

INTRODUCTORY COMMENTS
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On the Need to Restore Soil Fertility in Sub-Saharan Africa

* Africa's agricultural environments--especially the forest and transition areas--are fragile ecological systems, where deeply weathered, often shallow, tropical soils lose fertility rapidly under repeated cultivation.

* Since the end of World War II, advances in medicine have dramatically reduced epidemics and death rates, especially among the young, and thereby contributed to rapidly expanding populations and food requirements. The resulting increase in demand for food has led to a shortening in the traditional bush/fallow periods previously used to restore soil fertility and has also pushed many farmers onto more marginal lands.

* With more continuous cropping on the rise, nitrogen and organic material are being rapidly depleted while phosphorus and other nutrient reserves also are being depleted slowly but steadily.

* The loss of soil fertility is having disastrous indirect environmental consequences, such as serious erosion and alarming invasions of parasitic weeds like *Striga* spp, commonly called "witchweed" which is spreading throughout tropical Africa. Worsening shortages of wood as fuel for cooking and heating has led to increased use of crop residue and animal dung for fuel, thereby further accelerating the loss of soil fertility.

* The cereals--maize, sorghum, rice, wheat, barley--essentially "mine" the soil, taking up plant nutrients and converting them to grain and fodder. Nitrogen is the most yield limiting plant nutrient worldwide, with N uptake essentially linear with increasing grain yield.

* Phosphorus is the second-most limiting plant nutrient for cereal production. Without supplemental applications of phosphorus, especially in soils with a high capacity for immobilizing or "fixing" phosphorus, deficiency of this nutrient will hold back crop yields.

* Deficiencies of potassium, sulphur and various other macro-nutrients and micro-nutrients will hold back cereal yields, and will do so increasingly in future years as production becomes more intensified.

* The advent of cheap and plentiful chemical fertilizers and widespread diffusion has been one of the great agricultural breakthroughs of this century, especially since the end of World War II.

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* Even in China--which historically has made the best use of recycled organic matter, manure and night soil in the world--huge investments have been made in chemical fertilizer facilities. Currently, China is one of the largest producers and consumers of chemical fertilizers, whereas three decades ago it consumed virtually no chemical fertilizer. The widespread use of chemical fertilizers has contributed immensely to the spectacular increase in China's agricultural production within the past two decades. Virtually all Chinese farmers now use these products.

* Fertilizer is much more than just another factor of production in agriculture. Fertilizer is plant food and plants--like humans--don't grow very well without adequate nutrition.

* Properly applied, chemical fertilizers do not harm human or wildlife health. Moreover, because they increase plant biomass, fertilizers help to improve tropical soils by increasing the vegetative cover thus reducing erosion, and by increasing organic material content in the soil itself.

* Timing is of critical importance in fertilizer use. Nutrients must be applied on time and in the right way. This means that the fertilizer distribution system must work efficiently and farmers must be taught the fundamentals of plant nutrition and fertilizer use.

* However, the application of NPK fertilizers alone--in the absence of complementary crop management measures--can be economically counter-productive, especially in soils already very low in organic matter and subject to heavy leaching. Clearly, the use of green manure crops and grain legumes in rotations with cereals and roots and tubers are very important practices to maintain and improve, wherever possible, soil fertility as well as to help control weeds, diseases, and insects.

* Unless there is a radical change in food production trends, sub-Saharan Africa faces the prospect of enormous food deficits by the end of the decade, on the order of 40-50 million tons per annum, representing 25-30% of total domestic food requirements.

* There is no way that the nations of sub-Saharan Africa can cope with such huge deficits in basic food supplies. They have neither the money to buy, nor the infrastructure to move such quantities. Famine will be rampant; political and social order will collapse.

* Sub-Saharan Africa has the lowest fertilizer-use rates in the world. Presently, this region uses only 1/35 of the per hectare nutrient consumption of Europe or the U.S. Corn Belt, 1/10 the per hectare fertilizer consumption of Asia and 1/6 the consumption of Latin America.

* Chemical fertilizers have permitted the densely populated nations of Asia to better feed their burgeoning populations and to lower the real cost of food, benefitting the rural as well as urban poor.

* For every kilogram of the right fertilizer nutrient applied properly and on time, a modern improved cereal crop variety will produce 15-20 kg. of grain under moderately favorable environmental conditions.

* Governments must urgently establish master plans to develop national fertilizer sectors. A tripling in use rates must occur during the 1990s. To achieve their intended benefit, fertilizers must be distributed on time and within the reach of the majority of farmer-clients.

* Given incomplete farmer knowledge on the proper use of fertilizers, poorly developed transportation networks, the poverty of resource-poor farmers, and the environmental benefits of improved soil fertility, governments should subsidize the farmgate cost of fertilizer to promote greater--as well as proper and careful--use.

On the Importance of Modern Crop Varieties

* Agricultural development in sub-Saharan Africa will be retarded through the continued reliance on traditional unimproved varieties. These varieties have evolved on nutrient-depleted soils and generally have a low genetic grain yield potential due to unfavorable grain-to-stover ratios. When soil fertility is restored, most indigenous varieties respond poorly and manifest various structural, physiological, and pathological weaknesses.

* National and international agricultural research institutes have developed many modern varieties of the major cereals, grain legumes, and roots and tubers. These improved cultivars have increased yield potential, greater disease resistance, greater tolerance of environmental stress and improved nutritional quality. Those varieties that have been proven superior on farmers' fields, must be made available to farmers without delay.

* Sub-Saharan Africa has the lowest use rates for modern varieties in the world. Asia and Latin America have over two-thirds of their rice, wheat and maize areas planted to modern varieties.

* In contrast, with the exception of a handful of countries--South Africa, Zimbabwe, Kenya and Zambia--modern cereal varieties are used on less than 20% of the total area planted to cereals in sub-Saharan Africa.

* For modern cultivars to reach the farmer in sub-Saharan Africa, government must give high priority to developing their seed industry policy. The goal should be to provide a continuing stream

of the right kinds and amounts of quality seed to the majority of farmers on time and at accessible prices.

On the Importance of Crop Management Practices on the Cost Efficiency of Utilization of High Yielding Varieties and Chemical Fertilizers

* Appropriate crop management practices, including the choice of a well-adapted, disease-resistant, high-yielding variety, proper timing and application of the right kind and amount of fertilizer, proper date of planting, adequate stand and spacing of seedlings and timely control of weeds (and insect pests, if they become epidemic), are all essential toward obtaining best returns on expenditures for seed of improved varieties and fertilizer. The use of either or both a high-yielding variety and/or fertilizer without the use of good crop management, is a recipe for giving disappointing crop yields and poor economic returns.

Enhancing Food Production, Farm Family Income and Nutrition by Expanding Cultivated Area

* Unlike many Asian countries, (e.g. Bangladesh, China, India) where there is little additional land suitable for agriculture that can be brought under cultivation to increase farm size and family income, most African countries South of the Sahara still have much potentially arable but currently uncultivated land.

* Unfortunately, the hand tools--cutlass (machete) and hoe--generally restrict the area that can be cultivated by a family to about one hectare. While major emphasis must be given in the near term, to increasing yields through the application of improved production technology on the land now under cultivation with hand tools, during the next decade a program should be established to increase the use of animal power (especially oxen) so that the small farmer can expand his cultivated area to 3 to 4 hectares. It will be no small task to introduce trypanosome tolerant cattle and their use as draft animals into tsetse fly infested areas now devoid of livestock, and, consequently, where animal husbandry is unknown. Such a transformation would not only increase crop production and family income, but also provide better nutrition by also providing milk and meat.

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