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Major Forces Affecting the World Food Situation 1/

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There has been much discussion of the world food situation during the past few years. It has been on this Conference's agenda several times. In spite of all this discussion, there has been considerable confusion as to the nature of the world food problem. Opinions have swung like a pendulum between extreme pessimism and optimism.

In the late 1940's, there was considerable concern about world food shortages. The first Director-General of FAO warned that in the race between population and food, population was winning and we did not know how to stop it. Americans talked about the "Fifth Plate" to dramatize that for every four persons in 1950, there would be five to feed in 10 years.

This fear of food shortages soon disappeared as surpluses began to accumulate in the United States in the early 1950's. However, by the mid 1960's supply management and food aid programs began to reduce these so-called "burdensome surpluses."

In 1966, there was a rapid drawdown of world grain stocks and an increase in food grain prices, largely as a result of greatly expanded imports of grain by India and the USSR. India has suffered from a second year of

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1/ Paper presented at the National Agricultural Policy Conference, Tahlequah, Okla., September 11, 1968.

2/ Director, Foreign Regional Analysis Division.

drought and the USSR had two crop failures in 3 years. On top of this, Australia had a poor crop. The disappearance of excess stocks in the United States and an unfavorable wheat yield outlook contributed to the uncertainty. Grain acreage for the 1967 crop was increased considerably.

This situation was taken by many as evidence that the world food situation was deteriorating and again raised the question whether there would be sufficient food in the future to supply the rapidly expanding world population at acceptable levels of nutrition. Malthus and his theory that population would inevitably outrun food supply suddenly became popular again.

In 1967, the situation was somewhat different. Record grain crops had been produced in the USSR, Canada, and Australia. India harvested at least 100 million tons of food grains, compared with 73 and 78 million in the previous 2 years. Crops also improved in Pakistan, Latin America, Africa and West Asia. In Western Europe, feed grain production established a record and the wheat crop was a near record. South Africa also had a record feed grain crop.

Altogether, 1967 was one of record output for world agriculture and, most significantly, a record for the less-developed world. Per capita food output in the free world, less-developed countries increased by about 5 to 6 percent, a recovery to the previous record level of 1964 or slightly above. Largely because of drought in India, per capita production in the less-developed countries had fallen below the 1957-59 base period.

However, there are still many who believe the world is in imminent danger of running out of food. As late as September 1967, a prominent authority restated the theme which had been so prevalent during the previous 1½ years: "In simplest terms, population has been rising faster than food production.

The stork is outrunning the plough. There is less food per capita in the world today than a year ago. In the less-developed world, where food deficiency is already the greatest, agricultural production is far from keeping pace with the growth in population. ...For the past 6 years, the world has eaten up more basic food grains than we have produced. We have eaten up our so-called surpluses. We are rapidly eating up our secondary reserves, land previously withheld from production." <sup>3/</sup>

The Economic Research Service has been a voice of moderation in this wave of pessimism. In 1964, in our World Food Budget, we said that production in the free world, LDC's had increased annually about one third of 1 percent per capita since the prewar period and that it was expected to increase over the decade of the 1960's at about the same rate. We said there would be increasing pressure upon the food supply, but at rising levels of consumption. <sup>4/</sup>

In 1965, we wrote a paper entitled "Food Surpluses in a Hungry World" which indicated that, if production and trade trends continued, by 1970 exportable supplies of grains would exceed import requirements by more than 15 million tons.

At the Policy Conference in 1966, I restated these projections of more than adequate world grain supplies in the near future. I indicated that the only condition under which the United States would not be able to supply the less-developed world their food needs was if we were to suddenly--within one

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<sup>3/</sup> Waters, Herbert J., Paper given before the General Federation of Womans Clubs, U.S. State Department, Washington, D.C., September 14, 1967.

<sup>4/</sup> The World Food Budget, 1970, FAER 19, USDA, October 1964.

decade--try to furnish everyone in the LDC's an adequate diet, without any improvement in food production on their own part. We told this same story to the President's Science Advisory Committee <sup>5/</sup> and in numerous speeches.

Last year, two participants in your Conference discussed our study, The World Food Situation. <sup>6/</sup> In this report, we concluded that growth in production capacity would continue in the developed world and would be more than ample to meet the rising import needs of the less-developed world. In fact, even if the grain import requirements of the LDC's doubled, to almost 60 million tons, the excess production capacity of the developed countries would still reach 30 million tons.

The report also concluded that if the LDC's increased their levels of agricultural production to 4 percent annually--a rate achieved by only a few countries in the past--they would be achieving a high enough rate of growth in food production to provide minimum adequate calorie levels for their people by 1980 and break their dependence on food aid. However, this would require unprecedented increases in resource commitment to agricultural development. It would also require massive efforts by many developing nations and considerable assistance from developed countries.

In the past few months, there has been a complete turn-about in the attitude of many toward agricultural development in the LDC's. Some of the most pessimistic have become real optimists. Some have said that the 4

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5/ President's Science Advisory Committee, The World Food Problem, Vol. II, Ch. 2, White House, May 1967.

6/ Abel, Martin E. and Rojko, Anthony S., World Food Situation: Prospects for World Grain Production, Consumption and Trade, FAER 35, USDA, September 1967. See comments by Robert K. Buck and Terrell E. Arnold in the Proceedings of the 1967 Policy Conference.

percent growth rate discussed in our World Food Situation was even conservative. This swing was generated by the record crops last year in the LDC's and the success of the new high-yielding varieties of wheat and rice.

One authority recently stated: "The shorter growing season of the new varieties, and their ability to mature without regard to day length, make possible double and multiple cropping. Thus, as soon as the first crop of rice is harvested, another may be planted, to be still followed by another, if water is available and if harvesting, land preparation, and planting are done quickly. Alternatively, sorghums, wheat, or potatoes can be planted after the rice is harvested; or they may be interplanted among the rice crop before rice harvesting. The gross yield potentials are tremendous. In the Philippines, IR-8 rice, followed by grain sorghums permitted to sprout two times, has produced over 20 tons of cereals per hectare in 365 days, some three times the average U.S. corn yield."<sup>7/</sup>

The performance cited is from a test plot under very atypical circumstances. In my opinion it provides little guidance in forecasting future developments in the LDC's. Reluctantly, ERS must again take a moderate view.

I would like at this time to outline briefly our analysis of the world food situation, make an evaluation of the impact of the "new technology", and give our immediate outlook for world production and trade of the principal foods--wheat, rice, and coarse grains.

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<sup>7/</sup> Schertz, Lyle P., Paper presented at the American Society of Agricultural Engineers, Storrs, Conn., August 26, 1968.

Consumption-Production Gap in the Less-Developed Countries

There is still much hunger in the world today. Probably two-thirds of the world's people live in countries with nutritionally inadequate national average diets. The diet deficit areas include all of Asia except Japan and Israel, all but the southern tip of Africa, and most of South and Central America. The calorie level of the diets of the people in these areas averages about three-fourths that of the people living in countries with adequate diets and is 150 to 200 calories below the minimum nutritional standard of 2,400 calories required for normal activity and health. The consumption of about 40 pounds additional grain per person annually would be required to meet this calorie deficit. The total additional grain required for the free-world, less-developed countries would amount to about 25 million metric tons of grain. Almost two-thirds of this requirement is in four major food-aid countries--India, Pakistan, Indonesia, and Egypt, with over 45 percent in India. There is also a deficiency of protein in the national average diet of most of the LDC's.

During the past decade, food production increased at a slightly faster rate in the less developed countries than in the developed countries, but the per capita trend in the LDC's has been dampened by a high rate of population growth. Annual population growth has reached 2 1/2 to 3 percent in many developing countries, as widespread application of medical technology and improved food supplies have reduced death rates.

An important aspect of the world food problem is to bring birth rates into balance, and some progress is being made in this effort. In fact,

population projections for countries which now have very high growth rates assume a future decline in the birth rate, but assumptions regarding the timing and rapidity of the decline in birth rates differ widely. Governments of several LDC's have begun campaigns to encourage family planning. Clues to the success of such campaigns are scarce, since the registration of vital statistics in most underdeveloped countries is incomplete. The most encouraging signs come from Chile, Hong Kong, Singapore, Taiwan, and Trinidad, where birth rates have fallen so fast that the number of babies born in 1966 was less than in 1960. Fairly clear signs of a decline in the crude birth rate are now coming from Ceylon, Costa Rica, Jamaica, and West Malaysia. There are not yet clear indications of downward trends in birth rates in such big countries as Brazil, India, or Pakistan because of lack of statistics; we can only hope that intensive birth control programs there are having success similar to that realized in some smaller countries.

Over the past two decades, food production per capita has increased in the less developed countries at an annual rate of about one-third of 1 percent, whereas food consumption has been increasing at almost one-half of 1 percent per capita. The gap between production and consumption has been made up by increased food imports from the developed countries. Food imports by the LDC's have been mostly grain to increase the calorie intake. Prior to World War II, the free-world, less-developed countries (excluding the traditional grain exporters--Argentina, Mexico, Burma, Thailand and Cambodia) were net importers of only 2.3 million tons of grain, but for the past few years they have imported over 30 million tons. More than one-fourth of this has gone to India.

What have been the forces responsible for this gap between production and consumption?

Development Within the Less-Developed Countries

Prior to World War II, there was little concern about the welfare of people in the underdeveloped countries. The great mass of people in these areas subsisted as they had for centuries, at the hunger margin; this was more or less a fact of life.

Since then, 60 of these less-developed countries have become independent. Almost without exception, they have immediately embarked on a program of economic development. These have had varied success, but in general they have brought about some improvement in per capita income; 1 to 2 percent annually. With rising incomes, people demand more food. They also desire higher quality food which requires greater agricultural resources for their production.

More than 50 percent of the world population has an annual income of less than \$100 a person. At low income levels, a high percentage of total expenditures is for food, and a large part of increases in income will go for food. As incomes rise, if increased supplies are not available, food prices go up and the poorer people, whose ability to buy has not improved, can obtain even less food.

Because of the great importance of food prices to a large majority of the population, sharp rises in prices are likely to have political repercussions. Under such circumstances there are strong pressures to expand food imports. With food aid available, this expansion has been possible without diverting scarce foreign exchange resources.

The impact of population on food supplies in the developing countries is accentuated by the concentration of people in cities. The extremely rapid growth of urban population compounds the problem because it imposes the difficult task of improving the distribution system so food can be moved from producing areas to urban areas. To accomplish this task, incentives must be used to bring farmers into the commercial economy. Not only must there be an increase in food production, but marketing facilities must be built to transport, store, process, and distribute the farm products. When this task is not accomplished, urban centers have to rely on imports for much of their food supplies.

#### Availability of Food Aid

The United States has long shown a great concern for the hungry people of the world. Immediately after World War II, agricultural aid programs were instituted to supply food to war-torn areas of Europe. In the early 1950's, following a severe drought in India and Pakistan, special wheat loans were made to these countries.

During the 1950's, American farm output increased approximately 2.5 percent per year, whereas consumption was increasing at a much slower rate. Surpluses of several agricultural products began to build up. In an effort to dispose of these surpluses and at the same time give foreign countries an opportunity to obtain agricultural products which their limited foreign exchange would not permit them to buy, Congress in 1954 enacted Public Law 480: "To increase the consumption of U.S. agricultural commodities in foreign

countries." Since that time, the United States has shipped over 135 million metric tons of wheat and about 40 million tons of other grains under this program.

This tremendous excess food production capacity and the large accumulation of grain stocks has made it possible for the less-developed countries to expand their consumption faster than their production over the past decade.

The policy of the United States is to encourage and assist the developing nations of the free world to develop economically and to improve their own food production so that they will become less dependent on food aid. A very significant feature of the Food for Freedom program is the requirement of self-help efforts to accelerate food production within the food-deficit countries themselves. Food aid probably will continue to be needed for the next decade. But dependence of the LDC's on food aid should diminish as they accelerate agricultural development and economic growth to a level where they can produce or commercially import their food requirements.

#### New Technology

There has been a growing awareness of the high priority developing nations must place on agricultural progress. In the fifties and early sixties, many LDC's assumed that the road to economic growth was through industry, not agriculture. In the past, the United States also sometimes reflected a lack of concern for agricultural development programs by stressing industrially-oriented aid programs. This did not work. Our recent

strong emphasis on agricultural development as a condition for food aid has strengthened a trend among some governments toward greater emphasis on agriculture.

In Turkey, foreign exchange used to import fertilizer may this year exceed for the first time that used to import petroleum, traditionally the leading import commodity. Fertilizer availability in Pakistan has increased fourfold since 1960, and is expected to double again by 1970. India increased its agricultural budget by one-third after her first drought and is now using the equivalent of one-fifth of its export earnings to import fertilizer and fertilizer raw materials.

Thus, we find a new climate for agricultural development in some of the IDC's, especially in Asia. Farm prices are higher, making it profitable for farmers to use modern inputs such as fertilizer. These improved price levels are in considerable degree the result of scarcity. But they also reflect a change from the cheap food policies which have helped keep farm output at depressed levels.

Even with previous technology, this combination of higher prices and expanded fertilizer availability would probably have caused a significant upswing in food output. But the key to present prospects is new technology in the form of high yielding varieties of wheat, rice, corn, and sorghum. These new varieties are especially responsive to heavy doses of fertilizer, as many old varieties were not. When grown under proper conditions, they produce yields which may double, or more, those of the old seeds.

High-yielding dwarf varieties of wheat, developed with the support of the Rockefeller Foundation in Mexico, are proving adaptable across Asia as far north as Turkey and as far south as India. They are also beginning to be introduced in North Africa. In India and Pakistan, Mexican-type wheat now covers an estimated 15 to 20 percent of the wheat acreage.

High-yielding tropical rice varieties are more recent. The International Rice Research Institute in the Philippines, a combined Ford-Rockefeller venture inaugurated in 1962, has developed two new tropical varieties (IR-8 and IR-5) with yields equal to or better than the temperate zone varieties of Japan and Taiwan. The IRRI varieties are not yet as widely disseminated as Mexican wheat. In the 1968/69 crop season they will be planted on perhaps 4 million hectares or about 5 percent of the total rice land in South and Southeast Asia.

It is difficult to evaluate the increase in production from the new varieties for several reasons: This year and last year have seen good weather following 2 years of drought in a number of countries. Fertilizer consumption has been rising sharply and the total acreage of rice has been increasing. However, a rough estimate, based on very limited information, is that the new varieties will add about 7 percent to rice production in the region this year, compared with what production would be without them. This, of course, will be a major accomplishment, but the impact is still much less than the overall effect of weather which often causes a 15 to 25 percent fluctuation in rice yields from year to year in South and Southeast Asia. Also, it should be kept in mind that the production of rice in the area has been trending upward at nearly 3 percent annually in the past 10 years.

For a number of reasons it seems unlikely that the new rice varieties will quickly spread beyond about 10 percent of the rice area--50 percent of the irrigated area--in South and Southeast Asia. If this judgment is correct, then, in connection with the above estimate, it can be seen that the immediate potential is for another 7 percent increase from the new rice varieties. This will indeed be a great achievement but it is hardly a complete solution to the grain problems of the less-developed countries.

Looking to the future, there are several factors that will impede the new-variety programs. Most of these wheat and rice varieties are exotic to the regions where they are being introduced and, in time, will become susceptible to local diseases and insect damage. It is highly probable that new micro-organisms, previously unimportant, will become major causes of disease as field microclimates are altered by heavy fertilization and the dense plant population of the new varieties. Plant protection services, which require a very high level of technical skill, are primitive in most of the less-developed countries.

Without large investments in irrigation facilities, the potential of high-yielding rice varieties will not be realized in South and Southeast Asia. The older and most of the new irrigation systems in this area were not designed to control the water level in individual fields but to provide a constant flow of water from the upper to the lower fields. This continuous flow results in loss of fertilizer and plant protection chemicals. Furthermore, much of the irrigation facilities provide only supplementary irrigation

during the wet season and, therefore, are unsuitable for the new varieties. Only those farmers with reliable irrigation can afford the risk of the high cash costs of fertilizer and insecticides required by the new varieties.

Because of the short growing season of the new grains, hopes have been raised concerning widespread multiple-cropping. However, it has recently been estimated that the potential land for double-cropping of rice under existing irrigation is less than 10 percent of the total rice area in South and Southeast Asia.

In many areas, the lack of rice-drying facilities may impede the spread of the new varieties, which mature early during the latter part of the wet season. In the Philippines, the new type rice had to be sold at a discount in 1967 because of a shortage of drying facilities and the inferior quality of the rice.

In terms of quality, there is at least a short-run problem in several countries. The new rice is considered inferior to traditional varieties in milling qualities and taste. These characteristics, however, should be bred out in a few more years.

There are other factors that may slow dissemination of the new wheat and rice varieties. As the immediate food crisis abates, the priority given agriculture could weaken. Farm prices could fall below incentive levels in some areas, discouraging the modernization of agriculture. Fertilizer availability may not keep pace with demand.

All of these can happen, and to some degree most probably will. Therefore, it is important to be clear as to what this agricultural revolution is and what it is not. It is not a panacea solving all agriculture and development problems in Asia. It is a bright new hope.

It does not mean an inevitable march to food self-sufficiency by hungry nations. Population growth continues, and demand for food will grow even faster as incomes rise. Even if production in these countries improves to the point where it could supply minimum dietary needs, internal marketing and distribution institutions might not be able to bring the food to the right people. Also, calories alone will not meet the special nutritional needs of infants, pregnant women, and nursing mothers.

#### Outlook for Grain Production and Trade

Wheat: Wheat is one of the world's most important foods and is, by far, the most widely traded internationally. Exports have almost doubled in the past 10 years, reaching 63 million tons in 1965/66 but falling off 6 million tons the last 2 years. They now represent almost one-fourth of world production, compared with less than 15 percent 10 years ago.

Highlights of recent developments in wheat production and trade follows:

(a) The Soviet Union had two extremely poor crops in 1963 and 1965. The 1963 wheat crop was down 26 percent and stocks were low, resulting in large imports--23 million tons in the 4 year period to 1967/68. The 1966 crop was almost double the previous year, that of 1967 was very favorable, and 1968 appears to be slightly better than 1967.

(b) India and Pakistan had two consecutive years of drought in 1965 and 1966--the most severe of the century. These countries imported 27 million tons of wheat between 1965/66 and 1967/68. The 1968 wheat crops in India and Pakistan were 35 and 37 percent, respectively, above the previous 1965 highs.

(c) Mainland China has become a major importer. In the 7 years prior to 1966/67 China imported 34 million tons of wheat, mainly from Australia and Canada, but also from Argentina and France. There is evidence of wheat deficits in the large coastal cities of the north. Also, it appears that imported wheat is being substituted for higher priced rice which is then being exported.

(d) Canada and Australia have expanded production and trade as a result of becoming major suppliers for the Soviet Union and Mainland China. As the market in the USSR has fallen off, stocks have built up in Canada and now exceed those of the United States.

(e) France has become a major exporter, responding to the higher EEC price and restitution payments on exports. This has become costly to the EEC.

(f) U.S. wheat exports rose from 18 million tons in 1960/61 to 24 million in 1965/66, then fell to 21 million in 1967/68. Commercial sales accounted for only 36 percent of U.S. wheat exports in the period 1959 to 1963 but were 47 percent of the total in 1967/68.

The world wheat outlook for the near term is for ample supplies for domestic use and export, continuing pressure on prices (in spite of the International Grain Arrangement), and a slowdown in the growth of import demand. The United States has already responded to this "bearish" outlook by reducing its 1969 wheat allotment 12 percent to 51.6 million acres.

This wheat outlook is based upon the expectations that:

(a) The developing countries will sustain their recent growth in production, which will lessen the need for food aid.

(b) The per capita demand for wheat for food in most developed countries (Japan being an exception) will continue to decline as incomes increase.

(c) The Soviet Union will continue its traditional role as an exporter.

(d) Production in the major exporting countries will continue at the relatively high levels of the last few years.

(e) Among the major producers, there will not be crop failures of the magnitude of the 1963 harvest in the Soviet Union and the 1966 harvest in India.

Rice: Rice is the staple food of approximately half of the world's population. Nearly a billion people rely almost solely on rice for their daily calorie intake. Export volume of rice is little more than one-tenth that of wheat and accounts for only 4 percent of production.

World rice production changed little during 1963-66 and international prices have risen sharply in recent years despite import substitution of wheat and other grains. The 1967/68 world rice harvest increased almost 10

percent, reaching record proportions in India, Pakistan, Japan, the Philippines, and the United States. Mainland China reportedly harvested a near-record crop, substantially larger than in the previous year. However, the harvest in Thailand, the largest exporter in the Southeast Asian Rice Bowl, was cut about 15 percent by drought and the crop in Burma was only a little larger than the poor crop of 1966/67.

Although the world rice crop reached a new high, exportable supplies were relatively small in 1968. In 1967/68, the United States became the leading rice exporter--U.S. exports amounted to 1.9 million tons (milled), including about 1.1 million tons of commercial exports. The bulk of the Government-financed shipments went to South Vietnam and Indonesia. Western Europe is our largest commercial market.

Forecasts for 1968/69 point to greater supplies in both exporting and importing countries. Much of the increase in South and Southeast Asia may be attributed to new varieties and expanded fertilizer use. In other areas, such as the United States, Brazil, and Italy, there has been substantial expansion of acreage. Under growing pressure of mounting stocks and record production, world rice prices appear to be leveling off.

Coarse grains: Coarse grains account for over 48 percent of total world grain output, with the remaining production about equally split between wheat and rice. The LDC's use 65 percent of their coarse grains for food whereas the developed countries use only 6 percent for food. Production of coarse grains has increased about one-fourth in the past decade and exports have more than doubled. Exports now represent almost one-tenth of production.

Most of the volume increase in exports has been in corn, but as a percentage, the increase in sorghum has been greater. The United States accounts for 60 percent of coarse grain exports; the nearest competitor, Argentina, exports less than 10 percent of the world total.

Member countries of the European Economic Community along with the United Kingdom, Denmark, Spain, and Japan accounted for three-fourths of world coarse grain imports in 1966/67. The continuing expansion of domestic coarse grain production in all countries except Japan leaves trade prospects for grain exporting countries, including the United States, somewhat dim. Even in Japan, there is strong evidence that increased availabilities of coarse grains by 1970/71 from countries such as Australia and Thailand will squeeze the traditional market share of other suppliers, particularly the United States. High grain price policies pursued by some importing countries, such as the EEC, work against import demand expansion in two ways--domestic production is encouraged and demand for feed grains is dampened. Recent political developments in Eastern Europe reduce prospects for a near term increase in East-West trade. Also, expansion of livestock production and demand for feed is closely tied to per capita income and shifts in this variable have occurred very slowly in Communist countries.

The tremendous production potential inherent in some exporting countries and the dependence of others on grain for export earnings augurs for continued efforts to expand exports. Development of the livestock and poultry industries in some countries, however, will tend to slow increases in export availability.

These activities among major importers and exporters will generate pressure on world feed grain prices. Even if international grain prices do decline, major importers will not increase their imports as long as high domestic prices are insulated by import controls.

Summary

The less-developed countries have made considerable progress in increasing agricultural production. However, in most countries, development has fallen short of expectations and has not been sufficient to meet the expanding demand for food coming from a rapidly growing population and some increase in per capita income. In many countries, this gap has resulted in greatly increased imports of grain, largely as food aid from the United States.

Improvement in per capita food consumption and nutrition must proceed at a faster rate than in the past decade. Food trade and food aid will likely continue to make important contributions to diet improvement, as well as economic development. However, the gap will eventually have to be filled largely within each country itself.

Most less-developed countries have the potential for increasing food production sufficiently, or improving their ability to buy food, to insure enough food in the future to feed the rapidly expanding population at acceptable levels of nutrition. Even if production does not accelerate in the IDC's, there is sufficient capacity in the developed countries that the world is not going to run out of food in the foreseeable future.

There is an improved climate for agricultural development in the less-developed countries. This new attitude, along with new, high-yielding varieties of wheat and rice and greater availability of fertilizer, is a bright new hope for much of the hungry world. As great as these developments are, they are not the total solution to the world food problem. Much must still be done before food supplies will be assured for the majority of the human race.