

Africa's Growing Soil Fertility Crisis: What Role For Fertilizer?

BY: JONATHAN AGWE, MICHAEL MORRIS, AND ERICK FERNANDES

ISSUE 21
MAY
2007

AFRICA'S SOIL FERTILITY CRISIS

Agriculture in Sub-Saharan Africa faces a growing soil productivity crisis. Unsustainable farming activities have severely depleted soil nutrients throughout much of the region (Sanchez 2002, FAO 2003). According to the International Fertilizer Development Corporation (2003), 22 kg of nitrogen, 2.5 kg of phosphorus, and 15 kg of potassium, on average, are lost annually per hectare of cultivated land. Fertilizer use in Africa meanwhile is by far the lowest of any developing region. Farmers apply about 9 kg/ha of fertilizer in Africa, compared to 86 kg/ha in Latin America, 104 kg/ha in South Asia, and 142 kg/ha in Southeast Asia (Kelly 2006). Fertilizer use in Africa has changed little during the past decade. Low fertilizer use and inappropriate land and water management contribute to Africa's lagging agricultural productivity growth and the related decline in food production per capita.

Reversing Africa's decades-long decline in soil productivity levels poses a major challenge, and one that cannot be addressed without increased use of appropriate fertilizer nutrients. The 2006 World Bank Africa Fertilizer Strategy

Assessment was undertaken to inform policy makers, providing them with guidelines on measures to effectively raise fertilizer use. The guidelines were developed following a review of past fertilizer promotion schemes in Africa and a survey of current knowledge about technical and economic aspects of fertilizer use. This Note draws upon the material prepared for the above fertilizer strategy assessment, summarizes the information on the approaches to enhancing fertilizer supply and use in Africa, and identifies some future steps.

APPROACHES TO IMPROVING SOIL FERTILITY

Organic Nutrients and Soil Amendments

Agricultural yields are likely to be sustainable when soil fertility levels are maintained. Soil nutrients removed when crops are harvested or lost through erosion and leaching must be replenished. In most of Africa, application of organic materials, such as animal and green manures and recycling crop residues, can replenish only some of the soil nutrients. However, these organic amendments play a crucial role in improving fertilizer use efficiency, and soil moisture conservation, especially when combined with conservation tillage practices that protect soil structure, reduce erosion and runoff, and promote soil biological functions important for soil productivity (see Box 1).

Inorganic Fertilizer

Organic fertilizers are an important resource in managing soil fertility and where possible should also be used to enhance the efficiency of inorganic fertilizers. Due to inadequate availability and competing uses (fuel, forage, etc.) organic fertilizers often need to be supplemented with inorganic fertilizers to sustain the levels of productivity and production required to feed Africa's rapidly growing population. Improving soil productivity in Africa will, therefore, require the increased use of inorganic or "mineral" fertilizers.





Box 1. Conservation Agriculture Based on Nutrient Bookkeeping

Conservation Agriculture (FAO 2001) is an integrated approach to enhance the consistency and efficiency of input use in smallholder farming systems. The goal of conservation agriculture (CA) is to maintain crop yields, improve resilience against drought and other hazards, and protect and stimulate soil biological functions. Blanket fertilizer applications are avoided in favor of targeted applications that supply crop needs and prevent the loss of existing soil nutrients. CA taps biological and geochemical sources of crop nutrients via nutrient cycling processes, including biological nitrogen fixation and the capture of deep nutrients beyond the reach of crop roots. Farmers can better target the application of costly mineral fertilizer nutrients by monitoring the status of nutrients on their fields with nutrient bookkeeping methods like the Nutrient Monitoring or “NUTMON” system used in Burkina Faso, Ethiopia, Kenya, and Uganda. These integrated and multidisciplinary methods involve a range of stakeholders in managing natural resources generally and soil resources in particular.

Source: Available at www.nutmon.org.

EXPERIENCE WITH FERTILIZERS IN AFRICA

Why Has Africa Not Experienced an Asian-Type Green Revolution?

African and Asian agriculture differ in a number of important respects: agro-climatic, social, economic, and institutional. Africa’s farming systems are generally more diverse than those found in Asia and include greater numbers of livestock (Crawford et al, 2006). They are impacted by variable rainfall and soils with inherently poor fertility. African farmers are less likely to enjoy access to input-output markets (World Bank 2006a). Africa’s low and stagnant labor productivity (World Bank 2006b) results partly from the poor health of rural populations, lack of traction, and mechanized agriculture. The lack of enabling economic and political environments has contributed to under-investment in agricultural research and development, infrastructure, and institutions.

Why Have Fertilizer Markets Failed to Emerge in Africa?

A number of features of African fertilizer markets serve to undermine incentives for private participation, producing market failures that lead to suboptimal fertilizer use:

a. Fertilizer demand: It has been observed that the demand for fertilizer varies across space and time. Potential suppliers are discouraged by the spatially dispersed demand, the small size of local markets, and seasonal variability in fertilizer use. Fertilizer demand can be quite strong for use on commercial crops (World Bank 2006c), particularly if producers enjoy access to

credit and guaranteed markets. For use on non-commercial crops, demand is generally weaker, and for several reasons. Chief among these are lack of knowledge, information asymmetries, liquidity constraints, risk and uncertainty, and high opportunity costs. Because fertilizers often represent a substantial share of production costs, low profitability tends to weigh heavily in farmers’ decisions about whether or not to use them. When cost factors and risk factors act in tandem, as they do in most rain-fed environments, the impact on fertilizer demand can be significant.

b. Fertilizer supply: Producing, importing, and transporting fertilizer all entail substantial economies of scale and low-cost procurement becomes difficult when markets are small and scattered. Transport costs are particularly high owing to generally poor road and rail infrastructure, and contribute to lower fertilizer use—particularly in landlocked countries (Gregory, et al. 2006, World Bank 2006d).

In the more successful fertilizer markets in Asia and Latin America, the promotion of fertilizer use has often been part of larger rural development programs in which complementary investments in agricultural research and extension, irrigation, roads, and marketing infrastructure made fertilizer use more profitable, facilitating the emergence of dynamic commercial input-output markets. In Africa by contrast, these complementary investments are often lacking and private input markets have yet to emerge on a large scale (Earthscan 2005, World Bank 2005a,b,c,d).

HOW TO FACILITATE INCREASED FERTILIZER USE

Relatively few African countries have access to the raw materials necessary to manufacture most types of fertilizer. Fewer still have domestic markets large enough to support efficient manufacturing facilities. Initiatives that promote fertilizer use, therefore, usually stress cost-effective importing. Another common strategy to make fertilizers more affordable to farmers is for governments to subsidize fertilizer prices. Subsidies are currently experiencing a resurgence in popularity, but experience suggests that subsidies are costly and narrowly focused on farmers, i.e., they do little to improve performance incentives for supply side actors, including traders and financial service providers.

A number of interventions (improved seeds, irrigation, and output prices) offer promise for encouraging efficient and sustainable fertilizer use in Africa. These interventions seek to directly or indirectly influence market prices and the medium- to long-term costs and benefits facing fertilizer producers and consumers. More fundamentally, they address the underlying structural constraints that undermine farmers' incentives to use fertilizer and producers' incentives to supply it.

Entry Points for Facilitating Increased Fertilizer Use

Possible demand side interventions include:

- strengthening soil-crop research and extension (via support to public agencies as well as public-private partnerships and sponsoring on-farm trials and demonstrations),
- improving farmers' ability to purchase fertilizer, improved seeds and other inputs (by improving access to credit, phased and incremental use via smaller and hence more affordable bags, and implementing laws that allow farmers to use risk-free collaterals for commercial loans),
- providing farmers with financial tools to better manage risk (by introducing instruments tailored to farmers' needs, like improved weather forecasting and weather-indexed crop insurance),
- improving quality and dissemination of market information (e.g., through public and private sector information systems easily accessed by farmers, building private sector capacity to assemble and disseminate market information on a commercial basis),
- protecting farmers against low and volatile output prices (e.g., by investing in measures to reduce produc-

tion variability like irrigation, drought-tolerant crops, and storage systems),

- empowering farmers by supporting producer organizations (e.g., through investment in rural education and offering farmers training in organizational management skills),
- improving the agricultural resource base so that use of fertilizer is more profitable (e.g., through soil and water conservation measures and irrigation infrastructure).

Possible supply side interventions include:

- producing/mixing fertilizers matched to local cropping conditions,
- reducing fertilizer sourcing costs (e.g., by lowering trade barriers to increase the size of national and regional markets, enabling importers and, eventually, manufacturers to capture economies of scale and scope),
- reducing distribution costs (e.g., by improving road and rail infrastructure to lower transport costs),
- strengthening business finance and risk management instruments (e.g., through credit guarantee schemes and innovative types of insurance),
- improving supply chain coordination mechanisms (e.g., through regulations relating to product grades and standards and market information systems that help reduce information costs).

While all of these measures can contribute to increased fertilizer use, none is likely to prove effective in isolation. Policy makers should, therefore, select strategic combinations of supply- and demand-side measures to allow supply and demand to grow in parallel—providing the basis for the emergence of viable private sector-led commercial fertilizer markets.

What Role for Fertilizer Subsidies?

Despite the drawbacks of fertilizer subsidies (World Bank 2006e)—high fiscal cost, difficult targeting, and crowding out of commercial sales—they continue to receive strong support, mainly from farmers but also from some policy makers. Arguments in favor of fertilizer subsidies are usually based on the role that fertilizers can play in achieving real productivity increases, reversing land degradation, raising farmers' incomes, alleviating poverty, and providing a means of emergency relief.

Three questions should be addressed in considering the appropriateness of subsidies as instruments for promoting

increased fertilizer use. First, can they bring economic benefits that exceed their costs? Second, are there circumstances when subsidies are justified to achieve social rather than economic objectives? Third, can “market-smart subsidies” (World Bank 2006a) improve targeting and provide greater incentives for private sector input market development?

While the long-term policy objective must be to support the emergence of viable private sector-led fertilizer markets, subsidies may stimulate increased fertilizer use in the short run—preferably as part of an integrated package of improved technologies. Subsidies that distort the relative price of fertilizer will encourage inefficient use. A number of market-smart subsidies have been used with varying degrees of success in Africa to promote increased use of fertilizer along with complementary inputs in ways that stimulate input market development without crowding out private investment. Examples include demonstration packs, vouchers, matching grants, and loan guarantees.

CONCLUSION

Declining soil fertility and falling agricultural productivity pose an enormous development challenge in Africa. Increased adoption of improved crop, land, and water management practices will be needed to stop and eventually reverse land degradation.

Reversing the soil productivity crisis in Africa requires increased but targeted use of fertilizers, which in turn will demand building sustainable private sector-led input markets. Progress in improving fertilizer distribution systems will be unsustainable without strong effective demand for fertilizer. Effective demand will be assured only if investment in fertilizer is profitable for farmers, which will happen only if they witness consistent crop productivity improvements and have access to reliable markets for selling their products at a profit. Strengthening fertilizer supply systems, therefore, cannot take place in isolation. Building input markets must go hand in hand with building output markets and improving farmer access to both, as well as mitigating the crop production risk factors (weather, disease/pest) faced by farmers.

REFERENCES

- Crawford, Eric W., T. S. Jayne, and Valerie A. Kelly. 2006. *Alternative Approaches for Promoting Fertilizer Use in Africa: Agriculture and Rural Development Discussion Paper 22*. World Bank, Washington, DC.
- Earthscan. 2005. *Halving Hunger: It Can Be Done. The Hunger Task Force Report on the UN Millennium Project Task Force on Hunger*. London.
- Food and Agricultural Organization (FAO). 2001. *Conservation Agriculture: Case Studies in Latin American and Africa*. FAO Soils Bulletin No. 78. FAO, Rome.
- Food and Agricultural Organization (FAO). 2003. *Assessment of Soil Nutrient Balance: Approaches and Methodologies*. FAO Fertilizer and Plant Nutrition Bulletin 14. FAO, Rome.
- Gregory, D. I. and B. L. Bumb. 2006. *Factors Affecting Supply of Fertilizer in Sub-Saharan Africa*. Agriculture and Rural Development Discussion Paper 24, World Bank, Washington, DC.
- International Fertilizer Development Corporation (IFDC). 2003. *Input Subsidies and Agricultural Development: Issues and Options for Developing and Transitional Economies*. IFDC Paper Series No. P-29. Muscle Shoals, Alabama.
- Kelly, Valerie A. 2006. *Factors Affecting Demand for Fertilizer in Sub-Saharan Africa: Agriculture and Rural Development Discussion Paper 23*. World Bank, Washington, DC.
- Poulton, Colin, Jonathan Kydd, and Andrew Dorward. 2006. *Increasing Fertilizer Use in Africa: What Have We Learned?: Agriculture and Rural Development Discussion Paper 25*. World Bank, Washington, DC.
- Sanchez, P. E.. 2002. *Soil Fertility and Hunger in Africa*. Science, 295: 2019-2020.
- World Bank. 2006a. *“Promoting Increased Fertilizer Use in Africa: Lessons Learned and Good Practice Guidelines.” Africa Region Fertilizer Strategy Assessment ESW Technical Report*. World Bank, Washington, DC.
- World Bank. 2006b. *Sustainable Land Management: Challenges, Opportunities and Tradeoffs*. The Agriculture and Rural Development Department. World Bank, Washington DC.
- World Bank. 2006c. *Factors Affecting Demand for Fertilizer in Sub-Saharan Africa: Agriculture and Rural Development Department Discussion Paper 23*. World Bank, Washington DC.
- World Bank. 2006d. *Factors Affecting Supply of Fertilizer in Sub-Saharan Africa: Agriculture and Rural Development Department Discussion Paper 24*. World Bank, Washington DC.
- World Bank. 2006e. *Fertilizer Subsidies for Africa: Lessons Learned and the Way Forward*. Draft Paper by Paul Thangata and Malcolm Blackie. The Agriculture and Rural Development Department. World Bank, Washington DC.

This note was prepared by Jonathan Agwe, Operations Analyst in the Agriculture and Rural Development Department of the World Bank, with input from Michael Morris, Lead Agriculture Economist for the Africa region of the World Bank, and Erick Fernandes, Land Management Advisor for the Agriculture and Rural Development Department of the World Bank. This Note is based on four Agriculture and Rural Development Discussion Papers cited in the list of references. The papers can be downloaded from www.worldbank.org/rural.

