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Assisting developing countries toward food self-reliance

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ABSTRACT Per capita food availability in the developing world has increased by 20% since the early 1960s, according to the Food and Agriculture Organization, and today the world has twice as many people but 150 million fewer hungry people than in 1960. The world agricultural system has not done too bad a job over the past 35 years. It is likely that global agricultural production will continue to at least match growth in food demand over the next decade, assuming no major weather anomalies. Continued support of the Consultative Group for International Agricultural Research and programs involving U.S. universities is important to sharing knowledge about agriculture with colleagues in the developing world. This paper explores the reasons for providing agricultural development assistance, the benefits to the United States that come from doing so, and the special challenges facing the world over the next few decades.

Per capita food availability in the developing world has increased by 20% since the early 1960s, according to the Food and Agriculture Organization (1), and today the world has twice as many people but 150 million fewer hungry people than in 1960. The world agricultural system has not done too bad a job over the past 35 years. It is likely that global agricultural production will continue to at least match growth in food demand over the next decade, assuming no major weather anomalies.

But there are still 800 million hungry people and 185 million preschool children seriously malnourished in the developing world because of lack of food and water or disease. The likely future global adequacy is ensured largely by excess capacity in the industrialized countries; the picture will continue to be mixed for the developing world, where the 800 million underfed are concentrated.

Small developing countries with rapidly growing incomes, like South Korea or Malaysia, will have no difficulty importing food, even if unable to keep pace domestically. Others, like Thailand, will continue to export food and experience general food adequacy and economic growth.

At the other extreme, in many African countries per person food output has fallen over the last decade. In most Latin American country income and overall food availability are adequate, but a highly skewed distribution of land keeps many rural people locked in poverty despite a regional average income many times higher than in Africa. India has long faced a similar problem, although perhaps less severe.

The broad situation by major world regions is as follows. Asia has had the most rapid growth in per capita production. In the past 25 years the proportion of hungry people in East Asia has fallen from 41% to 16% even while population increased by 500 million (1). With a projected population of nearly three billion by 2050 and rapid per capita income

growth, its food needs will continue to rise sharply over the coming decades. In Africa, population growth rates already exceed food production growth rates in most sub-Saharan countries, pushing them into food crises whenever bad weather, civil unrest, or war strikes. As the continent will continue to have the most rapidly growing population of any region, this will put strains on its ability to provide food for its people. The proportion malnourished in Latin America fell from 18% to 14% over the past 25 years. Latin America is likely to keep pace with food demand but at the expense of further destruction of its natural forests, the most extensive in the world.

Over the past 40 years United States development assistance efforts have played a major role in making it possible for developing countries to achieve this record. But in recent years, development assistance has come under attack. In what follows, I explore the reasons for providing agricultural development assistance, the benefits to the United States that come from doing so, and the special challenges facing the world over the next few decades.*

Why Should the United States Help Other Countries Meet Their Food Needs?

Why should the U.S. help other countries meet their food needs? Traditionally, or since the end of World War II in any case, Americans have reached out to those in need around the world because they were in need. That is, simple charity has motivated much of our assistance effort, beginning with the reconstruction of postwar Europe and extending to Asia, Africa, and Latin America.

Americans are generous in giving to needs that touch them, especially to emergency needs, both at home and abroad. For example, in 1995 all American charitable giving, from foundations, corporations, individuals, and churches, amounted to \$144 billion. But of that amount, about 2%, less than \$3 billion, went overseas. Contributions to international causes declined by 7% in 1995, even while total charitable contributions increased by 11% (2).

Charity helps, but only in the short run. It may be necessary in an emergency, but few people like living on charity and few like to see people living on charity. Agricultural development assistance—helping people in poor countries to increase the productive capacity of their agricultural sectors—is a powerful way to help people meet their food needs, especially in countries where 60–90% of the population depends on farming for a livelihood.

Americans like to think we lead the world in everything, from Olympic medals to foreign aid, and we have in the past. But in 1994, the last year for which data have been tabulated,

Abbreviation: CGIAR, Consultative Group on International Agricultural Research.

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the United States provided less assistance to developing countries than did Japan, and roughly the same amounts as Germany and France. If you take it as a percentage of national income, the U.S. ranks about 20th of 21 industrialized countries (3).

From our 1996 federal budget outlays of \$1,260 billion, international assistance to other countries amounts to \$6.6 billion—less than 0.5% of the total. That includes food assistance, disaster relief, refugee assistance, capital to multilateral banks, Peace Corps, etc, and development aid. Simple charity used to be a strong motivating force, but it seems to have lost out in recent years.

The preservation of world peace is another reason to help other nations. Because there are so many forces that interact to destroy peace, it is sometimes difficult to see the connection between economic development and peace, but in the absence of development the seeds of war find much richer soil. Development means, of course, improved lives for the mass of the people in a country, not simply a few flashy buildings or a massive industrialization drive for the capital city. Development requires increased productivity of agriculture in most poor countries.

Some fear that helping countries increase their food production capacity will mean fewer U.S. agricultural exports. But experience shows otherwise. An examination of developing countries between 1971 and 1991 shows that when agricultural growth rates are high, general economic growth is high, and that each \$1 of general economic growth generates \$0.32 of total imports. Furthermore, each \$1 increase in agricultural output generates \$0.17 in agricultural imports. The 25% of fastest growing countries imported \$0.54 of agricultural imports for every \$1 of agricultural production increase (4). The explanation is simple: when poor countries grow rapidly their demand for food generally grows more rapidly that they can meet it. When countries reach high income levels their food demand grows much more slowly.

The reality is that developing countries, almost by definition, are largely agricultural. If they are to develop, it must come from their agricultural sectors. Those countries that tried to first develop an industrial sector have failed, or only seemed to succeed for as long as the agricultural sector was being taxed (usually implicitly) to subsidize the industrial sector.

U.S. consumers have a strong interest in ensuring adequate rates of food production growth in the rest of the world, especially the “big” countries such as Russia, China, and India. Should any of those be unable to meet the bulk of their future food needs domestically, the negative effects on equity and the impact on world food availability may be dramatic indeed.

Agricultural development assistance has been a two-way street, with U.S. agriculture receiving many benefits from overseas. All the major crops grown in this country originated elsewhere—wheat, corn, rice, barley, potatoes, etc. The genetic variation that is the basis for plant breeding that has led to the current high-yielding crop varieties planted by most American farmers all was obtained from other countries, most of it decades or even centuries ago. The result is that the amount of genetic variation available in the U.S. is limited, and when some new pest or pathogen arises, it may be impossible to find naturally occurring resistance in the germ plasm available here. Then explorers go elsewhere to find that. Large collections of germ plasm in international agricultural research centers are a first place to look, and American participation in the support of those centers gives us a moral claim on those resources.

In recent years rice and wheat varieties derived from germ plasm collected by the international centers have been important to increasing our wheat and rice yields. Philip Pardey and colleagues at the International Food Policy Research Institute estimate that by the early 1990s about one-fifth of the total U.S. wheat acreage and over 70% of the U.S. rice acreage was sown

to varieties that had ancestry produced by the international agricultural research centers. They estimate the economic value of those wheat and rice varieties was at least \$3.5 billion between 1970 and 1993. That compares to the total U.S. government support to the international wheat and rice centers of \$150 million, and less than \$1 billion to all the international centers in the Consultative Group on International Agricultural Research (CGIAR). Remember, this is “spillover” effect, because the target of these international centers is the developing world.

In today’s world insects and plant diseases can move long distances in short periods of time, and the potential for destructive pests to find their way into this country is very great. If there are effective agricultural research systems elsewhere, pests and pathogens of importance will have been identified and practical means of controlling them may have been developed even before they find their way into this country. Hence, strong agricultural research elsewhere not only can help the food security systems there but can help provide knowledge that may increase our own food security.

Can Development Assistance Be Effective?

Over the past 35 years, there have been many development successes. They are most evident in Asia, which is ironic because 35 years ago Asia was seen as the great challenge to development, and even 15 years ago was considered problematic. Thirty years ago Korea and Taiwan were poor countries receiving significant U.S. development assistance. Today, they lead the “Asian tigers” (Korea, Taiwan, Hong Kong, and Singapore). China’s development is incredibly rapid for such a large country. The movement goes even deeper, although many challenges remain. Bangladesh and India are experiencing regular increases in per capita incomes.

Indonesia is another case. There, 35 years ago some 70% of the population was below the poverty line, today less than 14% is; then it was the world’s largest importer of rice, today it is self sufficient in rice; then the life expectancy was 41 years, today it is 63. Development assistance by the United States was significant in helping all these countries become more self reliant.

Rapid population growth remains an immense challenge. The world’s current population of 5.6 billion people will likely reach 10 billion and may reach 15 billion before stabilizing. But we know that population growth slows with rising incomes, the education of young women, and increased availability of family planning.

The rate of global population growth is slowing: In the 25 years between 1950 and 1975 global population increased 63%; over the next 25 years it will have increased about 36%. Even in the poorest countries, which have the highest rates of growth, rates are slowing:

- in Kenya, from 3.8% annually in the 1980s to 3.5% annually in the 1990s
- in Bangladesh, from 2.7% in the 1970s to 2.2% in the 1980s, to 1.9% in the 1990s.

Development assistance has helped many Asian countries provide family planning assistance and reduce population growth. John Bongaarts and colleagues of the Population Council estimate that in the absence of family planning programs, which have been significantly assisted by development aid, the population of the developing world could be expected to reach 14.6 billion in the year 2100 instead of the 10 billion currently projected by the World Bank (5).

What Should the United States Be Doing to Assist Other Countries?

Food production has more than kept pace with food demand over the past 35 years, but not in every country. And, among

those who think about the question a lot, there has been an evolution in thinking. Thirty-five years ago the question was: Can food production keep up with demand? Later the question became: Can food production increase fast enough so food remains affordable to the poor? Today the question is: Can food production increase fast enough so that it remains affordable to the poor without so degrading the world's soil, water, and forests as to turn the world into a global human feedlot?

Food self-reliance—the ability to produce most of the food a nation needs and to buy the rest with export earnings—is necessary because national aspirations and self-respect demand it, and because rich nations will donate food only as long as they themselves have surpluses. The world is moving to a situation where such food donations will be available only in specific crises, so it is prudent for nations to aim for self-reliance.

While there is no overriding reason why any country must be self-sufficient in food, whether it is not, it must export something else to pay for imported food. Japan for example, while importing virtually no rice, imports 26 million tons of cereal grains and considerable amounts of other foods. Korea doubled its imports of cereal grains between 1980 and 1990. Most African countries are mineral or agriculturally based, so agricultural exports, at least in the short run, have an important role in financing imports. Individual countries will each follow their own path, but agricultural products will dominate exports in many African countries for the next 10 to 20 years.

The theory of change that drives much international agricultural assistance holds that appropriate technology can generate great positive contributions in the developing world with relatively small investments in research. Labor-using, capital-saving, and land-saving technology that is genetically or knowledge-based was the basis of the Green Revolution of the 1960s and 1970s. It clearly demonstrated that plant genetic improvements flow quickly to many farmers and generate benefits to them and to consumers.

A major role for the United States, and one the Rockefeller Foundation is addressing, is to support the generation of agricultural knowledge—through research—and the creation of capacity to generate knowledge. The broad goal is to help developing countries produce their own new agricultural knowledge for their own conditions, often in partnership with others. History shows that rising agricultural productivity has been the key to economic growth and development in every country that was once poor and once had a high proportion of its population dependent on farming. The most difficult challenges are in countries where cropland is being fully used—India, Bangladesh, China, and areas such as Java, Malawi, and other highland areas of eastern and southern Africa. Their crop yields must be increased to increase output.

Raising crop yields is a big challenge, but the sustainability of the systems being developed and used is also globally important. Modern high-yield agriculture of the kind long supported by the Rockefeller Foundation's agricultural program has been attacked on a number of fronts over the years. In our view, such attacks are misguided, and we remain convinced that high-yielding seeds and fertilizer are essential for sustainably improving productivity and wellbeing. However, not all practices that have been promoted in the past, such as broad-spectrum pesticides and continuous planting of a single crop, are appropriate. Means of assessing the longer-term questions must be developed and applied to ensure that practices that give high yields in the short run but falling yields and incomes in the longer run are not promoted.

International agricultural research centers have been key to raising crop yields in the past. In 1965 the International Rice Research Institute released the first of the modern semi-dwarf rice varieties. That class of varieties, which are capable of giving much higher yields than what they replaced, by 1990

covered 100% of East Asia's rice area and 60–90% of the rice area of most other Asian countries (6). Since 1965 Asian rice yields increased from 2 to 3.5 tonnes/hectare (t/ha); the number of people in the rice-dependent countries increased by nearly a billion, and the percentage of underfed children in Asia decreased slightly to about 35%. This is still unacceptably high, but without the technical change of the Green Revolution, food production would have been lower, prices would have been higher, and there would be even more hungry children.

A functioning global agricultural research system—the CGIAR—exists. However, over the past 5 years the financial support to that system has weakened, in no small part because of falling support by the United States. Whereas in 1992 the U.S. was the single largest donor, providing \$48.1 million to that system, in 1996 the contribution fell to \$30.5 million (7), even though the system is acknowledged to be one of the most effective uses of foreign assistance to which the U.S. contributes.

The CGIAR, extremely effective at research that can be shared across countries, can be complemented by efforts that enable countries to adapt the research findings to their particular situations. There is still a great need to improve the national capacity for agricultural research and management in developing countries, especially in Africa.

The Special Challenge of Africa

The potential contributions of the United States to increasing food production are especially needed in Africa. Africa is currently depending on imports for about 25% of its grain consumption, a dependency that has increased over the past 30 years as per capita food production has declined. In recent years about 25% of the imported grain was provided as donations from industrialized countries, and donations provided 10% of imported edible oils and other commodities. Average incomes declined in many African countries over the past 10 to 15 years, pulled down by disappointing agricultural performance.

Current crop yields in Africa are far below the genetic potential, as demonstrated in innumerable experiments. For example, in trials at Chetidze station, Malawi, yields of hybrid maizes released to farmers in the early 1990s gave 8 t/ha, compared with hybrid yields of 2.5 t/ha by the best group of communal farmers and average farmer yields of 1 t/ha. At the same station yields of open pollinated maize averaged 6 t/ha, while farmers were getting 0.6 t/ha with the same varieties. This suggests that most farmers are not optimizing the water, nutrient, and pest management conditions under which the genetic material is being used.

What can be done by outside organizations to help Africa address its food production needs? The international agricultural research centers of the CGIAR are conducting germ plasm improvement research on the major food crops of interest to African farmers. But the capacity of African institutions to adapt research results from elsewhere and hence appropriate the benefits of that research is limited. Biotechnology has the potential to provide very specific contributions in that process, but unless an outside organization is prepared to provide the entire physical and human capital required, there is limited near-term ability to appropriate the potential benefits of biotechnology to Africa's benefit. The main germ plasm-related need is to build African capacity for adaptive plant breeding and develop systems to evaluate, multiply, and sell good-quality seeds of important crops.

The international system is doing very little to assist African organizations to address the water, soil nutrient, and pest management challenges. On a continent-wide basis Africa uses less than 10 kg of plant nutrients per hectare of arable land, compared with 70 for Latin America and 150 for Asia (ex-

cluding China). This low rate of use is not only a result of Africa having started the process of agricultural intensification later than other regions but also because less is known about precisely what materials are needed and how best to use them. Also, poor roads and poor marketing systems mean that fertilizer costs are higher and crop prices lower than in most other areas of the world. This situation means that to be equally as profitable as in other regions, the efficiency of fertilizer use—the output-to-input ratio—has to be higher.

Fertilizer efficiency can be improved through a number of routes, each requiring improved knowledge specific to particular agro-ecologies, knowledge that can be informed from other experience. Methods to diagnose deficiencies of minor nutrients might contribute to improving fertilizer efficiency. Rotations, intercropping, and relay cropping may contribute to improving fertilizer efficiency and may improve the productivity of agricultural systems in other ways. Such approaches will be aided by systematically evaluating the adaptability of legumes for African agro-ecologies.

In addition to improving fertilizer efficiency, water control through high-efficiency small-scale irrigation on high-value crops will be appropriate and should be pursued. But the potential is limited, and most African agriculture will continue to be rainfed. Weeds, including striga, are especially important yield constraints in many places in Africa. Some believe that high striga rates may be related to low soil fertility, and would be controlled by raising soil fertility. While that would also be desirable for raising yields, if other striga control mechanisms could be developed they should improve productivity even with the same level of soil fertility.

Insects and disease pests of plants extract a huge toll from African food production systems. Aside from the work of the International Institute of Tropical Agriculture at Ibadan, Nigeria, in biological control, which has led to major successes in the case of cassava mealybug and green spider mite, and the efforts of the Nairobi-based International Center for Insect Physiology and Ecology (ICIPE), little is being done by the international agricultural research system to address these constraints other than crop resistance breeding. Biotechnology, of course, has great potential to address pest problems, but at least two kinds of institutional capacities must be strengthened before it can be brought to bear widely on pest problems in Africa: scientific and organizational. ICIPE and some national institutions have scientists, but the numbers are extremely small. In addition, organizational capacity to support science is lacking in many places. Reliable electricity and water, the most basic requirements, are often lacking. Chemicals, computers, and other equipment are becoming more available with the advent of recent structural adjustment policies. But the organizational capacity to assemble scientists and support mechanisms remains a challenge.

Aside from technological advances, much better information and appropriate policies will also be necessary before African agriculture prospers. Information in Africa is incomplete and costly. Whether it is information about past research on fertilizer materials, current crop prices in the next town or country, or trends in the global availability of fertilizers, information is difficult to get. And, in many countries, despite structural adjustment programs of the World Bank, fertilizer and seeds are still sold by government-run or government-controlled monopolies, or by a tiny private sector in which leading public figures have a direct influence.

Poor marketing systems have been mentioned. Parastatal marketing systems were not prevalent in Africa only because of the attraction socialist economics had to early independence leaders. The long distances, poor transportation, and relatively low density of producers makes for a "thin" market that may fail to attract many private traders. There is a need to document the structure, conduct, and performance of the agricultural marketing systems that are evolving under struc-

tural adjustment. There is also a need for public investments in roads and market information systems that would facilitate the development of private traders, thereby reducing the costs of marketing both inputs and products.

Agriculture must play an important role in African development. It will if Africa's leaders recognize the central importance of agriculture for development and encourage that role. They must remove policies that restrict effective market functioning and make appropriate investments in public goods such as roads, market information systems, and agricultural research. And Africa's friends can help with agricultural research that complements work on the continent and is addressed to high-priority needs.

Conclusions: The Role of the United States in Agricultural Development Assistance

One major contribution of the United States to global agriculture has been and should continue to be firm financial support for the CGIAR.

A second is support for programs based at universities here, such as the International Soybean Program, headquartered at the University of Illinois, whereby talented, dedicated people here share, on a cooperative basis, their advanced knowledge about agriculture with colleagues in developing countries.

Cooperation runs both ways, and our participation with other countries enables us to learn about insect pests and crop diseases that may in the future attack agriculture here.

Tropical soil ecology is, in my view, one of the main areas of ignorance that could benefit from cooperative research with tropical countries. Pest management is another such area.

Many rural areas lack current, accurate information on prices of crops and inputs in regional and national markets. Information systems to provide such data to farmers is an area in which U.S. assistance could be extremely useful.

Strong pressures have been brought to bear by our government and by the World Bank to get developing countries to turn more functions over to market forces. This pressure has not adequately addressed fertilizer markets in Africa, where many governments still control fertilizer distribution.

In some countries government seed systems have operated so as to effectively create monopolies for varieties produced locally. Like fertilizer systems, seed systems should be freed up, with government's role limited to requiring sellers to label products and enforcing the accuracy of labels.

Primary education, of girls as well as boys, is one of the most important forces leading to improved lives. But primary education must touch each person in a country—a massive job that is the appropriate role of the government of each country. While development assistance can perhaps bring educational theories or innovations, teaching and learning requires massive domestic action.

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