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GRICULTURAL DEVELOPMENT IN FREE CHINA

TAIPEL TAIWAN REPUBLIC OF CHINA. MAY 1965

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Most tropical and subtropical countries of the world share certain common characteristics and are confronted with somewhat similar problems. Generally, they have not yet adequately developed their natural resources and their economies are predominantly agricultural. A majority of their people live on the farm. Poor and dissatisfied, they are easily taken in by Communist propaganda. Only with increased farm production and increased income can their livelihood be bettered and the social and political order be stabilized and democratic institutions strengthened in those countries.

However, since the leading countries of the modern world are highly industrialized and prosperous, there has been a strong tendency for developing countries to imitate them by emphasizing industrial growth and neglecting agriculture. The outcome is that they continue to import large quantities of food and their people do not have the necessary purchasing power to buy industrial goods. In contrast, the Republic of China has adopted a different policy in the island province of Taiwan, The work began with the improvement of agriculture as a base and only gradually did industrial development follow.

Prewar Agricultural Development

The total area of Taiwan is 13,836 sq. miles and about two thirds of it is covered by the Central Mountain Range from north to south (Map 1). From the mountain down to the plains, the different altitudes provide cold, temperate, subtropical and tropical climates, in which different crops can be grown. They offer many opportunities but also demand a high level of technology and intensive farming operations for the successful development of agriculture.

At the end of the first Sino-Japanese war in 1895 Taiwan was ceded to Japan. The Japanese imposed a dependent colonial economy on the island for the purpose of increasing agricultural production for export to Japan and, in turn, importing manufactured goods from Japan such as textiles and fertilizers. From 1910 to 1939 they paid special attention first to sugar cane and rice production and later also to the production of tea, pineapples, and bananas by the improvement and extension of irrigation, drainage, flood control, application of chemical fertilizers, improvement of crop varieties and cultural methods, development of railway transportation and an electric power system, establishment of farmers' associations with warehouse and milling facilities and the development of farm credit.

World War II caused a deterioration in the irrigation system, a shortage of labor, lack of chemical fertilizers, and, consequently, a sharp decline in food and other agricultural production to the level of 1910.

Rehabilitation and Reform (1946-1952)

In the fall of 1945, soon after the Chinese National Government took over Taiwan, it abolished the Japanese control measures, including food control, and started the rehabilitation of agriculture and industry in order to increase production. All the Japanese were repatriated to their homeland.

During the Japanese occupation of Taiwan, the elementary education was universal, yet local leadership had not been developed, because competition with the Japanese in running the business of the island had been handicapped by a govern-

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^{**} The author has also written a volume on "Agricultural Development on Taiwan Since World War II", which was published by the Cernell University Press in 1964

ment regulation depriving the native people of the opportunity to enter college, except for medical studies. After the war Chinese administrators, engineers, and agriculturalists from the mainland therefore applied themselves to the task of rehabilitating and reconstructing the island with notable success. Hydraulic power plants, fertilizer plants, sugar mills, pineapple-canning factories, and tea-processing plants, which either had been bombed by American planes or had suffered deterioration during the war, were restored by Chinese engineers. The irrigation systems and the dikes for flood control were gradually repaired. The production of rice, sugar, sweet potatoes, and some other crops was steadily increased in the years between 1946 and 1948. Crop production, however, was limited by the shortage of chemical fertilizers because the Chinese Government did not have enough foreign exchange to pay for their import.

A crucial period came in 1949 when the National Government withdrew from the mainland, and Taipei became the capital of Free China on December 8, 1949. Taiwan thereby became a bastion in China's fight against Communism. The population of Taiwan suddenly increased from 6,807,601 in 1948 to 7,555,588 in 1950, not including the 600,000 men in the armed forces. The government laid special emphasis on increased food production. Good progress was made in seed improvement in rice and sugar cane, and the crop yield per hectare was increased. The production of 1,421,000 metric tons of brown rice in 1950 set a record, exceeding the high yields of 1937–1939 and leaving a surplus for export to Japan in exchange for fertilizers.

In addition to the increase in agricultural and industrial production in 1949-1953, the Naticnal Government made rapid strides in establishing organizations and making institutional changes for planned development. In agriculture the work began with the establishment of the China-United States Joint Commission on Rural Reconstruction (JCRR) in October 1948

in Nanking under the U.S. China Aid Act of that year. Since its transfer along with other government agencies to Taiwan in 1949, JCRR has provided maximum technical assistance and minimum financial aid to agricultural agencies. Originally composed of three Chinese and two American commissioners all appointed by the Presidents of their respective countries, JCRR now has only two Chinese, including the Chairman, and one American Commissioner. It has built up a small but highly qualified technical staff, put its fingers on the most important production and marketing problems, established priorities among them, and made grants to stimulate the expansion of agricultural research, education and extension in order to solve those problems. It has also assisted the government in implementing land reform, reorganizing farmers' associations, and planning and coordinating agricultural programs for the economic development of Taiwan.

To improve the economic condition of tenant farmers and stimulate production, the government enforced in 1949 a program for reducing farm rent from 50 to 37.5 percent of the annual major crop. The second phase of the government's land reform, which began in 1951, was the sale of public



Rural livelihood is markedly improved by land reform.

land to farm families. The third phase was the Land-to-the-Tiller program of 1953, giving literate, experienced tenants a chance to become owner-operators by the purchase of land, to be paid for over a period of ten years. Before this series of land reform 41 percent of the farm land was operated by tenants. This has been reduced to 16 percent. Farmers who have more income than in the pre-reform days are making land improvements, constructing better houses, buying more equipment, with improved economic and social status, they take on greater responsibilities in community activities. Furthermore, the purchase price for the land was paid for by 30 percent in government enterprise stock shares and 70 percent in land bonds redeemable in kind. Thus the government encouraged landowners to convert their investment from land to industry. This is an important factor for the rapid development of industry on Taiwan in the last decade.

Following the successful implementation of land reform, the government reorganized the farmers' association in 1953 by dividing its membership into two kinds, active and associate. Active membership is limited to one representative for each eligible family. To be eligible, a farm family must earn 50 percent or more of its income from active farming. Active members have the rights to vote, to hold office, to participate in election meetings, and to use all facilities of the association. Associate members are those who do not qualify as active members because they obtain less than 50 percent of their income from farming. Associate members enjoy all rights except those of voting and holding executive offices in the association. Thus the farmers' associations are now controlled by bona fide farmers.

A farmers' association in each rural township provides farmer members with technical advisory services, rice milling facilities, facilities for the storage and distribution of fertilizers, pesticides and other essential commodities plus banking services including deposits and agricultural credit. Some associations



The credit department of a farmers' association with its customers

also provide services for the marketing of vegetables and fruits. Eight out of ten farm farmilies in Taiwan belong to farmers' associations. JCRR and the Provincial Food Bureau have assisted the farmers' associations to construct or renovate rice mills and fertilizer storage warehouses. Assistance and training of association personnel have enabled the associations to improve their services and increase their earnings.

Planned Development (1953-1964)

With the removal of the Chinese National Government to Taiwan in 1949, it has become necessary to maintain a large military force as well as to support an expanding population. A steady increase in food production and the development of industry have been necessary to meet the increasing needs of the population.

An unfavorable balance of international payments occurred year after year from 1949 to 1953. This was the result of increased government expenditures and a sharp rise in demand for foreign exchange for the procurement of the capital goods required for industrial development. Fortunately, financial support has been received from the United States to meet the budgetary deficits and facilitate economic development.

Late in 1952 the Chinese Government established under the direct supervision of the Premier an Economic Stabilization Board, which has gradually developed into the present Council for International Economic Cooperation and Development (CIECD). This powerful body initiated economic planning for Taiwan with the First Four-Year Plan, 1953-1956, for the attainment of economic independence and followed it up with a second and again a third one in the years between 1957 and 1964. The three Four-Year Plans formulated agricultural, industrial, trade, financial, transportation, and educational policies, programs and goals.

Logs of tremendous sizes are shipped from Ta-hsuehshan about 2,000 meter above sea level.



As a result of these three Four-Year Plans the aggregate agricultural output of crops, livestock, fisheries and forest products in 1964 almost doubled that of the 1950-1952 average or that of the prewar peak year. The average annual growth rate of agriculture was 6.18 percent under the First Four-Year Plan, 4.99 percent under the Second, and 6.35 percent under the Third, aed 8.7 percent in 1965.

This increase of agricultural production has made it possible for Taiwan to provide the domestic food requirements of the population, which grew from 8,700,000 in 1952 to 12,800,000 in 1964 (Figure 1). The production of rice, the staple food of Taiwan, increased from 1,570,000 metric tons of brown rice in 1952 to 2,247,000 metric tons in 1964. The increase of total rice production was primarily due to the increase of the per hectare yield from 1,998 kg. of brown rice in 1952 to 2,937 kg. in 1964, though the rice acreage in the meantime had declined from 785,729 to 764,935 hectares (Figure 2). The increase in the per hectare rice yield was due largely to improved varieties, more and better use of

A demonstration farm for integrated techniques to improve rice cultivation



fertilizers, irrigation and pesticides, and better cultural methods. The production increase of other crops was also made largely by technological improvement, though the total area of cultivated land had slightly dropped from 876,000 hectares in 1952 to 872,000 hectares in 1963 (Figure 3). As a result of more food production, the consumption of rice and protein foods steadily increased in the period of 1952–1964 as shown in Figure 4.

The increase of agricultural production also boosted the net foreign exchange earnings from US\$114,200,000 in 1952 to US\$312,686,000 in 1964 (Figure 5) through the exoprt of sugar, rice, bananas, pineapples, tea, mushrooms, fruits, vegetables, and other primary and processed agricultural products.

However, farm income per capita has not kept pace with agricultural production, as the rapidly growing population was not accompanied by a proportional increase in the area of cultivated land. The latter went up only about 19.4 percent from the average of 1951–1953 to 1963, while the farm income per agricultural worker rose about 42.8 percent in the same years.

Under the three Four-Year Plans, agriculture and indus-



Asparagus, mushrooms and fruits of many kinds are canned for export.

try are basically partners. Industry has been developing rapidly, largely with U.S. economic aid. The expansion of power and fertilizer production has received high priority. Other important industries relating to agriculture are sugar, wheat milling, vegetable oils, part of textiles, food processing and canning, and pesticides.

Production has been increasing in both agriculture and industry, with the latter forging ahead at a faster pace. The net national domestic product increased from US\$,1,269 million in 1954 to US\$2,121 million in 1964. Expressed in percentages of the net national domestic product, agricultural products declined from 33.3 percent in 1954 to 27.7 percent in 1964, while industrial products increased from 24.2 to 27.4 percent in the same years.

Both exports and imports have been increasing. A favorable balance of trade was achieved for the first time in 1963. This amounted to over US\$50 million in 1964. But owing to the large sums of money spent for the importation of industrial machinery and raw materials, which accounted for 75 percent of the total imports in 1965, there was again an unfavorable balance of US\$67 million in that year.

Nonagricultural exports increased from 7.0 percent of Taiwan's total export in 1954 to 45.7 percent in 1965, while the exports of agricultural primary and processed products declined from 93.0 percent to 54.3 percent in the same years. Taiwan's economy has evolved from a predominantly agricultural to a mixed agricultural and industrial one.

U.S. economic aid to the Republic of China is to be phased out by the end of June 1965, and we need to develop our economy on a self-sustained basis. The challenging problems in our future economic development are: (a) to maintain a high growth rate of about 7 percent per annum of our gross national product, (b) to provide added employment opportunities for the expanded labor force resulting from population growth; and (c) to accelerate capital accumulation

in our domestic economy to meet the mounting needs for capital investment. To coordinate the efforts for accelerated economic growth, the Chinese Government has developed a fourth Four-Year plan covering 1965-1968 together with a ten-year projection covering 1965-1974 in order to cope with the need for gradual transformation of our economic structure under the changing situation. The anticipated growth rates for various economic sectors are 11.0 percent for industry, 8.0 percent for transportation and other services, and 4.1 percent for agriculture for 1965-1968 so as to achieve an aggregate growth rate of 7.0 percent during the 4-year period. The objectives of the agricultural plan are: (a) boosting the food production to meet the demands of a growing population and for better nutrition, (b) stepping up and diversifying agricultural exports, (c) developing the farm productprocessing industries, creating more employment opportunities for the rural population, and bettering the farmers' livelihood, and (d) continuing to emphasize population stabilization through family planning, hoping to reduce the natural rate of population increase from 28.80 per thousand in 1964 to 15 per thousand within the next ten years.

Factors Contributing to Agricultural Development

Why has it been possible for Taiwan to achieve such a rapid agricultural growth in the last 15 years? The factors that have contributed to this phenomenal development are of various kinds and they complement each other to bring about that happy result. The most vital factors may be grouped under several headings: (1) resources endowment, (2) technological factors, (3) organizational factors, (4) economic incentives, and (5) human factors. Let us say something about each.

The resources endowment of Taiwan is only moderate, as described in previous paragraphs, and does not require

any further elaboration here.

Agricultural technological improvements on Taiwan introduced through substantial capital investments have boosted the productivity of agriculture in Taiwan. Advantage has been taken of the tropical climate to develop systems of multiple cropping with three, four, or in some cases, even five harvests a year. Based on research, experiments and field demonstrations, and widely adopted by farmers, these technical improvements include those made in (a) plant industry—with improved varieties, cultural methods, and systems of multiple

Launching of a new fishing vessel built with fishery loan.





Dairy cattle contest.



Demonstration of the application of insecticide to aboriginal farmers.

cropping, and better use of irrigation water, chemical fertilizers, and pesticides, and better utilization of foothills through soil conservation practices; (b) animal industry-with hybrid hogs and cattle, use of artificial insemination for breeding animals, control of animal diseases, and development of balanced feed and grassland; (c) for estry-with improvement of large-scale nursery management and reforestation, introduction of valuable exotic trees, an aerial survey of forest resources and land use through the application of modern aerial photo interpretation and mapping methods; and (d) fisheries-with improvements in the skills of fishermen, motorization, and increase in the number and size of fishing boats for deep-sea and inshore fisheries.

The organizational factors include governmental and farmers' organization structures, research and educational systems, and the organization for channelling the resources and the technology down to the village and farm level for increasing output. There are government agencies relating to agriculture at the national, provincial, county and township levels, and farmers associations at the provincial, county and township levels. The two organizations, JCRR and the farmers' associations, are unique to Taiwan and not found in other countries. JCRR assists the government in planning and coordinating agricultural programs, and cooperates with government agencies and farmers' associations at different levels. The farmers' associations which are multiple-purpose cooperatives, serve as a bridge between the local governments and the farmers, particularly at the township and village levels.

At the national level, the Council for International Economic Cooperation and Development (CIECD) of the Cabinet is a body for economic planning and coordination with the Premier as Chairman, and the heads of the Ministries concerned, Chairman of JCRR and Governor of the Provincial Government as members. With the Minister of Economic Affairs as Chairman and the JCRR Commissioner as Vice

Chairman, the Agricultural Production Committee of CIECD consists of administrators, senior specialists and professors drawn from the Provincial Department of Agriculture and Forestry, the Provincial Food Bureau, the Provincial Water Conservancy Bureau, JCRR and agricultural colleges. We see, therefore, that in agricultural development, there is, on the one hand, a lateral coordination among agencies engaged in agricultural research, extension, marketing, financing, and administration, and, on the other hand, a linear operational coordination among the agencies from the central government down to township offices.

The government has stimulated the farmers' economic incentives through a series of measures, among which the most important are: (a) land reform, (b) supported price of sugar and guaranteed or negotiated prices of tobacco, pineapples, jute and bananas, (c) improved marketing systems of export crops such as bananas, oranges, pineapples, mushrooms and vegetables, (d) adequate supply of farm requisites such as fertilizers, pesticides, farm implements, and feeds through township farmers' associations, and (e) the supply of agricultural credit for production purposes.

The human factors have played a very important role in agricultural development. Four of these are most essential: (a) a progress-oriented stable government, (b) a small group of agricultural leaders with advanced training and long experience who have developed agricultural technology and planned and coordinated agricultural programs, (c) a large number of graduates from agricultural colleges and vocational schools working in government and private organizations for agricultural development, and (d) an intelligent and literate farming population. The great majority of farmers have received at least a primary school education. They are clever, ambitious, industrious and eager to learn new techniques and methods. With the help of agricultural specialists and extension workers, they have improved production and marketing techniques and raised the productivity of land, labor and capital.

Complementary Relationship Among the Various Factors

The above-mentioned factors have not acted independently for the achievement of agricultural development. They complement one another for the maximum effect.

A recent example of the interaction between the different factors is the impact of the improved marketing system on the banana export of Taiwan. Before the improvement of the banana marketing system in April 1963, the banana growers got, as their share, less than half of the export price and, therefore, lost interest in growing the crop. Though they observed the demonstrations on the better use of fertilizers, pest control and cultural improvements conduct ed by the agricultural experimental stations, they did not care to adopt such improved methods. But after the improvement of the marketing system to allow the banana

Loading of bananas and pineapple for export

growers to share 70 percent of the export price, farmers have enthusiastically adopted the improved methods to step up production, thus quadrupling the export value of bananas in 1964. It is expected that US\$60,000,000 of foreign exchange will be earned by banana exports this year (1965).

The case of Taiwan also shows a close interrelationship between the agricultural and industrial sectors in economic development. For instance, the rice variety Taichung 65 had been the most popular variety for about 20 years (1935-1955) during which fertilizers were imported at high prices. The optimum rate of fertilizer application for this variety is 80 kg. of nitrogen, 40 kg. of phosphoric acid, and 40 kg. of potash per hectare. As more and more fertilizers were produced with an accompanying decline in their prices under the three Four-Year Plans, more and more fertilizers were used by fermers to augment their rice yield. It was found, however, that Taichung 65 will show heavy blast and bad lodging at a nitrogen rate of more than 100 kg, per hectare. To correct this deficiency, new rice varieties have been developed that are more resistant to blast and lodging and show good response to heavy fertilization by nitrogen. One of them, Chianung 242, is resistant to blast and lodging and yields most when fertilized at the high rate of 120 kg. of nitrogen, 40 kg. of phosphoric acid, and 40 kg. of potash per hectare for the first crop and 100, 40, 40 kg., respectively, for the second crop. All the new varieties are well received by farmers, and are therefore rapidly replacing Taichung 65.

Applicability of Taiwan's Experience to Other Countries

The remarkable progress in agricultural development achieved by Taiwan has attracted the attention of many countries. By the end of 1964, 1,333 agricultural officers and specialists from Asia, 142 from Africa and 110 from

Latin America had visited this country to familiarize themselves with Taiwan's agricultural progress and accomplishments. During 1960-64, at the invitation of the African governments, the Government of the Republic of China sent farming demonstration teams (composed of 114 members) to Liberia, Libya, the Ivory Coast, Dahomey, Gabon, Ruanda, Senegal, Sierra Leone, Niger and Cameroun, 10 countries in all.

Each farm demonstration team to African countries consists of one or two agriculturalists as team leaders and six to 15 young, experienced farmers who are graduates of agricultural vocational schools. They work with local farmers and have grown rice, sugar cane, vegetables, and other crops in their host countries with notable success. This proves that Taiwan's experiences in crop production are applicable to dveloping nations in tropical and subtropical areas. However, the introduction of crop production techniques is just the beginning of agricultural development. In the light of the natural conditions and resources endowment of each country,

Agriculturists from African countries see the demonstration of a farm machine.



organizational and human factors and economic incentives are equally important for the long-range development of its agriculture.

Problems to be Solved

While the agricultural progress made in Free China in the postwar years has been remarkable, there is an urgent need to further boost the output of farm crops, forestry and fisheries as our economy attains to a higher level of development. Agriculture continues to play an important role in the overall development of the Taiwan economy, in terms of providing adequate food and raw materials and contributing an agricultural surplus for capital formation. However, faced as we are by the continued Communist threat our military burden not only cannot be lightened, but may even become heavier. In spite of the modest beginning we have made in easing the population pressure, we have still to provide added employment opportunities for the expanded labor force, and to provide an adequate food supply and improved diet for the population. The U.S. economic aid to Free China is definitely ending at the end of june 1965 and our economy has to be put on a self-sustained growth basis. The export of primary and processed agricultural products must be stepped up to help the country achieve and maintain a satisfactory foreign trade balance. Under the Fourth Four-Year plan in 1965-1968, the target annual growth rate of agriculture is 4.1 percent. This is a rather high goal we have set for ourselves, but it is the minimum required to meet our economic needs.

One of the prerequisites for agricultural growth is the incessant improvement of farm technology. This can be assured only through an intensification of agricultural research and

education. The agricultural experimental stations in Taiwan have succeeded in making practical improvements without much basic research. For instance, we have bred new varieties of rice, sugar cane, wheat, corn, tobacco, watermelon, and some other crops without cytogenetic study. We have developed better methods of culture, better and more effective use of fertilizers and irrigation water, without any basic research in plant physiology because we do not have the necessary personnel with advanced training. We are being faced with a number of problems which need technological breakthroughs or innovations through fuudamental research to provide a basis for further impovement. The same is true in the fields of food technology, marketing and wood utilization. It must also be emphasized that improved technology can be introduced in agriculture only through new capital investment in both physical and human capital. JCRR, together with other agencies, will continue to help attracting domestic and foreign investment in Taiwan's agriculture. For technological development itself, we must call on educational institutions in this country for assistance.

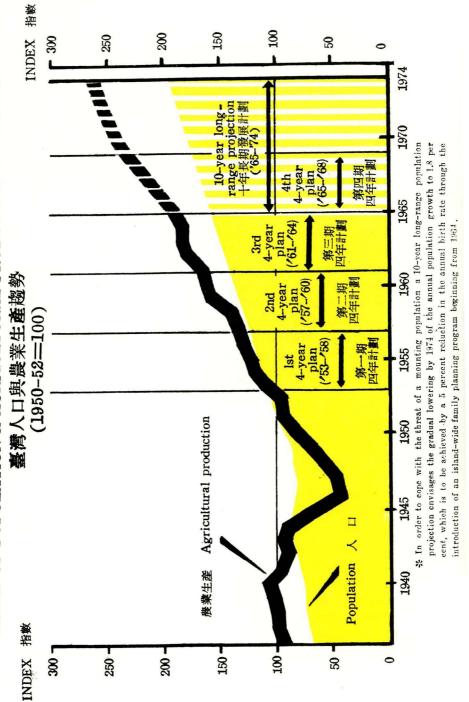
We hope that arrangements can be made with private foundations, land grant colleges, and government agencies in friendly countries for sending visiting professors or consultants to Taiwan to help develop research and train our students and also for offering scholarships to our technicians for advanced studies abroad. In this meaningful work the Joint Commission on Rural Reconstruction can serve as a cooperating agency with foreign institutions.

In this connection I should like to point out that, in view of the need for the further development of agriculture in Taiwan and of the useful services JCRR has performed in the past, the Chinese and American Governments have decided to maintain this bi-national organization for a period beyond June 30, 1965, but on a reduced operational scale and with some revision in the character of its program and staff

pattern. To cover the future operational cost of JCRR, proper arrangements have been made for the utilization of the local currency generated as a consequence of U.S. assistance in the past. Any technical assistance which American and other foreign research organizations, institutions of higher learning, particularly colleges of agriculture, and governmental agencies can render us in the coming years will not only help Free China to further develop her agriculture but also enable her to extend more technical assistance to developing countries, especially those in Africa.

TREND OF POPULATION & AGRICULTURAL PRODUCTION IN TAIWAN

Figure 1 B-



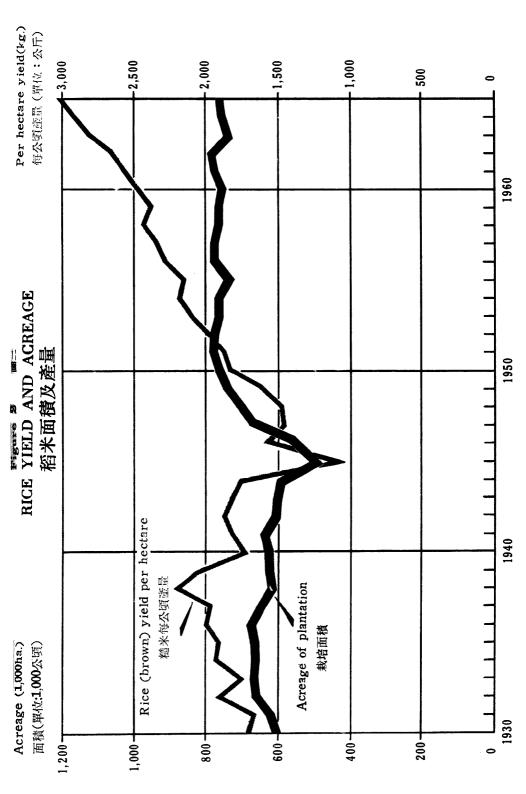
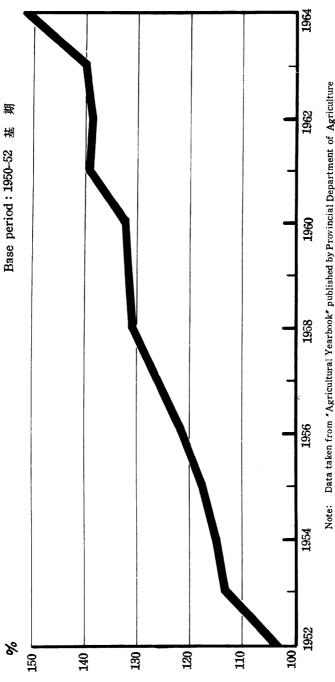


Figure 3 國三

AGGREGATE INDEX OF CROP YIELDS PER HECTARE 臺灣農作物單位面積產量綜合指數



and Forestry. Per hectare yields of seventy-six crops were used to compute the aggregate

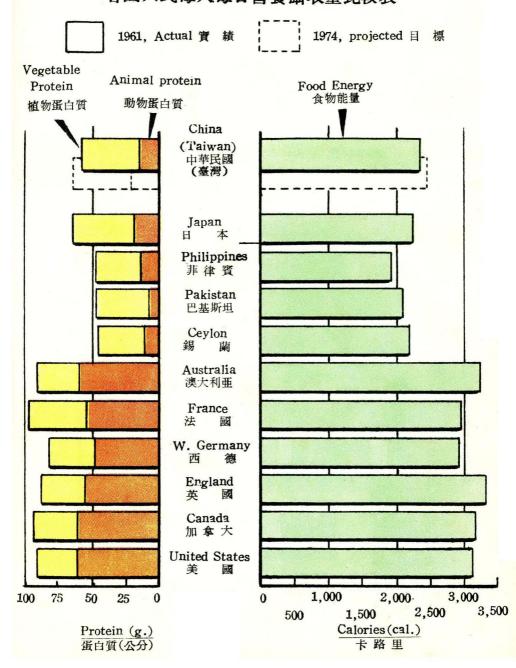
index with the formula:

某一年度作物單位面積產量綜合指數 转種作物基期之產量 上表係根據 七十六種作物單位面積產 體並照下列公式計算而得 $\cdot 1 = \frac{E \log \Sigma}{E \log \Sigma}$ I Aggregate index of per hectare crop yields for any given year, Vor.......Production value of each crop in the base period, 1930-52.

某一作物基期之單位產量 某一作物在某一年度之單位產量 Yo Per hectare yield of an individual crop in the base period, 1950-52. Y1.......Per hectare yield of an individual crop in any given year.

Figure 4 圖四

FOOD SUPPLY COMPARISON OF PER CAPITA DAILY NUTRIENT INTAKE IN SELECTED COUNTRIES 各國人民每人每日營養攝取量比較表



AGRICULTURAL EXPORTS & IMPORTS OF TAIWAN Figure 5

