FERTILIZER USE IN SUB-SAHARAN AFRICA: TYPES AND AMOUNTS

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Contents

Summary

The salient characteristics of fertilizer use in Sub-Saharan Africa (SSA) are (1) the extremely small quantities of both organic and inorganic fertilizers used, (2) the very low intensity (kg/ha) of use, and (3) the slow rates of growth in fertilizer consumption.

While many parts of the world are correctly concerned about the negative environmental impacts of excessive fertilizer use (eutrophication, salinization, aluminum toxicity, etc.), most of SSA is suffering the negative environmental consequences of too little fertilizer use (rapid loss of soil nutrients, inadequate production of biomass for recycling nutrients and soil organic matter, loss of forests and woodlands due to continuation of shifting cultivation, expansion of cultivation to marginal lands with a high propensity for erosion, etc.).

Aggregate fertilizer consumption in SSA will probably continue to grow slowly during the next five to ten years with inter-annual fluctuations in consumption remaining important in

many countries as they continue to struggle with economic reforms and programs to liberalization both input and output markets. Nevertheless, there is some evidence from individual country studies that both fertilizer demand and supply are becoming more dependable for specific cropping systems.

1. History of Fertilizer Use in Sub-Saharan Africa

The salient characteristics of fertilizer use in Sub-Saharan Africa (SSA) are (1) extremely small quantities of both organic and inorganic fertilizers used, (2) very low intensity (kg/ha) of use, and (3) slow rates of growth in fertilizer consumption.

1.1. Background

Historically, African agriculture has been characterized as a land-abundant production system. Under these conditions, farmers cultivated the same land for several years. Crop residues and animal manure were used by some to maintain soil quality, but most farmers relied on shifting cultivation rather than soil amendments to maintain yields. When yields declined, farmers cleared new land, allowing the previously cultivated land to lie fallow for ten to fifteen years.

During this fallow period, soil nutrients and soil organic matter were rebuilt. If the fallow period was extremely long, soil quality might have approached its pre-disturbance level, but this would have been an extremely rare situation. The more common case was a shorter fallow period followed by another cycle of cultivation without application of fertilizers—all of this leading to a secular decline in soil quality.

During the last few decades, SSA has experienced some of the highest population growth rates in the world (3 to 4% per annum). Rapid population growth has placed heavy demands on arable land in SSA where 50 to 90% of the population (depending on the country) rely on agriculture for their livelihood.

Consequently, many parts of SSA are now considered land-constrained because population densities are too great for farmers to allow their land to lie fallow for 10-15 years.

Although information on fallows is not abundant, scattered evidence suggests that current fallows rarely exceed 2 to 3 years—a period that is much too short to rebuild soil quality. Unfortunately, the decline in fallows has not been accompanied by the necessary increase in use of fertilizers (both organic and inorganic) to maintain soil quality and yields.

1.2 Quantities of Fertilizer Consumed

Overall, the entire African continent (including North African countries and South Africa) accounts for only 2 to 3% of world fertilizer consumption; the share for SSA is generally less than 1%. Figure 1 shows trends in aggregate fertilizer use for each of the five agro-ecological regions of SSA from 1961 through 1998 (for a break-down of the Regions, see the Glossary).

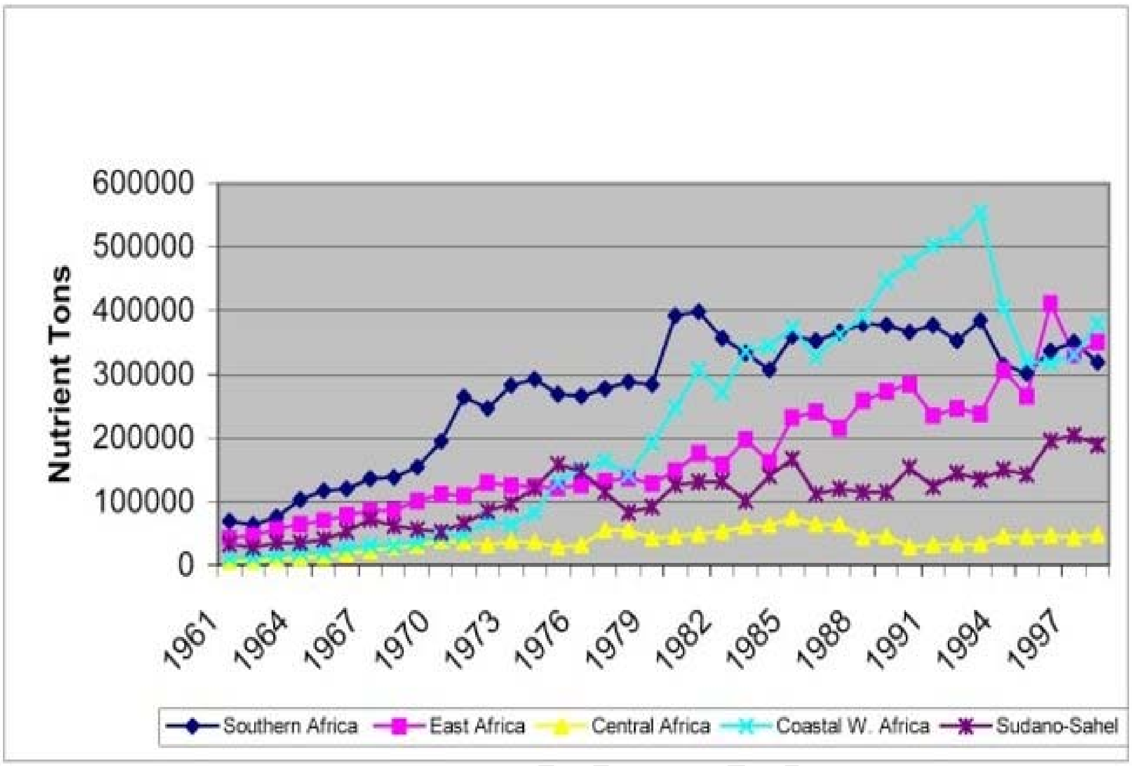

Figure 1. SSA fertilizer consumption: 1961-1998

During these four decades the Central African Region and the Sudano-Sahelian countries have generally consumed less fertilizer than other regions while the Southern and Eastern African regions consumed more.

Although Coastal West Africa had very low consumption during the 1960s, there was strong growth during the 1970s and by the late 1980s it was consuming more than either East or Southern Africa.

All regions except Central Africa experienced some sustained growth in fertilizer consumption between the late 1970s and the early 1990s. However, average SSA growth rates (about 7%) remain well below those in other regions of the world with rapid growth in agricultural productivity (e.g. 11% for Asia and 22% for south-east Asia from 1970-1995).

These regional figures mask a great deal of variability among SSA countries. For example, from 1991 to 1995 four countries (Ethiopia, Kenya, Nigeria, and Zimbabwe) accounted for 60% of all SSA fertilizer consumption. On a regional basis, Cameroon accounted for 69% of Central Africa's 1991-1995 consumption, and Nigeria for 82% of the Coastal West African consumption.

1.3. Intensity of Fertilizer Use

Figure 2 examines the intensity of fertilizer consumption by region for the last three decades. Intensity of use is represented by estimates of kilograms of fertilizer used per hectare of arable land (including land in permanent crops).

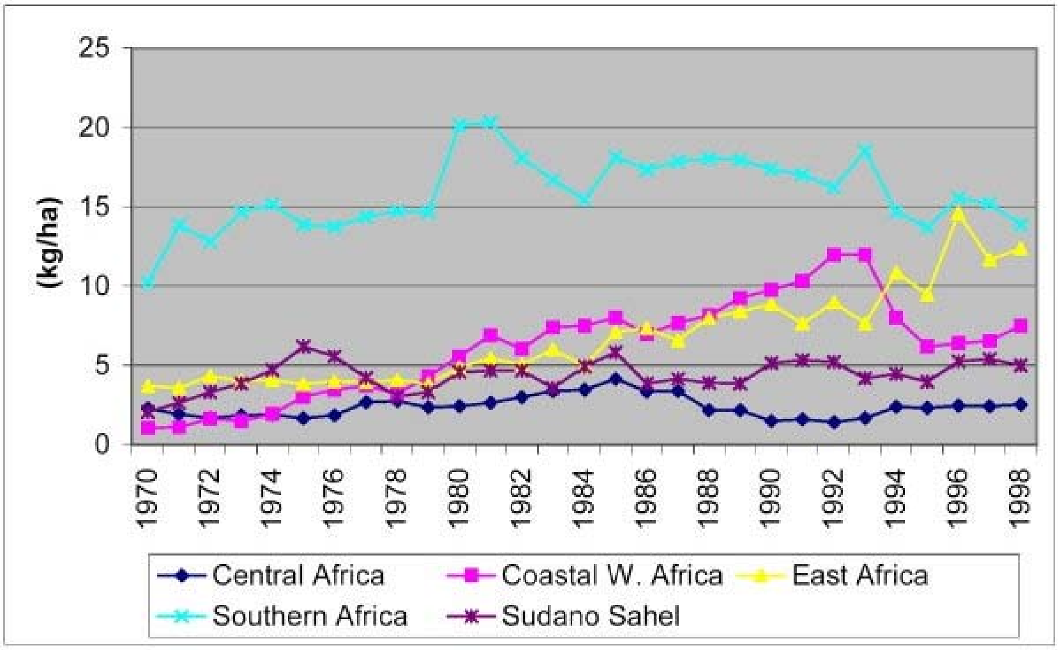

Figure 2. SSA intensity of fertilizer use: 1961-1998

Southern Africa (ranging from 10 to 20 kg/ha, depending on the year) is well ahead of the other regions; but the gap has been closing, with East Africa a close runner-up since the beginning of the 1990s (range of 10-15 kg/ha).

The Central African region and the Sudano-Sahelian countries remained below 5 kg/ha du

ring most of the period while Coastal West Africa has been in the 5-12 kg/ha range since the early 1980s. Some of these regional averages are heavily influenced by individual country observations.

For example during the 1991-1995 period, the sugar-producing Mauritus had an extraordinarily high rate (by SSA standards) of 259 kg/ha while Uganda had a very low rate of 0.20 kg/ha.

Overall, the average intensity of fertilizer use throughout SSA (increasing from 3 kg/ha in 1970 to 10 kg/ha in 1995 and then declining to 9 kg/ha in 1997) remains much lower than elsewhere (e.g. 54 kg/ha in Latin America, 80 kg/ha in South Asia, and 87 kg/ha in Southeast Asia).

1.4. Types of Fertilizers Used

The nutrient content of fertilizers consumed in SSA has remained relatively constant over time (Figure 3). Nitrogen represents the most important nutrient, accounting for about 52% of consumption from year to year. Phosphorus has increased slightly from about 26% to about 30%, and potassium has declined from about 22% to 18%.

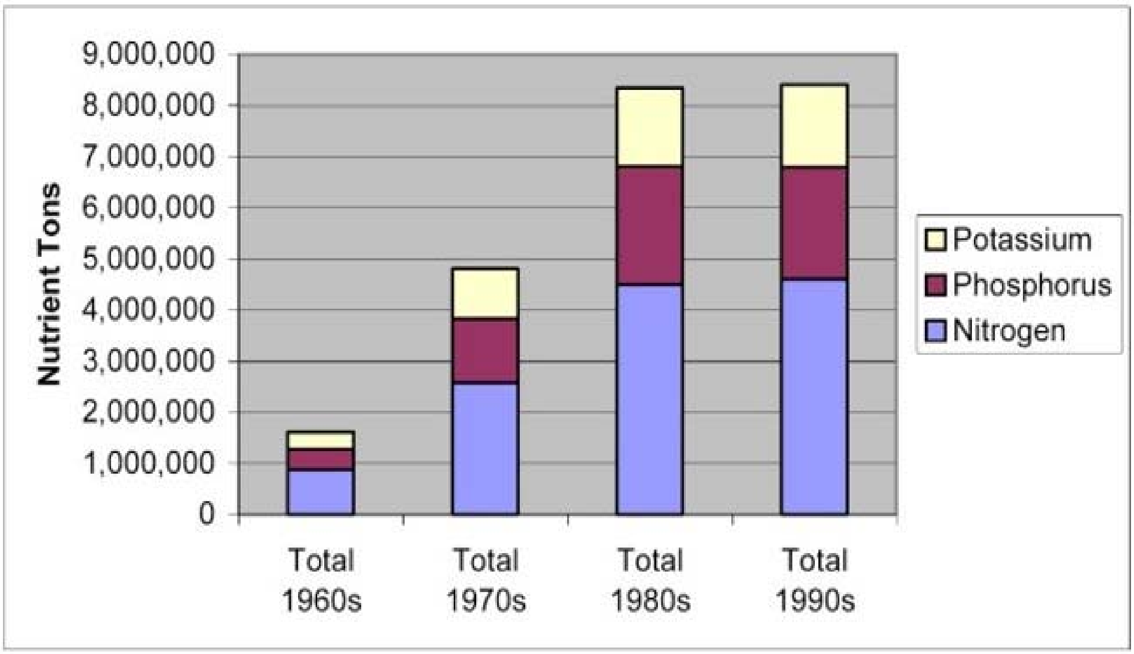

Figure 3. SSA fertilizer consumption trends by nutrient

Data available on different types of fertilizers consumed (e.g., DAP, MAP, urea, NPK complexes, etc.) are very patchy across countries making it difficult to say with certainty if changes have occurred in the types of fertilizers used.

In many SSA countries, fertilizer supplies are often provided as in-kind aid by bilateral donors (e.g. Japan or European countries) who tend to send NPK complexes. Since the 1980s, however, some countries have begun importing higher analysis fertilizers such as DAP and urea.

Figure 4 shows that urea consumed in 1995 was six times greater than that consumed in 1970.

As total nitrogen consumption in the 1990s was only two times what it was in the 1970s (Figure 3), this six-fold increase in urea probably represents a switch from reliance on NPK complexes and lower-analysis nitrogen fertilizers.

Figure 4 also shows that the relative importance of countries consuming urea has changed dramatically with time. In 1970, Sudan accounted for almost 90% of SSA's urea consumption, but in 1995 it represented about 15%, with approximately 40% being consumed by Côte d'Ivoire, Nigeria, and Zambia and the remaining 45% being distributed across a broad spectrum of other SSA countries.

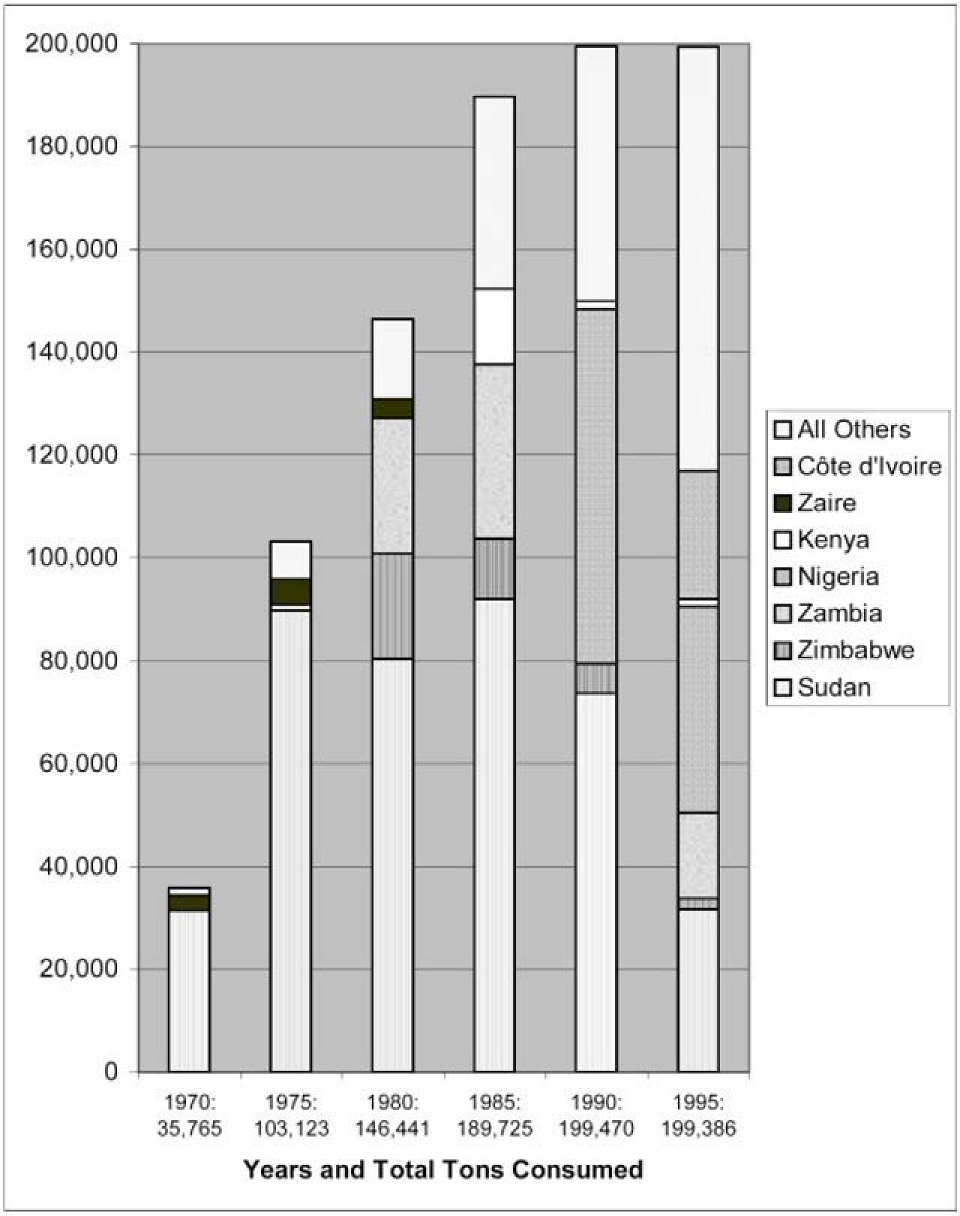

Figure 4. Evolution of SSA urea consumption

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Bibliography

Bumb, B. and C. Baanante. (1996). The Role of Fertilizer in Sustaining Food Security and Protecting the

Environment to 2020. Food, Agriculture, and the Environment Discussion Paper 17. International Food Policy Research Institution, Washington, DC. [Overview of problems and prospects for increasing fertilizer use in SSA with a focus on policy issues.]

Buresh, R., P. Sanchez, and F. Calhoun (1997). Replenishing Soil Fertility in Africa. Special Publication Number 51, Soil Science Society of America and American Society of Agronomy, Madison, WI. [Proceedings of an international symposium held in 1996; document provides extensive review of current state of knowledge about replenishing soil fertility in SSA and contains many additional references to scientific works dealing with the topic.]

Naseem, A. and V. Kelly (1999). Macro Trends and Determinants of Fertilizer Use in Sub-Saharan Africa. Michigan State University International Development Working Paper No. 73, E. Lansing, MI. [Presents detailed discussion of determinants of fertilizer consumption in SSA, showing changes in relative importance of some determinants over time.]

Weight, D. and V. Kelly (1999). Fertilizer Impacts on Soils and Crops of Sub-Saharan Africa. Michigan State University International Development Paper No. 21, E. Lansing, MI. [Detailed discussion of the positive and negative impacts that fertilizers can have in SSA and argues for a soil fertility approach that combines organic and inorganic fertilizers with appropriate management practices.]

Yanggen, D., V. Kelly, R. Reardon, and A. Naseem (1998). Incentives for Fertilizer Use in Sub-Saharan Africa: A Review of Empirical Evidence on Fertilizer Yield Response and Profitability. Michigan State University International Development Working Paper No. 70, E. Lansing, MI. [Presents a detailed review of SSA fertilizer response data with comparisons to other parts of the world and synthesizes evidence of fertilizer profitability in SSA.]

Biographical Sketches

Valerie Kelly is Associate Professor for International Development in the Department of Agricultural Economics at Michigan State University. Her research has focused on agricultural productivity issues in sub-Saharan Africa, particularly the development of policies that promote adoption of improved soil fertility management practices. She is editing a 2003 issue of the journal *Food Policy* on input use and market development in sub-Saharan Africa and has contributed to several MSU International Development Papers dealing with soil issues available at http://www.aec.msu.edu/ agecon/fs2/. She has also published several book chapters and journal articles dealing with input use and soil fertility issues in Rwanda, Mali, and Senegal.

Anwar Naseem is a Research Associate in the Department of Agricultural, Food, and Resource Economics at Rutgers University. His current research interest is focused on understanding the generation, transfer and impacts of innovation in agricultural biotechnology. He is especially interested in how public and private research sectors interact and affect innovative activity, industry structure, patent rights, and access to technological inputs in biotechnology. He also maintains an active interest in production and environmental economic issues in developing country settings, particularly those relating to estimating the distribution of benefits (both environmental and economic) from the adoption of new technologies. He received a Ph.D. in agricultural economics from Michigan State University and a M.S. from the University of Pennsylvania.