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# W H E A T   S T U D I E S

## *of the* FOOD RESEARCH INSTITUTE

VOL. XVII, NO. 6

(Price \$1.00)

MARCH 1941

### RICE AND WHEAT IN WORLD AGRICULTURE AND CONSUMPTION

*V. D. Wickizer*

The World War of 1914-18 focused attention upon the importance of wheat in the food position of Western nations and gave impetus to study which has greatly increased understanding of the world wheat situation. Despite the war developments of 1937-41, much less is known of rice, a food crop of comparable importance in the world as a whole, and of far greater importance in the Orient. This comparative study therefore focuses on the rice world centering in Monsoon Asia.

Rice and wheat together constitute the major element in food supplies for four-fifths of the world's population. Changes in their positions and prospects, aside from their immediate strategic or military importance, have considerable long-term significance. Contrasts between rice and wheat in methods, places, and conditions of production and consumption largely explain the position and importance of each cereal in agriculture, the diet, and the national economy; the degree of elasticity in supply and demand, and the behavior of prices; the character and extent of international trade; the nature of the problems entailing government intervention; the potentialities for and ease in expanding production; and the degree and type of population pressure on food supplies.

Per capita consumption of wheat and rice alike has tended to decline, though for quite different reasons. The decline in wheat consumption has been largely voluntary; the decline in rice consumption has not. Herein are considered the numerous trends in and problems of national nutrition, population, agricultural adjustment, trade development, and international politics which lie behind and explain changes in consumption of the two cereals, as well as competitive relationships which seem destined to assume greater importance in the future.

STANFORD UNIVERSITY, CALIFORNIA

**WHEAT STUDIES**  
**OF THE**  
**FOOD RESEARCH INSTITUTE**

Entered as second-class matter February 11, 1925, at the Post Office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.

Published eight times a year by Stanford University for the Food Research Institute.

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# RICE AND WHEAT IN WORLD AGRICULTURE AND CONSUMPTION

V. D. Wickizer

## I. CEREALS IN WORLD FOOD SUPPLIES

The food supply of most nations continues to be dominated by the cereals. As the cheapest sources of carbohydrate calories, they are man's principal reliance for the energy requirements of the body. Among different peoples, nations, and classes the degree of dietary dependence on cereals probably ranges from 15 to 90 per cent of the total calorie intake. More than half of the world's population derives over half of its calories from the cereals. Foodstuffs that are more expensive—animal products of all kinds, fruits and vegetables, sugar—make a far smaller calorie contribution to the world's diet.

The proportion of total food calories in the diet derived from cereals is a general indication of the economic status of peoples.<sup>1</sup> Poor nations can afford little diversity in the diet, little of the relatively expensive foodstuffs; hence they have generally cheaper diets and must use more cereals per capita than wealthier nations. Within national boundaries the consumption of cereals likewise varies inversely with the level of family income.

Of all the cereals, rice and wheat are by far the most important in food use. Within historical times, rice has always been the dominant food of the yellow and brown races, and for several centuries at least, wheat has probably been the preferred cereal food of the white race. Over a long period of years the price of wheat has shown a tendency to approach the price level of cheaper grains. Wheat has therefore become less of a luxury food as compared with other cereals, not considering rice, and the competition of rye, corn, oats, and barley with wheat in food use has tended to diminish. In many countries it has almost disappeared.

Rice has not displaced other grains to the same extent as wheat, but has maintained its position in consumption, a position long ago more important than was the place of wheat.

Thus the dominance of rice and wheat among the food cereals has not only continued but has tended to increase over the years. The other bread grain (rye) and the coarse grains (oats, barley, corn, and the grain sorghums) are also consumed in both the Orient and the Occident. None of these cereals, however, outrank wheat or rice in national diets, except in a few places. Taste preference undoubtedly supports continued use of some of them, but generally their availability and relative cheapness provide a better explanation.

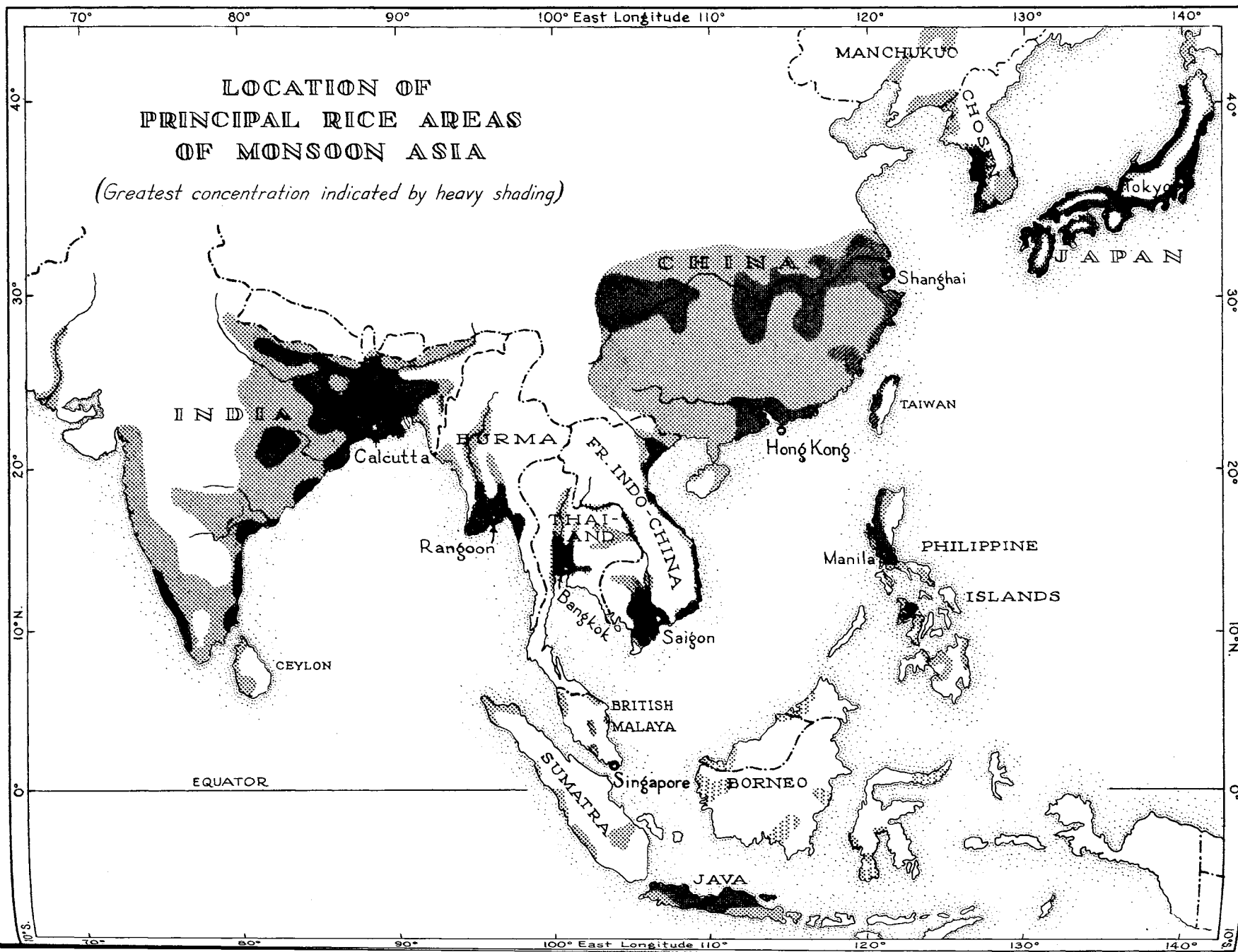
Nutritionally all cereals are substitutive in large degree, but agriculturally and in consumption they replace one another to a lesser extent. This is particularly true of wheat and rice, the two crops of first importance in the world's food supply. Although the "wheat world" and the "rice world" stand somewhat apart agriculturally and in consumption, there are important spheres in which they overlap; and in the future it is probable that this overlapping will become even more significant.

In most Western nations, wheat is more highly prized as a bread grain than any other cereal. The populations of countries with this strong preference for wheat enjoyed a rapid growth during the past century. At the same time transport was greatly improved, extended, and cheapened. These developments, plus the fact that the wheat plant happens to

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<sup>1</sup> This subject will be considered in a later issue of WHEAT STUDIES.



be adaptable to a wide range of climatic conditions, largely account for the spread of wheat production and consumption to every country in the temperate zone and to some in the tropics. The accompanying rise of an important international trade in wheat and flour is similarly explained.

Rice, unlike wheat, has remained mostly within its original home. Rice continues largely to support the dense population of the southeastern portion of the Asiatic continent and adjoining islands (Monsoon Asia), from India to Japan. In this characteristically hot climate, where abundant rain provides a plentiful water supply, the rice plant finds an ideal environment. Here the great bulk of the world's rice is grown and consumed. Hence world trade in rice, unlike the trade in wheat, is predominantly regional in character, i.e., inter-Asiatic. The "rice world" is thus more compact geographically than the "wheat world," but in numbers of human beings involved it is probably somewhat larger.

About four out of five of the earth's inhabitants belong either to the rice or to the wheat "worlds." In other words, wheat or rice contribute 50 per cent or more of the cereal calories in the diets of countries, and subdivisions of countries, accounting for about four-fifths of the world's population. There are also various smaller "cereal worlds" in which wheat and some cheaper cereal furnish in combination 60 per cent or more of the cereal and potato portion of the total calorie intake. According to the dietary dominance of specific cereals, or combinations of cereals, the world may be divided roughly as follows:

The rice world includes all countries of Monsoon Asia extending from India to Japan, plus outlying islands and Madagascar, but does not include northern China, Manchukuo, or northwestern India. Cereals constitute 70-90 per cent of the total calorie intake in these countries, which have an aggregate population of over three-quarters of a billion people—more than 40 per cent of the world total.

The wheat world includes northwestern Europe except the Scandinavian countries, southern Europe, Canada and the United States in North America, the southern part of South America, Australia and New Zealand,

and parts of North China. If to these areas are added portions of the population living in countries where rye, corn, or barley are dominant but where wheat is also important, something under 40 per cent of the world's population is accounted for. The range in importance of cereals in the national diets of these countries is roughly from 30 to 80 per cent. Most of the consumers for whom the cereals contribute less than 50 per cent of the total calories in the diet are to be found in the United States and the "white" portions of the British Empire.

As to other cereal worlds, rye is the dominant food grain in only one or two countries of central and eastern Europe, and corn dominates in such countries as South Africa, Mexico, and Peru. More important are the combination countries: wheat and rye share dominance in the Scandinavian countries, most central European countries, and the USSR (where wheat dominates in the south and east, rye in the northwest). Wheat and corn together supply over 60 per cent of the cereal calories in one or two countries in southern and central Europe, and in Egypt; and wheat and barley together supply a like proportion in a few Mediterranean countries of northern Africa. There are various other combinations involving three or more cereals (including millets and grain sorghums), e.g., Manchukuo, Brazil, Cuba, and Nigeria. In total, probably only one out of five of the world's inhabitants consumes predominantly some grain other than wheat or rice.

For practically all consumers in these miscellaneous "other" cereal worlds, cereals and potatoes contribute more than half of the total calories, and the potato or noncereal portion is usually not large. In temperate zones potatoes are important in the diets of some peoples, but their dominance in consumption seems to be found only in restricted localities. In various tropical countries other substitute sources of starch, starchy tubers such as cassava, rank in importance with cereals.

In general, the temperate zones of the world are areas of wheat, rye, corn, and potato consumption; the tropical zones, which include large portions of South America and Africa, are regions in which corn, millets,

sorghums, or starchy tubers predominate; and in Monsoon Asia rice predominates, with millets, pulses, and sweet potatoes also prominent.

"World" estimates of wheat and rice production commonly exclude roughly one-third of the earth's aggregate output. Inadequate and unreliable statistical data for China and the Soviet Union make it desirable to omit these two great producers (and several lesser ones) from much analytical work. The USSR is the world's greatest wheat producer, while China probably ranks as the third largest. Rice production of the USSR, on the other hand, is unimportant, but China's output is no doubt greater than that of any other country.

Actual world production of wheat and rice must necessarily remain somewhat conjectural. Rough global figures for the period 1935-40 indicate that the harvested tonnage of the two crops was about the same, around 150 million metric tons.<sup>1</sup> The "statistical" wheat world deals with an output about one-third less; the omitted countries (of which the most important are the USSR and China) accounting for production aggregating around 50

million tons. Omission of the same countries from the actual world rice output leaves the "statistical" world of rice production slightly smaller, i.e., somewhat under 100 (nearer 95) million tons of rough rice. The difference in this instance, however, is accounted for almost entirely by China. Statistical data are too imperfect to answer more precisely the question of relative importance of rice and wheat production today. Nor is this essential.

Rice, though as important a crop as wheat in world production, occupies only about half as much land. During 1935-40 the average area devoted to rice and wheat was roughly as follows, in million acres:

| Region                        | Wheat | Rice |
|-------------------------------|-------|------|
| World (actual) . . . . .      | 420   | 193  |
| USSR, China, Iran, Iraq . . . | 150   | 44   |
| World (statistical) . . . . . | 270   | 149  |

Such comparisons imply wide differences in yield per acre, and so in turn in methods of culture and intensity of land use. They suggest contrasts between extensive and intensive agriculture, and marked differences in the geography of production and trade.

## II. GEOGRAPHY OF PRODUCTION AND TRADE

Wheat has several major homes; rice only one. European countries ex-Russia produce one-third of the world wheat output, Canada and the United States under one-quarter, the USSR about one-fifth, China about one-eighth. Argentina and Australia, though not particularly large producers, rank with Canada and the United States as the chief wheat-exporting countries. The British Isles, various Continental European countries, Brazil, and China have been the principal importing countries. Although Europe is the most important wheat-growing region of the world, it is also the market for the bulk of the surplus wheat grown in the Western Hemisphere. The scope of the international wheat trade—in terms of distances, ships, freights, communications, exchanges, storage facilities, and commercial interests involved—at once suggests itself.

About 95 per cent of the world's rice, on

the other hand, is grown and consumed in Monsoon Asia. And less than one-fourth of the international trade in rice is with regions outside of eastern and southern Asia.

### WORLD RICE PRODUCTION

Table 1 summarizes the world situation with regard to source of rice supplies. When Burma was separated from India in 1937, China undoubtedly became the world's largest rice producer, though India ranks close behind. The eleven most important rice-producing countries of eastern and southeastern Asia for which statistics are available (i.e., those listed in Table 1, ex-China) produce approximately 60 per cent of the world's rice output.

The production of all other territories, some 35 or 40 in number, is relatively unimportant, probably around 5 per cent of the world total. A decade or so ago, production outside Monsoon Asia was even less significant; but in recent years increased attention has been

<sup>1</sup> About 5,510 million (60 pound) bushels of wheat and 7,350 million (45 pound) bushels of rough rice.

given to rice growing in many of the smaller colonies of European powers, and production has expanded considerably in South American countries. Of the numerous rice-producing countries outside Monsoon Asia, only Brazil and the United States come within striking

Japanese colony, and those of French West Africa and Spain are smaller than that of British Malaya.

Rice-consuming countries of the Far East may be divided into two groups: (1) those producing an exportable surplus which enters into trade; and (2) those required to supplement domestic production regularly, or from time to time, by imports from neighboring countries. In order of importance in international trade the countries in each group are as follows:

TABLE 1.—RICE PRODUCTION IN MONSOON ASIA AND WORLD TOTAL, FIVE-YEAR AVERAGES FROM 1930-31 TO 1939-40\*

(In terms of cleaned rice)

| Country                               | Thousand metric tons |                    | Per cent distribution |                    |
|---------------------------------------|----------------------|--------------------|-----------------------|--------------------|
|                                       | 1930-31 to 1934-35   | 1935-36 to 1939-40 | 1930-31 to 1934-35    | 1935-36 to 1939-40 |
| China .....                           | 29,990               | 34,950             | 33.3                  | 36.5               |
| India .....                           | 27,126               | 25,796             | 30.1                  | 27.0               |
| Japan .....                           | 8,085                | 8,637              | 9.0                   | 9.0                |
| Burma .....                           | 4,870                | 4,942              | 5.4                   | 5.2                |
| Java and Madura .....                 | 3,674                | 4,050              | 4.1                   | 4.2                |
| French Indo-China .....               | 3,547                | 3,945              | 3.9                   | 4.1                |
| Thailand (Siam) .....                 | 2,939                | 2,769              | 3.3                   | 2.9                |
| Chosen (Korea) .....                  | 2,287                | 2,728              | 2.5                   | 2.9                |
| Philippine Islands .....              | 1,364                | 1,444              | 1.5                   | 1.5                |
| Taiwan (Formosa) .....                | 1,093                | 1,242              | 1.2                   | 1.3                |
| British Malaya and Ceylon .....       | 506                  | 527                | .6                    | .6                 |
| Total 11 countries (ex-China) .....   | 55,491               | 56,080             | 61.6                  | 58.7               |
| Total Monsoon Asia <sup>a</sup> ..... | 85,481               | 91,030             | 94.9                  | 95.2               |
| All other <sup>b</sup> .....          | 4,619                | 4,570              | 5.1                   | 4.8                |
| World total <sup>c</sup> .....        | 90,100               | 95,600             | 100.0                 | 100.0              |

\* Data from official sources. See note p. 314.

<sup>a</sup> Excludes the Outer Provinces of the Netherlands Indies (all of the Netherlands East Indies except Java and Madura) upon which reliable data are not available; British Borneo; and Manchukuo, the production of which is small but is included in the "world total."

<sup>b</sup> Includes some 35 to 40 countries or states, but the figure given here is merely the difference between the production estimates computed for Monsoon Asia and the "world total."

<sup>c</sup> Estimated Chinese production added to the world-production estimates (ex-China) of the International Institute of Agriculture (89.2 and 91.3 million metric tons of rough rice or 59.3 and 60.7 million tons of cleaned rice, converted at 100 to 66.5, the factor used by the U.S. Department of Agriculture in deriving its world-production estimate from that of the International Institute of Agriculture), and the (British) Imperial Economic Committee (60.9 million metric tons cleaned rice for the earlier five-year period).

distance of the production of Taiwan (Formosa), the smallest rice-producing area of Monsoon Asia except British Malaya and Ceylon.<sup>1</sup> The rice crops of Italy, Madagascar, and Egypt average less than half that of the small

| Net-exporting countries | Net-importing countries |
|-------------------------|-------------------------|
| Burma                   | India                   |
| French Indo-China       | China                   |
| Thailand (Siam)         | Japan                   |
|                         | British Malaya          |
| Chosen (Korea)          | Ceylon                  |
| Taiwan (Formosa)        | Netherlands Indies      |
|                         | Philippine Islands      |

Chosen<sup>2</sup> and Taiwan properly fall into a sub-classification in that, being colonies of Japan, their surpluses are fostered for one reason only—to supply a single market, Japan proper, which seems destined to be permanently an importing area.

The aggregate production of all the net-exporting countries constitutes only a small fraction of total rice supplies. The countries of greatest population—China, India, and Japan—are the leading producers of rice and also the chief importers. Java and Madura produce as much rice as two out of the three principal exporting countries, export some, but are still net importers. Rice output in British Malaya and Ceylon is smallest of the group, and both countries are net importers. The Philippines, like Java and Madura, export negligible quantities of rice and have long been in the status of net importer, though only on a small scale during recent decades.

The proportion of the world production of the various cereals that moves across international boundaries is not large. Only for

<sup>1</sup> British Malaya and Ceylon are factors of importance in the rice trade though of small consequence in the total production of the region.

<sup>2</sup> The official Japanese romanization is now "Tyosen," but Chosen was the form until recently and remains so in the country itself.



wheat is it as high as 15–20 per cent.<sup>1</sup> Rice ranks second; yet aggregate rice exports amount to only about one-tenth of the world's rice crop and are really smaller because of the duplication involved in including re-exports from such important distributing ports as Singapore and Hongkong. Almost 95 per cent of all rice exports recorded from Asiatic countries originate in the five net-exporting nations specified above. Three of them—Burma, French Indo-China, and Thailand (Siam)—are responsible for about four-fifths of the total Asiatic export trade, and for practically all the shipments outside the Far East.

Since so large a proportion of the rice trade is confined to one part of the world, rice is not a commodity of major importance in world trade. This is especially true when consideration is given to the nature of the traffic. For example, exports of Chosen (Korea) and Taiwan (Formosa) represent a type of domestic transaction, since practically all shipments are made to Japan; similarly, Burma supplies rice to India and other British possessions in the region. Hence a considerable part of the trade is not really "foreign" as the term is ordinarily understood. Grains like corn and barley are more important commodities in the trade among the different nations of the world even though the tonnage exported may be smaller.

#### GEOGRAPHICAL DISTRIBUTION

Wheat is a crop widely diffused throughout the settled agricultural areas of the world's temperate zones. Rice is a crop confined mainly to the world's tropical and subtropical zones. It is most heavily concentrated in Monsoon Asia, especially in gently sloping lowlands, river valleys, and deltas. A general indication of the distribution of rice cultivation in Monsoon Asia is given in Chart 1 (p. 262).

<sup>1</sup> Some 8–10 per cent of the world's production of corn and barley is exported (usually less than the proportion for rice). The exported proportion of the world output of such grains as rye and oats is very small, roughly 3–4 per cent for rye and about 2 per cent for oats.

<sup>2</sup> M. K. Bennett and H. C. Farnsworth, "World Wheat Acreage, Yields, and Climates," *WHEAT STUDIES*, March 1937, XIII, 273.

<sup>3</sup> See pp. 273–75.

In large degree the geographical diffusion of wheat and the contrasting geographical concentration of rice are explained by differences in the natural environment suited to cultivation of the two plants. Wheat and rice compete very little for use of land. Wheat finds its greatest competitive advantage in the drier areas of the world; it is

... in the best position to compete with other crops in temperate climates where the annual rainfall averages 15–35 inches. In general, rainfall in the lower part of this range suffices in the cooler portions of the temperate climates, while rainfall in the higher part of this range is required in the warmer portions.<sup>2</sup>

Being a dry-land crop, wheat is commonly and successfully grown not only upon flatlands, but also upon rolling hills with slopes up to 30 degrees or somewhat more. Spring wheat is widely grown in latitudes so cold that the frost-free season is less than 120 days.

In subtropical and tropical climates where the annual rainfall exceeds 40 inches, wheat cannot compete successfully with other crops because its yields are greatly reduced especially through the ravages of plant diseases and pests. Of the relatively small part of the world's acreage that lies in the subtropical and tropical zones (between the 30th parallels), the bulk is cultivated in the dry winter season of moist climates, partly under irrigation (India, China); or under irrigation in dry tropical climates (Egypt); or in high and therefore relatively cool elevations (Mexico, Peru, Ethiopia). Rice, on the other hand, competes most successfully for land in a natural environment unfavorable for wheat.

The rice plant, *Oryza sativa*, is an annual grass, the culms (stalks) of which grow three to four feet high and are topped by spikelets bearing grains, the spikelets forming a loose panicle (head) somewhat in the fashion of oats. As the rice plant grows, it is commonly called "paddy" in Oriental countries ("rough rice" in the Occident); after the grain has been harvested and husked, the resulting product is some form of rice.<sup>3</sup> Although there are perhaps 2,000 more or less distinct cultivated varieties, only two general types need be distinguished here: *common rice* and *glutinous rice*.

Common rice, which constitutes the great bulk of production everywhere, can be cooked so that its kernels remain free, and is the article ordinarily referred to in discussions of rice production, trade, and consumption. Glutinous rice, which is far less important, is mostly produced and consumed locally (especially in China), and when cooked forms a gluey, sticky mass. This stickiness is not objectionable in the preparation of special foods such as pastries but detracts from the desirability of glutinous rice as a cereal for consumption as such. In fact, glutinous rices are so distinctive that in many places they are called by special names. They contain no substance resembling the gluten characteristic of wheat, but are termed "glutinous" because of their behavior in cooking.<sup>1</sup>

Rice is a comparatively "new" crop outside of Asia and northern Africa. In the distant past, rice culture had its beginning, probably, in southeastern Asia. In classic Chinese, rice culture is synonymous with agriculture, and in many Asiatic languages rice and food are synonymous. This would suggest the origin of rice long before recorded history. From India and China, where it was known about 3,000 B.C., rice spread to Egypt and other parts of northern Africa. From there it was introduced elsewhere in the course of exploration of the New World and Africa south of the Sahara.

All varieties of rice must have high temperatures for germination and growth. Heat is commonly assumed to be the factor defining the geographical limits of rice culture, and this requirement restricts its cultivation mostly to the subtropical and tropical zones. But in addition to heat, the rice plant requires an abundant supply of water. Rice grows, typically, in a flooded field, and in this respect it is unique among the world's great crops. The water requirement further narrows the area within the tropics and subtropics where the crop will flourish. In the extensive desert

regions of the subtropical and tropical zones, rice cannot be grown, except in a few irrigable places.

Yet there remain wide areas of these zones—in Africa and the Americas—where conditions of temperature and annual and seasonal rainfall seem suited to the requirements of the rice plant but unsuited to wheat. The absence of rice from such regions seems explicable partly in terms of topography and soil, partly in terms of historical origins, cultures, and densities of populations, and partly in terms of agricultural alternatives and stages of economic development.

Since rice is grown mainly in flooded fields, ground surfaces must be flat, or made level, and the water supply must be controlled by some sort of an irrigation system. If the water supply is to be utilized effectively, the soils should be heavy in type, with a high content of clay and silt. It is difficult and expensive to create level, water-retaining fields on steep slopes. Hence the lowlands, river valleys, and deltas of the world's moist subtropical and tropical regions are best adapted to the rice plant and its cultivation. Monsoon Asia probably contains a considerably larger proportion of such land than the equally warm and moist regions of Africa and the Americas.

The tropical and subtropical parts of the Americas and Africa differ from Monsoon Asia in several other important respects. Monsoon Asia is a much older area in terms of human history; it is far more densely populated, with heavier pressure of population upon food supply; and its agriculture is to a greater extent of the subsistence type, largely noncommercial. Southeastern Asia is also the original home of the rice plant. In parts of the newer regions of the Americas and Africa that seem climatically adaptable, colonization has not yet brought in a labor supply sufficient for rice cultivation. In other parts, rice has not yet been "discovered," and older indigenous crops occupy the attention of the primitive cultivators. In other parts, sparseness of population in relation to land and capital permits commercialized agriculture, but production is concentrated upon nonfood crops for export and rice is subordinated to

<sup>1</sup> Glutinous rices are also sometimes called dextrinous rice, because they have been assumed to contain dextrine instead of starch. This is an error; they contain genuine starch. This starch differs from the starch of common rice in that it gives a reddish-brown color when treated with iodine, as does dextrine, rather than a blue color as do nearly all starches.

restricted localities disadvantageous for other crops. Examples of such localities within the moist tropical and subtropical zones are found in the river-bottom lowlands of Texas, Louisiana, and Arkansas; in the coastal lowlands of British Guiana, southern Brazil, and Ecuador; and in the coastal lowlands of French West Africa. Other restricted rice-producing localities within Mediterranean climates, where the rice is produced under irrigation during the practically rainless summer season, are the Nile Valley of Egypt, the Po Valley of Italy, the coastal plains of Valencia in Spain, and the Sacramento Valley in California.

Not all of Monsoon Asia is characterized by heavy concentration of rice cultivation, as Chart 1 (p. 262) indicates. The rice acreage lies mostly along the valley plains of great rivers and in delta and coastal areas, where the construction of level, floodable, and fertile rice fields is simplest for reasons both of topography and of soil. Within and adjacent to the principal areas of rice cultivation, there remains much land so densely wooded, so uneven in topography, or so poor in soil that conversion of it to rice fields proceeds very slowly despite both the density of human population close at hand and the presence of water and warmth adequate for the rice plant. Farther from the principal rice-growing areas—inland from Burma, Thailand, and Indo-China, and in the great islands of Borneo and New Guinea—there may be land potentially convertible into rice fields, but at present it is so remote from centers of population as to make colonization extremely difficult. Furthermore, some of it is inhabited by savage tribes. Generally such land is mountainous and covered with dense tropical forest growth extremely difficult to clear.

#### ECONOMIC IMPORTANCE

Rice looms larger in the economy of the East than wheat does in the economy of any Western nation. Many a geographical region, state, or subdivision of a nation has its economy closely tied to a single crop or industry, but it is doubtful if any area in the world can be found where a single commodity looms so large in the lives of so many people as rice

does in Monsoon Asia. It is the principal crop in Japan, southern China, the Philippines, French Indo-China, Thailand, Java, India, and Burma. In many of these countries the rice acreage accounts for 70–90 per cent of the total area of cultivated land. In Burma, Thailand, and French Indo-China, 40–70 per cent of the total income from exports—revenue which makes possible the purchase of foreign goods—is derived from rice exports. Even in Japan, industrially and commercially the most advanced nation in this part of the world, agriculture occupies far more people than industry and trade, and over half the cultivated land area is devoted to rice.

Acreage figures, however, do not tell the whole story. In regions sufficiently warm in winter and with enough water both in the wet summer and in the drier winter seasons, two crops of rice are produced in a single year on the same land. In many other places with a sufficiently warm winter climate but not sufficient water in the dry monsoon, the land is also double-cropped, the rice crop of the wet monsoon being followed by some such crop as wheat, barley, beans, peanuts, sweet potatoes, or maize. A mere statement that a given percentage of the cultivated land area is in rice does not do full justice to the productivity of agriculture where the practice of double-cropping is followed.

In rice regions, furthermore, agriculture tends to center so predominantly around the one crop that much land which cannot be used for irrigated rice is not cultivated at all. Japan proper is the extreme case, where rugged topography permits the cultivation of only about 16 per cent of the total land area. The rest is woodland or waste land. Under a different culture, for example that of northwestern Europe, an appreciable portion of such land would be devoted to livestock and dairying. Japan, like China and most countries in southeastern Asia, has almost no livestock other than poultry. In some of these regions, in fact, land that is not irrigable is used only to produce firewood.

These differences in land use between the East and the West are partly the result of the high value of fuel in the Orient and partly the consequence of the relatively low yields to be

obtained from such land. In regions where draft animals are scarce and capital for machinery is lacking, and the land has to be prepared for the crop by human labor, only the better areas can be cultivated. The farm family cannot maintain itself from crop to crop solely by planting the unirrigated, relatively low-yielding lands. If the ground has to be spaded rather than plowed, it must be very good to furnish subsistence. Much of the agriculture of China and India, the greatest producers and net importers of rice, is carried on under conditions that provide little more than a bare subsistence for the farm family.

The most important area of *commercial* rice production in the world is that part of south-eastern Asia which includes Burma, Thailand (Siam), and French Indo-China, particularly the river valleys and deltas of the Irrawaddy, Menam, and Mekong. Each of these important rice-growing regions is served by a seaport—Rangoon on the Irrawaddy, Bangkok on the Menam, and Saigon on the Mekong. Through these ports passes the bulk of the rice entering into international trade.

Each of these three countries is something of a replica of the others in climate, topography, and land utilization, a similarity of conditions that has important economic consequences. Crops mature and are harvested at about the same time; hence rice shipments into export channels are highly concentrated. This nearly simultaneous movement results in intensified competition and consequent pressure on prices, ultimately affecting returns to growers and government revenues.<sup>1</sup>

#### ADAPTABILITY TO ASIATIC CONDITIONS

In Monsoon Asia, the southwest ("wet" or "summer") monsoon usually begins in May. It blows inland from the Indian and Pacific oceans, inaugurating a rainy season that lasts about 200 days and provides ideal conditions for rice growing over a considerable portion of the region. The summer rainfall exceeds 40 inches almost everywhere except in a wide strip of inland India mostly east of the 80° meridian, in central and northern China, and in the northern half of Japan. In the drier parts of these areas, the principal summer grain-crops are not rice, but millets and sor-

ghums or maize. Rice is the principal summer grain-crop throughout the moister parts of Monsoon Asia. The dry season, beginning in November when the winds shift direction and blow over the land surface to the sea (the winter monsoon), provides favorable conditions for harvesting.<sup>2</sup>

Of all the cereals, rice alone is pre-eminently suited to the natural, demographic, and economic conditions of the moister parts of Monsoon Asia. Few alternative agricultural opportunities present themselves. Neither wheat, barley, rye, nor oats will thrive as summer crops under such conditions of moisture and heat. Millets, grain sorghums, and maize do better, but can equal rice only in areas of less summer rainfall. As winter crops in the dry season, the small grains are grown successfully; but most dry-season crops are difficult to cultivate because of the hardness of the soil, the primitive nature of the natives' plows, and the scarcity of draft animals. In fact, the climatic and soil conditions best suited for rice are poorly adapted to any other major food crop.

There are also important economic reasons for the dominance of rice culture in Monsoon Asia. There is a compelling necessity for intensive utilization of the available land so as to provide sufficient food for the millions of people inhabiting these regions. Wheat could not support this dense population,<sup>3</sup> nor could other grains. Generally speaking, more rice

<sup>1</sup> Such importance in the world economy as rice enjoys from the standpoint of trade and shipping is derived largely from the surpluses produced on the Indo-Chinese peninsula. Rice exports are such an important source of revenue in these countries that the fortunes of the rice crop affect the welfare of some 50 million inhabitants.

<sup>2</sup> Little rice is grown in tropical forest regions having no dry season at all. Not only is the soil less adaptable and the topography unfavorable, but the absence of some dry weather hampers maturing of the rice grain and harvesting.

<sup>3</sup> Some dry-land crop may be planted following the rice harvest in regions without enough moisture for two crops of rice in the same year but where climate permits double-cropping. Wheat is not grown as the dry-land crop in Java, perhaps because smut- and rust-resistant varieties for that climate have not been developed, and perhaps because the natives prefer sweet potatoes, beans, peas, and maize to wheat. In Japan the dry-land crops tend to be barley and wheat, which thrive in the cool Japanese winter.

can be produced from a given unit of land than wheat or any other similar crop.<sup>1</sup>

Rice is an economical crop for the subsistence farmer, since it requires only 3–5 per cent of the yield for seed. By contrast, wheat requires from 1 to 2½ bushels to the acre, and this may amount to 10–15 per cent of the crop.<sup>2</sup> Rice requires little seed, because it is commonly planted in a seedbed and the seedlings transplanted to the field. In regions where this practice is not followed, as in California and in most places in Italy, the amount of seed used is about as great as that locally required for wheat.

Although more labor is required to produce rice than wheat, other factors tend to offset this disadvantage. Rice may be grown year after year on the same irrigated paddy fields and even double-cropped, while in regions where agriculture centers around such a crop as wheat or rye, there is usually little cultivation except where the soil is virgin. In addi-

tion, rice can be stored and preserved in a moist-hot climate far better than such cereals as wheat and corn,<sup>3</sup> and the practice of cultivation on flooded land provides a control over diseases and pests which is impracticable with grains grown under different conditions.

Finally, rice is one of the safest crops that can be grown, and this is important when so many millions of people are dependent upon the success of the crop for their basic food. There are hazards, of course—floods, typhoons (in Japan and the Philippines), and monsoon failures in certain areas—but the hazards are generally fewer for rice than for most crops. Because of the large amount of hand labor required, rice growing both depends upon and makes possible a dense population. Perhaps more than any other foodstuff, rice has a significance that cannot be measured by ordinary concepts of the importance of a commodity in the price economy of the modern world.

### III. METHODS OF CULTIVATION

The wide differences between the methods of wheat growing and of Oriental rice culture merit brief additional consideration. Sometimes wheat is merely one crop in a well-established rotational system, as in a number of older countries of Europe. Sometimes it is grown where no alternative crop or land use is as profitable, as in portions of western Kansas, the Canadian wheat belt, Australia, and Argentina. Wheat's adaptability to conditions unfavorable to most other grains, coupled with its price superiority, explains its presence in semiarid areas of the world where

the hazards of production are great. Sometimes wheat culture is adjusted to rice growing, often under irrigation and on the same land, but during the off-season for rice, as in parts of India, China, and Japan. Most of the world's wheat, however, is grown without irrigation.

In wheat culture, land and capital may loom much larger than labor as factors of production. Tracts may be extensive, and planting and harvesting may employ a relatively small amount of labor and a large amount of machinery. Such combinations are characteristic of the major wheat-exporting countries, where commercial wheat growing is largely "extensive" agriculture. Although some rice is produced by these methods, rice culture is typically "intensive" agriculture.

Unlike most other grains, rice is grown in more than one way. Indeed, the common classifications of rice (lowland and upland) are based not upon botanical peculiarities but on where and how grown. The crop known as "upland" (sometimes as "hill" or "mountain") rice is grown without irrigation, often in the most primitive manner, and accounts for

<sup>1</sup> E. B. Copeland, in *Rice* (London, 1924), has pointed out that it is not quite true that rice will produce food for a denser population than will any other crop. He cites the case of Java. There maize, manioc (cassava), and the sweet potato are grown because they thrive on land not suitable for rice. Furthermore, manioc will produce more food from a unit of land. This may also be true of such crops as yautia and sugar.

<sup>2</sup> In India the proportion of the wheat crop that must be set aside for seed is even higher. Maize and certain millets are often more economical in the use of seed than even rice, and tend to be planted on an enlarged scale following periods of adversity.

<sup>3</sup> See pp. 277–78.

only a very small proportion of total world rice production.

Upland rice is found in sparsely populated portions of southeastern Asia and neighboring islands where land is abundant but agriculture is poorly developed. It is also a crop of some importance in countries where all of the lands suited for the lowland or irrigated form of culture have been appropriated, and as the first crop on land ultimately intended for some other permanent crop. The varieties of upland rice planted differ from those grown in irrigated fields, the yields are small, and the crop is uncertain. Although some varieties are locally well regarded, in general the eating quality of upland rice is considered inferior.

Rice is also grown in swamps where there is standing water at certain seasons of the year. The great bulk of the world's crop, however, is grown in carefully leveled fields with irrigation. The grain thus produced is commonly known as "lowland" rice, but may also be referred to as "irrigated" or "swamp" rice.

Probably the earliest location of rice culture was in swamps or on periodically flooded land, the upland form of culture being a later development perhaps taken over by more primitive peoples. Support is found for this belief in that preparing the soil and combating weeds, at least in the tropics, is comparatively easy in wet-land farming as contrasted with dry-land farming. A dry-land crop like wheat requires some sort of tool for working the ground, though it be only a digging stick. For lowland rice no such tool is required. Even today there are localities where the rice field is neither plowed, spaded, nor hoed. The soil may be thoroughly puddled and all the weeds destroyed merely by driving a carabao around in the flooded field, or the cultivator and his family may accomplish the same purpose by splashing around in their bare feet. This procedure, however, cannot be considered typical of lowland rice culture as practiced in the Orient.

#### LOWLAND (IRRIGATED) RICE CULTURE

The typical Asiatic method of growing rice is a distinctive form of agriculture. Practices of lowland (irrigated) rice culture vary some-

what in different countries of the East and within the same country, but the most pronounced differences in methods are between Asiatic practices and those of the more advanced rice-growing regions in the West.

In the United States, for example, rice is cultivated in essentially the same manner as wheat, oats, or barley, except that the crop is irrigated. Farm machinery is used extensively. In some places, California especially, the production of rice is completely mechanized. In seeding on dry ground or in water, horses, tractors, or even airplanes may be used. Harvesting is commonly done with a combine which cuts, threshes, and sacks the rice in one operation.

In contrast, very little machinery is used in Asiatic rice-producing countries. Tools and implements are generally of the simplest type. Tractor cultivation has been attempted, but has not met with much success in the places where it has been tried. Most of the work involved is done by manual labor, supplemented by work animals when it is economically feasible to maintain them, and when the fields ("paddies") are easily accessible and not too small. Harvesting and threshing are usually by hand with the aid of some simple device.

Rice growing in the Orient is thus understandably one of the most labor-intensive types of agriculture known. In the more densely populated areas, land is not available for growing both food and feed; hence beasts of burden tend to be relatively scarce. In other regions where work animals are plentiful, their use for plowing is often precluded because the paddies are so small. Thousands of rice fields, in fact, are so tiny that the use of machinery would be impracticable even if it were available. Most of the work in connection with the production of rice and its preparation for consumption must be done by more flexible man. This means that millions of farmers are necessarily engaged almost exclusively in providing for the food needs of their own households.

The smallness of so many rice fields is chiefly explained by the topography of numerous rice-growing regions. A paddy must be level so that, when flooded, the water will stand everywhere at the same depth. Only on

the most level land, such as may be found in great river valleys or delta regions, is it possible to make a rice field of large size. In regions where the topography of the country is rolling or mountainous, terracing is necessary. There are mountain regions, e.g., in the northern Philippines, where hillsides are terraced to considerable heights with innumerable small irregular enclosures.

Since the construction of rice paddies has been going on through centuries, a little at a time, not merely are the fields small, but a number of them rather widely scattered around a village may be cultivated by a single family. With the paddies that he cultivates so scattered, the farmer spends much time and effort in going to and from his tiny fields.

This method of constructing rice paddies has also led to inefficiency in the location of irrigation ditches. Much labor and much water that might be applied to other lands are therefore wasted. The governments of some countries have devised programs for remedying this situation, but very little real progress has been made except possibly in Japan. The obstacles to redesigning land holdings to conserve labor and water supply are numerous and not quickly or easily overcome.<sup>1</sup>

**Planting the crop.**—The bulk of the world's rice crop is transplanted by hand from carefully prepared seedbeds, or nurseries, to the paddy fields, although in some regions, especially where labor is scarce, seed is sown broadcast directly on the field. In the cultural cycle, seedbeds are the first to be cultivated. They are plowed and harrowed several or many times, with or without the assistance of work animals, as soon as the soil has been softened by the early rains. About twice as much time and labor are ordinarily expended upon preparation of the seedbed as upon a similar area for transplanting.

<sup>1</sup> Fragmentation of holdings is a serious problem particularly in old and densely populated countries. In some areas of India more than a third of the farmers hold more than 25 separate small plots, a fraction of an acre in size, within the same village. See Royal Commission on Agriculture in India, *Appendix to the Report* [1928], Vol. XIV (London, 1928), pp. 133-34. In China, the small scattered plots of land and numerous spaces reserved for burial mounds make cultivation difficult and inefficient.

When the soil of the seedbed has been worked up to the consistency of a fine soft mud by hoeing, plowing, trampling, or harrowing, and is free from weeds, it is ready for sowing. In most areas the seed to be planted is first soaked in water and then broadcast by hand on the seedbed from which the water has been drained. After a few days, or immediately after the seeds have germinated, one or two inches of water are reintroduced and allowed to cover the surface of the nursery. The water level is gradually raised as the seedlings grow, and after 25-40 days they are large enough to be uprooted and transplanted. Uprooted, they are tied together in small bundles and carried to the paddies.

Once the nursery beds are ready, work begins on the preparation of the paddy fields. The methods used are similar to those employed in preparing the seedbeds except that cultivation is ordinarily not so thorough. Manures or fertilizers, in countries where they are used, are sometimes applied about 10 days before the seedlings are transplanted. In other cases fertilizer, or additional fertilizer, is added after planting.

With a few inches of water standing on the field, seedlings are planted by hand (usually by women) in rows or in hills simply by pushing them into the soft mud, using the fingers or a simple planting tool. Once the tasks of sowing and transplanting are completed, the crop itself requires little attention until harvest. The paddy field remains flooded until it is ready for draining before the harvest, though in some countries while the crop is maturing it may be drained at intervals for weeding. As the flowers appear and the ears begin to fill just before harvest, the water is allowed to drain off the fields.

**Harvesting and threshing.**—The rice harvest usually begins three to six months after transplanting, depending upon whether the varieties planted mature early or late. Except in Japan and China, harvesting is often a group enterprise; neighbors of the village help each other, with men, women, and children participating. Outside labor is imported in some areas especially for the harvest. Helpers commonly receive compensation in the form of a certain portion of each day's harvest,

distributed at the end of the working day—in places like Java, before the afternoon showers begin. In virtually all the rice-growing countries of the East, picturesque ceremonies accompany both harvesting and planting.

Methods of reaping, threshing, and winnowing are usually primitive. Although machinery has been designed and is on the market for mechanizing these preliminary operations, it is not yet widely used. Machine harvesters and threshers are seldom employed except on large estates or on experimental farms operated by the governments of the various rice-producing countries.

In most countries harvesting is done with a type of hand sickle which cuts off one or two feet of straw with the ears. In some parts of southeastern Asia (e.g., the Malay Peninsula, Java, and the southern Philippine Islands) another common method of harvesting involves cutting each ear separately with a special type of knife. In the latter case the straw is not always utilized but is left on the field to be burned off or plowed under. Once cut, the ears and attached stalks may be left on the ground for a few days or as much as a week for drying; but in Japan, where drying is more difficult, they are bundled and hung over small bamboo fence-like arrangements surrounding the paddy fields.

Bundles of harvested ears and attached

stalk are carted to the threshing floor, where some further drying occurs before threshing; or they may be placed in bags for "curing" for a period from two weeks to three months. Removal of the straw stalks from the grain is the first stage in the preparation for consumption, and is generally done locally on the many thousand threshing floors scattered through the growing regions.

In some areas bullocks, carabaos, or oxen tread out the grain; in other places humans perform the same operations. In still other areas the grains are beaten from the ears by flails—long sticks (usually bamboo) at the end of which are attached stout reeds which swing freely as the operator alternately raises his pole and then brings it down hard on the threshing floor.

The tramped or beaten material is "winnowed" by allowing it to fall gently from a platform while the wind carries away the chaff, dust, short pieces of straw, and the lighter kernels. Sometimes threshing consists merely of pounding the rice heads on a log. Such crude processes leave a residue of rough grain (paddy) containing more or less foreign matter and dirt, and more is acquired between the farm and the mills.

Such methods are no longer typical in wheat harvesting, though they persist in many countries where planes of living are similar to those in the principal rice-growing areas.

#### IV. MARKETING AND MILLING

Marketing machinery and milling techniques, both highly developed in the wheat world, are by comparison crude in the rice world. Rice is consumed largely in the general regions where it is grown; it is also consumed largely by growers in their own households, after simple local processing. This means that the physical distribution problem for rice is far smaller than for wheat. Wheat is much less commonly processed and consumed by growers without going through a marketing process, and is much more commonly sold as wheat and bought as flour. To convert paddy into rice for direct consumption is much easier than milling wheat into flour and then manufacturing some baked product from the flour.

Other factors than comparative prevalence of a subsistence economy have also contributed to the slower development of rice-marketing methods and milling techniques in Asiatic countries. The rice trade differs considerably in character from the international wheat and flour trade; competitive pressure among exporting countries is not so strong in rice as in wheat; and the physical problems of handling and storing rice and wheat are somewhat different.

#### CONVERSION OF PADDY INTO RICE

Rice milling in Oriental countries is a very simple process compared with the typical methods of converting wheat into flour or semolina. Paddy is ordinarily prepared for



consumption as rice with the aid of primitive devices on the farm, or by the use of small neighboring mills. Only in relatively few regions, especially the rice-exporting countries, is the grower's product largely sold and shipped for milling at an important commercial milling center. Even crude home or neighborhood milling seems not to detract seriously from the satisfaction to be derived from eating rice, which is normally consumed as boiled or steamed kernels. Very little rice is made into flour and practically none into bread.<sup>1</sup>

The initial preparation of rice for consumption involves threshing, which leaves *paddy* (rough rice). The rice kernel is enclosed in a hard hull; when this is removed by milling, whether commercial or otherwise, there remains *brown rice* (variously called husked, hulled, or whole rice). Brown rice is frequently cooked and eaten in this form, though a growing proportion of consumers, even in remote districts, seem to prefer additional milling. Under the hull of the rice grain, but separated from it and tightly attached to the starchy body of the kernel itself, is a brown skin composed of several layers which can be distinguished only microscopically. When this skin is removed by further milling, the resulting product is *cleaned rice* (white, shelled, skinned, or peeled rice).<sup>2</sup> Commercial milling removes these layers completely, but crude processing on the farm may remove just enough of the skin to overcome the objection to brown rice based on its roughage.

The essence of the rice-milling process, beyond the stage of brown rice, is gradually to peel off the skin of the berry, leaving the starchy endosperm unbroken—a process of abrasion. The essence of wheat milling (except durum for semolina) is to reduce the starchy endosperm to fine particles—a process which includes crushing and grinding the endosperm extracted from the skin of the berry.

A final process of milling produces *polished rice* (a term, however, used more or less interchangeably with white or cleaned rice). The parts removed by milling in the hulling and skinning stages yield bran with some dust or rice meal; in the polishing stage, more dust

and rice polish. The initial and coarsest by-products are used primarily for cattle feed and the last and finer ones for industrial purposes. Still another process of dressing (coating and facing with glucose and talc) may be added in commercial mills of Western countries, but is not common in Monsoon Asia.

To summarize, there are four principal classifications of rice, according to stages of preparation for market:

1. *Paddy or Rough Rice*: Harvested paddy, including some stalk; threshed paddy, including dirt and chaff; or paddy threshed and cleaned by sifting and winnowing. Paddy always is rice with the outer hull intact.
2. *Brown, Husked, Hulled, Shelled, or Whole Rice*: Paddy rice with the husk removed.
3. *Cleaned, White, or Skinned Rice*: Brown rice after "skinning" or "pearling."
4. *Polished Rice*: Cleaned rice after polishing, coating, or dressing with glucose and talc.

The distinctions between paddy and some form of milled rice are not always as clear as those between wheat and flour. There is a great difference both in volume and weight between a given amount of paddy and its equivalent in brown, cleaned, or polished rice. By volume the ratio of paddy to cleaned rice is approximately 100:50. By weight the relation varies between 100:50–80, but the most commonly accepted ratio is 100:60–65. In dealing with rice statistics of various countries it is especially important to know the form of paddy or rice to which the figures refer.<sup>3</sup> For wheat this problem does not arise except as wheat and flour are expressed in terms of one another for statistical purposes.

In most Asiatic countries that portion of

<sup>1</sup> Rice flour is low in gluten content, and therefore does not make leavened bread.

<sup>2</sup> In the United States and some other Western countries, cleaned rice is commonly referred to as "milled" rice, but in other growing regions milled rice means brown rice.

<sup>3</sup> In this study all statistics are reduced to a common (cleaned rice) basis. This has often been difficult because little or no distinction has been drawn in the official returns of the countries involved. For example, in the production statistics of the Japanese Empire, unhusked rice does not mean paddy, but *genmai* or brown rice. There is also confusion in the use of the terms "polished" and "unpolished." Unpolished rice is often used in the trade to mean uncoated, but

the rice crop not reserved for consumption on the farm is commonly transported to larger mills in the form of threshed paddy, and there prepared for market. Contrary to this general practice is that within the Japanese Empire. Practically all of the crop is partially milled before leaving the farm, the Japanese farmer marketing his rice almost always as brown rice. Final milling and polishing are done by rice dealers. Since milling is handled differently from country to country, statistics on rice mills for the various growing regions are not particularly enlightening.

Rice may undergo some milling anywhere along the marketing channel from grower to dealer, whereas wheat, especially in newer countries, is more often converted into flour at well-established milling centers. Technical considerations in baking are of such importance that the selection and blending of appropriate wheats and the manufacture of varied types of flour for specific baking purposes has become a highly developed business. Since no similarly intricate techniques are involved in converting paddy to rice, there exists less incentive, especially in the Orient, for high specialization in, and concentration of, the rice-milling industry.

#### DEVELOPMENT OF MARKETING

Competitive pressure among commercial wheat producers and among wheat-exporting countries has resulted in a complex and generally well-developed mechanism for marketing wheat. Although wheat growing is widely dispersed over the world, there are nowadays only five major regions of surplus production, in eastern Europe, Canada, the United States, Argentina, and Australia. These sources of supply, four of them thousands of miles from the European market, produce different qualities of wheat at varied costs of production, incur different transportation charges, and are at a net advantage or disadvantage depending upon aggregate production costs and marketing expenses. Marketing costs are

should more properly be applied to whole or brown rice, as practically all white rice is polished, though not always coated. Wherever it has been possible to ascertain the practice of the country concerned, conversion rates have been used in accordance with the custom in that country.

generally more variable than production costs; hence there has been a premium upon the development of efficient marketing organizations.

Three important rice-exporting countries (Burma, Thailand, and French Indo-China), which together supply most of the rice entering into international trade, also compete with each other both in Asiatic markets and in the markets of Europe and other parts of the world. But this competition has never been so keen as among wheat-exporting nations. The stakes have never been so high, or the pressure for improvement so great, and by Western standards marketing techniques in these countries are not far advanced.

The necessary bases for really efficient marketing of the Asiatic rice crop are at present largely lacking. For example, agreement on quantities involved in a transaction is basic for any bargaining on price. But, despite numerous attempts at establishing standards, many of them official, no generally accepted basis for trading exists throughout most of the rice-growing world, even in so elementary a matter as the weights and measures of a country. There are few grade standards for rice comparable with the government standards for wheat found in most Western wheat-growing countries. A buyer of paddy, to cite only one case, must therefore learn to know as best he can from experience the quality of rice grown from one region to another and by many individual cultivators.

In the general absence of marketing standards, trading necessarily becomes a highly individualistic matter. Trading risks are therefore large. The dealer must also bear the risks of price change, because there is no futures market in which to hedge. Since there must always be compensation for risk-taking when the risks are an incidental and unwelcome feature of business, the spread between producers' and retailers' prices tends to be wide. It is commonly believed that the resulting high costs of distribution bear most heavily upon producers who are least favorably situated for shifting the burden to others.

By temperament and organization the rice growers of Monsoon Asia are poorly equipped

for marketing their crops. Governments have been slow to strengthen their position by providing help in developing the machinery of marketing. The average farmer is forced by necessity to continue cultivation of his land, but his economic status tends to be highly unfavorable, and frequently he becomes the victim of exploitation. When conditions of the rice cultivator grow sufficiently bad, as during and following the world depression of the 1930's, middlemen become the target of political attacks.

Middlemen occupy a stronger position than growers. In many countries rice milling and distributing are in the hands of Chinese merchants, who also finance the marketing of an appreciable portion of the crop. By Eastern standards Chinese middlemen are generally considered good merchants; by Western commercial standards some of their business customs have no place in efficient marketing. But regardless of nationality, deficiencies in the manner and method of marketing the Asiatic rice crop are more fundamental than the cost of middlemen's services. Profits of middlemen are only one factor in the spread between the price the consumer pays for rice and the price the grower receives for his paddy in the field. All services that link grower with ultimate consumer are included in this wide margin, and most of them involve risk-taking. Lower retail prices to the consumer and higher prices to the producer are feasible simultaneously, but the achievement of these ends would seem to involve primarily the perfection of a marketing mechanism that would greatly reduce the risks of trading, and only secondarily a reduction in the profits of middlemen.

In most of the important Western agricultural countries, for example, commodity exchanges, located in large central markets, are part of the mechanism for marketing agricultural products. They serve both to facilitate trading and to distribute the risks to those willing and best able to assume them. In the Orient, organized and formal exchanges generally have little part in the process of distribution.<sup>1</sup> Because of the absence of uniform trading practices, a lack of communication and of other facilities neces-

sary for the functioning of a more advanced type of trading, futures markets are exceptional. Rice millers, therefore, ordinarily cannot shift speculative risks as millers of wheat frequently do by means of hedging operations.

Growing recognition of the need for improved marketing has led to government intervention in the affairs of the rice industry quite generally in the Far East (see pp. 303-14). Although under fire, rice dealers and brokers continue to hold the better position except where government has monopolized the trade or entered into the competition.

There is little evidence that the chronically bad financial condition of most producers has been much improved. Wherever the paddy buyer is the agent or employee of the miller, it is common practice to advance money to growers and to take liens on their crops. Or the landlord may advance the necessary money and supplies. A considerable amount of the rice land under cultivation belongs to large property owners who sublet it to small cultivators for a variable proportion of the crop. These tenants are usually without sufficient operating capital and must therefore borrow. The original advance, plus a high (sometimes usurious) rate of interest, must be paid off out of the crop raised.<sup>2</sup>

In one way or another, the greater portion of the rice crop of Monsoon Asia is mortgaged even before it is planted. Growers are obliged to dispose of the bulk of their output soon after it is harvested in order to meet their financial obligations. Such debts are frequently owed to the Chinese merchants or millers' agents, who until fairly recently were practically the only operators of the milling

<sup>1</sup> In Japan, the rice industry is somewhat better organized. The government has long interested itself in marketing and financing the crop as well as in matters relating to the production of rice. Rice exchanges, similar to the grain exchanges of the United States and Canada, were organized in all of the important cities of Japan, and speculation in rice was widespread and on a large scale. But all commodity exchanges are now monopolized by the government, and speculation has been practically prohibited. These refinements, until fairly recently, meant little to the grower, and benefited chiefly those involved in marketing the rice crop (see p. 309).

<sup>2</sup> Similar conditions tend to prevail in regions where crops like cotton and tobacco are grown, but are less common in the production of wheat and other grains.

business of Thailand, Indo-China, Malaya, the Philippines, and the Netherlands Indies.

Institutions for financing the planting, growing, harvesting, and marketing of the rice crop are still generally inadequate. Co-operative marketing and credit associations, usually under government supervision, have been organized in most countries, but they have made relatively slow progress and benefits have not been widely extended. Other assistance has been provided in several countries through the establishment of schemes for stabilizing prices. State aid is confronted with all the complex problems involved in the transition from a self-sufficing to a commercial economy. The transition is particularly difficult when the marketing of paddy is on such a basis that the grower frequently does not know the price he receives for his crop, the rate of interest he pays on borrowings, or the charges that are made for the supplies advanced him by his creditor.

The primitive circumstances in which most cultivators continue to live are hardly conducive to informed selling or to an early appreciation of the importance of standards in marketing. After paddy has reached the large assembling places or milling centers and is in the hands of merchants, however, greater adherence to specified trading standards appears. From the mill to consumer, the marketing process is relatively more efficient than the process of assembling supplies from growers. But even here current practices leave much to be desired, and great opportunities for improvement are apparent.

#### STORAGE PRACTICES

Rice storage is not the spectacular function in the marketing process that the storage of wheat has become with the development of concentrated domestic and overseas markets. In the rice world there is no counterpart to the extensive systems of grain elevators such as are found in the wheat-growing districts of North America and at shipping and overseas receiving ports elsewhere. Nor is there any system of handling rice comparable with the bulk handling of wheat, where whole ships are loaded by gravity from grain elevators and unloaded by suction at receiving

ports into other elevators for temporary storage preceding distribution.

Both wheat and rice harvests in any particular country are of fairly short duration, but wheat marketings tend to be more protracted than rice marketings. In a wheat-exporting country supplies are assembled after the harvest and stored at relatively few points. Shipments are made to overseas markets as orders are received, and this movement, though seasonal, is generally spread over the year. The distribution of rice in the Far East tends to be more definitely concentrated in the months immediately following the harvest.

Rice stocks are commonly held in many hands: by growers for the needs of the family, and by numerous intermediaries and distributors scattered throughout the market. Such holdings are necessarily small, and are intended generally to meet requirements only until the next harvest. Except where governments have intervened in order to influence a rice-price situation, rice stocks do not ordinarily become concentrated, nor are they carried over for more than one season. Hence, annual production of rice tends to correspond closely with annual utilization. There is no storage of supplies in excess of current consumption requirements comparable with the accumulations of surpluses that have occurred in the wheat world during recent years.

In fact, Japan is about the only Eastern country which has followed a regular practice of storing considerable quantities of rice. Under ideal conditions of storing, ventilating, and fumigating, and with more favorable climatic conditions than prevail in countries to the south, the Japanese government authorities supervise the maintenance of fairly large rice stocks. The rice thus stored is brown rice. Normally the carryover at the close of a season is equivalent to one month's or six weeks' consumption, but at the end of the bumper crop year 1933-34 it was approximately twice as great. The Japanese authorities consider that a surplus of something less than one month's consumption is sufficient for price control.

Outside of Japan, natural conditions are

less favorable for storage. All grains keep well under certain conditions, among which dryness is one of the most important. But it is impossible in most of Monsoon Asia to provide, except artificially, the conditions desirable for completely satisfactory grain storage. When no special precautions are taken or when they are impracticable, rice is best stored in the husk, i.e., as paddy, because in this form it can be stored, when necessary, for longer periods. Stored under the conditions generally prevailing in Monsoon Asia, paddy is less "self-heating" than rice, retains its flavor better, and is less subject to pests.<sup>1</sup>

If most rice growers and consumers did not live under rather primitive conditions with limited materials at their command, airtight storage of rice rather than paddy would be preferable. This would have the great advantage of occupying less room and reducing the weight involved—considerations important in transportation as well as warehousing. But even more important to Asiatics with generally poor diets is the effect of storage on the nutritional qualities of the grain.

Storage of rice is a crucial factor in adequate nutrition with respect to vitamin B<sub>1</sub> amongst rice-eating peoples. It has been established that rice can be stored without its husk with as good if not better results than those obtained with rice stored with its husk on. To succeed in the former method, however, there must be control of the moisture content of the grain, and it must be kept in airtight containers, or, better still, in an atmosphere of carbon dioxide.<sup>2</sup>

Although airtight storage possesses marked advantages over granary storage of rice and farm storage of paddy, under present conditions this method does not seem practicable, or perhaps necessary, and is very little used. The nutritional problem remains, however, particularly in areas where absence of dietary diversification concentrates all attention upon preserving the nutritional values inherent in the foods consumed. Preservation of vitamin properties is a considerably less important question in many wheat-eating nations (despite much emphasis upon it currently), for cereals are generally not so prominent in the diet, and vitamins are secured mainly from a variety of supplementary foods.

## V. UTILIZATION AND DIETARY POSITION

Unquestionably a larger proportion of the world's rice crop (in terms of brown rice, i.e., paddy with husks removed) is used for human food consumption than is true of the world's wheat crop. Percentages of the two crops utilized for various purposes may be appraised approximately as follows:

| Use              | Wheat      | Rice  |
|------------------|------------|-------|
| Seed .....       | 12         | 3-5   |
| Feed .....       | 6-10       | 3-5   |
| Industrial ..... | negligible | 3-5   |
| Food .....       | 78-82      | 85-91 |

Seed use for rice is less than half that for wheat. Feed use is smaller also, no doubt reflecting heavier pressure among rice-eaters

than among wheat-eaters to avoid loss of potential food supply. A variable but important part of the industrial use of rice is for the manufacture of food products. The fraction of the brown-rice crop destined directly for

[London, 1928], p. 143). The caterpillar is of much less importance to paddy and rice than the weevil. Rats also do much damage to stored grains, but storage places can be constructed that are largely rat-proof, and there are ways, such as trapping and poisoning, of dealing with such pests.

<sup>2</sup> B. S. Platt, "Rice and Its Importance for Human Nutrition," in Great Britain Economic Advisory Council, Committee on Nutrition in the Colonial Empire, *Nutrition in the Colonial Empire*, First Report, Part I (Cmd. 6050, 1939), pp. 198-99. These conclusions are based largely upon many years of work by two Japanese investigators, M. Kondō and T. Okamura, who studied the physical properties, germinating power, chemical content, and vitamin B content of rice and demonstrated that in so far as vitamin B is concerned "storage in straw bags in a granary is possible without serious loss up to about two years; but under such storage it has been found that after one year in a straw bag the taste of rice was undesirable, after two years taste, smell and colour were very bad and the rice could scarcely be eaten . . ." (Platt, p. 192).

<sup>1</sup> The most common insect pests of stored grain, rice and wheat alike, are the weevil and the caterpillar of the grain moth. The rice weevil, which multiplies most rapidly under damp conditions, is particularly dangerous to husked rice and limits the amount that can be stored during the rainy season. Similarly, with wheat "the main cause determining damage by insects is the presence of moisture above an allowable minimum . . ." (S. J. Duly, *Grain*

food use, not including the industrial use that is really food use in part, runs to 85–91 per cent, against 78–82 per cent for wheat. Furthermore, brown rice loses considerably less weight in the milling process than does wheat—roughly, only 10 per cent as against about 25 per cent. Thus possibly some 80 per cent of the weight of the world brown-rice crop is ingested by humans, against only about 60 per cent of the weight of the world wheat crop.

Furthermore, the nongrain parts of the rice plant are more commonly put to useful purpose. Wheat straw and chaff have little use beyond bedding for animals and as fuel, though the milling offals are valuable for feed. Rice hulls or husks not only are used as fuel for power-driven mills, but are beginning to be used as cellulose in making rayon, linoleum, and various packing and insulating materials; and rice straw is used in many parts of the Orient for thatching peasants' roofs, as a packing material, and to make mats, sacks, ropes, and baskets. Broken rice, and rice meal and bran, the chief byproducts of milling, also have important uses—to some extent for human consumption, but mainly for cattle feeding, brewing, distilling, vinegar manufacture, and starch making.

Differences in the degree of utilization of rice and wheat, however, are of less significance than the contrasts between the two cereals in the manner of consumption as human food.

#### FORMS OF CONSUMPTION

The fundamentally different manner in which rice and wheat are consumed is reflected in the place of each cereal in the diet. Wheat is most commonly ground to make a flour, then combined with other ingredients, and finally baked to produce some form of bread. In consumption bread is usually only one component of a meal; it is commonly eaten cold, hours or days after preparation. Rice is generally boiled or steamed and, without undergoing further change, is eaten hot shortly after preparation. It may be, and commonly is, the main component or basic part of the meal in Oriental countries. For taste and variety rice may be flavored with

a bit of fish, some hot condiment, or curry, or combined in numerous ways with peas and beans. It remains, however, the central item of food around which others are added as circumstances permit.

Although wheat is consumed chiefly as bread, the yeast-leavened form prized in the West is not everywhere the commonest. Unleavened flatbread dominates in wide regions of Asia and Africa; almost all the wheat bread consumed in British India and in many interior parts of China is of this type. There are also several regions where the more common end-products of wheat are macaroni and noodles. Moreover, in parts of the Orient where wheat is consumed, an appreciable fraction of it is not manufactured into flour but is used directly in the preparation of soy sauce, and much of the flour is used in cakes and sweetened foods rather than in bread.

For many, Japanese bread is really cake, commonly made with a fairly high sugar content; hence its use is somewhat restricted. Sweet goods, cakes, and similar baked products are more important in Japanese consumption than bread and rolls. Still more important is the use of wheat flour for alimentary pastes of the noodle type—products in which the soft flour manufactured from domestic wheat is better suited than for breadmaking.<sup>1</sup>

In China, as in Japan, wheat is not widely consumed in the form of yeast-leavened fine white bread. A coarse, hard, dark flat-bread is made in the rural areas; sweet goods are common in cities; but the largest consumption is probably in the form of noodles and dumplings. Rice, the more important cereal in China as a whole, is consumed about as it is elsewhere in eastern Asia—boiled or steamed.

Wheat is the only cereal from which a yeast-leavened bread white in color and bland in flavor can be made. Partly for this reason, the degree to which other foods may be substituted for rice is apparently greater than

<sup>1</sup> Probably 70 per cent of the Japanese wheat supply is utilized each year in the manufacture of flour. Another 20 per cent of the disappearance, as far as can be judged by the rather unsatisfactory data available on the subject, is not milled but goes for making sauces, soy sauce in particular.

for wheat. The method of preparation of most of the available rice substitutes, such as barley and millet, is the same as for rice. With bread, on the other hand, the method of preparation of substitutes is very different.

Wheat must be milled into flour and then fermented and baked. Any direct substitute must also be milled into flour, or prepared as starch, in order that it may be mixed with wheat flour and the mixture then baked. In practice, admixture of substantial amounts of substitute flours (except rye) with wheat flours tends to spoil the bread. Mere cooking and preparation thus create difficulties in finding substitutes for wheat that are not encountered with rice.

In Western countries rice does not substitute for bread, but, to a small extent, competes with potatoes and similar starchy foods and with noodles and macaroni made from wheat. In most cases the substitution of rice for potatoes is a matter of taste and variety and is unrelated to relative prices. Rice is consumed in the West almost without regard to baked products made from wheat. There is thus less opportunity for rice to displace wheat in the West than for wheat to partially displace rice in the East.

#### BASES OF PREFERENCE

Consumer preferences among rice-eaters seem to be stronger and more definitely expressed than preferences among wheat-eaters, and probably have a quite different basis. For wheat, the important factors are the ultimate use of the flour and the technical experience of millers in producing uniform flours of different types from a wide variety of wheats. With rice, technical considerations relating to intermediate processes play a very much smaller part in the determination of what constitutes "quality."

For cereals that are used in bread making, or in the production of many other baked products in which flour is the main constituent, quality concepts are based to a considerable extent, though not wholly, upon technical considerations of milling and baking.

The miller, other things being equal, prefers the wheat from which he can extract the greatest

proportion of flour; but the baker, also other things being equal, prefers the flour from which he can produce the greatest number of loaves per barrel. He compels the miller to consider not merely flour yield in evaluating wheat but also capacity to absorb water upon which the yield of bread largely depends. The bread eater in turn insists (especially in the United States) that bread shall be white and possess a certain texture, thereby limiting the baker's choice of flour. These limitations influence the baker's demands on the miller and further modify the miller's criteria for the evaluation of wheat.<sup>1</sup>

Rice millers also prefer some varieties to others, though their preferences are less exacting than those of wheat millers. Round-kerneled rices, for example, are preferred by millers to long-kerneled rices, because they are generally less susceptible to breakage in milling.<sup>2</sup> A high proportion of "brokens" reduces the value of the milled product, since all rice-grade standards include tolerances for an allowable percentage of broken or damaged grains.

For rice consumers in the Western market, appearance of the grain seems to be the chief basis of preference. Hence technical considerations in milling assume their greatest importance in countries outside the Far East. Convenience or ease in cooking are apparently not as important to the Western consumer of rice as to the Asiatic. But the Western consumer is not typical of rice-eaters generally, and the dishes prepared from rice in the Occident are usually quite different from those more common in the Orient. A tendency toward "mushing" when cooked,<sup>3</sup> for example, is not objectionable in a rice pudding, whereas in curry and similar dishes maintenance of the whole grain throughout cooking and serving is highly desirable.

<sup>1</sup> C. L. Alsberg, "Environment, Heredity, and Wheat Quality," *WHEAT STUDIES*, March 1934, X, 229.

<sup>2</sup> The fact that Japanese types of rice can be milled without great breakage may be one reason for the practice in Japan of partial milling on the farm before marketing (p. 275). Conceivably this may also have something to do with the Japanese preference for Japanese types.

<sup>3</sup> "Contrary to common belief, at least in the United States, any good rice can be cooked [so that the kernels remain distinct and free] . . . —Honduras, Piedmont, Javanese, Japanese, Patna, or any other—provided that it be thoroughly washed first, and that it be *not stirred at all* while cooking" (Copeland, *op. cit.*, p. 324).

The typical Asiatic rice consumer is able to distinguish very sharply between different types of rice and apparently has strong preferences for some varieties over others. The basis for such highly developed preferences is not wholly clear. Why the Japanese prefer one flavor and the Siamese another appears to be based partly upon taste that has been developed over generations. Rice varieties adapted to the soil and climatic conditions of one region probably possess flavor characteristics differing from those adapted to other regions. When conservatism is so strong in matters of taste and when the population tends to be immobile, the local consumer might well be inclined to regard rice grown in more distant regions and possessing different flavors as in some vague sense inferior. Furthermore, the extent to which rice is consumed in the Orient tends perhaps to develop discriminations beyond the comprehension of the Western consumer.

It is probably impossible, however, to determine the precise basis for preference in different localities. It is certainly not wholly a chemical matter. Texture of the boiled product may be even more important. If one asks intelligent Japanese, Chinese, Filipinos, and Javanese why they dislike certain types of rice, they are not able to give a clean-cut answer. Usually they can do no better than to say that the rice in question is "coarse." Sometimes they add "and poor in flavor."

Preferences based upon cooking properties vary but are usually related to flavor preferences. The Chinese, for example, generally prefer their rice firmer than do most Orientals, and they carry this preference with them wherever they migrate in southeastern Asia. The desirability of a "solid" or "soft" grain depends upon the manner of eating the cooked product—whether it is consumed along with other foods or as part of a mixture with other foods or sauces. In the case of parboiled rice, both convenience of preparation and taste of the cooked product are factors involved in its use. Parboiling is a special process of soaking, steaming, and drying rice which imparts a distinctive flavor that is appreciated by some consumers. Parboiled rice may be prepared the night before

it is consumed and is palatable as a cold dish. It is particularly suitable to plantation conditions where time and facilities for cooking are commonly not available.

The rice produced in Chosen and Taiwan was once quite different in quality and taste from that grown in Japan and therefore was less acceptable in the Japanese market. It was regarded with the same disfavor as rice grown in southeastern Asia. Japanese scientists succeeded in developing for the colonies varieties that now differ little from rice produced in Japan proper. Inasmuch as the Japanese have long been under pressure to increase the rice output of the Empire, it is probable that in the development and introduction of improved varieties much emphasis was placed upon high-yielding characteristics. In general, rices regarded as superior in flavor are not heavy yielders. One may venture to guess that perhaps the strongly developed Japanese preference for Japan-grown rice may somehow be connected with the government's efforts to enlarge the rice output. Consumer acceptance of varieties of rice well suited to assist in achieving this end would greatly facilitate the longer-term program.

British Malaya is another area where differences in consumer preferences for rice are marked. The explanation seems to lie in the presence of large numbers of Chinese and Indians in the population. Both groups are comparatively recent arrivals, and their preferences differ from those of the native Malays. Elsewhere the Bengalese and the Javanese are both reputed to be particular in making distinctions between different types of rice. It has been reported, for example, that Carolina rice grown in Calcutta could not be sold by any native dealer but had to be exported to London; that even famine could not induce the Bengalese to eat Burmese rice in Bihar in 1874; and that Carolina rice grown in Java had to be exported to Holland.<sup>1</sup> Just how much reliance can be placed upon such reports is difficult to say at this distance, but it is hard to believe that starvation would

<sup>1</sup> J. van Breda de Haan, "Waarom de Teelt van Carolina-Rijst in Britisch-Indië weinig ingang vond," *Teysmannia; Magazyn van Horticultuur en Landbouw der Tropen* (Batavia), 1903, XIV, 233.



be preferred to an unfamiliar or foreign rice.

At present no large amount of the type of rice preferred in Western markets is grown for export in Asia. Under present conditions rice grown in Monsoon Asia is best suited and best able to supply the Asiatic market, while rice grown outside Asia more nearly satisfies the desires of consumers in other parts of the world. But of the rice grown in the Far East, the surpluses of Burma, Thailand, and Indo-China are generally not acceptable in the closed special market of Japan.

#### PLACE IN THE DIET

Neither wheat nor rice is a "complete" food; no population does or could exist on a diet composed exclusively of either cereal. But if two populations were to derive maximum fractions—say 85 per cent—of their total food-calorie intake respectively from polished rice and from wheaten bread made solely of white flour, yeast, salt, and water, the nutritional advantage would lie with the bread-eaters if only because such bread contains an appreciably larger proportion of protein than does polished rice. Under such circumstances both populations would probably be exposed to shortage of the B-vitamin complex. If the wheaten bread were made from whole-wheat flour, and the rice were consumed as brown rice rather than polished, this particular vitamin deficiency would disappear; but the nutritional advantage would remain with the wheat-eaters because of the higher proportions of protein and fat in whole-wheat flour as compared with brown rice.

In general, rice is a far more important constituent of the diet of typically rice-eating populations of the Orient than wheat is in the diet of typically wheat-eating populations of the Occident. Whereas rice furnishes 70–90 per cent of all the food calories available or ingested in Oriental countries, wheat furnishes only 25–35 per cent of all the food calories available or ingested in Occidental countries such as the United Kingdom, the United States, and Canada.<sup>1</sup>

The Western countries can afford to relegate the relatively cheap cereal foods to an unimportant place in the diet, whereas the Eastern countries cannot. In the family

budgets of the laboring classes in the Orient, four-fifths or more of the family income is commonly required to cover outlay for food composed largely of the cheapest types; in the Occident, the proportion of the income spent for food is commonly less than half, and more expensive types of food are within reach. Under such circumstances of income, the wheat-eater in Western countries finds it easier to purchase his cereal requirements than does the rice-eater in Oriental countries.

In both groups of countries, there is currently a good deal of discussion concerning the need for improvement of national nutritional status; and suppression of white flour in favor of whole-wheat flour (or white flour enriched or fortified with vitamin B<sub>1</sub>), or suppression of polished rice in favor of brown rice, is widely advocated. Experts feel that the loss of the vitamin B complex through fine flour milling or high rice polishing has adverse nutritional consequences of substantial significance.

The risks of malnutrition obviously seem relatively larger among the Oriental populations. There the refined cereal constitutes much the larger proportion of the ingested food, while the noncereal foods from which more or less of the protein, fat, mineral salts, and B-vitamin complex might be derived constitute much the smaller proportion. Within Monsoon Asia, nutritional deficiencies are said to be most common in the rural areas. The proportion of the total population residing in such regions is far greater in the Orient than in Western countries, and dietary dependence upon the cereals in general and rice in particular is more marked.

The risk of malnutrition through deficiency of the B-vitamin complex is perhaps tending to increase in the Orient. Complete milling of rice removes not only the bulk of the vitamin in brown rice, but also considerable of the protein and most of the fat. Until relatively

<sup>1</sup> Other contrasts, of less significance here, are that the "average man" in the Oriental countries has a smaller body size, lives in a warmer climate, and hence ingests considerably fewer total food calories than the average man in Occidental countries. Furthermore, because of greater poverty and a lower level of economic productivity, less food is wasted or lost between points of production and ingestion by consumers.

recent years, white and polished rice was little used in Asia; the demand for it came from the Western world. As portions of the Orient have come under the influence of Western culture, and as milling equipment has been improved and extended into the back country, there has been a growing tendency to prefer a highly milled or polished rice.<sup>1</sup>

It seems not altogether certain, however, that the best way to combat dietary deficiencies in the Orient is by the consumption of only lightly milled rice, as long advocated. The less highly milled rices have the disadvantages of being usually more difficult to cook, less appetizing in appearance, and containing a larger proportion of roughage that may give rise to intestinal disturbances. Recently a process has been developed, known as "rice conversion," which purports to permit the milling of rice to make it white in appearance while preserving its vitamin content.<sup>2</sup> Those qualified within the industry can best judge whether this new process will "revolutionize" the rice industry as anticipated in some quarters.

In order to secure balance in the Oriental diet, rice needs to be supplemented by other foods rich especially in proteins. Such protein as is available to supplement the little found in rice<sup>3</sup> is secured in the Orient chiefly from legumes, and only to a very small extent from animal products, as in Western countries. But unless the incomes of millions of families living in the rice world can be substantially enlarged, the suggestions sometimes made for improving their diets by the introduction of greater amounts of dairy products,

meat, fruits, and vegetables seem quite impracticable and perhaps unnecessary if better use were made of vitamin-bearing foods found in the Orient.

#### RICE-WHEAT COMPETITION

Competition between rice and wheat in consumption arises when both cereals are physically obtainable and when there are groups in the population able and willing to shift from one cereal to the other under the pressure either of change in price relations or of change in relative abundance. Some competition arises from partial fulfillment of these conditions in scattered places within the wheat world, but it is not important. Adjacent to the borders of Monsoon Asia and the rice world, however, are two great regions of wheat production and consumption—northern China and the northwest of India.

Very little rice is grown in northern China, though the rice plant will grow as far north as Vladivostok. The country generally is sub-humid or semiarid and better suited for the production of unirrigated crops like wheat, millet, kaoliang, and corn. For millions of people living in this area rice is a luxury, eaten not more than a couple of times a year. Millet and kaoliang are staples for the masses, and wheat seems to occupy a position in between, being consumed by the middle class.

In southern China, where rice is the dominating crop, wheat is gradually beginning to be consumed along the coast and in the cities, but apparently is still considered somewhat of a luxury when it is highly regarded at all. The use of bread by soldiers, originally as a convenience, is seemingly taking hold, and the influence of the wheat-eating North Chinese has spread southward as millions have migrated in this direction during recent years.

Between these two extremes is central China, where the wheat and rice areas merge and overlap. From the Yangtse Valley to the Yellow River, much winter wheat is grown in rotation with rice, but also with soybeans, corn, and other crops, on both irrigated paddy fields and nonirrigated lands. This is a region where rice and wheat compete significantly for consumer favor.

The Central Provinces in India are also

<sup>1</sup> Regardless of nutritional needs, even consumers of ordinary qualities of rice tend to prefer higher milling. Note the complaint in the *Siam Science Bulletin*, No. 3 (Dept. of Science, Ministry of Economic Affairs, Bangkok, April 1939), pp. 54-55: "Nowadays there are hundreds of rice mills all over the country, even in remote corners, having no decent highways or railways, the rice milling machinery being transported in pieces by bullock carts or ponies . . . They [the rural population] now refuse to eat hand-milled rice in spite of medical advice."

<sup>2</sup> See S. O. Landry, "White 'Brown' Rice," *The Rice Journal*, February 1940, pp. 2-3.

<sup>3</sup> Ordinary varieties of polished rice usually do not contain more than 7 per cent protein (brown rice about 8 per cent), whereas wheat flours used in the United States contain from 8 to 15 per cent protein.

located similarly between wheat areas on the northwest and rice areas on the east and south. A rough estimate of the number of rice-eaters in India places the figure at about 240 million, contrasted with about 100 million wheat-eaters. As in China, the rice and wheat crops of India are largely consumed locally in the regions where they are grown, and rice and wheat compete in the region where the wheat-producing and rice-producing areas overlap.

For a large number of consumers living in these areas, and for others residing within a trading radius, the choice between the two cereals is unquestionably strongly influenced by comparative prices.<sup>1</sup> When rice and wheat are available, the proportions used will presumably vary with changes in the price differential between them. But the information bearing on questions of wheat-rice competition in such areas as these is decidedly scanty.

The record of price differentials existing between wheat and rice at given times and in given places is faulty, and the basis for the differentials cannot be briefly or adequately explained in general terms. Although statements are made frequently about relative prices, the expressed inferences about the

"expensiveness" of the two cereals are often misleading. Surprise is expressed, for example, that rice maintains its important place in the world's diet despite the fact that the price of wheat is generally below the price of rice.<sup>2</sup>

The relative prices of the two cereals quoted on some exchange may be misleading from the standpoint of consumption. Such prices cannot be fairly compared, because they do not adequately reflect the final cost to the ultimate consumer. Rice prices so quoted are almost always in terms of cleaned (or brown) rice, and this means that the rice grain has already lost half of its original volume by husking and one-third or more of its original weight. At most it has only 10 per cent more to lose. The wheat on which prices are quoted, on the other hand, has yet to lose 20-30 per cent of its weight in the process of being converted into flour.

From the standpoint of cost to the consumer, i.e., cost on the table as served, wheat must usually be converted into flour and the flour into pastes, bread, or other baked products. The conversion costs, plus distributive expenses and profits, are added to the original price. With rice, on the other hand, the distributive channel is short, and the only additional expense in processing comes from the preparation of a rice dish in the home. This is a simple matter involving only the housewife's time and a small amount of fuel and water. When a bowl of rice and a batch of noodles or a loaf of bread are ready to eat, the differential between the two cereals in final cost per 1,000 calories has narrowed appreciably, disappeared, or been reversed, whereas per pound rice may have been much more "expensive" than wheat.

The use of bread is growing somewhat in the East. Even so, wheat will continue to encounter many obstacles to providing more extensive competition to rice. If the price differential between the grains were to narrow so that bread at the table should become substantially cheaper than rice, wheat would still make slow progress because substitution would involve other changes in the diet. Bread may supplement the diet to the extent that the use of rice is curtailed, but a loaf of bread is

<sup>1</sup> Other significant places where rice and wheat compete in consumption are found in the large metropolitan consuming centers of the Orient. City markets, where rice as well as wheat and other grains must be imported from producing areas, are free from the numerous influences of a subsistence-type economy characteristic of extensive rural areas. The city dwellers' food choices are presumably influenced chiefly by taste and purse, not by the manifold considerations of subsistence environment, which may be more important than any other factors in the determination of the farmers' diets and indicated food choices. In urban areas of the East where diet diversification is feasible, and where Western influences are stronger, wheat consumption may gain at the expense of rice simply because wheat products are among desirable foods that are available and may be added to the diet. Every such addition tends to restrict, but not to eliminate, the use of rice.

<sup>2</sup> See O. E. Baker, "The Potential Supply of Wheat," *Economic Geography*, March 1925, I, 17, and E. W. Zimmermann, *World Resources and Industries* (New York, 1933), p. 234. Both of these writers compare prices of the two grains, as they are registered on grain exchanges. Japanese writers do likewise and in one case conclude that "the Japanese people live on a staple food which is the most expensive of all cereals" (Tsuneta Yano and Kyoichi Shirasaki, *Nippon, a Charted Survey of Japan*, 1936 [Tokyo, 1936], p. 97).

not a real alternative for a bowl of rice among rice-eating peoples. The sauces, condiments, legumes, fish, beans, and so on, that are served with rice in the Orient would have to be either adapted to new uses and combinations not common in Western countries or largely displaced by dairy products, derivatives of sugar, vegetables, and still further by meat or its equivalent. Such displacements would be prohibitively expensive for the masses of Eastern consumers.

If rice at the table, on the other hand, were twice as expensive as bread, the cost of the typical Asiatic diet would still be only half as much as the cost of the ration of European and American nations with a fairly high standard of living, despite the fact that Far Eastern peoples ordinarily consume double the amount of cereals. This is explained primarily by differences in composition of diets and in costs of the components. Since carbohydrates are less important in Occidental than in Oriental diets, the protein and fat contribution to total calorie requirements is greater. The chief sources of protein and fat in Western diets are meat and dairy products which are considerably more expensive per calorie

than the fish, beans, and vegetables which serve the same purpose in Eastern diets. A secondary factor is that the calorie requirements per adult male per day are smaller in the East than in the West.

In addition to dietary considerations, other factors are important in explaining why wheat has made only minor inroads in areas where rice is the most important food in the diet. These have been mentioned or implied earlier but may be summarized to advantage: food of two or three times the energy value can be obtained per unit of land in the form of rice as compared with wheat; large areas in Asia are beyond the reach of transportation and the price economy; climatic conditions suitable for rice growing but unsuited for other crops tend to retard a possible emergence from a subsistence economy; not only no alternative land use seems feasible, but no alternative occupation for farm labor presents itself; the dietary habits of Eastern peoples are firmly fixed and cannot for numerous reasons be readily altered; and the intensity of consumer preferences for rice among rice-eaters is apparently stronger than similar preferences for wheat among wheat-eaters.

## VI. TRENDS IN CONSUMPTION

Cereals occupy such an important place in the diet that changes over a period of years in per capita consumption of specific cereals are often indicative of significant shifts in the diets of particular groups or nations. Changes in the amount of wheat or rice used per capita may reflect alterations in the general quality of diets, in their quantitative adequacy, or both. In the world as a whole, per capita wheat and rice consumption have both tended to decline, but these lowered consumption levels have usually resulted from quite different causes.

The decline in wheat consumption, where it has occurred, has largely reflected rising levels of consumption in general with greater diversification of diets—a qualitative improve-

ment. From a quantitative standpoint, there exists no problem of the adequacy of supplies for Western wheat-eating nations. The land devoted to wheat growing, the yields obtained, and aggregate output have all shown a tendency to increase more rapidly than population.

Furthermore, ample potentialities exist for enlarging the world wheat supply if and when demand conditions call for expansion. Experience in the last forty years has shown the falsity of the alarmist view, so cogently expressed by Sir William Crookes in 1898, that because of an impending world shortage of wheat "England and all civilized nations stand in deadly peril of not having enough to eat."<sup>1</sup> Even if the surpluses that have been almost chronic in most of the 1930's are ignored, there is abundant scope for expansion of wheat output through extension of cultivation to land not now in use, by increase of wheat yields, and by diversion of land from other

<sup>1</sup> Cf. J. S. Davis, *On Agricultural Policy, 1926-38* (Food Research Institute, Miscellaneous Publications 9, Stanford University, California, 1939), chap. i, "The Specter of Dearth of Food: History's Answer to Sir William Crookes," pp. 3-23.

crops to wheat. Some of these changes have occurred despite low wheat prices; others can be counted upon to come by degrees, more rapidly if a price stimulus is provided. Although temporary shortage of wheat may well recur, as in 1936-37 and 1937-38, the world wheat problem is now more commonly one of surplus than one of scarcity, and may well remain so in the next few decades.

#### SUMMARY OF ASIATIC RICE SITUATION

The situation with rice is quite different. As with wheat, per capita consumption has declined, but apparently the chief reason for the decline has been that rice production has not kept pace with population growth in the rice world. Table 2, which summarizes pertinent data for 11 Asiatic countries, suggests that these tendencies have been in evidence for at least the past quarter of a century. The following five-year averages, expressed as index numbers, are illuminating:

| Period        | Rice production | Population | Production per capita |
|---------------|-----------------|------------|-----------------------|
| 1921-25 ..... | 100             | 100        | 100                   |
| 1926-30 ..... | 100             | 106        | 94                    |
| 1931-35 ..... | 106             | 113        | 94                    |
| 1936-40 ..... | 107             | 120        | 89                    |

Changes have been slow rather than alarmingly fast. Yet the disparity between supply and population is nevertheless apparent. In the short span of years here considered, population in these 11 countries (Monsoon Asia ex-China) has increased three times as rapidly as the growth in rice production. If population pressure on the land, already strong, continues to grow, the question of the adequacy of food supplies may become a serious one.

Although declining tendencies in per capita use of rice predominate, there have been some notably divergent trends within the group of countries for which data are available (Table 2). In so far as present statistics provide a reliable guide to the course of rice production and consumption in eastern Asia and the Pacific tropics over the past few decades, it may be observed that (1) as exports have expanded more rapidly than production, sharp decreases have occurred in apparent per capita rice consumption in all of the rice-exporting countries except French Indo-China; (2) of the

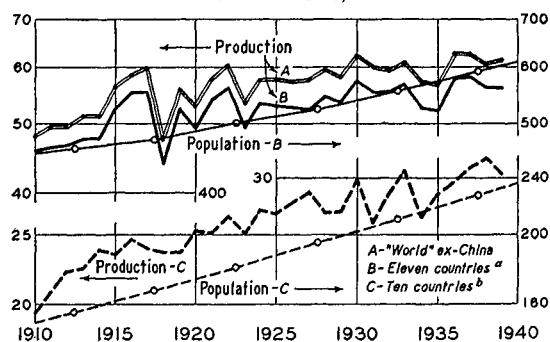
net-importing nations, India, Japan, British Malaya, and possibly Ceylon have become more dependent upon outside supplies, but consumption has been well maintained during recent years except in India, the most important importer; and (3) Java and Madura and the Philippine Islands have reduced their dependence upon foreign rice so that they are near self-sufficiency, but at a lower level of consumption.

Lack of statistics makes it necessary to exclude China, the most important rice-producing country in the world, from certain phases of any appraisal of the Asiatic rice situation. This deficiency is not, however, quite as serious as it seems at first, inasmuch as China has long been primarily a rice-importing nation and has not figured in the supply for other Asiatic countries. Consumption has probably declined in China, but at a rate presumably not much faster than in Asia as a whole, even though Chinese imports have fallen drastically since the early 1930's.

India, the greatest rice-consuming country except China, is by far the most important single calculable factor in the world rice situation. The heavy curve (partly an estimate) in Chart 2 traces the course of production of

CHART 2.—RICE PRODUCTION AND POPULATION TRENDS, 1910-40\*

(Million metric tons; million persons; logarithmic vertical scale)



\* Data from official sources. See note p. 314.

<sup>a</sup> Monsoon Asia excluding China.

<sup>b</sup> Monsoon Asia excluding China and India.

11 rice-producing countries of Asia (excluding China). Just above is a curve representing "world" rice production (also ex-China), and at the bottom of the chart are curves showing rice production and population growth for 10 countries of Monsoon Asia, i.e.,

TABLE 2.—CHANGES IN THE RICE POSITION OF ELEVEN ASIATIC COUNTRIES, ANNUAL AVERAGES FOR FIVE-YEAR PERIODS, 1916-20 TO 1936-40\*

| Period      | Pro-<br>duction              | Imports           | Exports           | Avail-<br>able<br>supplies | Popula-<br>tion | Per<br>capita<br>utiliza-<br>tion <sup>a</sup> | Pro-<br>duction       | Imports           | Exports           | Avail-<br>able<br>supplies | Popula-<br>tion    | Per<br>capita<br>utiliza-<br>tion <sup>a</sup> |
|-------------|------------------------------|-------------------|-------------------|----------------------------|-----------------|--|-----------------------|-------------------|-------------------|----------------------------|--------------------|--|
|             | (Million metric tons)        |                   |                   |                            | (Mil-<br>lions) | (Kilo-<br>grams)                               | (Million metric tons) |                   |                   |                            | (Mil-<br>lions)    | (Kilo-<br>grams)                               |
|             | Burma <sup>a</sup>           |                   |                   |                            |                 |  | India                 |                   |                   |                            |                    |  |
| 1916-20.... | 4.31                         |                   | 2.25              | 2.06                       | 12.9            | 160  | 28.11                 | 1.20 <sup>b</sup> | .34 <sup>b</sup>  | 28.97                      | 308.2              | 94   |
| 1921-25.... | 4.58                         |                   | 2.30              | 2.28                       | 13.5            | 159  | 26.67                 | .89               | .29               | 27.27                      | 311.2              | 88   |
| 1926-30.... | 5.00                         |                   | 2.92              | 2.09                       | 14.2            | 149  | 25.87                 | 1.10              | .31               | 26.66                      | 328.6              | 81   |
| 1931-35.... | 4.87                         |                   | 3.17              | 1.70                       | 14.9            | 115  | 27.13                 | 1.48              | .26               | 28.35                      | 346.4              | 82   |
| 1936-40.... | 4.94                         |                   | 2.99              | 1.95                       | 15.9            | 123  | 25.80                 | 1.73              | .33               | 27.20                      | 363.5              | 75   |
|             | French Indo-China            |                   |                   |                            |                 |  | Java and Madura       |                   |                   |                            |                    |  |
| 1916-20.... | 3.07                         |                   | 1.18              | 1.89                       | 18.3            | 103  | 3.30                  | .28               | .00               | 3.58                       | 33.5               | 107  |
| 1921-25.... | 3.34                         |                   | 1.26              | 2.08                       | 19.8            | 105  | 3.20                  | .33               | .02               | 3.51                       | 36.6               | 96   |
| 1926-30.... | 3.72                         |                   | 1.37              | 2.34                       | 21.4            | 109  | 3.52                  | .24               | .01               | 3.75                       | 39.9               | 94   |
| 1931-35.... | 3.55                         |                   | 1.21              | 2.34                       | 22.1            | 106  | 3.67                  | .14               | .01               | 3.81                       | 43.6               | 87   |
| 1936-40.... | 3.94                         |                   | 1.32 <sup>c</sup> | 2.61 <sup>c</sup>          | 23.4            | 112 <sup>c</sup>                               | 4.05 <sup>c</sup>     | .02 <sup>c</sup>  | .01 <sup>c</sup>  | 4.06 <sup>c</sup>          | 47.0               | 86 <sup>c</sup>                                |
|             | Thailand (Siam) <sup>a</sup> |                   |                   |                            |                 |  | Philippine Islands    |                   |                   |                            |                    |  |
| 1916-20.... | 1.92                         |                   | .86               | 1.07                       | 9.1             | 125  | .87                   | .13               |                   | 1.00                       | 10.2               | 98   |
| 1921-25.... | 2.76                         |                   | .93               | 1.83                       | 10.1            | 172  | 1.21                  | .08               |                   | 1.29                       | 11.1               | 116  |
| 1926-30.... | 2.71                         |                   | 1.24              | 1.47                       | 11.2            | 134  | 1.39                  | .05               |                   | 1.44                       | 11.9               | 121  |
| 1931-35.... | 2.94                         |                   | 1.40              | 1.54                       | 12.9            | 116  | 1.36                  | .01               |                   | 1.37                       | 12.8               | 107  |
| 1936-40.... | 2.77                         |                   | 1.41              | 1.36                       | 14.9            | 91   | 1.44                  | .06 <sup>c</sup>  |                   | 1.49 <sup>c</sup>          | 13.7               | 110 <sup>c</sup>                               |
|             | Chosen (Korea)               |                   |                   |                            |                 |  | British Malaya        |                   |                   |                            |                    |  |
| 1916-20.... | 1.81                         | .01               | .28               | 1.55                       | 17.1            | 90   | ...                   | ...               | ...               | ...                        | ...                | ...  |
| 1921-25.... | 1.92                         | .05               | .54               | 1.44                       | 18.6            | 77   | .23                   | .58               | .22               | .59                        | 3.6                | 167  |
| 1926-30.... | 1.98                         | .10               | .79               | 1.29                       | 20.4            | 63   | .18                   | .81               | .27               | .73                        | 4.1                | 181  |
| 1931-35.... | 2.29                         | .02               | 1.12              | 1.18                       | 22.1            | 54   | .31                   | .64               | .18               | .77                        | 4.6                | 170  |
| 1936-40.... | 2.73                         | .02 <sup>b</sup>  | 1.11 <sup>b</sup> | 1.41 <sup>bd</sup>         | 23.8            | 60 <sup>bd</sup>                               | .33                   | .79 <sup>c</sup>  | .18 <sup>c</sup>  | .94 <sup>c</sup>           | 5.2                | 184 <sup>c</sup>                               |
|             | Taiwan (Formosa)             |                   |                   |                            |                 |  | Ceylon                |                   |                   |                            |                    |  |
| 1916-20.... | .63                          | .03               | .12               | .54                        | 3.5             | 155  | ...                   | ...               |                   | ...                        | ...                | ...  |
| 1921-25.... | .69                          | .04               | .19               | .55                        | 3.8             | 142  | .15                   | .39               |                   | .54                        | 4.7                | 116  |
| 1926-30.... | .87                          | .07               | .30               | .64                        | 4.3             | 148  | .17                   | .48               |                   | .66                        | 5.1                | 129  |
| 1931-35.... | 1.09                         | .01               | .52               | .58                        | 4.9             | 118  | .20                   | .48               |                   | .68                        | 5.5                | 125  |
| 1936-40.... | 1.24                         | .00 <sup>b</sup>  | .62 <sup>b</sup>  | .62 <sup>b</sup>           | 5.5             | 113 <sup>b</sup>                               | .20                   | .55 <sup>c</sup>  |                   | .75 <sup>c</sup>           | 5.8                | 129 <sup>c</sup>                               |
|             | Japan                        |                   |                   |                            |                 |  | Total 11 countries    |                   |                   |                            |                    |  |
| 1916-20.... | 7.54                         | .65               | .08               | 8.11                       | 54.7            | 148  | 51.56 <sup>c</sup>    | 2.30 <sup>c</sup> | 5.11 <sup>c</sup> | 48.76 <sup>c</sup>         | 467.5 <sup>c</sup> | 104 <sup>c</sup>                               |
| 1921-25.... | 7.73                         | 1.12              | .13               | 8.72                       | 58.0            | 150  | 52.48                 | 3.48              | 5.88              | 50.08                      | 491.0              | 102  |
| 1926-30.... | 7.88                         | 1.38              | .11               | 9.15                       | 62.3            | 147  | 53.29                 | 4.23              | 7.32              | 50.20                      | 523.4              | 96   |
| 1931-35.... | 8.08                         | 1.73              | .09               | 9.72                       | 66.6            | 146  | 55.50                 | 4.51              | 7.96              | 52.05                      | 556.4              | 94   |
| 1936-40.... | 8.64                         | 1.75 <sup>b</sup> | .03 <sup>b</sup>  | 10.16 <sup>b</sup>         | 72.0            | 143 <sup>b</sup>                               | 56.08                 | 4.92 <sup>f</sup> | 8.00 <sup>f</sup> | 52.44 <sup>f</sup>         | 590.8              | 89 <sup>f</sup>                                |

\* Data from official sources (see note, p. 314) refer mainly to crops harvested in late autumn of 1915 and following, and trade of calendar years 1916 ff.; trade of India, Burma, and Thailand, however, for years April-March 1915-16 and following. All 1936-40 averages are preliminary owing to incomplete trade returns and some unrevised crop figures for 1939-40.

<sup>a</sup> Too much importance should not be attached to per capita utilization data for particular five-year periods, especially for countries where exports or imports are large in relation to production. Difficulties in combining trade data for Burma and Thailand (on April-March basis) with appropriate crop data for the purpose of calculating per capita utilization have been partially resolved by using a two-year

moving average of the trade figures. For some other countries, per capita utilization for the 1936-40 period has been computed or estimated from incomplete information.

<sup>b</sup> Three-year average.

<sup>c</sup> Four-year average.

<sup>d</sup> Estimate based on assumption that Chosen crop of 1937-38 was overstated.

<sup>e</sup> Excluding British Malaya and Ceylon. <sup>f</sup> Estimate only.

excluding India as well as China. Not only is the importance of Monsoon Asia in world rice output graphically illustrated, but the heavy weighting of the Indian rice position in the total world rice situation is also suggested.

If the current relationship between rice production and population growth in the East continues, the pressure of numbers alone may, in the not distant future, possibly create a serious situation in food supplies. Assuming no change in the Chinese population, various rates of growth for other countries, and continuation of current levels of per capita rice utilization, it appears that an increase of at least 10 million tons in the rice supply of Monsoon Asia over the average annual production in 1936-40 will be necessary during the next decade in order merely to maintain per capita consumption at the average level of 1921-35. Since little of this increase in output may be expected to come from China, Japan, India, or Java, all areas of dense population with limited possibilities for expanding rice output, the desirable additions to supplies that must come from a few small surplus-producing countries becomes strikingly apparent.

If it were not for India's growing rice deficiency, the potential inadequacy of rice supplies would appear far less threatening. China can and does seemingly forego large additions to her domestic supply when prices are too high or when internal conditions do not favor imports. Japan is now seldom required to call upon sources outside the Empire except in the event of temporary shortages, though such self-sufficiency in rice for Japan proper may be partially achieved at the expense of the colonies. Java, for the time being, and the Philippine Islands can effect whatever adjustments are necessary to insure sufficient rice supplies rather easily. And non-Asiatic demand upon the East has tended to shrink as Western rice-growing countries have become increasingly important suppliers of markets where consumption can be drastically curtailed when necessary without hardship. Remaining in the Far East are the relatively sparsely populated areas where insufficient rice is grown partly because attention is concentrated upon more profitable export crops.

The requirements of all such markets are quite small in comparison with the surpluses available for export from the three important near-by sources of supply.

The chief obstacles to the more rapid expansion of rice output are the facts that rice grows successfully only under certain climatic and soil conditions; suitable alternative crops are not available; planes of living are low; and political uncertainties, lack of adequate transportation facilities, and similar factors retard the development of more diversified national economies.

Opportunities undoubtedly exist for increasing rice yields<sup>1</sup> and bringing additional suitable lands under crops, even in a part of the world where intensive forms of agriculture are common. But such expansion is not a near-term prospect. What the longer-term potentialities are for enlarging world rice production is another matter. There is no particular reason for anticipating a marked early improvement in yields or an extension of the area devoted to rice in countries not under pressure to become self-sufficient, or in areas of surplus production unless there is a considerable increase in effective demand from foreign countries. In the principal net-importing countries, however, population pressure will require considerably larger rice supplies than have ever been produced thus far.

Over a longer period, a series of decades,

<sup>1</sup> Diverse natural conditions and cultural practices produce wide variations in the annual output of paddy obtained from given units of land. Yields within Monsoon Asia range from the meager returns secured from unirrigated upland fields in parts of Java, French Indo-China, and the Philippine Islands, to the heavy production of the intensively farmed, irrigated paddies of Japan, the latter being many times as great as the former. Trends in yields over the past 15-20 years have also been markedly different from one rice-growing region to another. The tabulation below is suggestive of the general level of productivity as between selected countries of Monsoon Asia and certain rice-growing countries in other parts of the world. Yields are expressed in quintals of cleaned rice per hectare, and are averages for the five-year period 1930-31 to 1934-35:

|                      | Quintals |                     | Quintals |
|----------------------|----------|---------------------|----------|
| Japan .....          | 25.3     | Spain .....         | 38.6     |
| China .....          | 16.9     | Italy .....         | 29.6     |
| Thailand (Siam) ..   | 10.2     | Egypt .....         | 18.4     |
| Java and Madura...   | 9.9      | United States ..... | 14.6     |
| India .....          | 9.5      | Brazil .....        | 8.8      |
| Philippine Islands.. | 7.3      | Madagascar .....    | 7.7      |

one may expect that new lands will be opened to rice cultivation, old lands reclaimed, and yields will be further improved as the pressure on food supplies increases. But perhaps the most important, and certainly the most unpredictable, element in the longer-term outlook is the technological developments that may lie ahead.

Notable, but not spectacular, progress has been made over recent decades in the breeding of improved, higher-yielding varieties and varieties adaptable to natural conditions once considered quite unfavorable to rice culture. The production of fertilizers may be so developed as to make practicable their use in large areas not at present employing them. Discoveries may be made in processing or treating rice prior to consumption that conceivably may alter concepts of quality, growing requirements, and techniques. So many unknowns exist that it would be foolhardy to carry too far the seemingly logical deductions to be made from current trends.

#### CHANGES IN CONSUMPTION PATTERNS

The rather clear indications that the rice-consumption level in the Far East as a whole has not been maintained most likely carries unfavorable implications, but does not necessarily do so for every country. A lower per capita use of rice may mean either that many consumers have less to eat, or that there has been an increase in per capita consumption of other foods, or both. If smaller use of rice is attributable chiefly to increased consumption of other foods, the important point is whether there has been greater use of superior and more diversified foods, or an increase in the consumption of cheaper substitutes for rice.

No conclusive evidence is available upon the extent to which portions of the population have been obliged to go hungry. Famine or near-famine conditions continue to emerge sporadically in parts of China, India, and other poorer regions of Monsoon Asia. Commonly such conditions are due more to a lack of or breakdown in distributive machinery, or a deficiency in the purchasing power of the affected groups, than to an insufficiency of food somewhere within the country. Nevertheless, large numbers of people are forced

from time to time to reduce the total physical volume of cereals and all foods consumed. This, of course, cannot be carried too far nor endured too long. Furthermore, with unemployment and inactivity accompanying the economic depression, the total calorie intake of an indeterminable number of plantation and other laborers was undoubtedly reduced. One may therefore assume that part of the explanation for declines in per capita use of rice lies in reduced calorie intake. This would seem to be true in India and China more than in most other countries.

In most cases, however, the explanation for reduced consumption of rice is probably to be found in alterations in the nature of the diet of particular portions of the population. Evidence of substitution is most difficult to obtain, and even when quantitative data bearing upon the utilization of other cereals are available final conclusions are not justified without more information upon the consumption of noncereal foods prominent in the diet.

Reference to Table 2 (p. 287) indicates that rice consumption in Japan has been well maintained at a high level, though there has been a slow but consistent declining tendency in per capita utilization over the past 20 years. There is some reason for believing that until the outbreak of war with China in 1937, alterations in the Japanese diet were in the direction of qualitative improvement through greater diversification in the foods consumed. There was a longer-term tendency for the consumption of wheat and flour to increase in Japan; but after 1927, when rice prices started to decline, per capita consumption of wheat fell off. Low rice prices discourage wheat consumption,<sup>1</sup> especially in the metropolitan

<sup>1</sup> There is some evidence that a price for rice exists above which wheat consumption tends to rise and below which it drops sharply—presumably because more rice is consumed. See C. L. Alsberg, "Japanese Self-Sufficiency in Wheat," *WHEAT STUDIES*, November 1935, XII, 77. Short rice supplies since 1940, and the highest rice prices in many years, presumably are stimulating wheat consumption. Low world wheat prices might conceivably produce substantial imports were it not for Japan's more important needs for conducting its Asiatic military campaign, and the resulting shortage of exchange. It seems probable that in later years some impetus may be given to increased use of wheat as the result of more extensive consumption of bread by the Japanese army since 1937.



areas where wheat has gained its greatest hold.<sup>1</sup> But for an appreciable part of the period under review, economic conditions in Japan tended to improve so that diet diversification rather than the substitution of cheaper foods may explain most of the decline in rice consumption.<sup>2</sup> The consumption of sugar, though not large, has grown; and in the Oriental diet, diversification takes the form of greater use of such foods as sugar, fruits, vegetables, and sea foods. Per capita consumption of all of these items has tended to increase in Japan.

Government attempts at manipulation of food choices for the purpose of furthering various phases of the Japanese general food supply program have been common in the past, and have become increasingly effective as price control has been extended to include most of the commodities consumers have the opportunity to buy. Rice and wheat consumption are officially encouraged, discouraged, or modified not only within the large cities of Japan, but throughout the Empire, depending upon the consumption level that is deemed desirable in the light of current or prospective supplies. The rice-price policy until recently (p. 309) has been one that would maintain rice consumption for the masses at a high level, while for a number of years greater buying power made it possible for portions of the population to diversify diets. As a net importer of rice, the Japanese government has been able to exercise a control over supplies

and consumption that would be impracticable in the exporting countries, and this is reflected in the stability of the figures computed on per capita rice utilization.

Rice consumption has also been well maintained in British Malaya and Ceylon. The data in Table 2 not only show that British Malaya has the highest per capita rice utilization of any country in Monsoon Asia, but that consumption in both countries during the latter half of the 1930's was at practically the same level as during the late 1920's. Furthermore, both show a decline in per capita utilization during the early 1930's, undoubtedly reflecting the substitution of cheaper foods during the depression when plantation agriculture was seriously disrupted, unemployment widespread, and purchasing power severely curtailed. Except for the depression years, however, there is little evidence of a trend toward dietary deterioration in the two British colonies.

The only other country in which rice consumption has not declined significantly within the past few decades belongs to the export group. In fact the data for French Indo-China suggest rising tendencies in per capita use of rice since the first World War. Even now, however, a per capita utilization of 105-110 kilograms is far below that of British Malaya (170-180) and Japan (145-150), and is probably nearer the consumption level of the rice-eating portion of India's population than that of most neighboring countries.

Although French Indo-China is the second largest rice surplus producing country, there are many places within the colony where rice does not thrive. Here maize is grown, consumed as a substitute for rice, and even exported. Rice consumption per capita is heaviest in the southern part of the colony where the exportable surpluses originate. In the areas of greatest population density to the north, local production is inadequate, and supplies must be shipped in from surplus-producing sections of the country, or maize and other substitutes must be used in greater volume. An increase in per capita rice utilization in French Indo-China is likely to mean that more consumers are able to eat rice rather than maize or that those consuming

<sup>1</sup> Outside the cities wheat has made little impression on the diet for a variety of reasons, but chiefly because of the lack of facilities for converting it into flour and for manufacturing a baked product in the home. Sweet goods are not so perishable as bread, and there is some central distribution of these products into outlying areas.

<sup>2</sup> An analysis by the U.S. Department of Agriculture discussing rice consumption in Japan states: "A study of the influence of wages on price of rice leads to the following conclusions: An increase in the prosperity of the manufacturing industry, assuming a subsequent increase in wages, probably would result in an increased consumption of wheat and foods other than rice, whereas there probably would be no change or possibly a slight decrease in per capita consumption of rice. On the other hand a decrease in wages is likely to result in increased consumption of rice." See C. E. Campbell, *Factors Affecting the Price of Rice* (U.S. Dept. Agr. Tech. Bull. 297, April 1932), p. 16.

both cereals may increase the proportion of rice in their diets.

In marked contrast with the relative stability shown in rice utilization data for Indo-China is the record of the other two major exporters.<sup>1</sup> Per capita rice consumption was at a high level (over 160 kilograms) in both Burma and Thailand in the early 1920's, but has declined quite severely since then, especially in the latter country. Of the three exporters, Burma has enjoyed the most, and Thailand the least, stable position economically. Declining paddy and rice prices have meant that growers and dealers have been obliged to market larger lots in order to obtain an income comparable to that in the past. This is shown by the rise in exports in relation to production, a trend not found in Indo-China, mainly because Indo-Chinese rice has been at a competitive disadvantage in maintaining and expanding foreign markets.

Substitution of cheaper grains and other foods for rice has no doubt occurred in both Burma and Thailand, but the total calorie intake has probably not been reduced much. The decline in the use of rice in Burma to around the 120-kilogram level suggests dietary deterioration, but probably not of such serious proportions as in countries where rice consumption was never so high. In Thailand, however, a downward adjustment to around the 100-kilogram level indicates that considerable shifts in diets have occurred since the early 1920's when rice production and consumption were greatly expanded.

During the past decade Thailand, an independent nation without ties to a mother country, has been hard pressed to keep her economy on an even keel. Rice has been more important in her total exports than in either Burma or Indo-China, and it was necessary to expand shipments in order to compensate for lower rice prices. Although rice production was increased during the depression years, exports rose more rapidly, and this re-

sulted in a further drop in apparent per capita rice consumption. Cheaper substitute cereals do not seem to be abundant in Thailand, and it is not clear just what foods have replaced rice in the diet. In so far as economic necessity has forced an increased use of vegetables and fruits, the native diet, which consists mostly of rice and fish, may have been improved in one sense, though there has probably been some over-all deterioration accompanying the decline in rice consumption.

Data on per capita rice utilization in the Japanese colony of Taiwan indicate that changes in the rice consumption pattern have been similar to those shown for Burma and Thailand. At the time of the first World War rice consumption at about 160 kilograms was apparently almost as high as it has ever been in the two larger export countries, but has declined over 30 years to a level of around 115 kilograms. The decline in rice consumption set in earlier than in Burma or Thailand, but was slow until the past decade. The greatest drop has occurred since the advent of the world depression. In addition to the factors explaining the lower level of utilization in other rice-exporting countries, the Japanese government's plans for diversifying the agriculture of Taiwan have also probably played a part, especially in recent years.

Government programs and policies have had a more striking and definite effect upon rice consumption in the larger Japanese colony of Chosen, which provides the most outstanding example of deterioration in the diet. Utilization of rice in Chosen has always been low; it is the lowest of any country included in Table 2, and less than half that of Japan. Koreans have always been accustomed to eat some wheat, but more of the coarse grains such as kaoliang and millet, though the consumption of rice is for them as much an index of the plane of living as it is in Japan. But, during the ten years 1926-35, they consumed one-third less rice per capita than during the decade 1916-25.

What happened, apparently, was that the Japanese government adopted a familiar colonial policy that made it attractive to the Korean producer to export rice to the mother country and to consume cheaper cereals at

<sup>1</sup> When exportable surpluses are such a large proportion of total production, as they are in the three export countries, small changes in actual exports create the impression of high variability in per capita use of rice which is somewhat deceptive. If exports were 10 per cent instead of 50 per cent of production, such changes would hardly be noticeable.

home.<sup>1</sup> Japan succeeded in converting Chosen into an ample granary. Rice became the Korean peasant's chief source of money income. For his own use he produced or purchased cheaper substitute foods like millets, which were imported in large volume. The cheapness of these grains was the more marked because Japan artificially controlled the price of rice and did not impose import duties on substitute foods. In the middle 1930's, after what were then considered ample rice supplies had been built up, it was no longer in the Japanese interests to continue this policy. It was accordingly reversed, and cheaper cereals were made expensive by the imposition of import duties in an attempt to expand Korean consumption of rice and thereby to reduce the flow to the Japanese market.<sup>2</sup>

Observers of Chosen's agricultural economy are in remarkable agreement upon the poverty and distress of the country and its people.<sup>3</sup> The country is often called "the land of spring hunger," a fact noted even in official reports of the Government General. There seems to be no question that the decline in rice consumption has reflected the substitution of cheaper foods and a qualitative and probably also a quantitative deterioration in the diet. Apparently the Korean peasant has

shared very little in the gains accruing to the colony from commercial development. The causes of the decline in per capita use of rice in Chosen have been rooted more deeply than in adverse economic conditions arising from the world depression.

In other parts of Monsoon Asia, the fall of rice consumption during the past decade and the increased use of cheaper cereals have reflected economic dislocations caused by the depression. Some native growers in Java, for example, customarily sell part of the rice they produce and consume the cheaper maize. There is also a period of scarcity (*patjeklik*) in most parts of Java just before the new rice harvest. But with the drastic curtailment of demand for export crops grown in the Netherlands Indies, many a native was thrown out of employment and could no longer afford rice. Some turned to the production of foods needed for the immediate family, including substitutes for rice. Changes in diet came in response to economic pressure. Although probably regarded by the native as a hardship, some of these changes apparently resulted in an improved state of health, for the depression forced greater consumption of fruits and vegetables, and these additions improved the composition of the diet. The same thing may have happened in Thailand, and perhaps other places, but no specific information is at hand to confirm this impression. Despite a general similarity of conditions affecting plantation agriculture, rice consumption in British Malaya and Ceylon seems to have been maintained at a higher and more stable level than in Java. Perhaps this is explained partly by the smaller density of population in the British colonies, and partly by better maintained purchasing power resulting from partnership in a vast empire more favorably situated to absorb the shocks of economic dislocations.

Even before the world economic depression and the dislocation of the Netherlands Indies economy, however, other foods were being substituted for rice in the diets of the Javanese. The consumption of both cassava and maize increased. Cassava occupies a place in the Javanese diet similar to the potato in parts of the United States and Europe, and its con-

<sup>1</sup> France has followed the same policy with wheat. By artificially creating a wide price differential at the point of export, the government provided a strong incentive for growers in French Morocco and Algeria to ship their wheat to the mother country and to live on barley at home. Although a policy that permits the development of a colony's resources should be beneficial, from the grower's standpoint the important question is the manner in which gains are distributed within the national economy.

<sup>2</sup> The problem was stated earlier by Seiichi Tobata: "As long as such substitute foodstuffs can be bought, the quantity of rice imported from Chosen will probably increase. In order, therefore, to check the importation of rice from Chosen, it will be necessary to force the consumption of rice in Chosen by limiting production, or else by raising the price of substitute foodstuffs." ("The Japanese Rice Control," in *Commodity Control in the Pacific Area*, ed. by W. L. Holland [London, 1935], p. 178.) Both methods were later employed.

<sup>3</sup> For example, see: H. K. Lee, *Land Utilization and Rural Economy in Korea* (Shanghai, 1936); W. I. Ladejinsky, "Chosen's Agriculture and Its Problems," *Foreign Agriculture*, February 1940, IV, 95-122; and A. J. Grajdanzev, "Korea under Changing Orders," *Far Eastern Survey*, Dec. 20, 1939, pp. 291-97.

sumption increases chiefly when other foods are scarce. The decline in per capita rice utilization to around 85–90 kilograms in Java and Madura has been gradual but persistent over the past quarter of a century. From studies of the diets of natives, A. M. P. A. Scheltema concludes that over a much longer period, since 1850, there has been no continuous rise or fall in the amount of rice consumed, and that when rice and maize are grouped together aggregate consumption of cereals is shown to have remained fairly constant.<sup>1</sup>

As in Java and French Indo-China, maize is also an important substitute for rice in the Philippine Islands. It was used in greater amounts along with beans and potatoes by many Filipino consumers during the depression years. More recently, conditions have improved in the Philippines, local rice crops have been abundant, and apparent per capita rice consumption has tended to recover. At around 110 kilograms, however, it remains lower than in the more prosperous 1920's.

The low wheat prices of the early 1930's undoubtedly encouraged substitution of wheat for rice in some regions. Imports of wheat into India and North China from Australia, and into North China from Canada, increased during this period. An opinion held in the rice trade at the time was that the fall in the price of rice was connected with the low price of wheat.<sup>2</sup> As rice prices declined during the years of the depression, China also increased her imports of rice very substantially. Such developments tend to confirm the impression that if the price is low enough to be within reach of the numberless low-income families, a vast potential demand exists in such countries for both rice and wheat.

<sup>1</sup> *The Food Consumption of the Native Inhabitants of Java and Madura* (National Council for the Netherlands . . . of the Institute of Pacific Relations, Report A, Batavia, 1936), pp. 13–14. About one-fourth of the total area used for native agriculture in Java is devoted to growing maize, which is consumed in addition to rice, or as a substitute for rice, when and where rice is difficult to obtain.

<sup>2</sup> *Interim Report of the Committee Appointed to Enquire into the Rice and Paddy Trade* (Rangoon, 1931), p. 14.

<sup>3</sup> Using 450 million for the population of China and "official estimates" of Chinese rice production during the 1930 decade.

More rice is consumed in India than in all of the other 10 countries included in Table 2 combined. Per capita use of rice around the 75–80 kilogram level is low but not so low for the rice-eating portion of the population as the figures suggest. If some 100 million Indians are wheat-eaters, the per capita use of rice by the rice-eaters would be roughly around 110–115 kilograms per year. Whatever the actual level of rice consumption, declining tendencies have been in evidence since 1916–20, and became more pronounced during 1936–40.

Smaller per capita rice consumption in India may reasonably be interpreted as representing dietary deterioration. As population pressure has continued to increase and as the purchasing power of the masses has tended to fall, the production and consumption of barley and millets—the poor man's crops and foods—have increased at the expense of both rice and wheat. The Indian food position is made even worse by successive droughts which frequently lead to a shrinkage in the rice and wheat crops.

The situation in China is very similar. High dominance of cereals in the diet, increasing population pressure, low purchasing power, and hazards of nature all conspire to render the food situation weak and vulnerable. In China cheap sorghums and millets have apparently been consumed in greater volume. Although sufficient data on Chinese rice production and population are lacking for judging trends in consumption, a rough estimate of the rice consumption level for the country as a whole places the figure around 75–80 kilograms.<sup>3</sup> This is quite low; but, when allowance is made for the fact that one-third to two-fifths of the Chinese population are not predominantly rice-eaters, the consumption of rice-eaters can be estimated as somewhere between 110 and 125 kilograms. This figure seems reasonable enough and compares favorably with the apparent consumption of neighboring rice-consuming areas.

The Chinese, like the Japanese, regard a rice diet as an indication of a high standard of living, and, though wheat competes with rice in broad rural areas and many urban centers, an appreciation of wheat has not been gener-

ally established, particularly in the rice regions of southern and central China. Furthermore, it is probable that in China cheaper and substitute grains<sup>1</sup> have been consumed in increasing volume by millions unable to afford either rice or wheat.

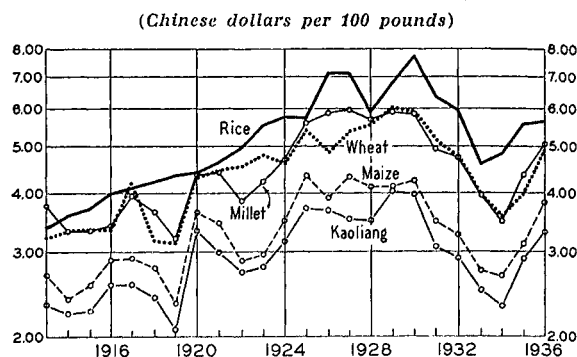
Like India, China has been a rice deficit country for many decades, and though the record of rice imports is available it is not very revealing. Foreign rice has been bought in large volume, but even peak purchases have never contributed more than a small fraction of aggregate rice supplies. Large quantities of wheat and flour are also imported during some years. Rice and wheat importations are absorbed chiefly in the large coastal cities; they tend to be greatest when prices are low, but sometimes large imports seem to reflect domestic crop shortages or disruption of communications with political unrest, devastations of nature, or both. So many unknowns exist in the Chinese situation that only frank guessing is feasible. But a few clues seem worth mentioning.

Some suggestive data at hand showing the course of wholesale grain prices in North China over a 24-year period are plotted on Chart 3. In North China the annual average price of Shanghai rice rose more or less persistently throughout the period 1913 to 1930 and declined sharply during the early 'thirties. The pattern for prices of each of the other grains, though different in detail, follows the same general course. In the changes from year to year, millet, maize, and kaoliang prices generally move together, and wheat prices tend to move with these rather than with rice prices. All cereals except rice fell in price between 1917 and 1919, rose rapidly between 1919 and 1920, and then (except for wheat) declined for a few years before resuming an upward trend. All grains showed a price improvement between 1934 and 1936, but rice prices turned upward a year earlier

than the other cereals, i.e., between 1933 and 1934.

Assuming relative purchasing power of the consumer to remain intact, it would appear from this record that, except for brief periods, there has been little incentive from the stand-

CHART 3.—WHOLESALE GRAIN PRICES IN NORTH CHINA, 1913-36\*



\* Data from *Nankai Index Numbers, 1936* (Nankai Institute of Economics, Nankai University, Tientsin, China, March 1937), pp. 9-10; converted from shih to weight units.

point of price for wheat-eaters to shift to rice or for rice-eaters to change well-established eating habits and shift to wheat. But there were many years during the period covered when there was little if any difference between wheat and millet prices. Both grains apparently would qualify as substitutes for rice on a price basis at these times. More important for consumers of lowest purchasing power is the fact that between 1913 and 1936 both maize and kaoliang were substantially lower in price than any of the other cereals.

One might expect that, if rice prices increased more rapidly than prices of other cereals over a long period of years, there would be a tendency for consumption habits to change and for substitutes to replace rice in the diets of many consumers. A study of prices over a 33-year period, 1894-1926, in Wuchin, Kiangsu, made by L. L. Chang, shows a 3.4 per cent annual increase in the price of late rice (unhulled), and a 3.3 per cent yearly increase for white (polished) rice. These annual price increases compared with a 2.9 per cent increase for wheat, about the same for broad beans, a 2.7 per cent yearly price increase for field peas, and a 2.3 per cent increase for yellow soybeans.<sup>2</sup>

<sup>1</sup> The availability and prices of other grains tend to modify the demand for wheat or rice and hence to complicate the establishment of fairly definite competitive relationships between the two more expensive cereals. See pp. 283-84.

<sup>2</sup> *Farm Prices in Wuchin, Kiangsu, China* (China Ministry of Agr., Bur. of Foreign Trade, Shanghai, June 1932), p. 36.

Even before the demoralization of China's currency during recent years, prices in China were rising owing to the fact that the value of silver was declining. Since the adoption of a managed currency during the middle of the 1930's, prices have risen still further. It is difficult to escape the conclusion that the buying power of the masses, already low, has become even smaller and that cheaper foods have replaced rice on a large scale.<sup>1</sup> Furthermore, it is probable that, as in India, there has been some reduction in the total amount of all foods consumed.

Changes in consumption patterns have occurred in almost all rice-consuming countries at one time or another. Most of the changes, however, are probably of short duration and forced by temporarily abnormal conditions—crop failures, high prices, economic depressions with unemployment, reduced purchasing power, and so on—and do not represent voluntary alterations in the diet which would be of significance over the longer term. Except for the influences of the world depression, and more recently of the Sino-Japanese war, no striking evidence has appeared of exceptional conditions that might be expected to precipitate important and permanent dietary changes. Eating habits established through centuries are modified very slowly in Oriental countries, and then only under pressure of unusual circumstances beyond the control of individuals. Depressions and wars are, or at least have been in the past, temporary phenomena. Alterations in the diet during such times cannot safely be assumed to have permanent significance. Yet the decline in per capita rice utilization, if the available data are not misleading, has been in progress for several decades.

For millions of Asiatics, improvement in the diet will be slow in a quantitative sense as well as in a qualitative one. Decline in per capita consumption of rice in the rice-eating

world reflects reduced levels of consumption in general and some retrogression in the plane of living. If enlarged incomes permitted advances in the living level among these peoples, the demand for rice presumably would increase, until per capita consumption would be appreciably higher than now.

History has not borne out Malthusian prophecies of extreme pressure of population on food supply. In large areas of the world, including most of the wheat world, man's ingenuity has so transformed food production and transportation that per capita consumption of all sorts has remarkably increased; and factors other than food shortage are primarily responsible for the slowing down in the rate of population growth. In much of the rice world, on the other hand, the Malthusian doctrine has had and still has more applicability. Population growth in the Far Eastern countries has been such as to tax rice supplies, and threatens farther to outstrip their expansion and to force a gradual decline in a plane of living, already very low.

Under these conditions temporary surpluses of rice are readily absorbed, in the producing country or elsewhere, without leading to accumulation of surplus stocks. This situation is strikingly different from that which prevails when wheat surpluses are created. Wheat surpluses tend to be cumulative, for with lower prices or increased purchasing power wheat-eaters tend to diversify their diets rather than to expand their consumption of bread and other wheat products. As long as there is an aggregate shortage of rice, there will be more prestige value in its consumption in the East than there is or will be in the use of bread in the West. Thus there is a social basis for rice consumption, and millions aspire to a plane of living that will permit a greater use of the preferred cereal.

Clearly there is no present prospect of overproduction of rice in the world as a whole. The rice world contains many who are not only malnourished but undernourished, and many who would gladly eat rice instead of grains they count inferior. The problem is to produce enough, and cheaply enough, to supply rice to all of those who eagerly desire to eat it in substantial quantities.

<sup>1</sup> Information on longer-term changes is not available. Fragmentary evidence obtained in 1929-33 indicated that rice consumption was decreasing in the Yangtze rice-wheat area, increasing in the wheat regions, and that in the rice areas the "people become so habituated to rice that they continue to make it the chief staple of their diet, even when it is more expensive than wheat" (L. A. Maynard and W. Swen in G. L. Buck, *Land Utilization in China* [Chicago, 1937], p. 430).

## VII. DEMAND, SUPPLIES, AND PRICES

The proportion of world consumption that is almost uninfluenced by international prices, if by prices at all, is no doubt appreciable for wheat, but it must be much larger for rice. Rice producers and consumers live in a subsistence economy to a far greater extent than wheat producers and consumers, so that the commercial rice world is much smaller than the commercial wheat world. In most years of peace, wheat prices have been the product of forces within the more extensive commercial wheat world, and therefore have provided a fairly good index of the world wheat situation. Rice prices are generally less representative of developments within the world rice situation. Such developments may be only partly or imperfectly expressed in terms of the price of rice. Comparisons pertaining to price influences, therefore, are not only somewhat difficult but may be misleading, and conclusions need to be qualified considerably.

## CONTRASTS IN DEMAND

Various factors influence the consumption of both wheat and rice for food purposes. Those based upon consumer preferences are much better understood for wheat than for rice, at least in the Western world. For wheat three main categories of demand may be recognized:<sup>1</sup>

1. A fairly constant and highly inelastic demand exists in countries where wheat flour and bread are among the cheapest staples in the diet or where incomes of most of the population are high enough to permit them always to indulge their preference for the more expensive cereal. This demand, from countries like the United States, France, Canada, Australia, and Great Britain, where per capita consumption has tended to decline, takes "probably well over a third and possibly over half of the world wheat production," excluding China.

2. A variable but somewhat elastic demand

<sup>1</sup> From a more complete exposition of the elements in the demand for wheat, in J. S. Davis, "The World Wheat Problem," *WHEAT STUDIES*, July 1932, VIII, 425-28.

<sup>2</sup> See p. 281 for a discussion of the probable basis for Japanese preferences in rice.

exists in countries where wheat is not the cheapest food in common use but where it is preferred and will be used in place of other cereals when it can be afforded. This section of demand accounts for 25-33 per cent of the total production (ex-China). It is represented by areas in the southern United States, Mexico, the Danube Basin, Italy, northern Africa; by most countries of northern and eastern Europe, where rye is widely used; and to a lesser extent by India and China.

3. A highly elastic demand for food use, but of a low-price stratum, is best represented by a country like China, where purchases are made in large volume only upon extreme price concessions. This portion of the world market for wheat for human consumption has never assumed very large proportions but may eventually offer substantial potentialities for future expansion of wheat consumption.

In addition to the demand for food purposes there is a modest demand for wheat for cattle feeding. At very low wheat prices, however, there is a highly elastic demand for feed purposes which has no counterpart in rice. Surplus wheat must seek additional outlets in countries where other cereals predominate, or compete with feed grains. Rice surpluses seldom emerge, but when they do they are readily absorbed for food in the countries where rice predominates in consumption.

The nature of the demand for the part of the world's rice crop that is used for human consumption cannot be characterized with any degree of precision. The statistical record is too sketchy, and the movement in international trade alone provides no useful indication of the character and strength of demand under varying price conditions. But consumer preferences for rice, as reported by competent observers, may give a fairly reliable basis for certain inferences regarding the nature of the demand.

First, there is in Japan a strong and rather inelastic demand for Japanese-grown rice.<sup>2</sup> The colonies of Chosen and Taiwan produce a closely similar type of rice almost equally acceptable to the Japanese. California rice ranks next in acceptability in Japan. Least

desired are the rices from Burma, Thailand, and French Indo-China. These were formerly imported in varying amounts on a price basis. Today, however, lowering of rice prices outside Japan has little effect on Empire consumption, inasmuch as supplies and prices are controlled by the government.

Second, outside the Japanese Empire, there is a large demand for low-priced, ordinary rice, not highly milled, for consumption by native labor throughout southeastern Asia. Highly milled rices are generally too expensive for this mass market. In a sense this circumstance is fortunate, for the diet of consumers in this group is typically such that the protein and vitamin values that would be lost through the polishing process are needed. The demand is probably rather elastic, and lower rice prices would probably stimulate consumption or shift more rice-eating to higher grades.

A smaller demand exists for medium and fancy qualities of rice for a middle- and upper-class native market at higher prices. Ordinary Burma rice, Siam "field" type, and Indo-Chinese rice, all serve this Eastern market.

Fourth, there is a demand arising chiefly in Europe for medium-grade (and a small amount of fancy-quality) southeastern Asia export rice for remilling. Remilled rice was formerly re-exported for human consumption, but now it is used chiefly for starch making, brewing, and other industrial purposes. Normally this demand was elastic, and lower rice prices would be expected to increase the quantity used. But in recent years the imposition of artificial barriers to trade has prevented much stimulation of consumption.

Finally, a fifth group of consumers demand a well-graded, highly-milled, and attractive-appearing rice for food use. This is the Western market. It is supplied by Western-grown rices of so-called Japanese type from such countries as Spain and Italy, and by other types grown and highly regarded locally, e.g., rices of the southern United States. Consumers in this category are generally able to pay the highest prices for rice, but demand is ordinarily little influenced by price except among such groups as resident Asiatics.

Before the first World War, the Burma

(*Ngaseins*) and Siam (Gardens) types tended to dominate the Western markets not served by local production. Rices from southeastern Asia no longer completely meet the demand for a uniform, well-appearing, polished rice. Formerly a considerable amount of this export rice was sold in Western markets on a price basis; but during recent years the price differential between these rices and those grown by export countries outside Asia has narrowed considerably, and in some cases has almost disappeared. Furthermore, several countries outside Asia which were once net importers of rice, e.g., Brazil, Egypt, and Peru, are now net exporters and competitors.

The demand for both wheat and rice includes highly inelastic and elastic elements, but the elastic portion would seem to be much larger for rice than for wheat. This is mainly because the bulk of the rice crop is consumed by people living on very low planes for whom rice is not the cheapest food, while a large proportion of the wheat crop (ex-Russia, ex-China) is consumed by people on higher consumption levels for whom bread is the cheapest food. In the wheat world, growers are dissatisfied with wheat prices low enough to permit much of the elastic demand to be effective. In the important rice-consuming countries, urgent wants for rice are seldom fully met or even directly expressed in prices.

#### VARIABILITY OF SUPPLIES

In the noncommercial portions of the wheat and rice worlds, consumption tends to fluctuate with production within the country or growing region. The internal price level may rise with short crops or fall with large crops, but the drafts upon outside supplies are normally small in the first instance, and the contributions to export are slight in the second.

In the USSR, China, the Near East, India, and various other sections of the wheat world, and especially in India and China in the rice world, consumers necessarily vary their intake more or less according to the size of local crops. Such an adjustability of requirements when applied to millions of rice- or wheat-eaters tends to act as a stabilizing influence. For such consumers there seems to be not only a variable composition of the cereal portion



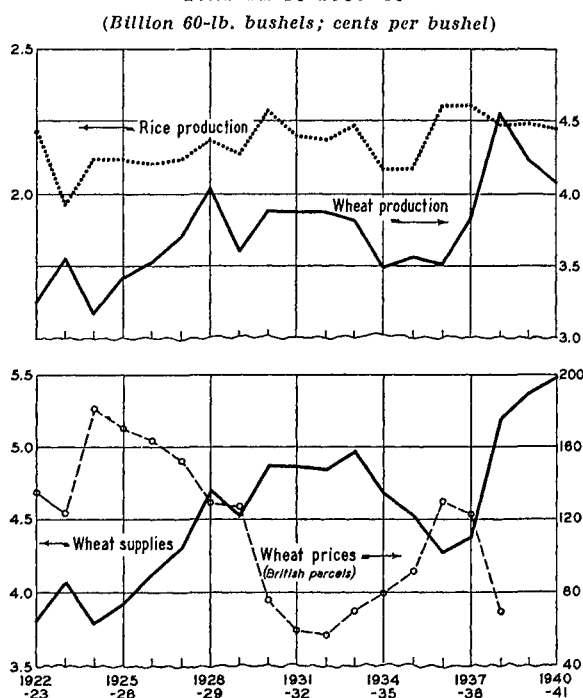
of the diet but also a variation in the total physical volume of cereals consumed. This behavior in consumption is more important for rice than for wheat, since the proportion of the world's wheat demand arising from people for whom the cost of cereals for food absorbs a large fraction of their income is much smaller than for rice. Economic conditions within rice-consuming areas of low purchasing power, and political conditions (especially in China) that facilitate or hamper the distribution of available supplies, are more important influences on consumption than the price fluctuations of grains in outside world markets.

For the wheat world, however, annual fluctuations in supply are reasonably well expressed in international prices. Since the demand for wheat, on the whole, is remarkably stable, wheat prices are highly responsive to changes in supply. Total world wheat supplies consist of current production plus old-crop stocks remaining at the end of the preceding crop year. Year-to-year variations in world wheat output, which indicate the additions to aggregate supplies, are characteristically large. These relationships are illustrated by Chart 4, on which are plotted data on world wheat production (ex-China and ex-USSR), total supplies, and prices at Liverpool over a period of almost two decades. The inverse relationship suggested between world wheat supply and a representative series of international wheat prices is even more clearly illustrated by a comparison of world carryover and wheat prices.<sup>1</sup>

In comparison with other crop production series, world wheat output seems relatively stable, a stability arising chiefly from the wide geographical dispersion of production. In contrast with world rice output, however, wheat production appears quite variable. Large fluctuations in the size of wheat crops are readily explained. Wheat, not commonly grown under irrigation, is subject to great natural hazards, and its cultivation has spread to poorer and subhumid or semiarid lands with uncertain yields. It continues to be grown in such areas because no alternative

crop is equally profitable. Many of these areas with highly variable yields are largely responsible for the wide annual fluctuations in output. Furthermore, they contribute substantially to excessive wheat supplies, for acreage and volume of output in such regions respond but slowly to changes in the market price of wheat. Annual fluctuations in the size of the world rice crop are less than half as great. The upper portion of Chart 4, showing world

CHART 4.—WORLD RICE AND WHEAT PRODUCTION; WHEAT SUPPLIES AND PRICES AT LIVERPOOL, 1921-22 TO 1939-40\*



\* Rice production (ex-China) from Chart 2; world wheat production and supplies (ex-USSR and China) and British parcels prices from series carried regularly in WHEAT STUDIES

rice and wheat production, does not illustrate this greater stability of rice output quite as well as the figures themselves. World rice production (ex-China) varied only 2.8 per cent from year to year, on the average, between 1925 and 1939, while world wheat production (ex-USSR and China) for the same 15-year period showed an annual average variation of 6 per cent.

The response of world rice output to a changed level of rice prices is also probably slower than the response of wheat despite the

<sup>1</sup> See V. P. Timoshenko, "Monetary Influences on Postwar Wheat Prices," WHEAT STUDIES, April 1938, XIV, 270-72.

fact that the wheat supply is relatively inelastic. In some wheat-growing regions, costliness of production may act to discourage planting in periods of low wheat prices. In others, where wheat has a fixed place in a rotational system or where no alternative crop is as profitable, changes in the wheat price level ordinarily have little effect on the planted area and output, regardless of production costs. The mechanization of wheat growing and harvesting tends to lower the cost of production, so that a permanently lower level of wheat prices, at least in relation to other commodities, does not necessarily mean unsatisfactory returns to all growers. Mechanization retards the adjustment of world wheat output to a decline in wheat prices. So also does government intervention, which has tended to separate the grower's income from the price of wheat. Governmental efforts to influence wheat prices through production-control schemes, loans, subsidies of various types, relief grants, and so on, have been an important factor in all of the major exporting countries during the past 10 or 15 years; and government payments have likewise operated in a number of importing countries to sustain or increase wheat production. Cumulative surpluses tend to emerge, but some adjustment of acreage occurs.

In the rice world, shrinkage of output in response to low prices would be even slower. The more exacting requirements of the rice plant, the intensive methods employed in producing the crop, the heavy investment of generations in terracing the land and in providing irrigation facilities, and the dependence of millions of people upon rice as a means of subsistence, all conspire to create a high degree of short- and long-run stability in the rice supply, as well as to make the production of rice costly. From time to time, it is true, crops are short enough to exert a strong influence on rice prices; but the normal variability in output is smaller than for wheat. Surpluses do not accumulate in regions where population tends to create pressure on land resources and food supplies. The problems of excessive supplies common in the wheat world are not likely to arise in the rice world except locally, or to persist on an important scale.

Crops greatly in excess of normal use do not occur in the rice world, and when local surpluses do arise they are readily absorbed. No strong commercial incentive exists for extended holding of stocks, since the eating quality of rice deteriorates fairly rapidly under ordinary storage conditions found in Monsoon Asia and supplies are subject to damage from insects and pests (pp. 277-78). One factor in the heavy losses the Japanese government suffered through its policy of rice control was the necessity for selling old-crop rice from its stocks at market prices lower than prevailed for the new crop, which was used as replacement.<sup>1</sup> Outside of Japan climatic conditions are even less favorable to rice storage.

Even when a short-run commercial incentive exists for holding stocks, most rice growers are so poor that they have to sell their supply quickly. Some growers can hold their paddy perhaps for a few weeks in the expectation of firmer prices. Dealers and speculators are more frequently financially able to carry stocks for a period of months. Storage facilities, however, are very limited even for dealers and millers. Annual crops tend to be distributed widely and rather quickly and then held in small lots by numerous intermediaries and consumers.

In the exporting countries, usually not much more than the equivalent of one month's shipments are in the hands of the trade. These are merely working stocks. Carryovers at the end of a season are not much larger. For example, in Burma at the end of 1930 the carryover was estimated at 150,000 tons, "a figure only a little higher than usual."<sup>2</sup> For the leading exporter, shipping 3.4 million tons in that year, such a carryover is very small compared with the stocks of wheat that have accumulated in several exporting countries during recent years. The rice trade involves large risks, and it is therefore doubtful that ordinarily a trader will wish to add to the normal

<sup>1</sup> There is apparently no comparable deterioration in eating quality with wheat. In fact, up to a certain point, new-crop wheat improves with age. Moreover, flour milled from wheat, whether old or new, improves in baking quality with age for several months.

<sup>2</sup> *Interim Report of the Committee Appointed to Enquire into the Rice and Paddy Trade*, p. 16.

risks by attempting to hold for many months a commodity that deteriorates appreciably.

#### ASPECTS OF PRICE BEHAVIOR

Annual changes in levels of world wheat prices are heavily dependent on the surpluses and deficits of countries which constitute the commercial part of the wheat world. Within this region, the demand for wheat for food is ordinarily more nearly "saturated" than in the noncommercial portion. If supplies are above the level required for the food needs of the commercial wheat world, they tend to force prices down to a point at which the surplus flows into feed use, or into food use outside this area. But in the process, huge stocks of wheat may be built up and held off the market in anticipation of price recovery. This discourages a rapid distribution of surpluses in the noncommercial parts of the wheat world, especially when these are not located advantageously in relation to the surplus-producing area.

Prices in the commercial rice world are influenced by essentially the same factors up to a certain point. Their behavior, however, is somewhat different from wheat prices, particularly with reference to their annual variability. Although rice prices apparently do not always reflect supply-demand relationships adequately, for reasons already enumerated, nevertheless the major contrast between wheat and rice price behavior has a more fundamental basis. It is to be found chiefly in the facts that wheat supplies tend to be both more abundant and less stable than world rice supplies, that wheat stocks accumulate while rice stocks ordinarily do not, and that the elastic portion of the demand is larger and more strategically located for rice than for wheat.

A relatively stable rice supply, coupled with a strong, persistent, and more elastic demand for rice, should and does result in a certain stability in rice prices. A variable wheat supply, coupled with a generally quite inelastic demand, contributes to wheat price instability.

In the rice world there is no great market comparable with the British and Continental markets for wheat where the competition of exporters creates something like a "world"

price. The three surplus rice-producing countries of southeastern Asia account for only a small proportion (12-13 per cent) of the world's rice supplies. Important as these surpluses may be to neighboring areas of deficient supply, or those of the Japanese colonies to the mother country, the chief importing markets for rice in Asia have been in countries that are also the most important rice producers. Their import requirements constitute a very small percentage of total supplies. Countries of deficient supply, like British Malaya and Ceylon, where the proportion of total supplies that must be imported runs very much higher (more nearly comparable with some wheat-importing nations), constitute markets of importance in the rice trade, to be sure, but they do not serve as places for the establishment of an Asiatic or "world" rice price.

Geographical proximity (which usually means lowest transportation costs), political ties, or both, are the factors that in most cases determine which specific export producer will enjoy an advantage in a particular market.<sup>1</sup> Relatively few outlets remain today where the three rice exporters compete on a nearly even basis. In more distant markets, such as Europe, freight costs<sup>2</sup> provide a smaller relative handicap in competition, but the European

<sup>1</sup> Burma enjoys such advantages in India and Ceylon, Thailand in British Malaya, and French Indo-China in China and the Philippine Islands.

<sup>2</sup> Changes in the cost of freight may create diversity of price movements in different markets. This may be illustrated by developments during recent years in price relationships between Burma No. 2 rice in Rangoon and in London. Prices (from *International Yearbook of Agricultural Statistics, 1931-32* and *1938-39*) are expressed in gold francs per quintal.

| Year      | Burma No. 2 |         | Freight        | Per cent of London price |         |
|-----------|-------------|---------|----------------|--------------------------|---------|
|           | London      | Rangoon | Burma-UK/Cont. | Rangoon                  | Freight |
| 1927..... | 36.11       | 26.68   | 3.72           | 79.4                     | 10.3    |
| 1928..... | 34.03       | 26.05   | 3.29           | 76.6                     | 9.7     |
| 1929..... | 32.72       | 25.59   | 3.04           | 78.2                     | 9.3     |
| 1936..... | 11.71       | 8.23    | 1.80           | 70.3                     | 15.4    |
| 1937..... | 13.72       | 8.83    | 2.93           | 64.4                     | 21.4    |
| 1938..... | 12.19       | 8.41    | 2.37           | 69.0                     | 19.4    |

In the late 1920's the Rangoon price of Burma No. 2 rice was 78-79 per cent of the London price, and freight rates constituted another 9-10 per cent, leav-

market has also declined considerably in importance, and importing countries with colonies have discriminated in favor of colonial producers.

Under these circumstances, there is no single important market place for recording prices in the manner in which quotations for most other cereals are established. Nevertheless, the available data afford a useful basis for certain comparisons of wheat and rice prices in the major wheat- and rice-exporting countries. The data below show the average annual percentage changes in the prices of each cereal in specified countries over the 15-year period from 1925 to 1939:<sup>1</sup>

| Rice                                 | Wheat                              |
|--------------------------------------|------------------------------------|
| Burma (Rangoon) ..12.6               | Canada (Winnipeg) .19.7            |
| French Indo-China (Saigon) .....15.6 | Argentina (Buenos Aires) .....17.2 |
| Thailand (Bangkok) 16.3              | Australia .....17.8                |

In each case rice prices are somewhat less variable, and the most significant of the rice prices series, that for rice exported from Rangoon, shows the greatest stability of all.

This behavior of rice prices in contrast with wheat prices seems the more remarkable when the three major rice exporters can be considered as one compact area within southeastern Asia subject to essentially the same natural and economic influences, while the wheat exporters are widely separated geographically and their economies are less dependent upon wheat exports. Rice production in Burma, Indo-China, and Thailand, as a group, has been less stable (average annual percentage variation, 7.4) even than world wheat output. Although such yearly fluctuations have considerable significance for the export countries because they measure the surplus available for sale abroad, their im-

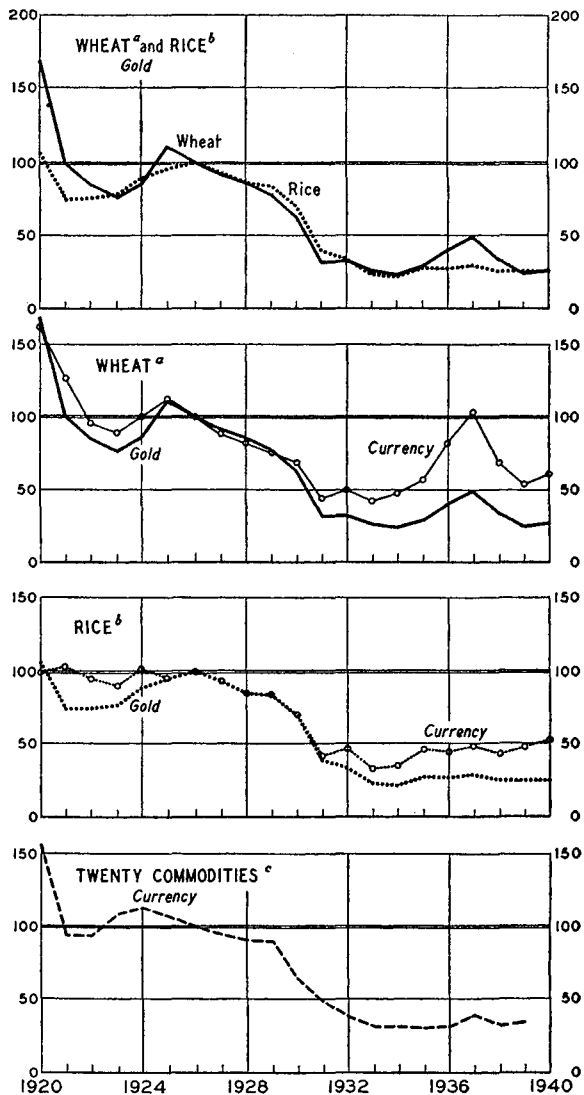
ing 11-13 per cent margin for absorbing other charges. In the period 1936-38 the Rangoon price was 68 per cent of the London price, and freight was 19 per cent, leaving the total about the same as during the earlier years. In order to lay down Burma rice in London at a competitive price, rice exporters, and also the Burmese paddy grower, with prices (in gold) about one-third of their 1927-30 level, were compelled to absorb the relative increase in freights.

<sup>1</sup> Wheat prices for crop years 1924-25 to 1939-40 are taken from series regularly carried in *WHEAT STUDIES*; rice prices of representative grades exported to Asiatic countries. All prices converted to a common basis, i.e., gold.

portance to rice-importing countries is less; hence the smaller effect on prices.

Chart 5 traces the course of rice prices in Burma and wheat prices in Argentina over the past two decades. Although annual

CHART 5.—EXPORT PRICES OF RICE (BURMA), WHEAT (ARGENTINA), AND OTHER COMMODITIES (JAVA), ANNUALLY 1920-40\*  
(Index numbers, 1926 = 100)



\* Data from official sources. See note, p. 314.

<sup>a</sup> Buenos Aires, 78 kilos.

<sup>b</sup> Rangoon, "Big Mills Specials."

<sup>c</sup> Java. See note 1, p. 302.

fluctuations in Rangoon rice prices are smaller than Buenos Aires wheat prices, the longer cyclical movements are similar, reflecting two consecutive periods of the postwar

deflation of international prices. Prices of both grains tend to rise and fall during the same years, but the amount of increase or decrease varies. Currency changes have had a more pronounced influence on Argentine wheat prices (which were more stable than wheat prices in other exporting countries) than on Burma rice prices, but the broad forces causing cyclical changes in price levels are the same. This is illustrated by the inclusion of a curve indicating the course of prices for typical export commodities from south-eastern Asia. The index is based upon 20 commodities exported from Java (Batavia, Semarang, and Sourabaya),<sup>1</sup> but includes many items also sent abroad from Ceylon, British Malaya, and the Philippine Islands, and may therefore be considered suggestive of the broad movement in prices of raw materials and foodstuffs having a world market.

Burma, French Indo-China, and Thailand are the sole source of surplus rice supplies open to all buyers. The most important actual and potential markets are near-by China and India. They represent normally the largest outlets and are the elements in demand with the greatest degree of elasticity. Yet fluctuations in production in China and India have little influence upon rice prices, partly owing

to the elasticity of demand in those countries, and partly owing to the tendency to adjust consumption to domestic supplies. The adjustment of requirements to the size of local crops is quite general, but perhaps greatest in these mass markets. On the other hand, the demand from such sources as British Malaya, the Netherlands Indies, and European countries is less elastic and variations in production in these markets seem to exercise the major influence on the price of rice in Burma, Indo-China, and Thailand.<sup>2</sup>

If this is correct, export rice prices may frequently assume a temporary level that discourages the flow of Asiatic rice into the two main outlets. But an easing of prices seems to be sufficient to move practically all the surplus, so that stocks do not accumulate. Despite a considerable shift in import markets, the exported fraction of the annual rice crop of Burma, French Indo-China, and Thailand has remained fairly constant, increasing somewhat with low prices and shrinking with high prices. A dropping off in demand from the smaller but key markets such as the Straits Settlements, the Netherlands Indies, and Europe, has had the effect of lowering rice prices enough to permit increased sales to India and China, but particularly China. There is apparently a much smaller lag in effecting such distribution of temporary or potential rice surpluses than occurs with wheat.

Presumably in countries dependent upon imports to only a small extent, with a rise in rice prices purchases can be more readily curtailed or stopped without the difficulty accompanying a similar curtailment of wheat imports in wheat-eating countries, which are less self-sufficient. Only a few rice markets are in a position making it necessary to import a certain minimum supply almost regardless of price. On the other hand, a lowering of rice prices would be more likely to result in a stimulation of rice trade and rice consumption than a similar price reduction for wheat.

The outstanding features of long-time developments in the ratios between prices of different grains (excluding rice) has been their tendency to approach one another.

<sup>1</sup> The index is compiled and published regularly by the Dutch government. See *Statistisch Jaaroverzicht von Nederlandsch-Indië* [Batavia] for various years. The purchasing power of millions of native agricultural workers on plantations or estates is a factor of particular importance affecting the trend of rice prices as they are expressed in the rice-exporting countries. The principal markets of the southeastern Asia rice exporters are located in the neighboring islands or peninsulas specializing in the production and exportation of such commodities as rubber, tea, sugar, and copra. The world prices of such products provide some index of the prosperity of the countries producing them, and of the employment and buying ability of the agricultural population in plantation industries. Prices of these 20 commodities during 1921-25 averaged 142 per cent of the 1913 level, but fell to 121 during the years 1926-30. For the five years 1931-35 they were only 49 per cent of the 1913 level and for the four years 1936-39 averaged 47 per cent.

<sup>2</sup> The demand from more distant markets appears to be a determining factor in fixing the price level for all rice exports from Burma, the apparent price "leader." Thus, even though more than half of Burma's rice is now shipped to India and Ceylon, these markets have less influence on prices than the more distant ones.

While the price spread between wheat and other grains remains relatively large, wheat prices have shown a strong tendency to come nearer the price level of other grains.<sup>1</sup> It is highly probable that wheat has also become cheaper in relation to rice.<sup>2</sup> Advances in production technique have lowered the cost of growing wheat, whereas the cultivation of rice has been improved very little. The cheapening of wheat in relation to rice is a trend of some significance not only for China and

India, but for all of the rice-eating peoples of the world.

It would seem, therefore, that wheat has an advantage over rice in further establishing itself in the world's diet, because the longer-term tendency for wheat prices to decline faster than rice prices more readily permits the exploitation of price markets. Cheap, and still lower-priced, wheat seems a more likely prospect than an important and permanent decline in the price of rice.

## VIII. BASES FOR GOVERNMENT INTERVENTION

So important are rice and wheat in the economies of nations that some degree of government intervention is almost inevitable. Price fluctuations may call for aid to agricultural producers, protection to consumers, or both. Since the onset of the great depression of the 1930's, governments have played an increasingly active role in farm relief and food supply problems. In many countries this activity is but a continuation of courses adopted much earlier; in others it is a recog-

nition of changed conditions in the political and economic spheres.

### PROBLEM OF FARM PROSPERITY

The problem of farm prosperity is not confined to any one country. In most Western countries it has perhaps assumed a disproportionate importance in the activities of government. In the East, however, it has probably received underemphasis. Every rice-producing and consuming country of eastern Asia and the Pacific tropics, not excepting Japan, is so predominantly agricultural that the welfare of the agricultural group would seem to be of major importance.

Farmers the world over are concerned with cereal prices in two important respects: (1) the general level of wheat or rice prices in relation to the prices of other commodities, and (2) the fluctuations in cereal prices, especially seasonal variations. Among wheat growers the first has perhaps received more attention than the second; among rice producers the second aspect of prices seems to have attracted more attention than the first.

In the wheat and rice worlds alike, attempts to shelter domestic producers of cereals from the impact of low prices during the past decade were gradually transformed in many net-importing countries into attempts to achieve self-sufficiency in food. The implications of such policies have been more serious for wheat than for rice, chiefly because of the differences between rice and wheat in supply position and trade importance.

For some cereal-importing countries, moreover, ambitions to become self-sufficient are

<sup>1</sup> Naum Jasny, *Competition among Grains* (Food Research Institute, Grain Economics Series 2, Stanford University, California, 1940). See especially chap. viii, "Historical Aspects of Price Ratios," pp. 186-92.

<sup>2</sup> Index numbers published in the *Journal of the Royal Statistical Society* ("Wholesale Prices in 1939," by the editor of *The Statist*) (Vol. CIII, Part 111, 1940, p. 356) suggest a marked long-term divergence in rice and wheat prices, at least in the United Kingdom. Average prices for the period 1867-77 are taken as the base, or 100. A cheapening of wheat relative to corn is also indicated by the following data:

| Year     | Wheat                |          | Rice                            | Maize                                    |
|----------|----------------------|----------|---------------------------------|--|
|          | English<br>"Gazette" | Amerlean | Rangoon<br>cargoes to<br>arrive | American-milled<br>La Plata<br>from 1924 |
| 1873.... | 108                  | 113      | 95                              | 92                                       |
| 1922.... | 88                   | 95       | 148                             | 96                                       |
| 1929.... | 77                   | 91       | 143                             | 112                                      |
| 1933.... | 42                   | 46       | 78                              | 53                                       |
| 1939.... | 39                   | 54       | 111                             | 82                                       |

Rice prices, as recorded in the United Kingdom, are probably open to as many objections as the use of wheat prices in some market of the Far East as a measure of broad price trends for that grain (see p. 301). However, note the study of L. L. Chang (cited on p. 294), which definitely indicates the cheapening of wheat in relation to rice in a part of the world where such a development may be expected to have the greatest influence on consumption.

not particularly new or recent. Efforts have been made over several decades to reduce the dependence upon outside sources of supply through stimulation of domestic production.<sup>1</sup> Sometimes these efforts have been well organized and largely successful in accomplishing their purposes. The Japanese Empire is the best example of this situation for rice, and Italy is one of the best for wheat. Sometimes these efforts have been spasmodic, varying in intensity and effectiveness with the fortunes of other crops or industries within the countries concerned, and with the political outlook. British Malaya, a rice-importing country, is an example of this situation.

The success of agrarian programs in coun-

<sup>1</sup> Some rice importers, like the Philippine Islands and the Netherlands Indies, find such an objective attainable. It is perhaps attainable also in other countries, but in varying degrees the achievement may become uneconomic. British Malaya, for example, is a rice-deficiency country not so much because there is not enough land for rice growing as because the complex of land, labor, and capital is more profitably employed for other purposes, such as producing rubber and tin. The large immigrant population working on European-owned plantations is fed with imported rice. To a certain extent the same comments apply to Ceylon, though here the available lands appear to be less suitable to rice culture. If it were not for the Outer Provinces of the Netherlands Indies, many of which are largely undeveloped, the position of Java would be similar to that of Malaya. It would be uneconomic to attempt to grow enough rice on this one island to support the entire population. Land now being used for profitable export crops would be required for rice cultivation. The same problem does not arise in the Philippines; there the deficiency in the rice supply is very small, lands of suitable character are available for extending rice acreage, and yields could be increased without great difficulty.

<sup>2</sup> Before the 1914-18 World War, prices of products of the East were low in relation to world prices; hence Western rice growers had little opportunity to compete on a price basis in the European market. After the war, Western prices dropped more rapidly, and have continued to decline, so that the East's advantage on a price basis has largely disappeared. An official inquiry into the reasons for the fall in Burma rice prices during the world economic depression (*Note on Burma Rice Prices* [Burma Dept. Agr. Survey 14, Rangoon, 1932], p. 28) has this to say: "It was not that the Burma rice marketed in Europe had deteriorated in quality . . . it had been superseded. Where before the War it accounted for 70 to 80 per cent of the total trade done in domestic rice, it now accounted for a bare 10 to 20 per cent, and where before the War it was recognized as a cheap rice, it is now no longer recognized as cheap, but merely as inferior."

tries of deficit wheat supply has intensified agricultural and trade problems in the wheat-exporting areas. Loss of markets and falling prices, coupled with a tendency toward excessive world output, have led to numerous government control schemes. In the East, policies of encouraging local rice production and shutting out or greatly restricting imports have been perhaps even more general than in wheat-consuming countries. But the net effects on prices have been less marked, because the scale of operations has been much smaller.

Even so, during the world depression of the early 1930's, official inquiries were conducted in some of the rice-export countries and elsewhere for the purpose of developing plans for the relief of growers and for the promotion of export business.<sup>2</sup> In all of the rice-eating countries governments were compelled to give attention to "the rice problem" in one form or another. It was the combination of low prices, plus the perennial evils of seasonal fluctuations, however, that made the problem acute. In the wheat world, the level of prices was itself the foremost consideration.

#### PURCHASING POWER OF RICE

A low level of rice prices is of greatest significance when it means the impoverishment of the grower class whose numbers bulk large in the total population of Oriental countries. If costs of living and producing rice declined as much as rice prices, the farmers' position would not be greatly changed. But usually they do not. Some costs are more or less fixed, and when prices in general are better maintained than rice prices it means a reduction in the growers' buying capacity which creates hardship and demands for government relief.

If rice prices do not rise as much as prices generally, or decline more, the "purchasing power" of rice has declined. If rice prices increase more than the prices of other commodities, or decline less, then rice commands a greater purchasing power as a commodity. This has nothing to do with cheapness or dearness of rice, which is a relationship between the individual's purchasing power as measured by money and prices in the same currency. The purchasing power of rice is of

chief significance to the owner of rice, the farmer, or the merchant. From the consumer's standpoint, the attachment of greater values to rice may mean hardship or a reduced level of consumption.

The diversity of behavior of prices in general in several countries of Monsoon Asia is illustrated by the index numbers given below (average annual wholesale prices, as published by the League of Nations, 1929=100):<sup>1</sup>

| Year   | India<br>(Calcutta) | Netherlands<br>Indies | French<br>Indo-China<br>(Saigon) | China<br>(Shanghai) | Japan<br>(Tokyo) |
|--------|---------------------|-----------------------|----------------------------------|---------------------|------------------|
| 1919.. | 139                 | ...                   | ...                              | ...                 | 142              |
| 1924.. | 123                 | 117                   | ...                              | 93                  | 125              |
| 1929.. | 100                 | 100                   | 100                              | 100                 | 100              |
| 1934.. | 63                  | 46                    | 63                               | 93                  | 81               |
| 1939.. | 76                  | 57                    | 106                              | 232                 | 126              |

After at least doubling in all countries between 1913 and the years immediately following the first World War, prices took varying courses downward until 1934-35, after which they rose in all five countries, but by widely different amounts.<sup>2</sup>

The onset of the world depression in 1930 caused a drastic deflation in prices in all countries which led to the adoption of different types of monetary policies. The diverse effects of these policies are shown by the index numbers for 1939 in comparison with the common base period, 1929. Lowest prices were in the Netherlands Indies (57 per cent of the 1929 level), which adhered to gold, while prices in French Indo-China, Japan, and China, all above the 1929 level, reflected varying degrees of price inflation or currency depreciation.

When rice prices in each country are compared with the general price level, some approximation to the purchasing power of rice may be obtained. In all five countries, the

<sup>1</sup> *Statistical Year-Book and Monthly Bulletin of Statistics* for various years.

<sup>2</sup> While prices in three countries continued to fall in 1924-29, in China the cheapening of silver, and in Indo-China the depreciation of the French franc to which Indo-Chinese currency was pegged, were influential in causing the wholesale price level to rise.

<sup>3</sup> Rice prices have been divided by the indexes of wholesale prices in each country and the result expressed in the form of index numbers, with 1924-26 as the base period.

power of rice to command other goods has apparently declined—in India and Java after 1930 and in other countries since about 1926.

During the period the general decline in prices, the price of rice fell by a greater amount than all commodities, as illustrated by the index numbers of purchasing power (1924-26 = 100) below:<sup>3</sup>

| Year       | India | Java | Indo-<br>China | China | Japan |
|------------|-------|------|----------------|-------|-------|
| 1926 ..... | 112   | 106  | 105            | 100   | 105   |
| 1931 ..... | 96    | 98   | 63             | 66    | 79    |
| 1936 ..... | 93    | 81   | 64             | 66    | 102   |
| 1937 ..... | 83    | 71   | 77             | 68    | 90    |
| 1938 ..... | 89    | 82   | 88             | 62    | 90    |
| 1939 ..... | ...   | ...  | 70             | 70    | 89    |

In view of declining tendencies in per capita rice consumption which may be attributed to factors other than a falling off in demand, it may seem paradoxical that the purchasing power of rice has not been better maintained. If India and China, both huge reservoirs of ineffectively expressed demand, are disregarded, however, the apparent inconsistency that suggests itself when a general or composite view of the Asiatic rice situation is taken largely disappears.

Lack of comparability and representativeness of the wholesale price indexes, diverse factors that have affected the course of rice prices, and differences in the rice position of the various countries preclude observations of much significance.

Unquestionably there has been a deterioration in the rice producer's economic position in the Orient, though such deterioration may not be universal, and though the above data are not adequate evidence. Low prices for the product he has to sell have not in most cases been offset by sufficiently low prices for the commodities and services he must buy. This has been the lot of many producers of basic foodstuffs since the 1920's. It is not surprising, therefore, that pressure for government intervention has been great.

In Far Eastern countries, however, another aspect of prices—seasonal behavior—has received more attention, perhaps because the effects of seasonal variations are more readily identified with the weakness of the cultiva-



tor's position and perhaps because governments consider the remedy easier and more feasible politically than attempting to manipulate the rice price level. The latter might lead to government subsidies, currency manipulations, or other actions affecting smaller but more powerful groups of the population, whereas in attacking the problem of seasonality, speculators or alien merchants may be held responsible for a price behavior not in the interests of growers.

#### SEASONALITY IN PRICES

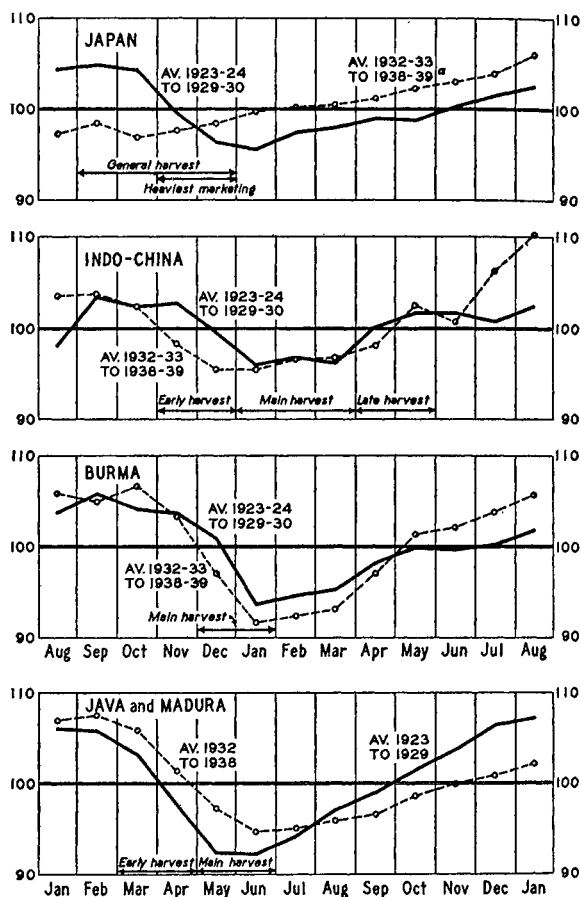
The amount of seasonal variation in prices typical of any commodity reflects chiefly the seasonality of production and minimum cost of storage, and secondarily, the organization of the trade. Rice growers are generally under-financed and therefore unable to hold stocks long enough to time their sales. It is doubtful, however, that this condition contributes as much toward allegedly excessive seasonal price fluctuations as the absence of effective bidding among buyers. When financial weakness of growers operates to force them to take unduly low prices, it is probable that they depend upon credit obtained in such a way that competition between buyers for their crop is diminished or excluded. Cultivators borrow to carry on growing operations, and creditors expect repayment of their loans as soon as the crop is harvested. Likewise, in some areas the government land taxes fall due during or immediately following the principal harvest.

Most growers therefore are forced to find a market for their crop as soon as possible in order to meet their obligations. The huge volume of offerings within a relatively short period of time is almost always accompanied by lower prices, a fact which has led to a common belief in the Orient that the concentration of offerings is mainly responsible for what are considered to be abnormally large declines in the price of rice. Usually the lowest prices of the year are recorded during the two or three months in which the harvesting is done and the bulk of the crop is sold, passing out of the farmers' hands. Chart 6 illustrates this characteristic behavior of rice prices in certain selected countries of Monsoon Asia.

The same tendency toward post-harvest decline in prices appears in wheat-producing countries, though in less extreme degree. The wide geographic distribution of wheat production means that harvesting is taking place in

CHART 6.—AVERAGE SEASONALITY IN RICE PRICES IN SELECTED COUNTRIES OF MONSOON ASIA\*

(Index numbers, yearly average = 100)



\* Monthly price data from official sources (see note p. 314) averaged for seven-year periods with the result expressed as a percentage of the average of all months, and without correction for trend.

\* Reflects price control legislation passed in 1933. See pp. 308-10.

some part of the world the year round; hence the movement into overseas marketing channels is distributed over a 12-month period. Although the heaviest shipments occur in certain months, the fact that some movement is taking place all the time acts as a price-stabilizing factor. With rice, production is heavily concentrated in one part of the world,

and the bulk of the annual crop, not only for export but for domestic marketing within each country, is harvested at practically the same time.

During the past few decades, the wheat grower, unlike the rice grower, has been the recipient of numerous forms of government aid in financing, storage, other marketing assistance, or guaranteed prices, in practically all of the important wheat-exporting countries. Thus, his position has been improved with regard to marketing his output. At the same time, direct price-influencing measures have tended to dilute whatever normal seasonal price tendencies may in the past have been operative.

Furthermore, the more removed agriculture is from the subsistence type of environment,

the less influence seasonal price behavior will have upon the economic position of the grower.<sup>1</sup> Much of the world's wheat is grown under conditions of commercial farming; much of the world's rice is not. The machinery of marketing itself, while vulnerable in many respects, acts as a lubricant to the movement of produce from growing regions to consuming centers and thus facilitates the supply-demand adjustment. Were it not necessary for the rice grower to discharge his pressing obligations in the form of rent, interest, and taxes, he could, in theory, be immune from the price considerations. But though he may live almost outside the reach of the price economy, those having claims upon him do not; thus his lot tends to be one with small prospect of any early improvement.

## IX. PRICE CONTROL SCHEMES FOR RICE

Observers of the problems of agriculture in the Far East are in general agreement about the disadvantageous position of the rice cultivator. It is not surprising, therefore, that government intervention in the affairs of the industry should become more common with ailing internal economies and international political uncertainties during the past decade. Although government intervention has taken many forms over a longer period of years, only relatively recently has the influence of government been directed toward control over the behavior of prices.

Intervention has often taken the form of assistance to the grower through the development of irrigation projects and flood-control systems, the allotting of free lands or the clearing of land suitable for rice, the distribution of selected seed to improve yields, the creation of financing and marketing organizations, or perhaps only technical advice or the services of market information. In all such cases the influence of government on rice prices is felt very slowly and indirectly.

On occasions, particularly in the net-importing countries, governments have acted to protect consumers against high rice prices through control over exports and imports, creation of state-owned stocks for distribution, licensing of middlemen and regulation

of their margins, supervision of weights, measures, grades, and so on. Again the effect upon rice prices is indirect.

Probably of most interest are the various schemes for price control which have been developed more recently in the rice-importing countries. In the rice-exporting regions, price influencing and subsidizing programs comparable with those tried in most of the principal wheat-exporting countries have not as yet appeared. No government-sponsored rice program thus far has had as a principal objective an imposed limitation on the size of the rice supply.

### RICE CONTROL IN JAPAN

The Japanese government has been attempting, indirectly or directly, to control the price of rice since 1921, when the first basic Rice Law was promulgated. After two decades of experience, the problem of satisfactorily reconciling the conflicting interests of Japanese farmers, producers in the colonies, distributors and dealers, and rice consumers generally, does not appear to be solved. The number

<sup>1</sup> In Western countries both the magnitude and the adverse effects upon the farmers of seasonal fluctuations in wheat prices have probably been exaggerated. See Holbrook Working, "The Post-Harvest Depression of Wheat Prices," *WHEAT STUDIES*, November 1929, VI, 1-30.

of times the objectives and methods of the control scheme have been changed leads one to infer that successive plans have been greatly influenced by political expediency. Whenever modifications have been made in the original legislation, the scope of government control over the rice industry of the Empire has been broadened.

Originally the main concern of the government was to step up production to meet the demands of a rapidly growing population and to keep prices down in the interests of consumers. Disturbed conditions following the first World War, crop shortages, high rice prices, and "rice riots" all played their part in the legislation of 1921. The Japanese farmer was having difficulty in making a living from rice cultivation, and was moving to the cities where there were greater opportunities as industrialization of Japan progressed. These circumstances presaged defeat of government efforts to improve the country's food position. There seemed reason for the government to assume a more active role in directing the agrarian activities of the Empire.

At the outset the Japanese program provided a quantitative type of influence over supplies. The main object was to encourage production in order to bring down prices to consumers. Nothing was said about prices as such until the basic law was first amended in 1925, and the phrase pertaining to adjustment of "supply to demand" was altered to cover "the supply of rice and the market price." The third important stage in development of Japanese rice-control legislation came in 1931, when a standard for price control was set which removed the ambiguity involved in earlier laws.<sup>1</sup>

A radical reform was introduced into the control scheme in 1933, when the basic law of 1921 was repealed, and replaced by one known as the "Rice Control Law." This legislation carried farm relief features and included, among other provisions, the means for restricting by extreme flexibility in import duties, not only the imports of foreign rice, but of substitute foodstuffs such as millet, sorghum, and kaoliang, used extensively in some regions, especially Chosen. A change in the technique of price fixing was also in-

involved in the 1933 legislation. By the 1931 legislation the government had set minimum prices (determined by the cost of production) and maximum prices (determined by the cost of living) for the entire year. Farmers in need of funds, knowing this, offered the government large amounts of rice at the opening of the season. These offerings acted to depress prices; hence modifications in the law were necessary.<sup>2</sup>

By this time the earlier efforts to increase the rice output at home and in Chosen and Taiwan were bearing fruit, and the government authorities faced a problem of potential overproduction. One method of controlling the situation was to force greater consumption of rice in the colonies, particularly Chosen, in order to cut down the exports to Japan proper which were believed by Japanese farmers to be depressing the price of Japan-grown rice and thus adversely affecting the interests of home producers.

In 1936 three other measures were enacted into a law which supplemented the 1933 act. The most important of these was the "Autonomous Rice Control Law," which was designated to effect through rice producers and dealers themselves an autonomous control of the distribution of surplus rice in the whole Empire and thereby to aid the rice-purchasing program of the government. This legislation was enacted during a period of growing surpluses, the record carryover for 1935 of roughly 2.4 million metric tons being twice as great as the average carryover of the five preceding years and equal to approximately one-quarter of annual consumption requirements.<sup>3</sup> The plan was to place upon producers and distributors part of the burden of holding stocks. The load was becoming too heavy for

<sup>1</sup> For a history of control legislation up to 1933, see Tobata, *op. cit.*, pp. 157-97.

<sup>2</sup> The minimum price for January is now fixed and announced in December, and is increased each month up to March by an amount equal to the cost of storage and interest. For the period April to October the minimum price is that reached by March. In this way it was planned to discourage premature selling and to reduce the cost to the government of excessively large offerings coming right after the harvest.

<sup>3</sup> The 1933 legislation, to curtail additions to the home supply from the colonies, became effective in the fall of 1933 when Japan's bumper crop of 1933-34

the government alone. Existing marketing agencies were to be supplemented by the formation of co-operative associations, especially in the colonies, for holding given quantities of rice, assigned on a quota basis, which could not be released for sale and distribution without government permission. The government was to finance the operations.

Apparently this plan did not work well, for in 1939 a Rice Distribution Control Law was passed, which established a semiofficial company called the Japan Rice Company, Limited, for the purpose of monopolizing all of the rice markets of Japan. Speculation is now prohibited, brokers and dealers are placed under a licensing system, and other steps have been taken for the purpose of regulating the price of rice through the control of distribution.

In the fall of 1939 the rice problem in Japan became one of the most important domestic issues confronting the cabinet. Japan's rice position had again undergone a change. A crop failure in Chosen and a small crop in Taiwan presaged smaller supplies for Japan proper. Within the rice year ending October 31, 1939, the carryover in Japan had fallen more than 50 per cent to the lowest level since 1918, and alarm was felt that a critical situation in food supplies might easily arise. Agitation for government action to avert a shortage resulted in raising the rice price in November from 38 to 43 yen per koku, the highest price since 1925. Measures to economize rice supplies were also taken. The extent to which rice could be polished was limited, with the objective of saving about 2.8 million koku during the year; and officials urged the mixing of wheat and rice, increased consumption of bread, and more complete use of leftovers.

The Japanese rice control scheme has been longer in operation and is more comprehensive than government programs instituted later in other Asiatic rice-growing countries, and it seems to have served as a guide for them. The conditions which have brought about government control activities are in

(over 9 million metric tons) coincided with good crops in Chosen and Taiwan and helped to increase the carryover, which began to accumulate at the close of the 1930-31 season.

general the same throughout the East, but seem to have appeared earlier, and in more acute form, within the Japanese Empire. Perhaps the reason for this was the earlier industrialization of Japan. Superficially, the problem of price stabilization appears to be relatively simple; but the history of the Japanese scheme confirms the experience of many Western nations that the difficulties are really very great.

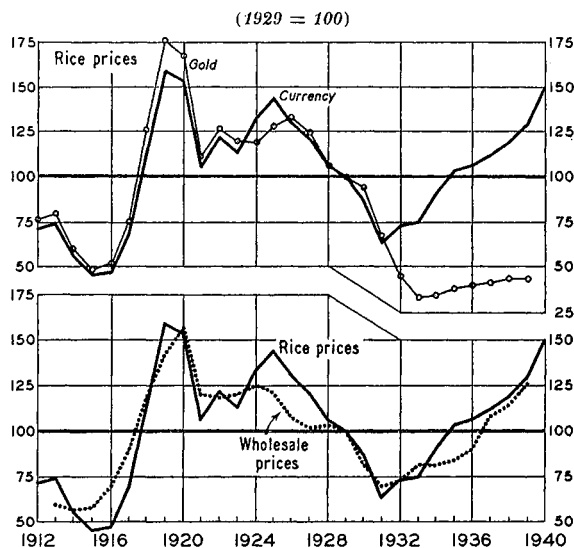
Price-stabilization schemes are usually price-raising schemes, at least in the beginning, for they are planned in the interests of growers. At least part of the original purpose of the Japanese plan, however, was also to lower prices to consumers. If these ends are to be accomplished simultaneously, there must be considerable leeway for manipulation of prices through interference in the trading and marketing process. Actually, this is what the Japanese government has done. From the growers' standpoint, the results of all the legislation up to the middle 1930's were largely negative; the control administration failed to prevent price declines that adversely affected agricultural interests.

The price of rice in Japan, averaged by seasons, has shown somewhat less variability since 1921, especially when comparisons are made with the period 1912-21 (Chart 7, p. 310), but the evidence does not warrant attributing this behavior necessarily to governmental intervention. Comparisons with rice prices in other countries where no price-influencing measures have been employed are impracticable, since the qualifications necessary for the manifold factors that have affected prices in these countries would deprive such comparisons of real significance. Chart 7 shows the course of rice prices in Japan in the form of index numbers, both in terms of the national currency (yen) and in terms of gold, together with an index of wholesale prices. In general, since 1921, Tokyo rice prices have not risen as high nor fallen as low, though on a gold basis Japanese prices in the early 1930's fell lower than rice prices in such other importing countries as India and Java.

In December 1931 Japan departed from the gold standard for the second time, and the inflationary influences of the new monetary

policy resulted in a rise of domestic prices after 1932. The relation between rice and wholesale prices in Japan in the middle 1920's was relatively favorable to the rice producer, but when rice prices started to decline, they fell more rapidly than the general price level,

CHART 7.—INDEX NUMBERS OF RICE AND WHOLESALE PRICES IN JAPAN, 1912-40\*



\* Rice prices at Tokyo (average quality brown); wholesale prices, Bank of Japan index.

adversely affecting the farmer's position (see pp. 304-5). For a few years in the early 1930's until the influence of the war with China became felt, the grower's purchasing power was apparently somewhat improved but has not since returned to its earlier level.

Nor does it seem that prior to the 1933 legislation the government was outstandingly successful in reducing the amount of seasonal fluctuation in rice prices.<sup>1</sup> Since then rigid fixing of monthly minimum prices for an entire year (note 2, p. 308) and the outlawing of speculative trading, have arbitrarily eliminated practically all semblance of normal seasonal price behavior. (See Chart 6, p. 306.) Growers have been given an incentive for holding their rice off the market and not attempting to dispose of it all at once right after the harvest. In effect, minimum prices have been guaranteed which cover the cost of carrying through the first quarter of the year following the fall harvest.<sup>2</sup>

Each modification in the control legislation

seems to have arisen from failure of existing measures to anticipate changes in conditions or effects of enforcement.<sup>3</sup> The 1939 legislation monopolizing all rice markets and licensing brokers and dealers,<sup>4</sup> for example, was an outgrowth of weaknesses which appeared in the operation of earlier laws. By decree the government announced price limits and the amount it desired to purchase. The very announcement seemed to be enough to encourage speculative activity and to maintain rice prices near the upper limit though never actually at it, for, under the law, the government was obliged to begin selling activities once the maximum price had been reached.

<sup>1</sup> The evidence is not clear. In his study of Japanese rice control, Tobata (*op. cit.*, p. 194) cites studies which lead to different conclusions. "We may observe . . . that since . . . 1921, the monthly variations have increased, although we may at the same time observe that, but for the Act, the variations might have been much greater as a result of changed conditions of supply." From another study (the difference between the highest and lowest monthly average of the nominal price of rice in Tokyo during a year, divided by its yearly average), ". . . we may conclude that the Rice Control Act has served to reduce the monthly variations in the nominal price of rice. The problem is, which of the two observations shows the actual economic relation between the price of rice and the producer, as well as the consumer?"

<sup>2</sup> Probably three-fifths of the total Japanese rice crop is grown under the tenant system, the landlord receiving his rent in grain. In the past more than half of the tenants' crop was disposed of soon after the harvest in order to meet pressing obligations. Concentrated offerings depressed prices and created storage and other problems for the government. Frequently, after selling his share of the crop during the first quarter, the tenant was later obliged to repurchase rice for his own needs at much higher prices. This was a situation wherein speculators could profit at the expense of producers, and which the control legislation was designed to improve.

<sup>3</sup> Complicating the problem of price stabilization for the Japanese authorities has been the factor, referred to earlier (p. 296), of the particular preference of Japanese consumers for Japanese rice. From the beginning it has largely defined the character of the rice supply to be furnished the Japanese population. In no other country has this consideration assumed equal importance.

<sup>4</sup> The Rice Distribution Control Law of 1939 prohibited the settlement of futures transactions except in actual rice. The volume of such transactions in the Tokyo and Osaka markets amounted to 137 million koku in 1932, declined to 79 million koku in 1933, the year of the promulgation of the rice law, shrank further to 29 million koku in 1938, and in 1939 amounted to less than 4 million koku.

Since the rice administration was morally bound to support its announced prices, purchasing all rice offered or selling its entire supply if necessary to stabilize prices within the set limits, the net effect was usually that the government made both its purchases and its sales at the current market. This meant that the operation almost always resulted in a loss.

The Japanese rice-control program has been expensive. The funds allotted for carrying out the provisions of all legislation were successively increased from 200 million yen provided in 1921 to 850 million yen plus an emergency reserve of 300 million yen in 1934. Paying the producer the maximum price and selling to the consumer at the minimum, which amounts to direct subsidy to both, always results in a loss which the government must absorb. It was costly to carry the large stocks built up in years of surplus prior to 1939. After one year's storage, rice deteriorates so much that the government must sell old stocks at current market prices and lose about 4 yen per koku.

Although the Japanese system may be effective in extending some relief to farmers and consumers, it has been unsuccessful as a means of price control largely because of the absence of any regulation of production. There is probably no phase of the Japanese rice control program that has not been incorporated and tried in some of the numerous price stabilization schemes for agricultural commodities in Western countries. Only production-control programs are absent thus far in the East, but even in face of a tendency toward shortage in aggregate supplies, production control has been and is seriously considered in certain countries, e.g., the Philippine Islands.

#### RICE CONTROL IN THE PHILIPPINES

Like Japan in 1921, the Philippine Islands were faced with a problem of shortage following a poor harvest in 1935. Low prices to producers, rising prices to consumers, much speculation, and the threat of hardship created by a rice shortage led to government investigation and action. A commission was appointed to study the rice crisis and make recommendations. Nationalization of the rice

industry was seriously considered. What emerged in 1936 was the establishment of a National Rice and Corn Corporation for the purpose of stabilizing prices. The corporation undertook to import and distribute rice at a price considered fair to both producers and consumers.

The Philippine plan was frankly modeled upon the Japanese scheme. From the outset, however, it was recognized that the temporary crisis might soon pass and that within a few years supplies might be so abundant as to call for some form of production control. Moreover, the scheme was designed to relieve the plight of the Philippine rice grower. The investigating commission put it thus:

The industry is dominated by speculative activity at the expense of the tenants and small farmers who, for need of cash or food, are compelled to sell their share of the crop long before or immediately after the harvest, thus glutting the market and bringing prices down to ruinous levels for a brief period. The margin of variation in the price of palay is very wide, extending sometimes to over 150 per cent. The whole industry is in an unhealthy condition. Producers and consumers are practically at the mercy of a few rice dealers, middlemen, and speculators who control the industry.<sup>1</sup>

When the newly formed corporation entered the market in December 1936, palay (paddy) prices in Cabanatuan, Nueva Ecija, the center of the rice trade, ranged between 1.50 and 1.80 pesos per cavan of 44 kilos. Purchases were first made at 2.50 pesos, considered a "fair" price which would cover the cost of production and permit the grower a reasonable profit. Prices soon rose to 2.30 and 2.40 pesos in this important district. Another short crop in 1936-37 was favorable to the corporation's operations, and price stabilization was rather easily effected with the fund of 4 million pesos at its disposal.

By 1937, however, the problem was no longer one of shortage. The 1937-38 crop was large, and so were the crops of the two years following. The need for production control, if prices were to be successfully maintained, became apparent. Officials of the NARIC began to point out this need in 1938.

<sup>1</sup> *Report of the Rice Commission to the President of the Philippines* (Manila, 1936), p. 6.

The record crops harvested between 1937 and 1940 were believed to have been due in part to the price-stabilization policy and practice of the corporation. Other contributing factors were: (1) the opening of vast tracts of public lands through various land grants; (2) intensive government propaganda for settlement of Mindanao, particularly Cotabato, by "home-seekers" and by private immigrants; (3) the liberal practices followed by the Philippine National Bank with respect to the granting of long-term agricultural loans; and (4) the conversion of sugar fields into rice lands due to the quota limitations placed on the export of sugar to the United States after the passage of the Tydings-McDuffie Law.<sup>1</sup> In addition, the efforts of the agricultural department to introduce better methods of cultivation, seed selection, and fertilization presumably tended to increase yields.

Problems of overproduction are much more difficult to solve than those arising from temporary scarcity. The NARIC has funds sufficient to purchase only a fraction of the supplies that might readily become available on continuation of present tendencies toward large production. Without the power to control production, the problem of regulating prices will become increasingly difficult. The control scheme seems likely eventually to come to a disastrous end unless the government is prepared to subsidize the industry for an indefinite period. The funds available for such stabilization seem unlikely to be ample. The government of the Philippines would be in a much better position to support prices to producers if it could control the domestic rice output in such a way as to require continued importations of a small proportion of the Islands' rice-consumption requirements.

<sup>1</sup> B. C. Lopez, "Need for Production Control," *NARIC Service Recorder* (mimeographed), June 1938, I, 9.

<sup>2</sup> V. Buencamino, *Solving the Rice Problem* (National Rice and Corn Corporation, Manila, 1937), p. 1.

<sup>3</sup> It is commonly asserted that the excessive profits of middlemen explain the low return to the grower and the high cost of rice to the consumer, but the evidence suggests "that the Chinese merchants are performing essential marketing services at a fairly low cost." See H. H. Miller, *Principles of Economics Applied to the Philippines* (Boston, 1932), p. 198.

#### CONTRASTS BETWEEN JAPANESE AND PHILIPPINE PLANS

Although government intervention in the affairs of the rice industry has occurred in practically every rice-growing country of Monsoon Asia, the activities in Japan and the Philippines serve to illustrate the type of intervention designed primarily to stabilize rice prices. The mechanics of administration and operation differ in some important respects. For example, the Philippine corporation buys palay and converts it into polished rice before placing it on the market. Part of its capital is employed in the construction and operation of warehouses and mills. The Japanese scheme, on the other hand, involves dealing in brown rice almost exclusively. The government buys, stores, and sells rice in this form and has not attempted to become a factor in rice milling.

Part of the explanation for the milling and marketing activities of the NARIC in the Philippines lies in a situation quite commonly found in southeastern Asia but not in Japan. That is, the milling and marketing functions are largely performed by aliens, especially the Chinese, so that between the native farmer and the ultimate rice consumer is a group alleged to exercise a vital influence over rice prices. The Chinese rice millers and merchants have dominated this business for generations, but have recently become the focus for blame for all the ills of the rice industry.

In setting forth the main problems confronting the rice industry in the Philippines, the manager of the NARIC lists the following in order of importance:<sup>2</sup> (1) the problem of the tenant (*kasamá*) and small farmer; (2) the control of prices; (3) distribution and financing; and (4) nationalization. On the fourth problem, that of nationalization, it is frankly admitted that progress toward a solution has not been wholly satisfactory. The objective of gradually passing the milling and distribution of rice from Chinese to Philippine hands will require time for its attainment for a variety of reasons.<sup>3</sup> The Chinese engaged in this business even before the Spanish regime in the Philippines. They have the experience and trade ties with other Chinese in neighboring countries. The Filipino seems

not to be so good a business man, though government officials from President Quezon down are optimistic about the Filipino's ability to learn the business within another ten years when complete nationalization is foreseen.

While the NARIC appears to be well organized and operated as a business corporation, its dependence upon political support may prove a great handicap to efficiency. Officials of the corporation apparently feel the need for additional operating capital as the threat of surplus supplies looms larger. They seem favorably inclined toward the enactment of an autonomous rice control law as in Japan, compelling producers to withhold part of their supply from the market until its release is authorized by the government. From minor rejoicing at the profits which accrued to the corporation at the outset, they are now more inclined to favor the Japanese policy of "service to the people." That is to say, faced with the problem of oversupply, the corporation must expect losses from its stabilizing operations. As in Japan, losses incurred in programs involving the subsidization of important sections of the population may be interpreted politically as the measure of the service rendered.

The NARIC has been successful in reducing seasonal fluctuations in rice prices without resorting to the extreme measures employed in recent years by the Japanese control authorities. As a means of helping the native rice grower to break the vicious circle of increasing debt, the corporation's price-stabilizing activities may prove an important contribution. The data necessary for showing the influence of the corporation's activities on rice prices since its incorporation in 1936 are not at hand. Moreover, the record, if available, would not be conclusive. But the data and charts in the offices of the corporation in Manila suggest a rather successful effort at smoothing the short-time variations in prices, at least up to the close of 1939.

Although any government institution must serve the interests of the nation if it is to persist, the Philippine experiment in rice control has apparently not as yet been seriously confronted with the irreconcilable facts that

higher prices for the rice grower mean more expensive rice for the consumer. Thus far the alleged excessive profits of the foreign middlemen have provided some leeway for operations, but in the end it will be surprising if a way can be found for subsidizing both the rice producer and the rice consumer without heavy drains upon the government treasury.

#### GOVERNMENT INTERVENTION IN OTHER COUNTRIES

In China, control over exports has long been exercised, and more recently imports have been discouraged in various ways in order to promote a national program of self-sufficiency in food. In French Indo-China rice prices have been affected most directly by export duties, currency manipulations, and treaty arrangements. The government of Thailand has a 10-year plan which involves colonization of new areas in order to relieve population pressure and to build new districts of debt-free farmers. Once the colonists are settled, the government will purchase their crops at officially set prices which, however, will be below the market because the difference is intended to help repay the cost of settlement. One of the purposes of this program is to assist the Thai farmer to become independent of Chinese landowners and middlemen.

The government of British Malaya has sporadically attempted to stimulate home rice production for many years. Rice-growing is the chief occupation of the native Malays, but large importations are required each year from Thailand and Burma in order to feed the Chinese, Indians, and other races who outnumber the Malays. In addition to offers of cheap land, irrigation facilities, free water and seed, and so on, the governments of some states have now guaranteed a minimum price (\$2.50 [Straits] per picul) for paddy delivered to government mills for three years beginning in 1940. Some of the more recent of such activities reflect wartime conditions and the placing of British Malaya on a war footing. Dealers in rice and rice prices are now strictly regulated. The rice trade had already fallen somewhat under government control through the food control bill of 1939, but since the



outbreak of war in Europe wholesale and retail maximums for all grades of rice have been fixed by the Food Controller.

Early in 1939 a new rice policy was also adopted by the Netherlands Indies government. It was designed to support the price of domestic rice and to insure a steady supply for regions of deficit production within the islands. A Victuals Fund Commission was organized to carry out these objectives. It immediately began to purchase large quantities of rice in eastern and central Java in order to hold prices within a range of 2.90 to 3.25 florins per quintal, which was determined by the Department of Economic Affairs as necessary to assure a fair return to growers and middlemen.

The Javanese plan involves the accumulation of reserve stocks in various centers, such as the east coast of Sumatra, southeastern Borneo, northern Celebes, as well as Java, for distribution to areas of short supplies. Local dealers will be compensated by the government for carrying these stocks. Import restrictions on rice were imposed in the early years of world depression in order to stabilize the domestic market, and have been applied for varying periods ever since. Although control schemes for most of the chief export commodities from the Netherlands Indies have been in effect since 1931, the techniques evolved have not been used directly with rice, which is not an export crop. However, within the past year or two, the Dutch policy for rice seems headed toward essentially the same type of price-stabilization activities as those carried on by the Japanese and Philippine governments.

National governments of the countries involved in the world wheat problem face the

prospect of subsidizing a portion of the population in one manner or another for some time to come. There is no similarly depressing prospect for rice in most rice-growing countries, though what might be termed an agricultural problem exists in an acute form in several Far Eastern countries, and agriculture in this part of the world very frequently means rice culture. If the East were developed commercially, the farm problem would take on the importance it now commands in Western countries; but so long as large areas support tremendous numbers of people in a subsistence environment and central governments are no stronger, there is small likelihood that the state will facilitate adjustments in the rice situation, as such, in an important degree in the near future.

However, in countries where conditions have existed that seem to call for some kind of government stabilization, the tendency appears to be that, once started, state controls are extended and their scope broadened. Rice control in Japan will hardly be dropped in the foreseeable future; it may be extended or dropped in places such as the Netherlands Indies and the Philippine Islands; it is not likely that it will be introduced in India and China; and, though it might be attempted in the three export countries the prospects seem poor for any degree of permanency in such plans. For the typical Asiatic rice grower, governmental intervention will probably have limited significance for some time to come. Despite fluctuating price levels he will undoubtedly continue for a long time to live and work his land essentially as his forebears did, and to hope that his labor will be rewarded with good crops and enough food to continue his personal existence and that of his family.

*By V. D. Wickizer, with the benefit of critical suggestions of colleagues, especially M. K. Bennett, who made many valuable contributions. Charts prepared by P. S. King and tables by Rosamond Peirce.*

*No attempt has been made in the present study to note, explain, or indicate the manner of handling numerous problems involved in dealing with the rather poorly developed statistical materials on rice, population, and related matters, originating in Far Eastern countries. This has been done in connection with another Institute study on rice to appear later this year (Grain Economic Series No. 3) from which the statistics used herein have been drawn.*

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