems in the supply chain from imports to farmers.

**Conclusion**

Clearly, the way to get farmers to improve soil fertility is to address their constraints systematically and comprehensively, with clear understanding at each step. This can be done only by adapting technology to the farmer’s reality, and by developing the technology in the farmer’s field on the basis of close and continuous consultation. Ownership of the technology is key to adoption.

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