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UNITED STATES DEPARTMENT OF AGRICULTURE
Economic Research Service
Development and Trade Analysis Division

ECONOMIC PROGRESS OF AGRICULTURE IN THE LESS-DEVELOPED COUNTRIES*

by

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The Agricultural Development Problem

Historical records clearly show that no country has moved from chronic stagnation into the take-off stage of economic development without first achieving a substantial gain in agricultural productivity. The United Kingdom, Germany, Japan, and a few other countries have relied heavily upon imported supplies of agricultural products, but this usually was after they had achieved substantial economic progress in agriculture and industrial development was well underway. In a few of the less-advanced countries development of petroleum, mineral, or other natural resources has led to large increases in incomes for a small part of the total population, but where this has not been accompanied by improvement in agricultural productivity, most people have continued to live under conditions of abject poverty.

Economic growth of the less-advanced countries depends heavily upon economic progress in improving the economic performance of the agricultural sector just as it did in the more-advanced countries at earlier stages of their economic development. In the less-advanced countries where per capita incomes average \$100 or less a year, agriculture accounts for 60 to 70 percent of total employment and for 40-50 percent of gross national product. But similar conditions

* This paper is based on research conducted under an agreement between the Agency for International Development, Department of State, and the Economic Research Service, on factors affecting agricultural productivity in the less-developed countries.

prevailed in the United States, Canada, Australia, and West European countries only 150 years ago and more recently in Japan, Israel, and other countries where economic growth has been rapid in recent years.

A major question facing the less-advanced countries today is: How to increase agricultural productivity rapidly enough to meet requirements for national economic growth? In many of these countries, population growth is 2 to 3 percent a year and in some it approaches 4 percent. Population growth rates in most of the less-developed countries are more than double those that prevailed in Western Europe or Japan during the years when they began to move upward on the economic development ladder. Supplies of agricultural products in the less-advanced countries must increase 4 to 5 percent a year to meet increases in domestic demands resulting from population growth and slowly rising incomes and to avoid price inflation that would disrupt industrial growth.

Is it possible for these countries to double agricultural output in the next 20 years? This would require a compound growth rate in total agricultural output of 3.6 percent a year. Actually, growth rates of nearly 5 percent will be required in countries where population is increasing 3.5 percent or more a year. These rates are more than twice as high as those achieved in the developed countries. For example, during the 1870-1920 period when agriculture was making large contributions to economic growth in the United States, total agricultural output increased at a compound rate of 2.2 percent a year. Of course, reduction in population growth rates in the less advanced countries during the next generation or two may reduce the rates of increase in agricultural output required for economic development, but population growth is not likely to decline much in the next 5 or 10 years. And it is the next few years with which we need to be most concerned.

Expansion in agricultural production must be achieved largely through increased productivity or efficiency if agriculture is to contribute effectively to national economic development. Productivity per person employed in agriculture must be increased so that there will be an economic surplus for improving the welfare of rural people and for transfer out of agriculture to provide capital for industrial growth and to meet expanding consumption needs of the urban population. And this must be done with relatively small amounts of capital from industrial sources. The great hope, of course, is that technological innovations can be introduced into the agricultural economies of the less-advanced countries to achieve really significant breakthroughs in agricultural productivity.

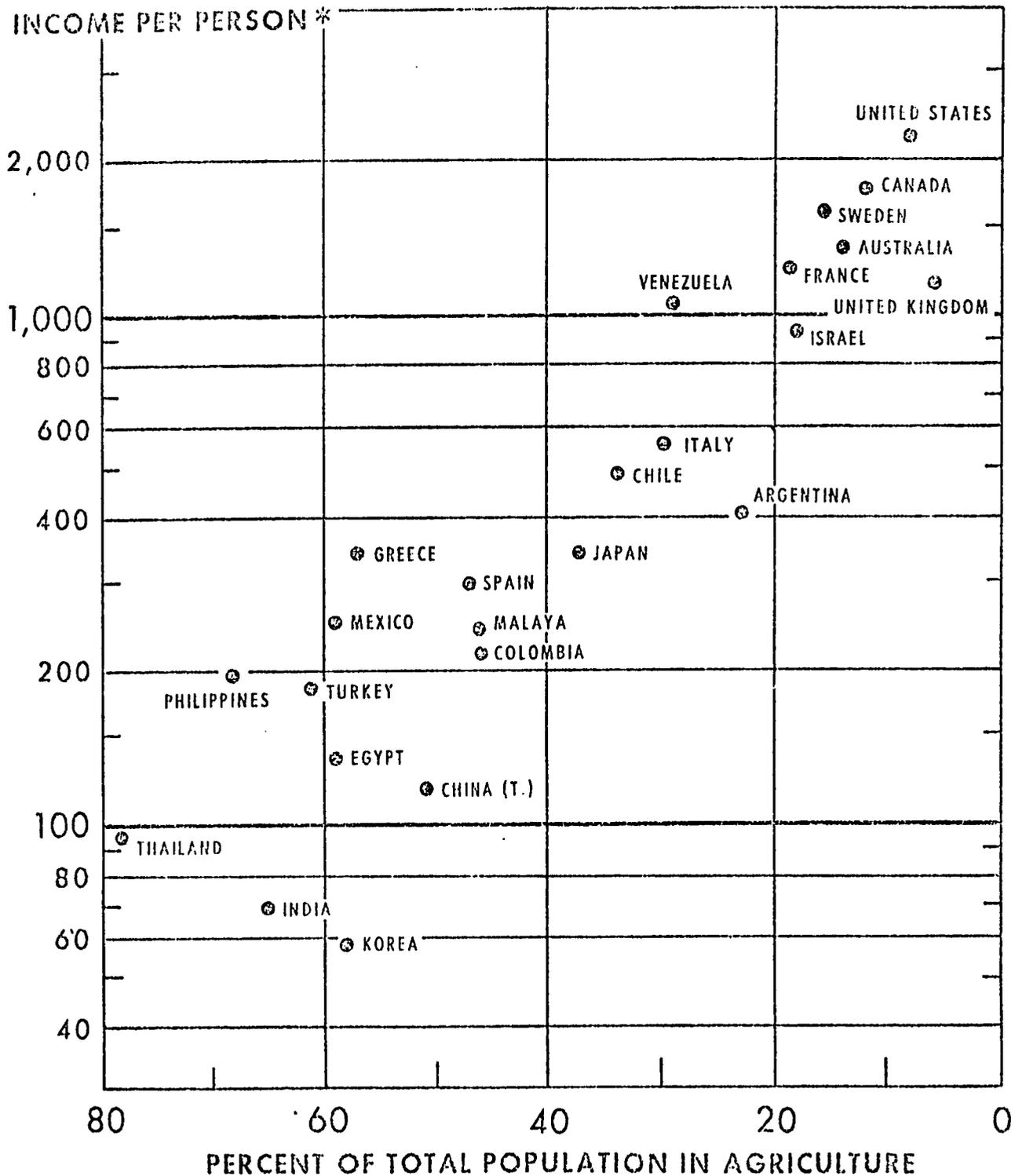
It is against this background that I consider what experience shows with respect to attainment levels and developmental rates for agriculture in the less-advanced countries.

Present Levels of Agricultural Development

The countries commonly classified as less-advanced differ markedly from each other in level of development achieved in agriculture as well as in the rest of the economy. Estimates of income per person, weak as they are for use in international comparisons, provide the best single indicators of national economic development. Figure 1 shows that income per person varies from less than \$100 a year in India, Pakistan, and Thailand to between \$100 and \$200 in Taiwan, Philippines, Iran, Egypt, Turkey, and Brazil and to between \$300 and \$400 in Colombia, Mexico, Malaya, Yugoslavia, and Spain. Obviously, the less-advanced countries are located on different steps on the development ladder.

Agriculture's share of total employment provides an approximate indication of the level of agricultural development. Historically, the total number of people engaged in agriculture does not begin to decline until the proportion of total

INCOME PER PERSON AND PERCENT OF POPULATION IN AGRICULTURE, 1959-61



* 1959-61 UNITED STATES DOLLARS.

employment in agriculture declines to about 50 percent. This was true for the United States and Japan, for example. In many of the less-advanced countries, agriculture's share of total population is much more than 50 percent and total agricultural population in these countries likely will continue to increase for another generation or two. Even in countries like Taiwan, Malaya, Colombia, and Costa Rica, where agriculture's share of total population is close to 50 percent, total agricultural population likely will continue to rise for another 20 years unless population growth rates are drastically reduced.

Two points merit emphasis in considering present levels of agricultural development. The first is that incomes average much lower in agriculture than in other sectors. Table 1 shows that income per person in most countries averages less than half as high in agriculture as it does in the rest of the economy. In Mexico, Venezuela, Thailand, and the Philippines, income per person averages only 20 percent as high in agriculture as in other sectors. Low incomes in agriculture indicate that rural people do not share equally with urban people in the national income. They also suggest that labor productivity in agriculture is low. There, of course, are wide differences in labor productivity within agricultural sectors of the less-advanced countries. Many have well-developed market-oriented production for some crops, especially those exported, where productivity averages fairly high. But the bulk of the farm production in these countries is carried out under primitive methods, largely for subsistence purposes, with relatively low levels of productivity.

The second point relates to the role of agriculture in national economic development strategy. Comparison of the structural characteristics of countries at different stages of development shows that agriculture's share of gross domestic product and of total employment averages much less for the high-income

Table 1 --Gross domestic product per person and agriculture's share of gross domestic product and total population, selected countries, 1959-61 ^{1/}

| Country | Gross domestic product per person | Agriculture's share | | Ratio of income per person in agriculture to income per person in rest of economy |
|---------------------------------|-----------------------------------|------------------------|-------------------------|---|
| | | Gross domestic product | Agricultural population | |
| | Dollars | Percent | Percent | Ratio |
| <u>Western Developed</u> | | | | |
| United States..... | 2,281 | 4 | 8 | 0.5 |
| Canada..... | 1,817 | 7 | 12 | 0.5 |
| United Kingdom.... | 1,182 | 4 | 6 | 0.7 |
| France..... | 1,268 | 10 | 19 | 0.5 |
| Australia..... | 1,389 | 13 | 14 | 0.9 |
| <u>Latin America</u> | | | | |
| Argentina..... | 413 | 16 | 23 | 0.6 |
| Brazil..... | 165 | 28 | 58 | --- |
| Chile..... | 497 | 14 | 34 | 0.3 |
| Colombia..... | 242 | 35 | 46 | 0.6 |
| Costa Rica..... | 375 | 37 | 55 | --- |
| Mexico..... | 249 | 20 | 59 | 0.2 |
| Venezuela..... | 1,068 | 7 | 29 | 0.2 |
| <u>Near East and South Asia</u> | | | | |
| Egypt..... | 138 | 31 | 58 | 0.3 |
| India..... | 69 | 48 | 65 | 0.5 |
| Iran..... | 178 | -- | 55 | --- |
| Israel..... | 956 | 12 | 18 | 0.6 |
| Pakistan..... | 76 | 57 | 65 | --- |
| Turkey..... | 187 | 41 | 61 | 0.4 |
| <u>Far East</u> | | | | |
| Japan..... | 347 | 15 | 37 | 0.3 |
| Philippines..... | 197 | 34 | 68 | 0.2 |
| Taiwan..... | 120 | 32 | 51 | 0.5 |
| Thailand..... | 95 | 38 | 78 | 0.2 |
| Malaya..... | 243 | 45 | 46 | 1.0 |
| South Korea..... | 59 | 39 | 58 | .4 |
| <u>Other European</u> | | | | |
| Greece..... | 342 | 30 | 57 | 0.5 |
| Spain..... | 299 | 26 | 47 | 0.4 |
| Poland..... | 530 | 26 | 48 | --- |
| Yugoslavia..... | 248 | 30 | 57 | --- |
| Soviet Union..... | 761 | 21 | 39 | --- |

^{1/} Data are from The State of Food and Agriculture, 1964, page 69, Food and Agriculture Organization of the United Nations, Rome, 1964 for all countries except Brazil, Iran, Pakistan, Poland, Yugoslavia, and the Soviet Union which were estimated from other reports of the United Nations and the Food and Agriculture Organization. Agriculture, as defined here, includes farm production, fishing, and forestry.

countries than they do for the low-income countries. The low incomes associated with a large proportion of total employment in agriculture has led some people to think that emphasis on industrialization at early stages of development is the best way to achieve economic growth. But this overlooks the fact that countries which today are in the high-income category were successful in achieving a substantial agricultural surplus at an early stage in their development which provided a basis for industrial growth. Similar surpluses are not available today in most low-income countries. In fact, many are experiencing severe shortages of food and other agricultural raw materials.

The data referred to above on agriculture's share of gross domestic product do not fully measure the importance of agriculture in total economic activity. A large part of the labor and capital goods employed in nonagricultural sectors of the less developed countries is used for transporting, storing, and processing agricultural raw materials. Likewise, much industrial and commercial activity is concerned with agricultural supply industries, those furnishing tools, machines, fertilizer, pesticides, and other materials for use in farm production and also with supplying consumption goods for rural people. If we counted all the economic activities dependent upon agriculture, we would find that agriculture is the dominating sector in these countries. Without expansion of agricultural production at relatively low costs, national economic development may be stopped dead in its tracks.

Uneven Progress in Improving Agricultural Productivity

What does the record show with respect to progress in improving agricultural productivity? It is important to consider, separately, changes during the last 25-year period and those during the last decade.

All countries have achieved large increases in total agricultural production during the last 25 years. Table 2 shows that this is true for low-income countries as well as high-income countries. But in the case of many in the low-income category, expansion in total agricultural production has not kept pace with population growth. For example, agricultural production per person averaged less in 1961-63 than in 1935-39 in Argentina, Chile, Egypt, Iran, Pakistan, Indonesia, Taiwan, and Yugoslavia. Expansion in agricultural production has barely kept pace with population growth in India, Brazil, and Spain. On the other hand, Mexico, Japan, Thailand, and Greece show very large increases in agricultural output per person.

Most countries showed remarkable progress during the late 1940's and early 1950's, but agricultural output per person decreased in several beginning in the late 1950's and continuing thus far in the 1960's. For example, agricultural production per person in India, Pakistan, and Korea was less in 1963 than in 1960. Table 3 shows that agricultural production per person in several countries increased little over the 1952-54 level. The record clearly shows that few countries have increased total agricultural production by as much as 4 percent annually over an extended period. Only Mexico, Costa Rica, Venezuela, and Israel, among the countries listed in table 3, had a compound annual growth rate in total agricultural production of 4 percent or more in the last 25 years. Greece, Yugoslavia, and Taiwan have increased total agricultural production by 4 percent or more in the last decade, but this partly represents recovery from depressed production during World War II.

Population growth rates have gone up greatly in many low-income countries in the last decade, with reductions in death rates resulting from improvement in health and sanitary conditions. And this is one reason for decreases in

Table 2.--Changes in total population and in total and per capita agricultural production, selected countries 1/

| Country | Percentage changes, 1935-39 average to 1961-63 average | | | Agricultural production per capita 1952/54=100 | | |
|---------------------------------|--|-------------------------------|------------------------------------|--|---------|---------|
| | Population | Total agricultural production | Per capita agricultural production | 1935-39 | 1960 | 1963 |
| | Percent | Percent | Percent | Percent | Percent | Percent |
| <u>Western developed</u> | | | | | | |
| United States... | 44 | 70 | 18 | 85 | 100 | 100 |
| Canada..... | 69 | 67 | -1 | 94 | 89 | 97 |
| United Kingdom.. | 14 | 95 | 71 | 68 | 113 | 119 |
| France..... | 13 | 52 | 34 | 103 | 117 | 117 |
| Australia..... | 60 | 71 | 7 | 103 | 107 | 111 |
| <u>Latin America</u> | | | | | | |
| Argentina..... | 59 | 11 | -30 | 132 | 87 | 95 |
| Brazil..... | 90 | 103 | 7 | 107 | 119 | 112 |
| Chile..... | 68 | 66 | -1 | 99 | 103 | 95 |
| Colombia..... | 82 | 106 | 13 | 91 | 104 | 102 |
| Costa Rica..... | 119 | 202 | 38 | 68 | 100 | 93 |
| Mexico..... | 94 | 249 | 80 | 70 | 121 | 127 |
| Venezuela..... | 124 | 169 | 20 | 94 | 111 | 115 |
| <u>Near East and South Asia</u> | | | | | | |
| Egypt..... | 68 | 43 | -15 | 123 | 108 | 112 |
| India..... | 48 | 55 | 5 | 102 | 110 | 105 |
| Iran..... | 67 | 60 | -4 | 112 | 110 | 109 |
| Israel..... | 127 | 224 | 43 | 115 | 161 | 163 |
| Pakistan..... | 47 | 19 | -19 | 126 | 103 | 100 |
| Turkey..... | 75 | 91 | 9 | 90 | 101 | 101 |
| <u>Far East</u> | | | | | | |
| Japan..... | 35 | 89 | 40 | 102 | 134 | 143 |
| Philippines..... | 91 | 110 | 11 | 104 | 110 | 118 |
| Taiwan..... | 114 | 58 | -26 | 144 | 102 | 105 |
| Thailand..... | 64 | 157 | 57 | 75 | 114 | 111 |
| Indonesia..... | 46 | 31 | -10 | 111 | 101 | 102 |
| Malaya..... | 78 | 90 | 7 | 96 | 104 | 103 |
| South Korea..... | 78 | 33 | -25 | 142 | 117 | 101 |
| <u>Other European</u> | | | | | | |
| Greece..... | 25 | 65 | 32 | 103 | 113 | 136 |
| Spain..... | 30 | 30 | 0 | 109 | 108 | 115 |
| Poland..... | -5 | 2 | 7 | 107 | 122 | 107 |
| Yugoslavia..... | 26 | 20 | -5 | 127 | 124 | 119 |
| Soviet Union.... | 17 | 35 | 15 | 104 | 122 | 116 |

1/ Based on index numbers computed by Foreign Regional Analysis Division, Economic Research Service, USDA. Index of agricultural production per capita for 1961 shown for 1960 in case of Iran, Israel, Poland, and Yugoslavia.

Table 3. Compound growth rates for total agricultural production and population for selected periods and countries

| Country | Agricultural production | | Population growth | | | Change in agricultural production per person in agriculture 1935-39 to 1960-62 5/ |
|---------------------------------|-------------------------|-----------------------|-----------------------|-----------------|-----------------|---|
| | 1935-39 to 1959-61 1/ | 1952-53 to 1961-62 2/ | 1935-39 to 1959-61 1/ | 1950 to 1960 3/ | Current rate 4/ | |
| | Percent | Percent | Percent | Percent | Percent | |
| <u>Western Developed</u> | | | | | | |
| United States.. | 2.2 | 1.5 | 1.5 | 1.7 | 1.7 | 88 |
| Canada..... | 2.1 | -.3 | 2.1 | 2.7 | 2.1 | 45 |
| United Kingdom. | 2.7 | 2.3 | 0.5 | .4 | .8 | 21 |
| France..... | 1.7 | 2.9 | 0.5 | .9 | 1.2 | 40 |
| Australia..... | 2.2 | 3.4 | 1.9 | 2.2 | --- | 35 |
| <u>Latin America</u> | | | | | | |
| Argentina..... | 0.4 | .9 | 1.9 | 1.6 | 1.7 | 10 |
| Brazil..... | 2.9 | 3.6 | 2.6 | 3.2 | 3.1 | -- |
| Chile..... | 2.1 | 1.2 | 2.1 | 2.9 | 2.3 | 4 |
| Colombia..... | 2.9 | 2.5 | 2.4 | 2.2 | 2.9 | 15 |
| Costa Rica..... | 4.5 | --- | 3.2 | 3.9 | 3.9 | -- |
| Mexico..... | 5.1 | 7.0 | 2.7 | 3.1 | 3.1 | 39 |
| Venezuela..... | 4.0 | 3.5 | 3.3 | 4.0 | 3.4 | 38 |
| <u>Near East and South Asia</u> | | | | | | |
| Egypt..... | 1.4 | 2.9 | 2.1 | 2.4 | 3.5 | 11 |
| India..... | 1.8 | 3.0 | 1.6 | 2.0 | 2.4 | 11 |
| Iran..... | 1.9 | 3.6 | 2.1 | 1.9 | 2.5 | -- |
| Israel..... | 4.8 | 10.1 | 3.3 | 3.5 | 3.5 | 79 |
| Pakistan..... | 0.7 | 1.7 | 1.6 | 2.1 | 2.2 | -- |
| Turkey..... | 2.6 | 3.5 | 2.3 | 2.9 | 2.9 | 12 |
| <u>Far East</u> | | | | | | |
| Japan..... | 2.6 | 3.7 | 1.2 | 1.4 | 1.0 | 54 |
| Philippines.. | 3.0 | 2.9 | 2.6 | 3.2 | 3.2 | 6 |
| Taiwan..... | 1.8 | 4.7 | 3.1 | 3.4 | 2.9 | 12 |
| Thailand..... | 3.9 | 3.8 | 2.0 | 3.6 | 3.1 | 16 |
| Malaya..... | 2.6 | 3.5 | 2.3 | 3.1 | 3.2 | 16 |
| South Korea.... | 1.2 | 2.7 | 2.3 | 1.9 | --- | -- |
| <u>Other European</u> | | | | | | |
| Greece..... | 2.0 | 4.0 | 0.9 | 1.0 | .9 | 19 |
| Spain..... | 1.1 | 2.8 | 1.1 | .9 | .8 | 17 |
| Iceland..... | 0.1 | --- | --- | --- | 1.8 | -- |
| Yugoslavia.... | 0.7 | 6.1 | 0.9 | 1.2 | 1.1 | -- |
| Soviet Union... | 1.2 | --- | 0.6 | --- | 1.8 | -- |

1/ Computed from Table 2.

2/ Computed from linear trend lines of index numbers of total agricultural production, The State of Food and Agriculture, 1964, FAO, 1964.

3/ Tabulated from United Nations sources.

4/ Data from Economic Data Book, Agency for International Development, 1964, Washington, D.C.

5/ Estimates obtained by deriving estimates of agricultural population from data on agriculture's share of total population and from index numbers of total agricultural production reported in The State of Food and Agriculture, 1964, FAO, 1964.

agricultural production per person in some countries. Food shortages resulting from failure of agricultural production to keep pace with increased demands accompanying income and population growth have been met in part by reductions in exports and increases in imports, largely under food aid programs of the developed countries. Food aid programs have contributed to economic growth in food shortage countries by helping to prevent rapid price inflation and disruption of industrial development programs.

The less-advanced countries have achieved small but significant gains in land and labor productivity during the last decade. Estimates presented in table 3 show that agricultural production per person of the agricultural population increased 10 to 12 percent during the 1952-62 period in Egypt, India, Turkey, and Taiwan. Colombia, Thailand, Greece, and Spain show increases of 15 to 18 percent. But Japan and other developed countries experienced much larger increases.

Total agricultural population has decreased in the high-income countries, but it has increased in the less-advanced at a rate only slightly lower than that for total population growth. Obviously, nonfarm employment opportunities have influenced improvements in labor productivity in agriculture. In the less-advanced countries where rural population growth has been rapid and agriculture accounts for more than half of total population, the nonagricultural sectors have been able to supply employment opportunities for only a small part of the net increase in agricultural population. However, small decreases in agriculture's share of the total population are taking place in these countries which indicates they are making economic progress.

There are wide differences among countries in the relative importance of higher yields and expansion in cropland area as sources of additional production.

Figure 2 indicates that cropland area went up more than yield per acre during the 1948-63 period in Colombia, Mexico, Turkey, and the Philippines. However, crop yields have gone up greatly in many countries. For example, they increased by 40 percent or more in Colombia, Greece, Spain, and Taiwan during the last 15 years or at a compound growth rate of nearly 3 percent a year.

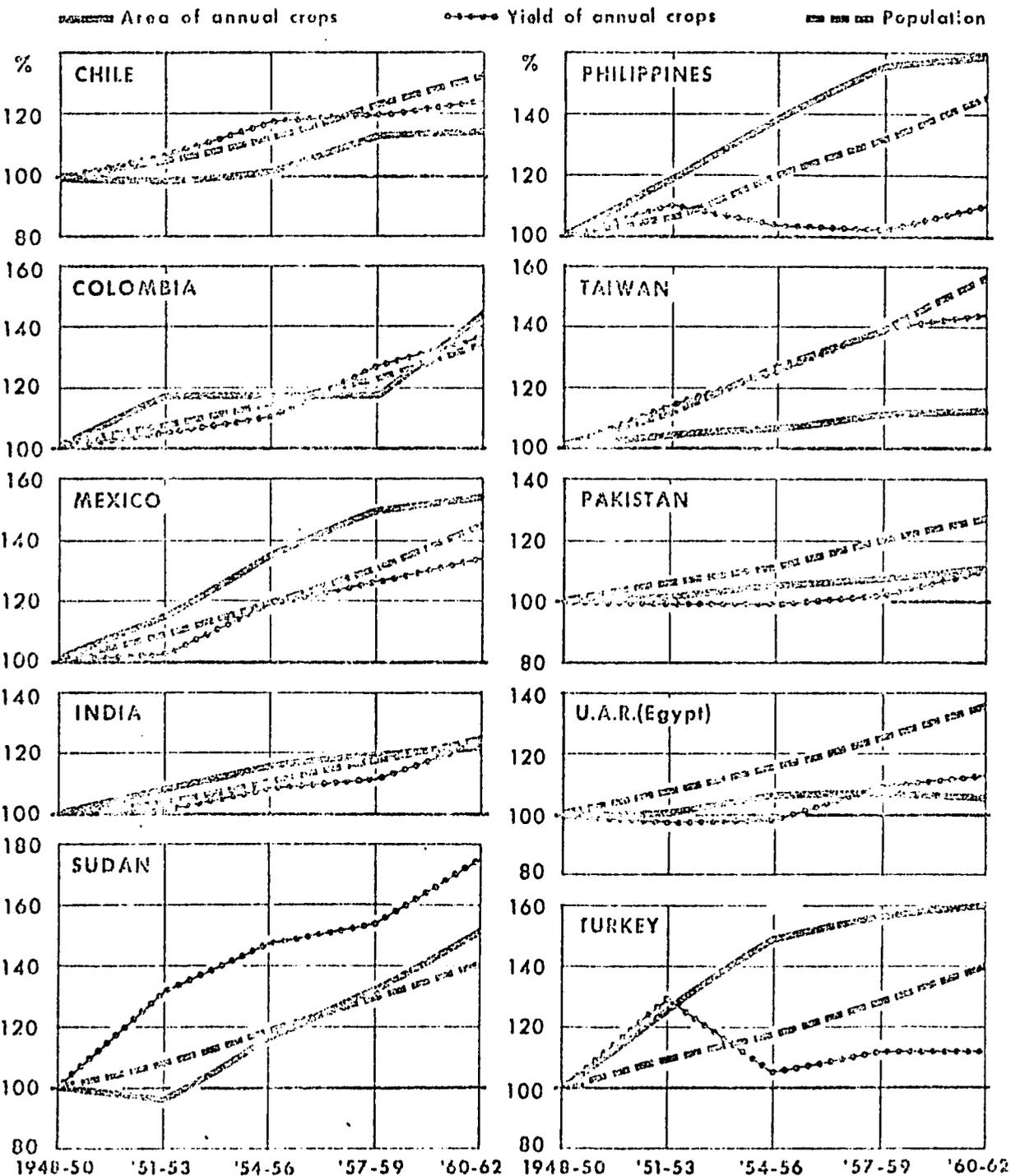
Agriculture and National Economic Growth

Much remains to be learned about the interrelationships between agriculture and national economic growth (2, 5, 6, 7) 1/. But it is widely recognized that increased productivity in agriculture is essential for national economic development in the less-advanced countries for three major reasons: (1) to supply an economic surplus that can be consumed or used for further production in agriculture or transferred out of agriculture to provide capital for industrial growth and to meet expanding consumption needs of the urban population; (2) to make possible the release of labor and other resources for use in the nonagricultural sectors, and (3) to increase the purchasing power of rural people, expand markets for industrial goods, and help bring about needed structural changes in national economic organization. The complementary relationships between agriculture and other sectors also are important. Improvements in agricultural productivity depend heavily upon adequate supplies of fertilizer, pesticides, tools, machines, and other materials required to apply better production methods and also upon transportation, storage, processing, and other facilities for marketing farm products. And increasing supplies of consumption goods from industry are essential to provide economic incentives to farmers for expanding farm production.

1/ Underscored numbers in parentheses refer to Literature Cited, p. 29.

Production gains result from area and yield increases

INDICES OF POPULATION, AREA, AND YIELD 1948-50 = 100



U. S. DEPARTMENT OF AGRICULTURE

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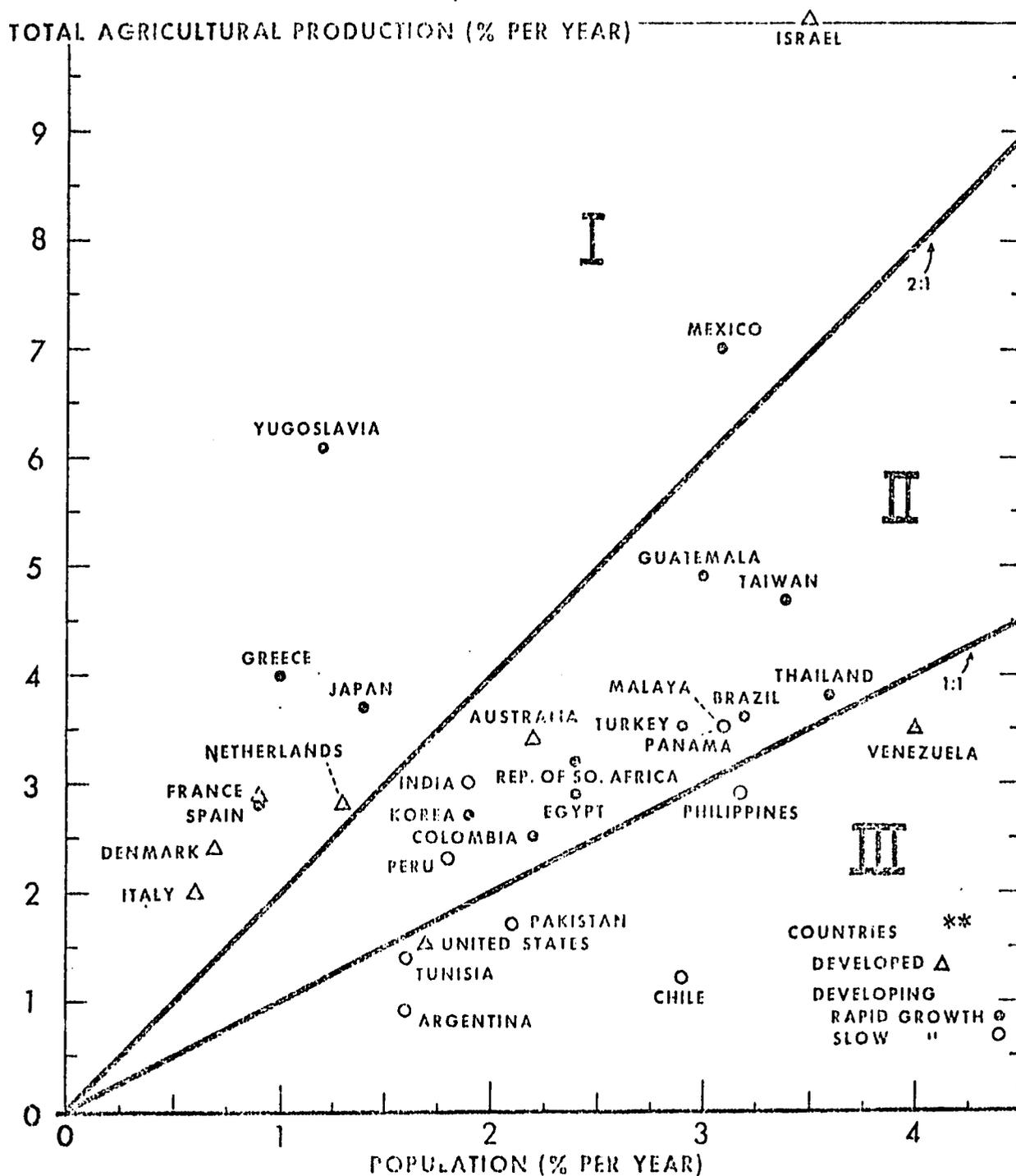
Figure 2

Compound growth rates for total agricultural production during the 1952-62 period shown in figure 3 for slow- and rapid-growth countries illustrate the importance of an adequate supply of agricultural products for national economic growth. Countries fall in three sections on the chart: (I) a few where agricultural production increased two or more times as rapidly as population; (II) a large number where production increased more but less than twice as rapidly than population; and (III) a few where production went up less rapidly than population. Per capita output of agricultural products went up greatly in rapid-growth countries like Japan, Greece, Mexico, and Spain, but it declined in slow-growth countries like Chile, Argentina, and Pakistan.

Figure 4 shows that growth in agricultural sector output and in gross national product are closely associated. Agricultural sector output is gross value of agricultural production less value of materials and services furnished by the nonagricultural sectors for use in farm production. It is the value of product added by agriculture or the net contribution of agriculture to national output and therefore differs from total agricultural production. All values are in constant prices.

Countries that experienced high national growth rates during the 1950's also had relatively high growth rates in agricultural sector output. This was true of developed as well as less-developed countries. As would be expected, there is considerable variation around the line of relationship drawn in figure 4. Resources differ among countries, and some are better adapted than others for expanding production in agriculture. Still, it is significant that growth rates for agricultural output and national output move upward together. For example, rapid-growth developing countries, those where gross national product per capita increased 2 percent or more annually during the 1950's,

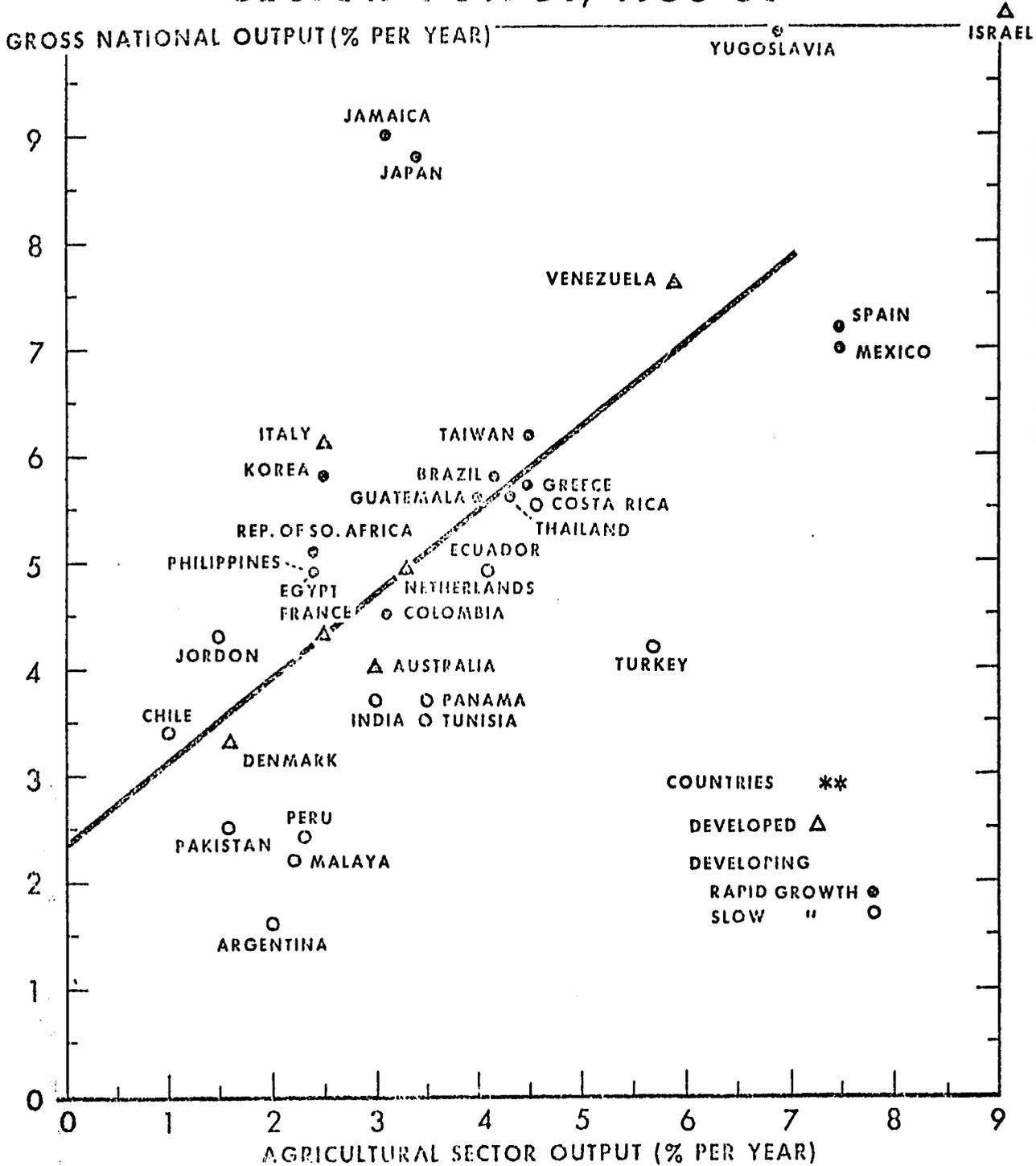
ANNUAL GROWTH RATES FOR TOTAL AGRICULTURAL PRODUCTION AND POPULATION, 1952-53 TO 1961-62*



* COMPOUND ANNUAL GROWTH RATES BASED ON DATA FROM FOOD AND AGRICULTURE ORGANIZATION AND UNITED NATIONS.
 ** DEVELOPED: PER CAPITA ANNUAL INCOME \$500 OR MORE. DEVELOPING: PER CAPITA ANNUAL INCOME LESS THAN \$500.
 RAPID GROWTH, PER CAPITA INCOME GROWTH RATE 2 PERCENT OR MORE ANNUALLY; SLOW GROWTH, LESS THAN 2 PERCENT.

Figure 3

ANNUAL GROWTH RATES FOR GROSS NATIONAL PRODUCT AND AGRICULTURAL SECTOR OUTPUT, 1950-60*



* COMPOUND ANNUAL GROWTH RATES FOR GROSS NATIONAL OUTPUT AND AGRICULTURAL SECTOR OUTPUT IN CONSTANT PRICES.
 ** DEVELOPED: PER CAPITA ANNUAL INCOME \$500 OR MORE. DEVELOPING: PER CAPITA ANNUAL INCOME LESS THAN \$500.
 RAPID GROWTH, PER CAPITA INCOME GROWTH RATE 2 PERCENT OR MORE ANNUALLY; SLOW GROWTH, LESS THAN 2 PERCENT.
 SOURCE: UNITED NATIONS, THE GROWTH OF WORLD INDUSTRY, 1938-1961.

generally had high growth rates in agricultural sector output. On the other hand, growth rates for agricultural sector output were low for the slow-growth countries, those where gross national product per capita increased less than 2 percent annually.

Failure of food production to expand sufficiently to keep pace with growth in demand accompanying population and income growth is reflected in increases in prices for food relative to those for other commodities. Percentage increases in relative prices for food at retail during the 1948-61 period for selected countries were as follows: Peru, 17; Brazil, 13; Argentina, 10; Pakistan, 8; Colombia, 6; Turkey, 5; India, 2.

Factors Affecting Agricultural Development

The factors affecting economic progress in agriculture in the less-advanced countries are numerous and complex. They vary from one country to another and also among regions within countries. However, we know that increased productivity requires the adoption of improved technology, the use of additional capital goods from nonfarm sources, and investments in land improvements. It also requires the establishment of economic incentives and institutional conditions affecting credit, tenure, marketing, and taxation that make new farming methods profitable and reduce production risks and price uncertainties.

I want to consider briefly what experience shows to be the effects of five factors on economic progress in agriculture. They include (1) land resources per person, (2) effective use of abundant labor, (3) capital inputs and technological innovations, (4) prices and economic incentives, and (5) efficient size farm units.

Land Resources Per Person

Figure 5 shows that within the world's densely populated areas, there are countries that have achieved a high level of economic development as well as

countries just beginning the development process. Countries with less than .40 hectares, or about one acre, of arable land per capita, might be defined as densely populated. Among these countries, there are many that have high incomes per person as well as many that have low incomes.

Within the more sparsely populated areas of the world there also are many countries that have low incomes as well as many that have high incomes. A large supply of land resources per person obviously does not assure economic growth and high incomes per person.

The fact that many densely populated countries have high incomes should be encouraging to low-income countries that are striving to improve economic conditions for their people.

The outstanding difference between the developed and less developed countries is not arable land area per person but crop production per unit of arable land area. Table 4 shows crop yields for cereals and other characteristics of countries classified in four groups in figure 5. Cereal yields average two and one-half times as high in the densely populated high-income countries than they do in the densely populated low-income countries. Similarly, crop yields for cereals average nearly twice as high in the sparsely populated high-income countries than they do in the sparsely populated low-income countries. Even more significant is the fact that increases in crop yields in the low-income countries have lagged behind those in the high-income countries.

But it should not be concluded that land resources have no influence on agricultural productivity and economic development. Countries with large supplies of land and other resources per person obviously have advantages over those with few resources. Countries now classified in the developed category had much larger

supplies of land resources per person during early periods of their development than do the densely populated countries today. Land resources may be viewed as a form of capital that influences the total volume of agricultural production. Increases in amounts of capital per farm worker are required to increase output per farm worker.

Table 4.--Cereal production per hectare and other characteristics of countries grouped according to arable land area and income per person ^{1/}

| Items | Countries grouped according to arable land and income per person | | | | |
|--|--|------------|-------------------|------------|---------------|
| | .40 hectares or less | | Over .40 hectares | | All countries |
| | \$250 or less | Over \$250 | \$250 or less | Over \$250 | |
| | I | II | III | IV | |
| Cereal production per hectare, 1960-61 average in metric tons..... | 1.18 | 2.86 | 1.09 | 1.89 | 1.60 |
| Percentage changes in cereals from 1949-50 to 1960-61 | | | | | |
| Production per hectare.... | 24 | 28 | 12 | 29 | 24 |
| Area..... | 16 | -1 | 28 | 0 | 8 |
| Production..... | 45 | 27 | 44 | 29 | 34 |
| Arable land per person, hectares..... | .31 | .17 | .97 | .95 | .37 |
| Percentage of world total | | | | | |
| Population..... | 41 | 15 | 12 | 32 | 100 |
| Arable land..... | 23 | 4 | 21 | 52 | 100 |
| Percentage of labor force in agriculture..... | 67 | 26 | 64 | 35 | 48 |
| Percentage of national income from agriculture.... | 44 | 10 | 41 | 11 | 14 |

^{1/} Based on most recent data available from FAO and UN sources. Data for mainland China were not available. Estimates of percentage of labor force in agriculture and of national income from agriculture are based on incomplete data. See Figure 5 for countries in each category indicated by the Roman numerals.

Productive Use of Abundant Labor

Rapid population growth means less opportunity for savings and capital formation. Coale and Hoover in a recent study demonstrate the influence of high

population growth rates on capital formation and economic development (3). They made estimates of national and per capita income for India with continuation of the currently high population growth rates and with reduction in these rates by 1986. According to their projections, total national product would increase more if fertility is reduced than it would if fertility rates continue high. In other words, more people mean less total production. They estimate that per capita income would increase less than one percent annually with continuation of the current rapid rate of population growth.

The fact that the rural labor force is increasing in the less-advanced countries and will continue to do so for the next generation or two means that it is extremely important that productive work be found in rural areas for these people, either in farm production or in improvement of rural resources that will result in future expansion of farm production or otherwise add to national output. As mentioned earlier, growth rates for rural population have been only slightly lower than those for total population during the last decade in most of the less-advanced countries. For example, during the 8-year period from 1953 to 1961, agricultural population increased 20 to 30 percent in the Philippines, Thailand, and Taiwan. It increased 10 to 20 percent in India, Pakistan, Turkey, Egypt, Mexico, and Chile. High rural population growth rates have tended to retard improvements in labor productivity of rural workers. In most countries, effective use has not been made of abundant rural labor for capital formation projects.

Because private enterprise is not likely to provide full employment for increasing numbers of rural workers, there is need for rural public work programs. Efficient use of public funds necessitates giving priority to projects that will result in capital formation by using direct labor with a minimum of new equipment and to activities that will increase agricultural output as rapidly as possible.

Such land improvement measures as terracing, land leveling, drainage, minor irrigation, and reclaiming of wastelands meet this requirement. Access roads and needed storage facilities are examples of capital improvements which can utilize direct labor and local materials.

It must be remembered that most of these countries have large pools of unemployed people in cities and towns. The first expansion in urban employment likely will absorb these pools before drawing heavily on rural areas. But over the long-term future, the rural sector should play an important role in economic development by supplying workers for industry.

Capital Inputs and Technological Innovations

Low levels of productivity per acre and per person in the less-advanced countries result from the use of primitive methods and small amounts of capital. It is physically possible to double or triple crop yields in many of the densely populated countries. For example, cereal production per acre averages nearly four times higher in Japan than in most other Asian countries. These results are achieved by applying appropriate combinations of improved technology involving the use of better seed, fertilizer, pesticides, and other materials.

The high levels of productivity per acre and per worker achieved in the developed countries have required the use of large amounts of capital goods from nonfarm sources. For example, annual inputs of working capital now amount to \$25 to \$50 per acre of land under cultivation on most types of farms in the United States. The comparable figure is probably \$15 to \$20 per acre for farms in Israel and Japan where crop yields average relatively high. On the other hand, inputs of working capital average only about \$4 per acre on rice farms in the Philippines. They are only slightly higher in the most progressive farming areas in India.

Technological innovations in farming get introduced through the use of new capital inputs from nonfarm sources. Much can be done to increase crop yields through better cultural practices, but most improvements in farm technology involve the use of small amounts of capital goods from industrial sources. Even the acquisition of improved varieties of seeds represents an additional capital input. Fertilizer, pesticides, and better tools and machines, of course, must be acquired from outside agriculture.

Prices and Economic Incentives

Rural people in the less-advanced countries live under physical and social conditions that differ greatly from those in the more-advanced countries. But farmers in these countries probably respond to economic incentives in about the same way as do farmers in the advanced countries. This was the conclusion of a study of agricultural production made by the Central Treaty Organization in 1962 (1). Most farmers, when asked why they did not use chemical fertilizer, said that it costs too much, that they had no money to buy it, or that the landlord did not furnish it. Very few said that they did not think it economical.

Many things influence economic incentives including markets, tenure, credit, and supplies of consumer goods. But perhaps most important is the fact that price ratios between farm products and production requisites are so unfavorable that the use of purchased capital inputs to apply new production methods is not profitable. In this connection, the data in table 5 showing the quantities of nitrogen and phosphate fertilizer that could be purchased with a kilogram of wheat and rice in different countries in 1956-59 are significant. A kilogram of rice or wheat purchased only one-third as much fertilizer in India as it did in Japan, United States, or West European countries. Yield increases from application of fertilizer 3 times higher in India than in Japan were necessary in order to

make the use of fertilizer equally profitable in both countries. Price conditions may be similar for other capital inputs required to apply improved farming methods. Obviously, improvements in the distribution of farm production requisites that lower their costs to farmers are needed to improve farm production efficiency. Reduction in price uncertainties through guaranteed markets also are essential.

Table 5.--Quantities of fertilizer that could be purchased in selected countries with rice and wheat, 1956-59

| Country | Kilograms of nitrogen in ammonium sulphate that may be purchased with one kilogram of: | | Kilograms of P ₂ O ₅ in super-phosphate that may be purchased with one kilogram of: | |
|-----------------|--|-------|---|-------|
| | Milled rice | Wheat | Milled rice | Wheat |
| India..... | .24 | .24 | .27 | .27 |
| United States.. | .62 | .24 | .98 | .38 |
| Japan..... | .78 | .34 | 1.01 | .44 |
| France..... | --- | .25 | --- | .37 |
| West Germany... | --- | .38 | --- | .51 |

In many of the less-advanced countries, much emphasis has been put on improving the production and marketing of export commodities, but little attention has been given to agricultural products produced for domestic consumption. The market exchange economy needs to be extended to include commodities produced chiefly for subsistence or domestic use. This will lead to greater specialization in production among regions and create more effective incentives for applying better farming methods. Actually, little has been done to take advantage of opportunities for improving living standards in the less-advanced countries by improving efficiency in producing and marketing farm products for domestic use.

Efficient Size and Yields

The small size holdings in densely populated areas (frequently less than 2 hectares), and the fragmentation of each holding into several tracts, have led many people to conclude that efficient farm operation can be achieved only through consolidation of land into large farm units, and some type of joint or group operation. Certainly, consolidation of fragmented holdings into contiguous units where it results in increased production will be beneficial. But the evidence that we have been able to bring together shows quite conclusively that it cannot be assumed that reorganization of farming into large-scale units will increase production per unit of cultivated area. In fact, several studies indicate that crop yields average higher on small farms than on large farms.

Farms in developed countries average larger than those in the less-advanced countries when measured by land area but not in number of workers. Table 6 shows, for example, that number of workers per farm averages about as high in India as in the United States. It averages only a little higher in Japan and the Philippines than in Denmark or the Netherlands. Differences in land area per farm reflect differences in total arable land area available per person and differences in stage of development. Farms in India, for example, would average as large as those in the Netherlands if employment on farms decreased to the same proportion as in the Netherlands, or from 70 percent to less than 20 percent.

It needs to be remembered that organization of farming in large scale units does not make more land or capital goods available per farm worker, nor does it mean automatic adoption of new technology. The countries that have achieved rapid progress in improving agricultural productivity in recent decades have done so with relatively small farm units under secure forms of tenure that assure farm people that they will share equally in the benefits of increased production.

Table 6.--Land area and number of workers per farm or holding and arable land per person, selected countries 1/

| Country | Land area per farm or holding | Workers per farm or holding | Arable land per person of | |
|-----------------------------|-------------------------------|-----------------------------|---------------------------|------------------|
| | | | Agricultural labor force | Total population |
| | Hectares | Number | Hectares | Hectares |
| <u>Developed countries</u> | | | | |
| United States..... | 123 | 1.7 | 29.2 | 1.00 |
| Canada..... | 113 | 1.2 | 54.5 | 2.29 |
| United Kingdom..... | 27 | 2.2 | 6.0 | .14 |
| New Zealand..... | 193 | 1.5 | 4.9 | .27 |
| Denmark..... | 17 | 2.4 | 5.8 | .61 |
| Netherlands..... | 9 | 2.5 | 1.4 | .09 |
| Israel..... | 14 | 5.7 | 3.0 | .18 |
| Japan..... | 2 | 2.9 | .4 | .06 |
| <u>Developing countries</u> | | | | |
| Argentina..... | 366 | 3.0 | 13.1 | 1.42 |
| Brazil..... | 113 | 4.8 | 1.4 | .26 |
| Mexico..... | 105 | 16.0 | 4.1 | .55 |
| Turkey..... | 8 | --- | 2.6 | .88 |
| Egypt..... | 3 | 4.1 | .6 | .09 |
| Taiwan..... | --- | --- | .6 | .08 |
| India..... | 3 | 1.6 | 1.2 | .36 |
| Pakistan..... | --- | --- | 1.5 | .31 |
| Philippines..... | 4 | 3.3 | 1.2 | .24 |
| Thailand..... | 4 | 4.3 | .9 | .37 |

1/ Computed from reports of the Food and Agriculture Organization and other agencies of the United Nations. Data on arable land per person are for 1959, 1960, or 1961, but data on land area and workers per farm or holding are for years as early as 1950 or 1951 in some instances.

Farm size conditions in Japan are of special interest because of the large increases in agricultural productivity achieved there during the last 50 years. Numbers of farms in different size categories have not changed much since 1910. Most farms are relatively small. For example, only about 2 percent were larger than 5 hectares in 1960. Widespread distribution of farmland in a large number of owner-operated units has helped to achieve high rates of capital formation, intensive use of scarce land resources, and

very high yields. Marketing facilities, production requisites, credit, agricultural education and research, and other supporting services have been essential for improving agricultural productivity. But experience indicates that they can be developed as effectively with a large number of farm operators as they can with land, labor, and other farm resources concentrated in relatively few farm units.

In Conclusion

Finally, it is important to ask: Is it realistic to expect that the less-advanced countries can increase total agricultural production by 4 or 5 percent a year over the next 20 or 25 years? Economic development plans of these countries assume that such increases are possible. In fact, development plans of many countries call for increases in total agricultural output of 6 percent or more a year. If increases of 4 to 5 percent a year over the next 20 or 25 years are not possible, does not this mean that significant improvement in income levels of the less-advanced countries will be delayed until population growth rates are drastically reduced from present high levels?

Experience during the last 25 years indicates that few countries have been able to increase total agricultural production by as much as 4 percent a year. In the case of most countries, the compound growth rate for total agricultural production has been 3 percent or less a year. What is there in the picture ahead that will make it possible for the less-advanced countries to increase greatly their agricultural output growth rates? During the last 25 years, a large part of the expansion in total agricultural output has been achieved by expanding the total area under cultivation, but the densely populated countries will need to rely chiefly on higher crop yields in the future. The great hope today, of course, is that modern technology can be

applied to achieve significant new breakthroughs in agricultural productivity. But this will call for more effective agricultural development programs than we have had in the past.

Rapid population growth in the less-advanced countries today leaves little or no margin over consumption needs for investment in future growth. In fact, many people in the less-advanced countries do not get enough food energy to do a full day's work and most do not get enough protein and other nutrients for nutritionally adequate diets (8). Population growth rates must decline if income levels are to increase substantially in the next decade. Dr. Philip Hauser has pointed out that, "One hundred persons multiplying at one percent a year for 5000 years of human history, would have produced a contemporary population of 2.7 billion people per square foot of the earth's surface! Such an exercise in arithmetic, although admittedly dramatic and propagandistic, is also a conclusive way of demonstrating that a 1 percent per year increase in world population could not have taken place very long in the past; nor can it continue long into the future." (4, p. 14).

I conclude that a dual approach is needed. Population growth rates must be reduced and new ways must be found to accelerate the agricultural growth process if the less-advanced countries are to achieve satisfactory income growth rates.

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