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# FOOD, FARMING, AND THE FUTURE: IMPERATIVE FOR STABILIZATION OF TRADITIONAL AGRICULTURAL SYSTEMS

by

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# FOOD, FARMING, AND THE FUTURE: IMPERATIVE FOR STABILIZATION OF TRADITIONAL AGRICULTURE SYSTEMS

More than thirty years have passed since northern hemisphere nations in their role chiefly as colonial powers began seriously to consider agricultural problems of the developing countries. Over that period those problems have been recognized for their complexity and intimate involvement with the environment and with many aspects of the social and economic life of the people. Suggested approaches to increasing agricultural production in the developing world have ranged from blanket, naive application of Western techniques and technology to despair and belief that the problem lies beyond the capability of mid-latitude science. Numerous agricultural schemes and programs have been introduced especially since World War II, but they have given woefully little consolation that we are moving toward solutions to the vexing questions that surround sufficiency of food in the future.

In plans and prospects focusing on food and the future, minimum attention has been directed toward traditional food production systems, the role of folk agriculture in economic development, and possible ways of working within those systems to upgrade rather than replace them. Although we recognize the importance of traditional or smallholder agriculture,[1] our knowledge of those systems is rudimentary at best, yet it appears they will have to bear primary responsibility of providing essential foodstuffs in developing areas over the next

[1] N. Islam (ed.), Agricultural Policy in Developing Countries (New York: John Wiley & Sons, 1974), pp. xv-xix.

century or so. Despite considerable applied and experimental effort on the parts of both colonial and independent governments, no superior agricultural systems have been forthcoming to replace those traditional to developing areas of the wet and dry tropics; extant agricultural systems of the developing areas are the result of meshing over thousands of years of social, religious, and economic elements with plants and animals in a variety of environmental circumstances. The green revolution, even if successful, does not represent a new system; it is merely the genetic manipulation and chemical stimulation of selected economic plants long familiar to man the cultivator.

Traditional agriculture accounts for a significant segment of the population of developing areas. Half the world's farmers are involved in traditional agricultural economies[2] and, in contrast with developed countries, it is estimated that between the years 1960 and 2000 the agricultural population in developing countries will rise from 920 million to 1480 million.[3] In the developing areas of Africa 80% or more of the population is rural and connected chiefly with agriculture. Numbers of people, social and economic circumstances needing attention, and present and future foodstuff needs of a growing population, all suggest that traditional agricultural systems need fullest attention in our quest for food in the future.

Traditional agriculture cannot be isolated from a full range of factors that bear on it and that are tightly intertwined with it.

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[2]C. R. Wharton, Jr., Subsistence Agriculture and Economic Development (Chicago: Aldine Publishing Co., 1969), p. 19; also T. Shanin, Peasants and Peasant Societies (Baltimore: Penguin Books, 1971), p. 17.

[3]T. Kristensen, "The Approaches and Findings of Economists," International Journal of Agrarian Affairs, Vol. 5 (1967), pp. 130-156.

Some factors are international and lie beyond the reach of single nations; rising cost of fuel and fertilizer impacts differentially on developing countries, but it eventually reaches the cultivator in the field. Other factors are regional; people moving to the Guinea coastal states to avail themselves of work and wage opportunities bring about manpower loss to the rural, interior areas. Still other factors come within the purview and jurisdiction of single countries, such as urbanization, market infrastructure, or wage differentials between rural and urban areas.

This paper examines the importance of traditional agriculture in the developing countries of West Africa. Stabilization of traditional agriculture is imperative to meet the need of food in the future in this region, and at the same time it may also aid in resolution of other concurrent problems such as rapid urbanization and under- or unemployment. Rural and national economic development cannot go forward without due regard to the underpinnings of that sector of the economy which affects such a large proportion of the population.

## FOOD IN THE FUTURE

Africa fortunately has not had to face the magnitude of food insufficiency that has troubled southern Asia. Yet, large areas of Africa, such as the Sahel, are subject historically to drought conditions resulting in famine and suffering both for man and his animals. The most recent Sahelian drought of the late 1960s and early 1970s has dramatically caught the attention of the world

although it may have been no more severe than the dry cycle of the early 1920s. Dimensions of human suffering are perhaps more severe in the recent drought as the result of movements of people into the desert margins under governmental encouragement and international aid programs,[4] but the ubiquitous and effective news media have dramatized the situation and for the first time the world is aware of the environmental zone called the Sahel. It should be remembered, however, that the word Sahel derives from the Arabic term meaning "border," a connotation connecting it with the Sahara Desert but which should also be extended to its marginality for human occupancy!

Africa is not free from concern for sufficient food, however, and some of its problems in this respect stem from what Rene Dumont called "false starts."[5] Inappropriate colonial ventures do not, however, explain the whole of the food problem confronting the continent. Total food production in Africa has increased at an annual average rate of about 2.5% between 1952 and 1972.[6] On the other hand, per capita output of foodstuffs over the continent during the same period barely rose at an annual average rate of 0.2%, while at the same time per capita production of food for West African countries in 1972 may have dropped as much as 15% below a 1961-65 average as the result of the severe drought in the Sahelian zone.[7] The reasons for the negligible

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[4] J. C. Caldwell, "The Sahelian Drought and Its Demographic Implications," Overseas Liaison Paper No. 8, American Council on Education (Dec. 1975), pp. 17-23; also, E. P. Eckholm, Losing Ground: Environmental Stress and World Food Prospects (New York: Norton & Co., 1976), pp. 58-66.

[5] R. Dumont, False Start in Africa (New York: Praeger Publishers, 1966), especially chapters 3 and 4.

[6] 1974 Report on The World Social Situation (New York: United Nations, 1975), p. 210.

[7] U. Lele, The Design of Rural Development: Lessons from Africa (Baltimore: Johns Hopkins Press, 1975), p. 4.

increase in per capita food production are known, and they should be kept clearly in mind. Annual rate of population increase in Africa averages 2.7% and for West Africa it is 2.6%.[8] Thus, population increase over the past two decades has paralleled growth of agricultural output and consequently per capita production has not changed appreciably. Although African governments have recognized the necessity for more effort to raise agricultural output, limited attention and limited success are thus far the results of these efforts.

Africa cannot afford to permit increase in agricultural production barely to match its population growth. Recent data indicate that Africa is deficient by about 7% in dietary energy supplied its population (Table 1). These data mask variable dietary intake among different socio-economic groups and between urban and rural populations, and they obscure dietary problems of that portion of the population hit by famine as the result of climatic disasters or other reasons. Thus, significant portions of the population have caloric intake well below the average for the continent as a whole and nutritional levels ofttimes lie at or below the subsistence threshold.

The protein requirement in recent years has been adjusted downward by one-third[9] and protein intake in Africa is now considered adequate (Table 1). However, if caloric intake is insufficient, as is the case for Africa as a whole and as is undoubtedly true among certain portions of the population affected by catastrophic disasters, protein is

[8]Demographic Yearbook 1974 (New York: United Nations, 1975), Table 2.

[9]1974 Report on The World Social Situation, footnote 6, p. 212.

Table 1. Available Supplies of Dietary Energy and Protein in 1965 and 1970 Expressed as Percentage of per capita Nutritional Requirements

| Region | Daily per capita requirements[a] | | Available supplies | | | |
|---|---|---|---|---|---|---|
| | | | 1965 | | 1970 | |
| | Energy (kilo-calories | Protein[b] (grams) | Energy | Protein | Energy | Protein |
| | | | (percentage of requirements) | | | |
| World | 2,380 | 38.7 | 100 | 169 | 101 | 173 |
| Developed countries | 2,560 | 39.5 | 116 | 221 | 121 | 229 |
| Developing market economies | 2,280 | 38.4 | 93 | 142 | 96 | 147 |
| Africa | 2,330 | 41.5 | 92 | 140 | 93 | 141 |
| Asia and the Pacific | 2,220 | 36.6 | 89 | 135 | 93 | 141 |
| Latin America | 2,380 | 37.7 | 104 | 169 | 106 | 172 |
| Western Asia | 2,460 | 45.5 | 94 | 145 | 97 | 147 |
| Asian centrally planned economies | 2,355 | 38.3 | 86 | 151 | 88 | 153 |

[a]Revised standards of average requirements (physiological requirements plus 10 per cent for food wastage at household level).

[b]Provisional data expressed in grams of local protein, i.e., adjusted for protein quality differences in national diets as compared with an "ideal" or reference protein.

Source: 1974 Report on the World Social Situation. 1975. (New York: United Nations)

catabolized for energy. Furthermore, it is assumed that the population is healthy and, therefore, that full utilization of protein occurs. Under disease and parasite load, protein demand increases greatly; under these circumstances protein surplus is much reduced and it may, in fact, be deficient. Moreover, the kind of protein consumed is significant. Animal protein supplying all nutritionally essential amino acids accounted in 1967 for more than one fourth of total protein intake in only three African countries, none of which were in West Africa.[10]

Foodstuffs account for a significant proportion of the total value of imports into African countries. Eight selected countries in West Africa, four of which are coastal and five of which might be considered within the Sahel and Sudan zones, indicate that foodstuffs approximate 10% to 30% of the total import value (Table 2). The percentage of foodstuffs imported into the more affluent countries over the past few years has remained steady or risen; economic stability and growth in Nigeria and the Ivory Coast are manifest in sizable and increasing importations of food.

Among less affluent countries in West Africa the amount of foodstuffs imported varies from year to year, a reflection of fluctuating commodity prices and foreign exchange available to purchase items on the world market. Yet, the value of foodstuffs for countries whose economies are not so strong is strikingly high (Table 2); Sahelian countries appear to expend 10% to 20% or more of their foreign exchange on food imports.

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[10] World Economic Survey, 1969-1970 (New York: United Nations, 1971), p. 48.

Table 2. Percentage Value of Wheat and Food Imports For Selected Countries in West Africa, 1968-1973*

| Country | Year | Wheat as percent of total food imports | Food as percent of total commodity imports |
|---|---|---|---|
| Nigeria | 1968 | 24.1 | 7.4 |
| | 1969 | 41.2 | 8.3 |
| | 1970 | 26.6 | 7.6 |
| | 1971 | 23.5 | 8.1 |
| | 1972 | 23.1 | 9.6 |
| | 1973 | 29.5 | 10.3 |
| Ivory Coast | 1968 | 14.5 | 12.5 |
| | 1969 | 11.4 | 11.7 |
| | 1970 | 15.5 | 12.6 |
| | 1971 | 5.6 | 12.4 |
| Sierra Leone | 1968 | 10.3 | 17.5 |
| | 1969 | 12.0 | 16.4 |
| | 1970 | 12.5 | 21.5 |
| | 1971 | 13.4 | 19.2 |
| | 1972 | 14.8 | 17.5 |
| | 1973 | 18.0 | 24.0 |
| Senegal | 1968 | 9.0 | 34.8 |
| | 1969 | 11.9 | 31.6 |
| | 1970 | 16.9 | 26.1 |
| | 1971 | 14.5 | 29.2 |
| | 1972 | 11.8 | 25.7 |
| Mali | 1968 | 14.4 | 18.0 |
| | 1969 | 9.5 | 14.2 |
| | 1970 | 10.7 | 26.9 |
| | 1971 | 9.7 | 25.6 |
| Upper Volta | 1968 | 21.5 | 18.7 |
| | 1969 | 18.4 | 16.9 |
| | 1970 | 25.0 | 17.3 |
| | 1971 | 26.9 | 17.6 |
| | 1972 | 22.7 | 19.1 |
| Niger | 1968 | 15.9 | 8.4 |
| | 1969 | 10.4 | 9.4 |
| | 1970 | 25.6 | 10.6 |
| | 1971 | 15.7 | 9.6 |
| Chad | 1968 | 39.4 | 10.3 |
| | 1969 | 14.2 | 16.3 |
| | 1970 | 10.9 | 15.7 |
| | 1971 | 15.2 | 15.6 |

Source: Computed from data in Yearbook of International Trade Statistics 1974, Vol. I (New York: United Nations, 1975)

* Data not available through 1973 for some countries.

Even more noteworthy is the significance of luxury and prestige commodities. Wheat, which has become increasingly valued especially in urban areas, accounts for 10% to 40% of the value of all food imports. Nigeria between 1970 and 1973 quadrupled its tonnage imports of unmilled wheat while increasing the value of its foodstuff imports by 240%; during the same period the value of all Nigerian imports, both food and nonfood, rose only by 75%.[11] Worldwide demand for wheat in recent years has risen sharply as the result of shortfalls in production in the U.S.S.R. and elsewhere, and countries with weak economies now face competition in the open market for wheat stocks that are scarce and demand high prices.[12]

Continued rapid urbanization and rising expectations of the population will likely increase demand for import of prestige foods. Further, agricultural output has barely kept pace with population increase, and foodstuff importation can be expected to continue to supply part of national needs. It will be recalled that energy intake in Africa as a whole is deficient by about 7%, and thus it is not likely that food imports can be cut greatly without damage to the nutritional wellbeing of the population. At the same time, however, the cost of food imported diverts foreign exchange that could be used in many other ways for economic development.

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[11] Yearbook of International Trade Statistics 1974 (New York: United Nations, 1975).

[12] L. R. Brown, "The World Food Prospect," Science, Vol. 190 (12 Dec. 1975), pp. 1053-1059.

## FARMING FAILURE

Colonial history and more recent history of independent African states are strewn with the wreckage of unsuccessful attempts to introduce large-scale agricultural schemes. Perhaps one of the best studied projects is that of the Office du Niger in Mali, a scheme designed to raise cotton as a cash crop and rice for subsistence on the alluvial soils of the inland Niger Delta.[13] Originating in 1919 and with pilot projects giving indication of success, the general development of the Middle Niger basin commenced in 1931. Nearly one million hectares were to be irrigated and this sparsely populated area was to be an island of prosperity by transferring farm families from more heavily populated areas then under French control.

The Office du Niger project experienced major problems from its inception. By the mid 1960s the hydraulic infrastructure was irrigating approximately 50,000 hectares and not the several hundreds of thousands as originally envisioned. Administrative overhead has been disproportionately high, and living conditions in the development have never attracted farmers as was anticipated. As a result, the Office has shifted back and forth between direct farming with wage labor and family farming by settlers. Yields of cotton and especially rice have been low, although efforts at intensification did improve output of cotton crops more than that of rice. Labor constraints led to rapid mechanization after World War II. By the mid 1950s it was evident

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[13] J. C. de Wilde, Experiences with Agricultural Development in Tropical Africa, Vol. II (Baltimore: Johns Hopkins Press, 1967), pp. 245-300.

that the experiment with mechanization had not proved successful because of exorbitant costs of the machinery itself and because of unwise use of it by farmers simply wishing to relieve themselves of work. Despite economic failure and a host of problems that emerged, the Office du Niger continued to expand in part because of available external financing.[14] Failure does not sound the death knell of such operations; as with bureaucratic operations anywhere in the world, such projects, once initiated, show amazing resiliency and longevity!

Large-scale, mechanized agricultural schemes that dot the African map have had little impact on the rural masses or traditional agricultural systems. Nevertheless, 70% of the land and 60% of the labor involved in African agriculture are involved in subsistence production,[15] a rather significant portion likely to remain in the coming decades. Undue attention to massive agricultural projects necessarily lessens effort and concern directed toward traditional agricultural systems; however, some institutions, such as the International Institute of Tropical Agriculture in Ibadan, Nigeria, have commenced programs aimed specifically at traditional agricultural practices and the systems involved.

Emphasis on large, mechanized farms at the expense of traditional systems creates further problems. In the cotton development scheme in Fana, Mali, export crop specialization resulted in a low ratio of food crop area to cotton area. With failure of rains during the 1971-72 season, food crop production declined considerably and farmers

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[14] J. C. de Wilde, footnote 13, p. 291.

[15] J. C. de Wilde, Experiences With Agricultural Development in Tropical Africa, Vol. I (Baltimore: Johns Hopkins Press, 1967), p. 21.

discovered they did not have enough food to carry their families and migrant seasonal labor through the off season.[16]

In a groundnut and cotton scheme in Upper Volta, rapid expansion of commercial crops has been achieved by simultaneous introduction of high-yielding sorghums that release land for alternative uses.[17] However, these new sorghums are less drought-resistant than their traditional cousins, and they therefore expose the cultivator to greater risk when rains are inadequate. For the wealthy few who can irrigate their crops or who can afford to take the risk, this technical deficiency is acceptable. For the much greater number who can do neither, but who nonetheless want to increase their income, the risks are huge. If the rains fail, the cash crop and the subsistence crop are both lost, and for this reason it will be surprising if, after the recent Sahelian drought, the high-yielding sorghums have retained their place in subsistence cropping of the area. Thus, rural development can raise incomes, but it also greatly raises the uncertainty of those incomes and it may jeopardize critical food supplies.

Problems of insuring food supplies are frequently exacerbated by pricing and marketing policies of governments. Mali during 1972 and 1973 experienced large cereal deficits in urban areas and during those years imported large quantities of grain.[18] Yet, the government was unable to procure adequate amounts of grain in a world market hit hard by demand and with limited reserves. Nevertheless, the government was reluctant to raise food prices because of its sensitivity to

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[16] U. Lele, footnote 7, p. 31.

[17] C. Elliott, Patterns of Poverty in The Third World (New York: Praeger Publishers, 1975), p. 55.

[18] U. Lele, footnote 7, p. 31.

urban demands for price stability and because it was cognizant of the potential for unrest among the urban unemployed. As a result, food crop prices are suppressed and the incentive to raise food crops is reduced in favor of producing higher-priced crops for export.

Concentration of agricultural effort on large-scale farms at the expense of small-holders also widens the socio-economic gap between the two groups. Large-scale rice farmers (more than 20 hectares) in the northern portion of Ghana have more than one fifth of all rice land in the country.[19] With a profit between N¢85 and N¢195 per hectare, the large rice farmers are earning high incomes by comparison with even the wealthiest cocoa farmers! In contrast with laborers, who doubtfully receive more than N¢200 annually, the income of the rice farmer is striking and the disparity between the two groups is significant. Such income differentials affect other social spheres and may be extended to succeeding generations. Thus, the percentage of landholders' children attending schools in 1970 was greater than that of sharecroppers' children throughout Ghana.[20] Such educational, economic, and social disparities among groups creates political and social situations not conducive to stability and development.

## FOODSTUFFS IN THE FUTURE: THE ROLE OF TRADITIONAL AGRICULTURE

The task of matching agricultural output with dietary needs of a burgeoning population is formidable. Placement of great faith in large-scale, mechanized agricultural schemes as a means of meeting

[19] C. Elliott, footnote 17, p. 55.

[20] C. Elliott, footnote 17, p. 113.

future food needs seems unwise; the record of colonial ventures and current prestigious schemes is spotty at best. It is reasonable to suggest, therefore, that small-holders within the traditional agricultural sector must continue to shoulder most of the responsibility for providing essential foodstuffs over the next century or so. Traditional agriculture has contributed the bulk of the foodstuffs in the past, but under increasingly limiting conditions that have made it difficult to keep pace with the march of population; decreasing fallow periods, dropping soil fertility, and shortage of land for cultivation are among the factors that have led to breakdown of traditional systems.[21] Migration of many of the most able-bodied has further constrained traditional agriculture; with rural per capita income so low, with social amenities generally lacking, and with remarkably little institutional and governmental effort directed toward traditional agriculture, migrants cannot be faulted for seeking opportunities in urban areas.

Approximately 80% of the daily caloric requirement in West Africa is met by starchy staples such as rice, maize, sorghum, millet, yams, cocoyams, and cassava (manioc). Total grain equivalent available per person per year in these countries averages between 200 and 300 kilograms.[22] It will be recalled that African countries show an energy deficit in caloric intake of about 7%, and thus average grain equivalent

[21] D. E. Vermeer, "Population Pressure and Crop Rotational Changes Among the Tiv of Nigeria," Annals of the Association of American Geographers, Vol. 60, No. 2 (June 1970), pp. 299-314.

[22] About 3.5 to 4.0 kilograms of root and tuber crops are equivalent to 1 kilogram of maize, rice, or sorghum; K. L. Robinson, "The Economics of Increasing Staple Food Production in West Africa," internal paper, International Institute of Tropical Agriculture, Ibadan, Nigeria, May 1974.

values represent approximate subsistence levels of food consumption. Such average amounts of grain equivalent per person give little excess for storage or feeding of livestock; it is generally assumed necessary to have 400 to 500 or more kilograms per person to support a grain-fed livestock economy.

It is possible to approximate future grain equivalent requirements by multiplying projected population growth by 250 kilograms per person, thereby obtaining the increase in foodstuff production necessary just to maintain subsistence caloric intake. Further, it is possible to estimate the additional hectarage that must be placed under cultivation to insure that minimum foodstuff production. I have applied these notions to a single country, Nigeria, inasmuch as it spans both wet and dry portions of West Africa and since it is the most populous country of the region; similar calculations could be made for the whole of West Africa. Furthermore, as will be noted later, it seems likely that increased production will come chiefly from the more humid zones of West Africa, and Nigeria straddles the chief environmental zones of the region.

Nigeria has a population in 1976 of about 65 million and an annual average rate of increase in population of 2.7% (Table 3). With an annual population increase of about 1.7 million, annual increments in total starchy staple requirements fall in the range of 450,000 to 500,000 tons per year. At current yields[23] it will require an additional 400,000

[23]Best estimates of crop yields are slightly less than one ton of grain equivalent per hectare for maize, sorghum, and millet, and slightly more than a ton per hectare for root and tuber crops; data from K. L. Robinson, footnote 22.

Table 3. Population and annual average rate of increase of Population, West Africa, 1974

| Country | Population (millions) | Rate of Increase (percent) |
|---|---|---|
| Chad | 3.9 | 2.1 |
| Dahomey (Benin) | 3.0 | 3.1 |
| Gambia | 0.5 | 2.5 |
| Ghana | 9.6 | 2.7 |
| Guinea | 4.3 | 2.4 |
| Guinea Bissau | 0.5 | 1.5 |
| Ivory Coast | 4.7 | 2.5 |
| Liberia | 1.6 | 2.3 |
| Mali | 5.5 | 2.5 |
| Niger | 4.4 | 2.7 |
| Nigeria | 61.2 | 2.7 |
| Senegal | 4.3 | 2.4 |
| Sierra Leone | 2.7 | 1.5 |
| Togo | 2.1 | 2.6 |
| Upper Volta | 5.8 | 2.3 |
| TOTAL | 114.1 | |

Source: Demographic Yearbook 1974 (New York: United Nations, 1975), Table 3, World Summary

hectares each year simply to maintain present per capita intake of starchy staples. The magnitude of such increases is difficult to fathom! Within the next generation some 8 million additional hectares (about 31,000 square miles) must be brought under cultivation to insure continuation of a subsistence food intake; the amount of land thus required is slightly less than 10% of the total area of Nigeria. Large-scale agricultural schemes will not be able to meet the food problems of the country.[24] It will require that several million small-holders be motivated to increase production of foodstuffs to meet the minimum needs of an expanding population over the next generation.

Provision of the essential foodstuffs for the coming generation will be a major undertaking for the rural population. Conservatively assuming the rural population will remain at 75% of the total,[25] that the present pastoral (noncultivator) population is 5 million, and that the annual average rate of increase for the rural population will continue at 1.6%,[26] I calculate the rural population at the end of the next generation to be about 57 million. Family sizes vary greatly, but a recent survey in the East Central State of Nigeria found a modal family size

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[24]As noted in the previous section, the history of large-scale agricultural schemes is not encouraging and the prospects for the future are no more bright. In the Midwest State of Nigeria, which reaches from rain forest conditions to savanna with about 115 cm. of precipitation, three large-scale agricultural projects were underway in 1975. One scheme was three years old and had 1200 hectares planted to rice of a planned total farm of 5200 hectares. Another was just beginning clearing of land, and the status of the third I do not know.

[25]U. Lele, footnote 7, p. 4.

[26]The annual average rate of increase of urban population is estimated at 4.9% and that of rural population is 1.6%, the difference resulting from rural-urban migration; 1974 Report on The World Social Situation, footnote 6, p. 190.

of 5 to 8 persons and that about 70% of the family sizes fall in the range of 5 to 12 persons per household.[27] Conservatively assuming a family size of 6 people, therefore, the rural population at the end of the next generation will be composed of 9 to 10 million households.

Assuming these calculations are reasonable, it would suggest that each household by the end of next generation will have to increase its area of cultivation by nearly one hectare. Cultivators generally farm less than two hectares,[28] and thus to feed the next generation will require that each peasant work half again as much land he presently does. It can be questioned if the bottlenecks and constraints associated with the sexual division of labor can be overcome and whether hectarage cultivated can be increased on the order of 50%.[29]

The demand for greater amounts of foodstuffs will no doubt be met by increasing yields per hectare through greater use of fertilizers. Assuming that half the additional requirement of 450,000 tons of grain equivalent per year will be met through increasing yields on land already cultivated to starchy staples,[30] an additional 20,000 tons of plant nutrients would be required each year. Such an amount of fertilizer

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[27] J. C. Flinn and J. Lagemann, "Farm Management/Utilization Study, East Central State, Nigeria," internal paper, International Institute of Tropical Agriculture, June 1974.

[28] W. N. Ezeilo, J. C. Flinn, and L. B. Williams, "Cassava Producers and Cassava Production in the East Central State of Nigeria," internal paper, International Institute of Tropical Agriculture, June 1975.

[29] U. Lele, footnote 7, p. 26.

[30] Based on evidence obtained in Nigeria and elsewhere and using modest rates of fertilizer application of 50 to 100 kilograms per hectare, one kilogram of fertilizer (N or $P_2O_5$) adds about 10 kilograms of grain equivalent; K. L. Robinson, footnote 22.

equals the total quantity of plant nutrients (N, $P_2O_5$, and $K_2O$) applied to all crops in Nigeria in 1971-72 (Table 4); most fertilizers presently are applied to nonfood, export crops such as cotton, cocoa, oil palm, and peanuts. Increasing fertilizer use by 20,000 tons each year over the next generation will jump those imports 20 fold. Nigeria, which is economically prosperous, may well be able to purchase those quantities on the world market. Poorer countries of West Africa will find proportionate increases in fertilizer importation a considerable drain on their foreign exchange. Fertilizer consumption is strikingly low throughout the West African countries and for some countries is negligible, perhaps partly a reflection of constraints of foreign exchange on those economies (Table 4). The problems of distribution in countries with weak infrastructure would also hamper increased fertilizer use. Further, some evidence exists that cultivators might be reluctant to use plant nutrients on food crops when it has not been their practice in the past;[31] some of this reluctance may be derived from lack of money for such purchases, but it seems to go beyond economics to a matter of cultural heritage. Nevertheless, peasants whose annual incomes generally are below $200 will have to be provided some subsidy by government to enable them to purchase fertilizers for food crops; again, such subsidies would pose little problem for the stronger economies, such as Nigeria, but they might present formidable obstacles for countries with weaker economies.

[31] W. N. Ezeilo, et al., footnote 28. When this survey was conducted, less than 10% of the farmers had used fertilizers on cassava that year, and the data indicated no difference in yield between fertilized and unfertilized plots.

Table 4. Fertilizer Consumption, Selected West African Countries, 1961/62-1973/74
(thousand metric tons)

| Country | 1961/62-1965/66 | 1966/67 | 1967/68 | 1968/69 | 1969/70 | 1970/71 | 1971/72 | 1972/73 | 1973/74 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Nitrogenous | | | | | |
| Nigeria | 0.8 | *4.6 | *4.0 | *4.0 | *5.0 | *5.5 | *11.7 | *3.7 | 4.3 |
| Ivory Coast | 2.6 | *4.0 | 4.5 | 3.6 | 4.5 | *7.8 | *5.0 | *8.8 | 6.0 |
| Sierra Leone | -- | -- | 0.1 | *0.2 | 1.1 | 1.2 | *0.9 | 0.5 | 1.1 |
| Senegal | 2.7 | 5.4 | 5.3 | 3.4 | *3.0 | 3.8 | 5.0 | 5.2 | 7.4 |
| Mali | 0.1 | *0.6 | 0.8 | 0.9 | *0.8 | *3.0 | *3.0 | 3.1 | 5.0 |
| Upper Volta | -- | -- | -- | -- | 0.3 | 0.4 | 0.4 | 0.6 | 0.4 |
| Niger | -- | *0.1 | *0.1 | *0.1 | *0.1 | *0.1 | *0.1 | 0.4 | 0.2 |
| Chad | 0.2 | *0.4 | 0.6 | *0.8 | 0.9 | 1.1 | 1.3 | 1.1 | 2.2 |
| | | | | Phosphate | | | | | |
| Nigeria | 1.1 | *1.8 | *2.2 | *5.4 | *6.5 | *7.0 | *5.8 | *7.2 | 4.1 |
| Ivory Coast | 1.3 | *2.0 | 3.1 | 2.1 | 2.0 | *2.5 | *5.0 | *4.0 | 7.3 |
| Sierra Leone | 0.2 | 0.5 | 0.7 | *0.8 | *1.0 | 1.2 | *0.5 | 0.5 | 1.1 |
| Senegal | 3.8 | 5.0 | 10.7 | 5.3 | 3.0 | 2.7 | 3.7 | 5.9 | 7.8 |
| Mali | 0.2 | 0.9 | 0.8 | 1.4 | *1.6 | *2.5 | *4.2 | 4.1 | 3.8 |
| Upper Volta | 0.1 | *0.1 | *0.1 | *0.2 | 0.2 | 0.2 | 0.4 | 0.5 | 0.1 |
| Niger | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chad | -- | *0.1 | 0.5 | *0.6 | 0.9 | 0.8 | 0.8 | 0.7 | 1.4 |
| | | | | Potash | | | | | |
| Nigeria | 0.3 | 0.9 | 1.1 | *0.7 | *0.4 | *0.6 | *2.9 | *4.5 | 2.5 |
| Ivory Coast | 5.1 | *6.5 | 6.3 | 6.0 | 7.3 | *14.2 | *16.3 | 17.9 | 14.9 |
| Sierra Leone | -- | -- | -- | *0.1 | 0.2 | 0.2 | *0.2 | *0.2 | 0.5 |
| Senegal | 3.0 | 5.8 | 5.9 | 3.4 | 1.7 | 1.4 | 4.8 | 4.6 | 7.9 |
| Mali | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Upper Volta | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Niger | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chad | -- | -- | -- | -- | -- | -- | 0.2 | 0.6 | 1.1 |

Source: Statistical Yearbook 1974 (New York: United Nations, 1975), Tables 172, 173, 174.
Asterisk (*) indicates United Nations or FAO estimate.

## COMMENTS AND CONCLUSIONS

The imperative for stabilization of traditional agricultural systems is clear. A burgeoning population must be fed by an agricultural sector that has shown no increase in per capita output over the past two decades and that presently contributes at a subsistence level. Large-scale, mechanized agricultural projects have been tried and found wanting; they have not proved economic, they have not achieved their planned production goals, and they do not contribute significantly to the overall foodstuff needs of individual countries or the region as a whole. As the result of concern with large-scale schemes, traditional agriculture has been essentially ignored and it is in a weak position to meet food needs of the future. Pricing policies have been set to resolve social and political stresses especially in urban areas, and this has further undermined the farmers' interest in foodstuff production. Yet, traditional agriculture appears destined to bear primary responsibility for feeding the populations of the future as it has in the past.

Although effort directed toward traditional agriculture would generally upgrade the rural economy, it is inevitable that differential impact would occur and that economic and social benefits would accrue more to some areas and countries than to others. The interior, drier zones appear less well favored than the wetter savannas and dry rain forest portions farther southward. Periodic dry cycles and droughts of devastating intensity affect the dry margins of the Sahara, and such environmental constraints would suggest it is unwise to expand

hectarage greatly in those areas. Even if sufficient water is available, irrigation agriculture is a sophisticated science and irrigation must be carefully controlled lest salinization and alkalinization spoil the soils. Further, soil fertility of the drier regions is inherently less than that of the wetter savanna and adjacent dry margins of the rain forest. To offset soil deficiencies will require massive increases in use of plant nutrients; economics, weak national and regional distribution systems, and peasant reluctance militate against widespread fertilizer use in the near future. In addition, the bulk of the population presently exists in the southern regions of West Africa, and consequently the economics of transportation would suggest that major increases in bulk foodstuff production should occur near densely populated areas.

It appears, therefore, that the southern parts of West Africa will have to carry a disproportionate share of the effort to increase foodstuff output. Yet, the densely populated southern areas have less available land to bring under cultivation than areas farther north. Furthermore, countries along the Guinea coastal zone will incur the heaviest costs of agricultural development. These could be offset by prospect of sale of foodstuffs to interior states, but the result would be further development of the southern regions and a flow of money southward from interior regions. This in turn would produce differential wellbeing favoring the southern areas in terms of development, employment opportunities, and also wages; it is precisely these factors which have established the present migration from the interior to the coastal areas of West Africa.[32]

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[32]C. Elliott, footnote 17, pp. 45-49.

The unglamorous record of large-scale agricultural projects leads to the conclusion that we must consider anew the place and potential of traditional agriculture in feeding future populations of West Africa. Review of the literature dealing with agricultural development indicates only token consideration is given traditional agriculture although it is recognized as a significant segment of the rural economy. As a result, traditional agriculture has been left in the backwater of neglect while focus has been on expanding the horizons of large, mechanized operations. The green revolution once held out some prospects for agricultural revolution in the developing world, but it turns a rather pallid gray when it is directed toward the millions of small-holders who have not the requisite land, labor, and capital for its implementation. No doubt traditional agriculture has been ignored partially because of its octopus nature; its tentacles reach out into so many spheres of economic, social, and political life that it becomes nearly impossible to encompass. Yet, those systems must provide the bulk of the foodstuffs for coming generations; they must be understood and their accumulated wisdom must be used and perhaps upgraded rather than replaced.