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ECONOMIC DEVELOPMENT OF AGRICULTURE IN TAIWAN

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This report is condensed from a study of "Factors Associated with Differences and Changes in Agricultural Production," by Dr. David H. Spaeth, formerly with the Economic Research Service. This study was conducted under a participating agency agreement between the Economic Research Service, U.S. Department of Agriculture, and the U.S. Agency for International Development.

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ECONOMIC DEVELOPMENT OF AGRICULTURE IN TAIWAN

INTRODUCTION

To the social scientist who seeks to explain the process of economic development, Taiwan is a paradox. Situated 90 miles off the coast of south China astride the Tropic of Cancer, the island has a subtropical climate. High rainfall coupled with high temperatures leads to rapid oxidation of organic matter, severe leaching of plant nutrients and laterization processes. These conditions yield hard, tight soils of low natural fertility. Mineral resources, especially fossil fuels and metallic ores, are limited. Natural disasters such as earthquakes occur frequently, and an average of three to four typhoons rake the island each year.

The rate of population growth and the current density of population of the inhabited areas are among the highest in the world. Farms are small; farm families are large. In ethnic characteristics, religion, and other cultural features, Taiwan is closely related to other parts of Asia which have yet to emerge as areas of significant and sustained growth.

Against its limited resource endowment and high population pressures, Taiwan appears as a focal point of adversity; a place where one would least expect to find sustained economic development. But Taiwan has progressed. Over a period of 50 years, its economy has emerged from a relatively backward state, characteristic of much of Asia, to achieve a highly productive agricultural and rapidly expanding industrial capacity.

This report covers the major findings of a study undertaken to unravel this paradox of agricultural modernization under conditions most likely to inhibit such progress. The study was initiated in the belief that an understanding of Taiwan's agricultural development will hold important lessons that can be applied to the problems of modernizing agriculture in other underdeveloped regions of the world. Therefore, emphasis is placed on the organizational or institutional conditions necessary for implementing and increasing motivation for progress. In general, this study addresses itself to three questions: (a) what changes in agricultural output took place in Taiwan, (b) how were increases in production and productivity achieved, and (c) what changes in the arrangements between people were necessary to achieve these?

HOW OUTPUT AND PRODUCTIVITY CHANGED

The changes in agricultural output that took place in Taiwan, the subject of the first question, are illustrated by the following statistics: An index of output, constructed on a 1935-37 base, indicates a long-term (1910-60) average annual growth rate of 2.7 percent. During the first period of reconstruction, 1945-52, there was an average annual growth rate of 12.9 percent, with 4.0 percent in the second period, 1952-60. A comparison of the index of output with the annual rates of population growth, which averaged 2.4 percent from 1910-60 and ranged from 3.3 to 3.8 percent since 1952, shows that Taiwan agricultural output has outpaced its population growth both from the long-term point of view and since the end of the reconstruction period (table 1 and fig. 1).

Table 1.--Average annual growth rate of agricultural output in different stages of agricultural development in Taiwan, 1910-60

Stage of agricultural development in Taiwan	Period	Average annual growth rate of agricultural output	Average annual growth rate of total population
		Percent	Percent
Initial stage under Japanese colonial rule	1910-20	1.7	1.4
Continued development under Japanese colonial rule	1920-39	4.2	2.4
Development during World War II	1939-45	-12.3	0.5
Recovery & rehabilitation stage after World War II	1945-52	12.9	4.9
Further development after the rehabilitation stage	1952-60	4.0	3.6
Prewar period	1910-39	3.3	2.0
Postwar period	1945-60	8.1	4.2
Whole period	1910-60	2.7	2.4

Source: Chinese-American Joint Commission on Rural Reconstruction (JCRR).

INDEX OF AGGREGATE AGRICULTURAL OUTPUT IN TAIWAN

Base Period, 1935-37

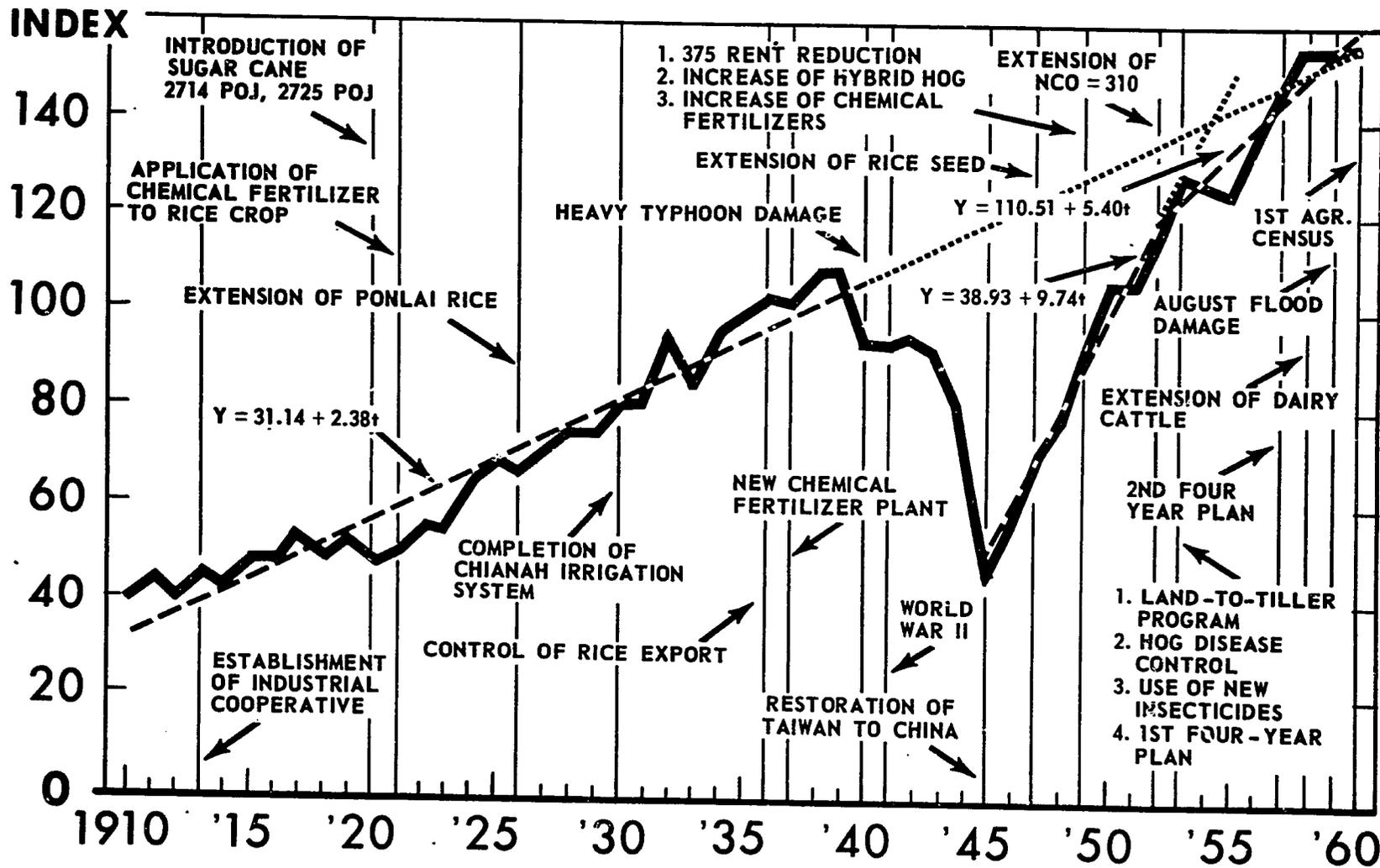


Figure 1

The aggregate increase in output can also be identified. Since the 1911-15 period, the total output of food (including livestock) has not fallen below 97 percent and livestock has not exceeded 15 percent of the total output (table 2 and fig. 2). Rice, sweet potatoes, and sugarcane have accounted for over 70 percent of the total crop area over most of this period. The statistics show that growth in aggregate agricultural output has increased and that this growth stems from increases in the output of comparatively few food crops.

One explanation for these changes in output can be found by looking at the aggregate measure of inputs. It can be seen that output per unit of input increased; therefore, output increases were achieved by combining inputs more efficiently through time (Appendix table 2).

Taiwan's agricultural output was achieved mainly by supplying an increasing number of nutrients to plants or animals of better genetic capacity, per unit of plant area and time. The production process was carried on in a constantly improved environment, with the product increasingly protected from loss due to disease and pests.

The dominant feature of the physical environment for agricultural output in Taiwan is that the total land area available for cultivation has been relatively fixed since 1935 (fig. 3). Therefore, it was necessary for the Taiwanese to resort to land-substitution methods to increase agricultural output. These methods included multiple cropping, increasing the density of plants and animals per hectare, and development of more rapidly maturing varieties and intertillage.

Although agricultural output is the direct result of a combination of physical resources, labor is needed to manipulate the resources. This introduces the matter of how human agents performed in relation to the physiological processes which linked resource use to output. Labor is not considered as an input to a rice plant; but as labor is required to grow rice, it thereby enters the production process. Appendix tables 3 and 4 show the changes in use of resources in relation to agricultural production in Taiwan since 1935. The sharp rise in working capital indicates that increased amounts of working capital--fertilizers, pesticides, etc.--were required to increase output over time.

The increasing difference between the cultivated-land area and crop area was the result of an increase in multiple-cropping practices. A comparison of the number of agricultural workers with labor input (man-days) indicates that the agricultural labor force worked more days per year as the intensity of fertilizer and water use increased and improved varieties were developed (fig. 4). Variations in the input mix (fig. 5) indicate the substitution of working capital for land and the relatively constant

Table 2.--Percentage distribution of crops and livestock in total agricultural output, Taiwan, 1911-60

Food commodities	1911-15:	1916-20:	1921-25:	1926-30:	1931-35:	1936-40:	1941-45:	1946-50:	1951-55:	1956-60
	<u>Percent</u>									
Main food:										
Common.....	61.44	55.25	55.04	54.01	56.13	52.26	52.58	58.43	55.43	51.92
Substitute.....	7.42	6.87	7.23	7.13	7.01	6.64	7.73	10.38	8.24	8.26
Auxiliary food:										
Beans.....	1.35	1.14	0.79	0.53	0.40	0.31	0.36	0.85	0.98	1.51
Vegetables.....	-----	0.96	2.89	3.43	3.66	3.42	3.56	5.25	4.41	4.16
Fruits.....	0.97	1.54	2.86	3.13	3.56	3.71	3.12	2.80	1.95	2.16
Miscellaneous (including sugar)....	15.09	20.43	18.31	19.19	17.11	21.48	22.83	12.95	14.25	15.04
Meat, livestock, and poultry products	13.11	13.22	12.33	12.05	11.58	11.33	8.94	8.20	12.19	14.48
Total food.....	99.38	99.41	99.45	99.47	99.45	99.15	99.12	99.86	97.45	97.53
Fiber crops.....	0.50	0.48	0.47	0.44	0.48	0.77	0.72	0.64	0.86	0.97
Special crops.....	0.12	0.11	0.08	0.09	0.07	0.08	0.16	0.50	1.69	1.50
Total output.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

5

INDICES OF MAJOR CROPS AND LIVESTOCK PRODUCTION, TAIWAN

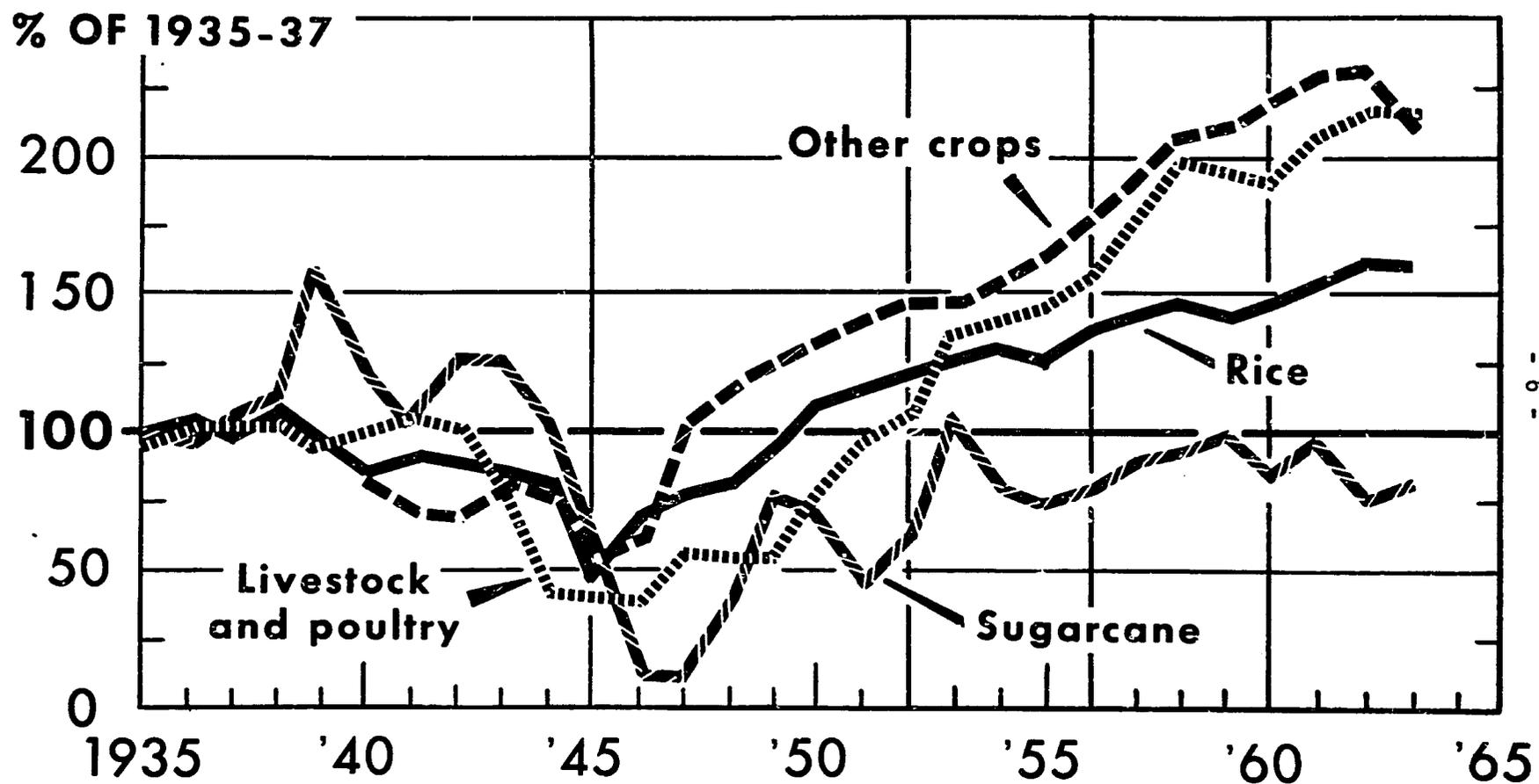


Figure 2

INDICES OF CROP AREA AND AGRICULTURAL LAND AREA IN TAIWAN

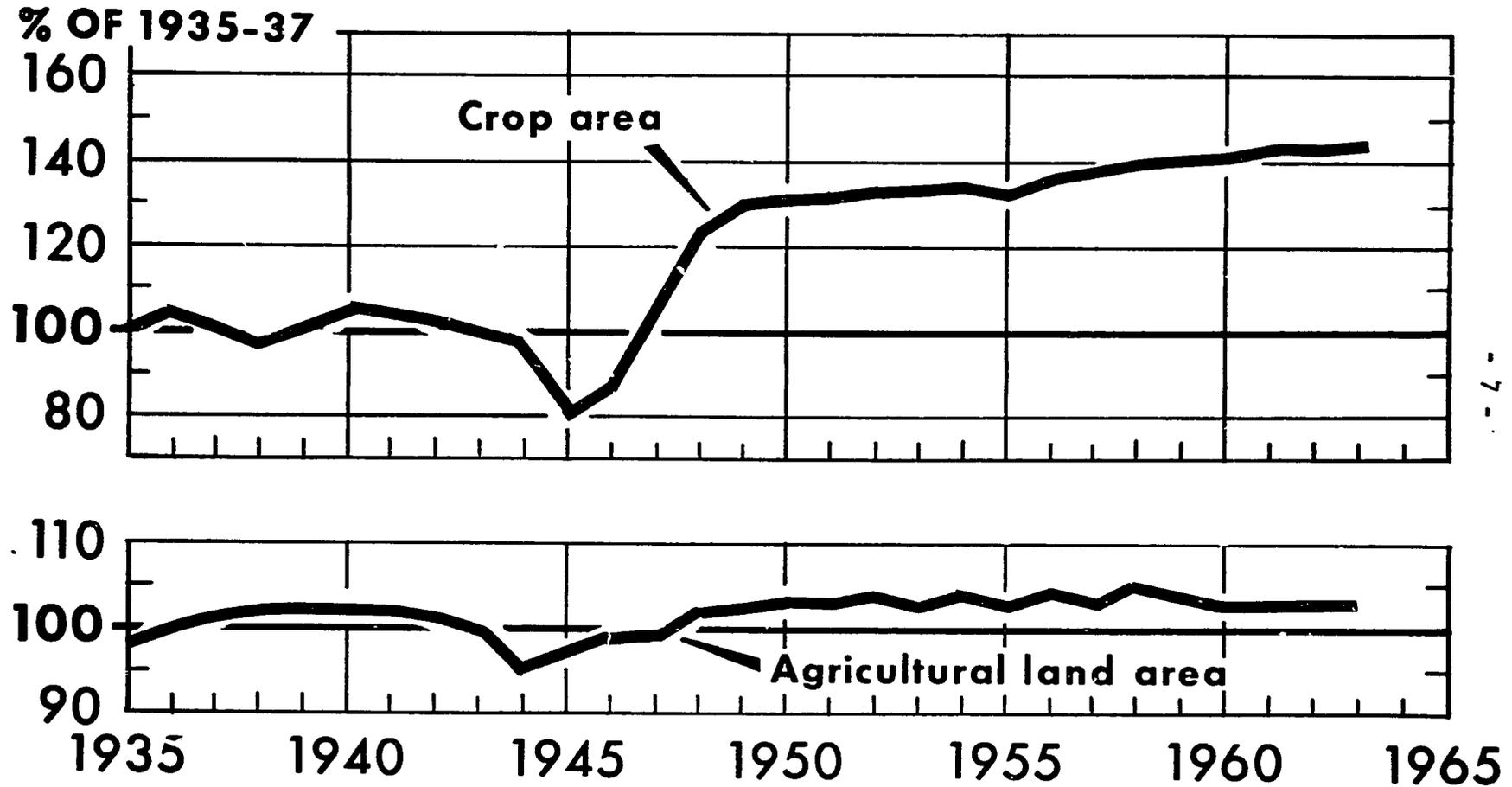


Figure 3

INDICES OF NUMBER OF AGRICULTURAL WORKERS AND LABOR INPUT IN TAIWAN

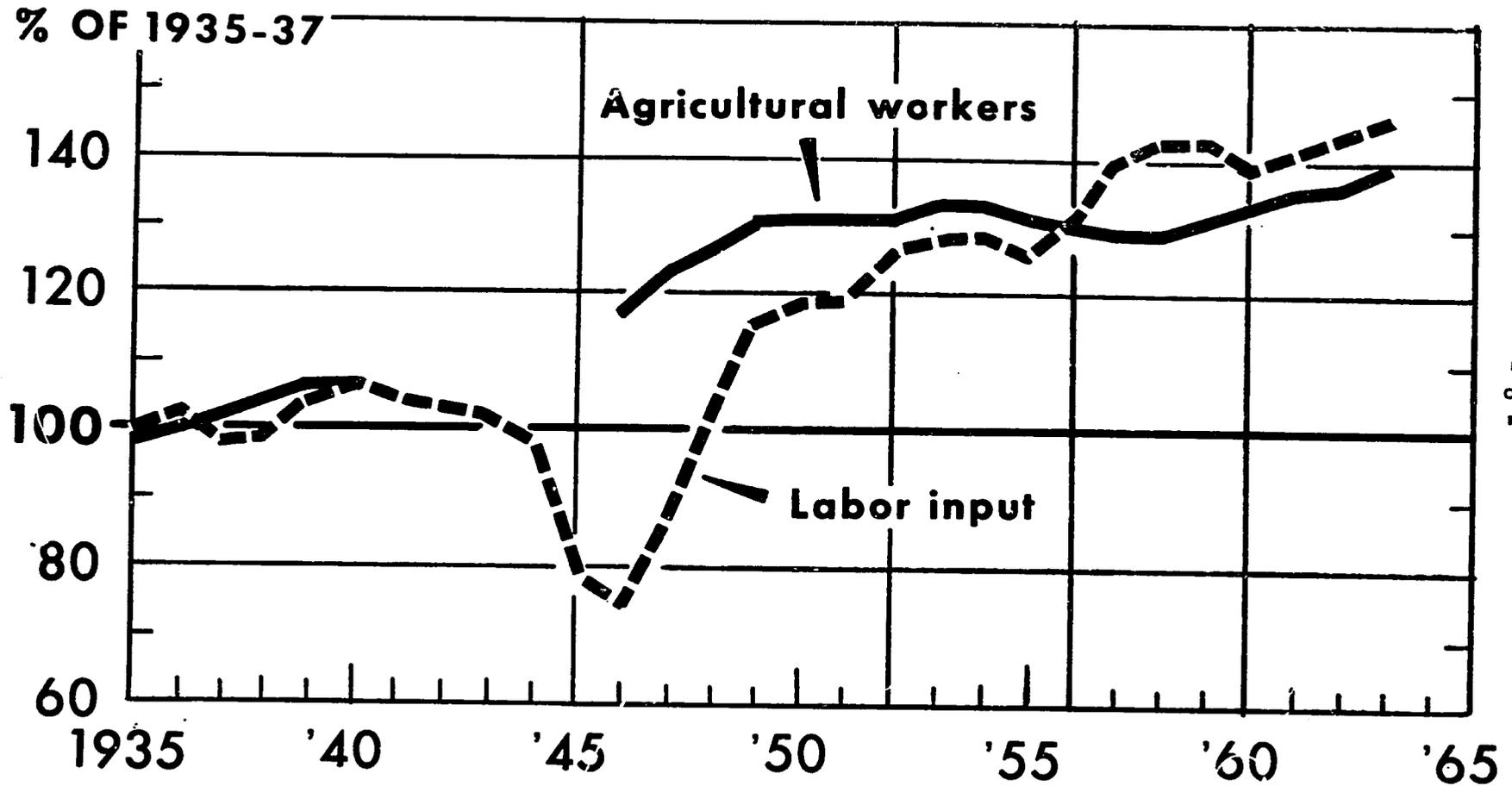


Figure 4

PERCENTAGE DISTRIBUTION OF INPUT CATEGORIES IN TAIWAN AGRICULTURE

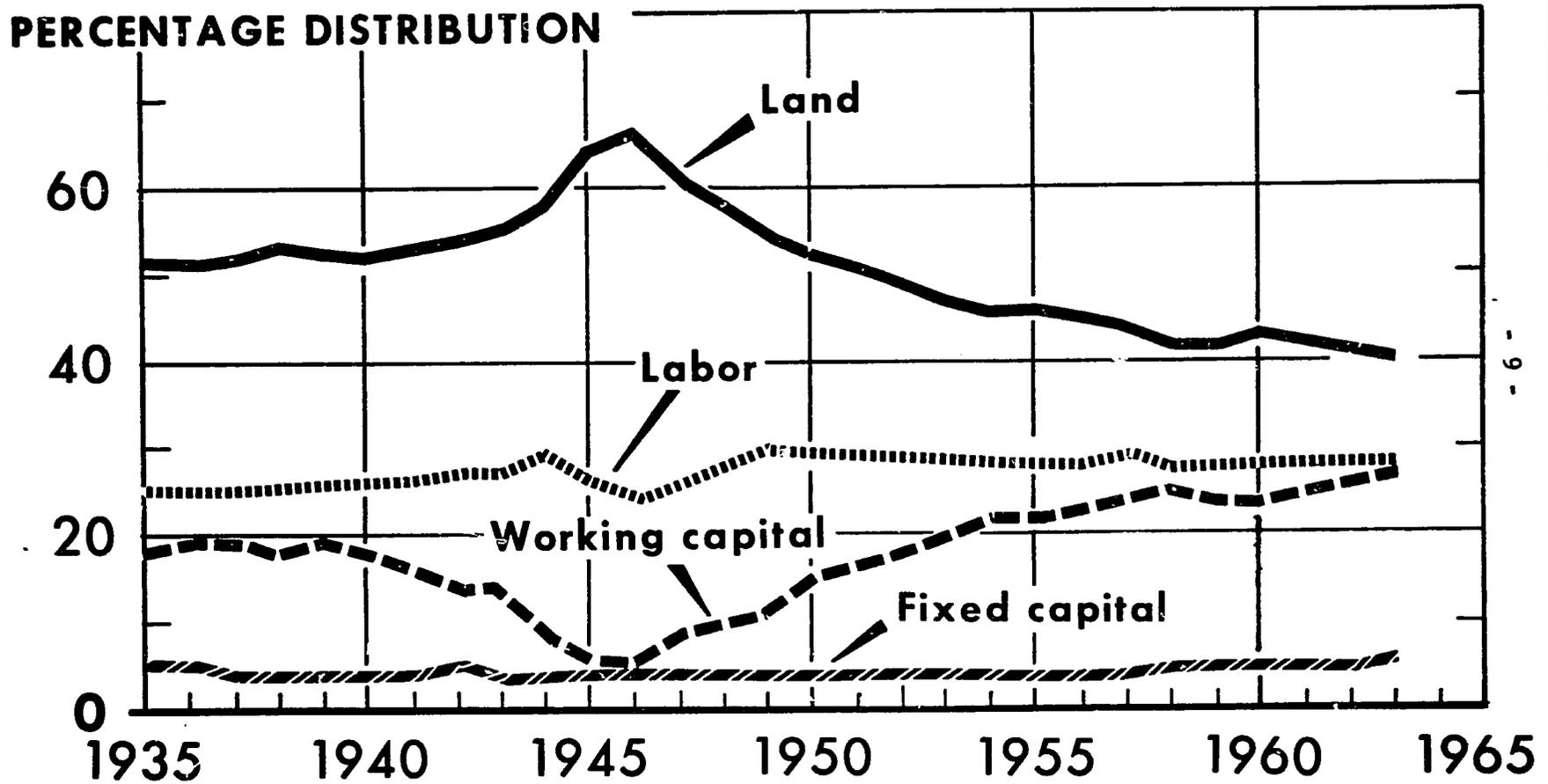


Figure 5

proportions of labor and fixed capital. By computing the area of land used, man-days of work, and working and fixed capital (in constant dollars), it is possible to compare individual resource inputs with the aggregate output and to measure output per unit of the individual resources (Appendix table 5 and fig. 6).

From this, it is seen that the notable features in Taiwan agriculture were the sharp rise of land productivity accompanied by sharp declines in the productivity of capital. Labor productivity and crop-area productivity increased together while productivity per farm worker increased at a faster rate than productivity per man-day. That is, capital input coupled with intensified land use allowed farmers to work harder and more effectively. Under Taiwan's severe geographic limitations and rapid population growth, additional increases in both labor and land productivity depended heavily on increased inputs of both fixed and working capital.

Separating inputs into land, labor, working capital, and fixed capital, it is seen that a relatively fixed land area was combined with slowly increasing amounts of labor and fixed capital and greatly increased amounts of working capital to achieve increases in output. Since working capital is a measure of the use of such things as improved seeds, fertilizers, irrigation service, and pesticides, attention is drawn immediately to technological innovation rather than increases in labor, land, and accumulated fixed capital as a significant direct cause of increased agricultural output (fig. 7).

TECHNOLOGICAL INNOVATION

Agricultural changes in Taiwan employed both known technology and the development and adoption of new technology. A pattern of technological innovation developed in the post-World War II recovery period that was similar to colonial development strategy. This pattern proceeded in the following manner. First, the best available technology was systematically sought out, demonstrated, and put into use by persuasion, subsidy, and if necessary, penalty. Second, external or foreign technology was examined for those materials, breeds, implements, pesticides, and practices which could be directly applied. Third and simultaneously, basic and adaptive research facilities were activated to undertake long-term agronomic, engineering, and medical research. Distribution of technology was achieved by means of demonstrations and intensive extension activity.

Irrigation was the critical factor affecting land utilization and multiple cropping since rainfall in Taiwan is not distributed uniformly throughout the year. In addition to increased irrigation facilities, research led to the development of a system of rotational irrigation.

INDICES OF LAND, LABOR, AND CAPITAL PRODUCTIVITY IN TAIWAN

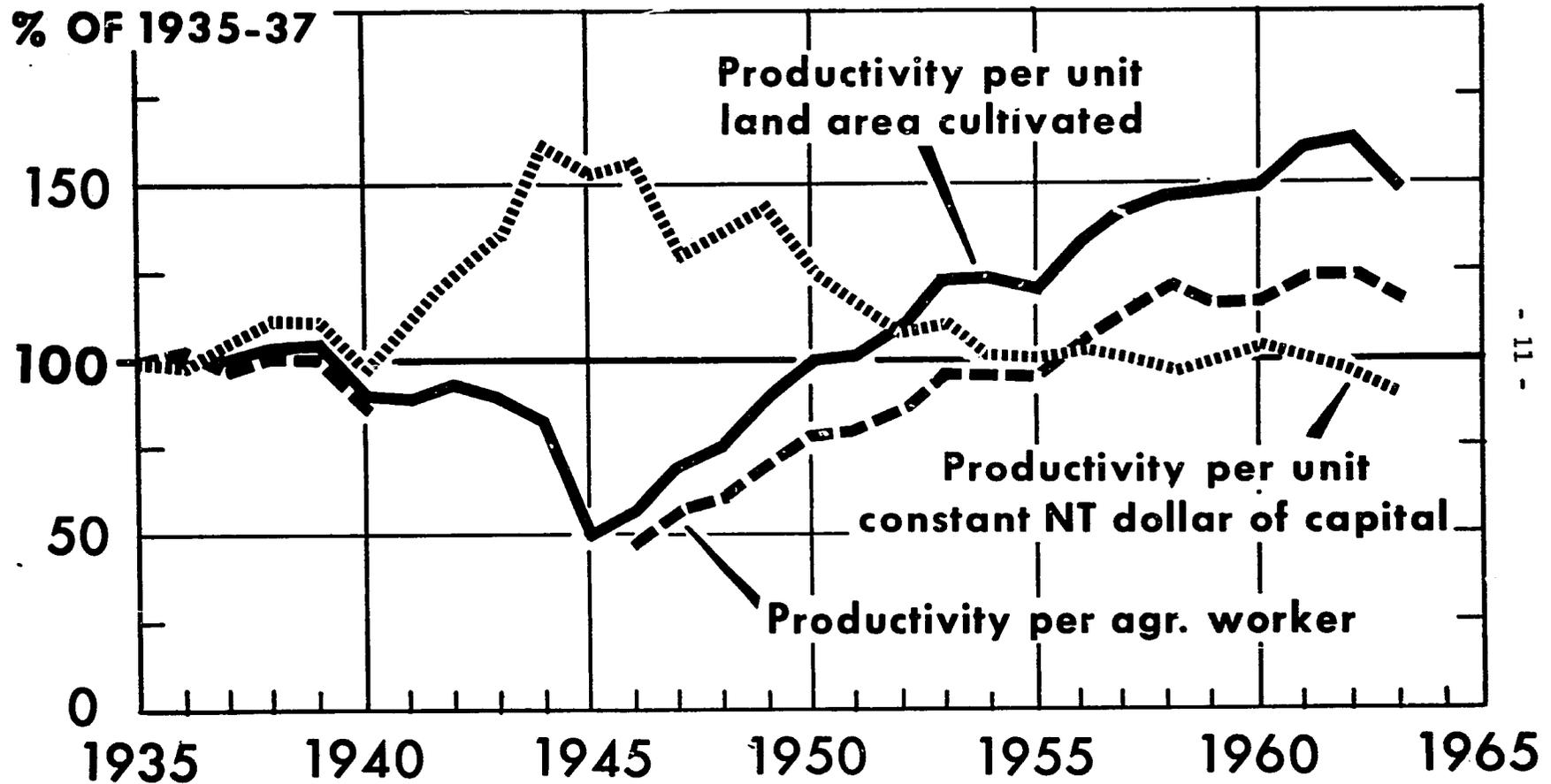


Figure 6

INDICES OF FIXED AND WORKING CAPITAL IN TAIWAN AGRICULTURE

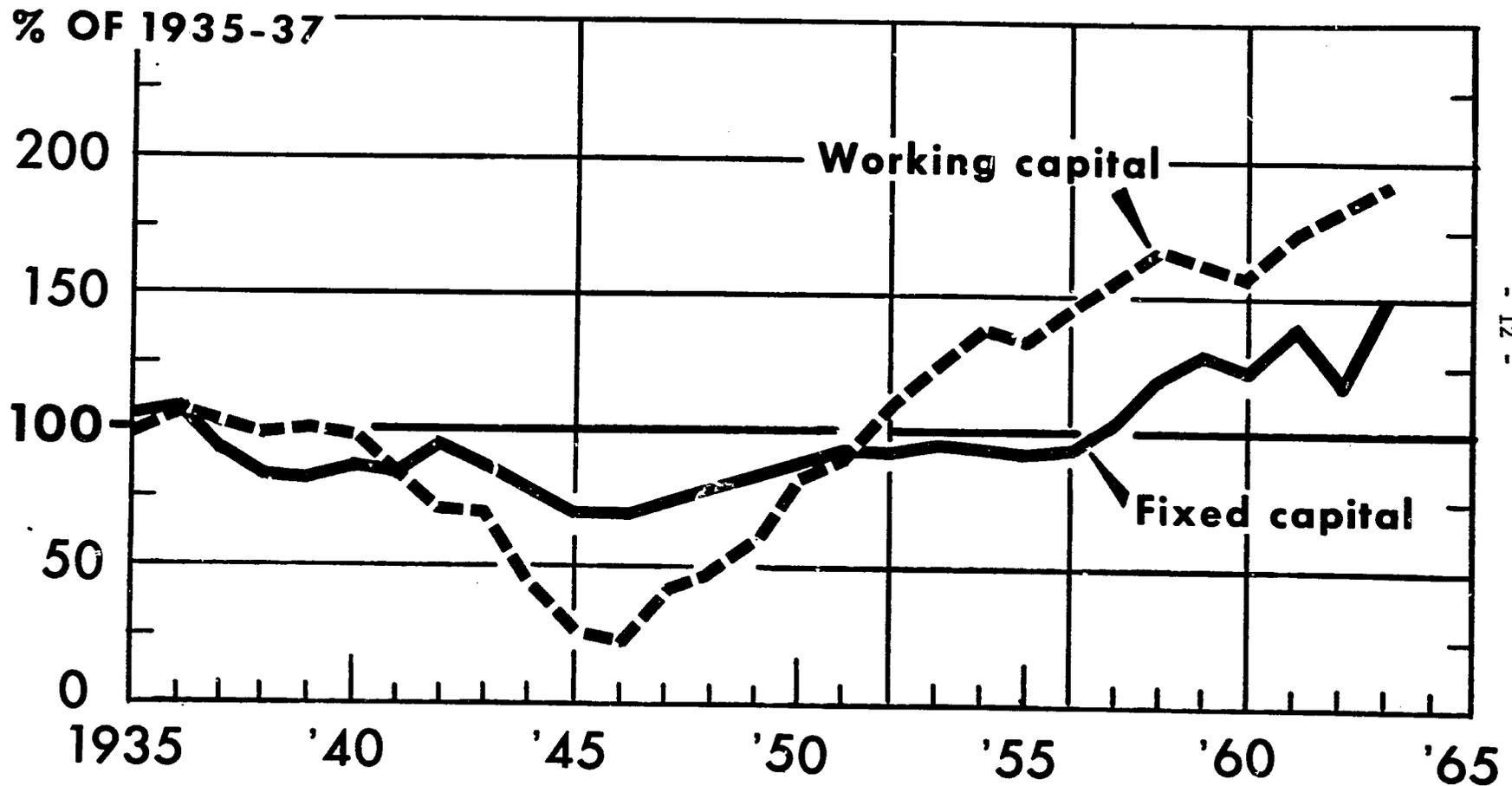


Figure 7

This resulted in reducing water needs by 20 to 50 percent which, in turn, allowed a larger area to be irrigated. An analysis of crop production with and without irrigation showed that a 1-percent increase in irrigated acreage resulted in 1.16-percent increase in multiple cropping index, or an increase in value of agricultural products of 10 million U.S. dollars per year.

Increased water for irrigation in the fifties resulted from new dam construction as well as the improvement of existing dams. Also, drilled wells came into greater use. Multiple-purpose reservoirs were planned in 1957-60 to conserve water for irrigation, to control damage by floods, and to supply power for industry.

Increases in the level of irrigation services and improvements in crop varieties expanded the capacity of various crops to efficiently use higher levels of fertilizer inputs which, in turn, increased yields. In 1963, the use of fertilizer was nearly 15 times that of the 1911-15 period.

The efficiency with which the physiological processes transform nutrients into products is seriously affected by disease, insects, and pest damage. After World War II, pesticides were used extensively in Taiwan. Nonchemical pest control methods used included breeding for resistance to disease and insect damage and timing of cultural practices to control buildup and to avoid peak periods of insect infestation.

In addition to using greater quantities of fertilizer, pesticides, and water, further increases in yield were achieved by improving the physiological environment with respect to the requirements of each crop. This was achieved in part by adaptation of crops through breeding to sub-areas within Taiwan, and also by improving cultivation practices.

The changes described above took place in conjunction with the development of new and improved plant varieties. In several cases, initial attempts to increase yields by manipulation of inputs preceded or led to increased plant breeding activity; and the capacity of new varieties to absorb inputs led to the expansion of water and fertilizer supplies. The outstanding example was the development of Ponlai (Japonica) rice in Taiwan, which was released in 1923. The key factor involved was the selective breeding of plants that would adapt to the climatic conditions of Taiwan rather than Japan. While initial yields from this variety dropped sharply with extension of the variety, the higher value of the rice in Japanese markets encouraged the increased use of irrigation and fertilizer. These, in turn, led directly to expansion of Taiwan irrigation and fertilizer manufacturing capacity. Several new varieties of rice were developed and released by the fifties. In developing new rice varieties, from 7 to 18 years were required from original selec' 00

final release (table 3). By 1963, the four rice varieties released in 1957 accounted for 40 percent of the Ponlai rice area planted. Taichung 1, a native (indica) hybrid released about the same time, accounted for over one-fourth of the planted area of native rice by 1963.

Table 3.--Lead-time for crossbreeding, selection, and releasing improved rice varieties in Taiwan

Variety	Year crossed	Year selected	Year released	Total number of years
Hsinchus 56....:	1939	1943	1957	18
Chianung 242....:	1946	1948	1957	11
Tainan 1.....:	1942	1952	1957	15
Kaohsiung 53....:	1949	1951	1957	8
Taichung 1.....:	1949	1953	1956	7

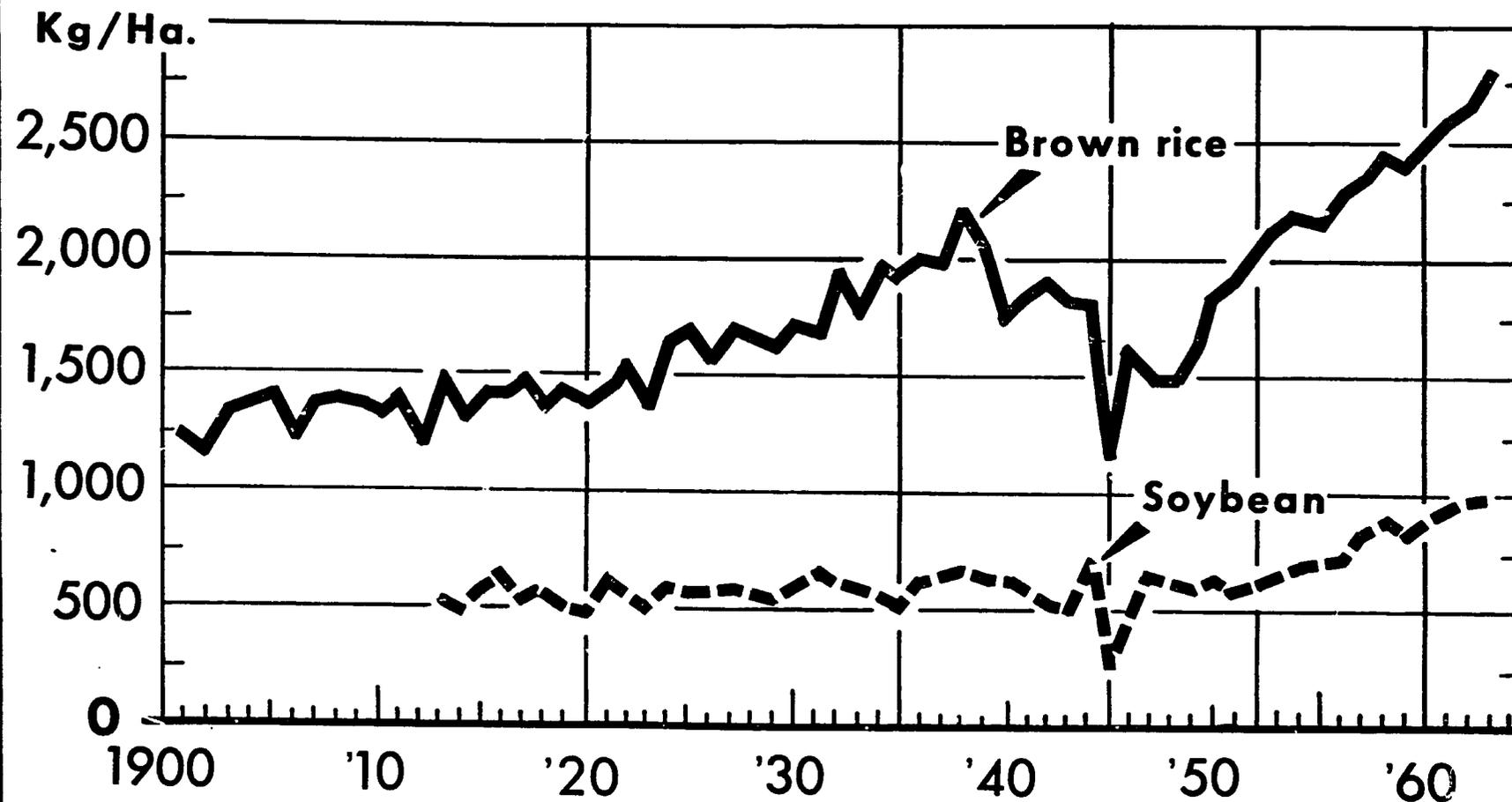
Source: Plant Industry Division, Chinese-American Joint Commission for Rural Reconstruction (JCRR).

As a second example of the impact of varietal change, the development of sugarcane varieties led to acceleration of crop rotations in southern farming areas permitting increased cultivation of cotton, wheat, and soybeans as intertilled catch crops. Cane variety N:Co310, introduced in 1947, had high ratooning capacity, resistance to wind damage and disease, and delayed elongation during the growing period which permitted extensive intertillage. Less area was needed for the propagation of new cuttings, and the growing cycle could be shortened from 18 to 14 months. Research in the sixties emphasized development of canes for poorer soils. This allowed the shifting of more cane production to slopeland, thus releasing paddy land for higher valued crops.

A new soybean variety was introduced from an experiment station in Japan in 1952 and released after 4 years of experiment station trials in Taiwan. Palmetto, an American variety introduced into Taiwan in 1953, was released for commercial planting in 1957. By 1960, this variety had replaced 50 percent of the native varieties grown in the important Koahsiung Pintung area.

As evidence of technological advance, yield increases are noted for all of the major food crops. In the 60-year period brown rice yields increased from 943 to 2,815 kg. per hectare, soybeans increased from 522 to nearly 1,000 kg. per hectare, sugarcane increased from 25,572 to 81,571 kg. per hectare, and sweet potato from 5,169 to 13,717 kg. per hectare (figs. 8, 9, and 10).

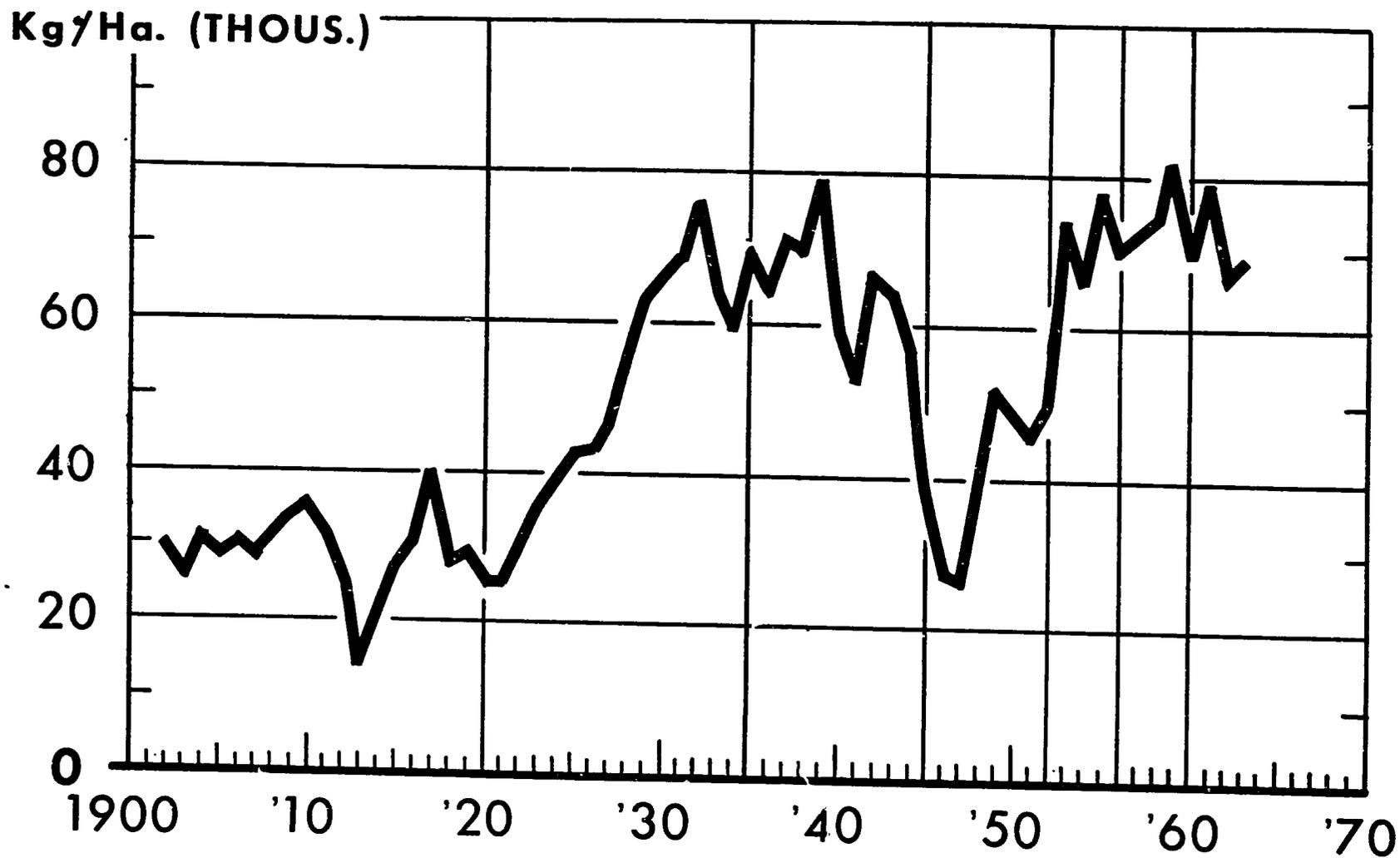
RICE AND SOYBEAN YIELDS IN TAIWAN



- 15 -

Figure 8

SUGARCANE YIELD IN TAIWAN



- 16 -

Figure 9

SWEET POTATO AND VEGETABLE YIELDS IN TAIWAN

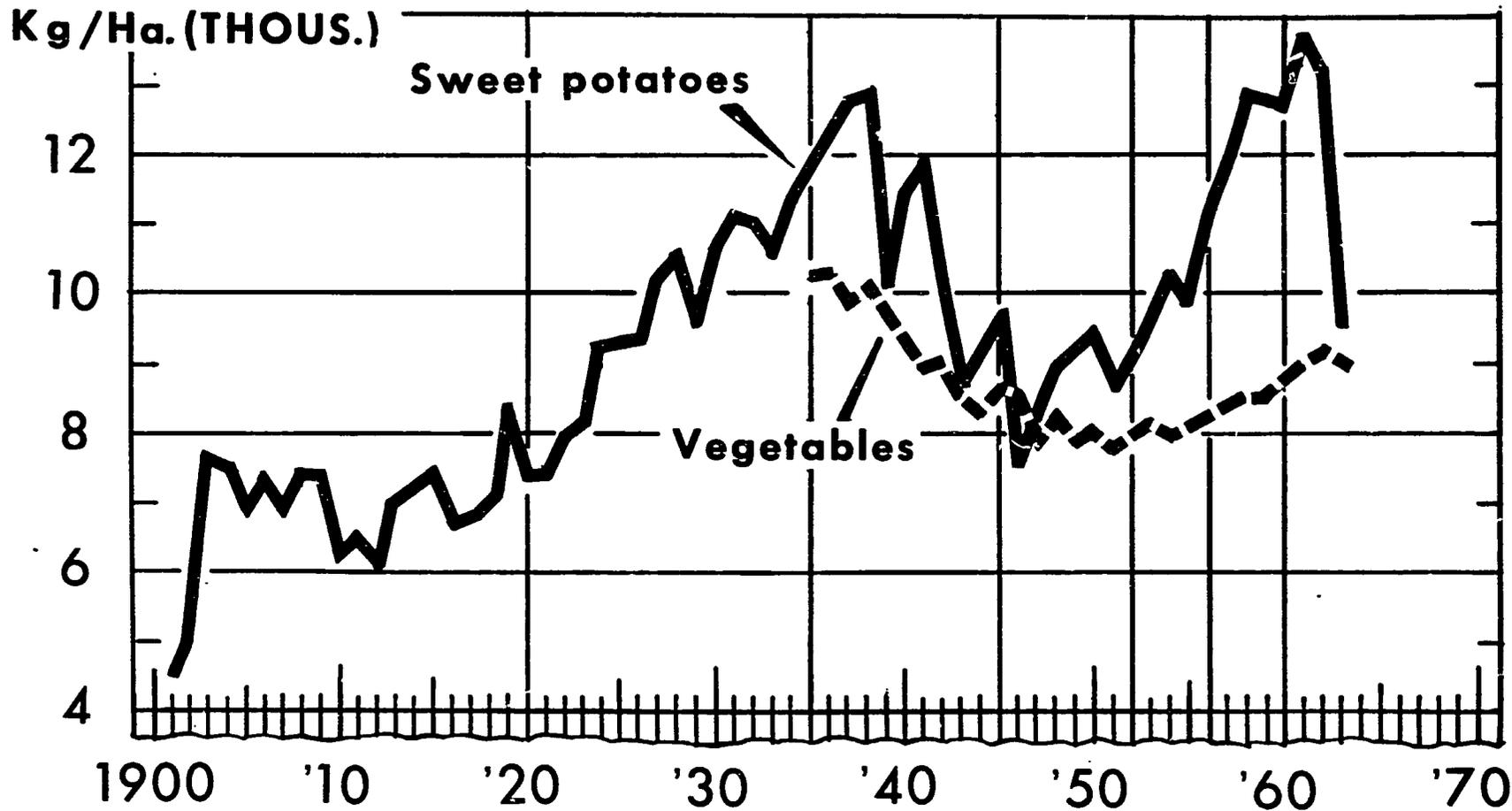


Figure 10

Although new methods of using fertilizer were introduced, the principal emphasis was not on innovation, but on increased application of known methods. One example of new fertilizer technology, however, was the discovery that split applications of nitrogenous fertilizers and potash on rice were more effective in increasing grain yields than single applications. In a more specialized finding, synthetic compost for mushrooms was developed which contributed to the development of the rapidly growing mushroom industry. Also, programs involving the use of calcium cyanimide and lupine-green manure were developed for tea.

While multiple cropping was an established practice in Taiwan by the fifties, the development and improvement of intercropping systems helped farmers to grow new crops in the winter and between crop seasons. Relay planting--the starting of young plants in densely planted nursery beds--was also encouraged. Under this system, crops occupy the land area for a shorter time period. This practice, plus plant breeding and selection for rapid maturity, permitted several crops to be grown in one year.

The first 4-year plan (1952-56) formally recognized that future gains would come from increased use of new technology at the farm level. It was recognized that the gains possible by rebuilding the pre-existing economy had already been largely achieved; therefore, an accelerated program of research and field trials was necessary to further increase production.

Out of the first 4-year plan a commitment to continued research on a long-term basis developed. Foreign advisors and technicians assisted in two ways: bringing to Taiwan an additional body of knowledge and skills, and helping to adapt improved practices to Taiwan conditions.

In addition to foreign advisors and technicians, the Taiwan agricultural development effort was assisted by trained agricultural technicians from Mainland China. While exact numbers and categories of Mainland agricultural people who came to Taiwan in the latter part of 1949 and the early part of 1950 are not available, unofficial estimates made by JCRR officials of the approximate numbers are shown in table 4.

Agricultural extension and information programs had a dual impact: the distribution of information, thus educating farmers regarding new practices; and helping farmers see the possibility of greater economic gain through demonstrations and persuasion. In addition to organized extension efforts, there was also the spontaneous extension process carried on by observation and word-of-mouth. The spontaneous spread of information not only implemented, but may have exceeded organized extension activity in getting farmers to adopt improved practices.

Table 4.--Number and job classifications of Mainland agricultural personnel working in three Taiwan agricultural organizations, 1950

Organization	Employees from		Percentage	Job classification of	
	Mainland China	Taiwan	of Mainland to total	Mainland personnel Technical/ scientific	Adminis- trative
	<u>Number</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Number</u>
Taiwan Provincial Department of Agriculture <u>1</u> /....	1323	2607	34	540	783
Taiwan Provincial Chung Hsing University <u>2</u> /.....	110	57	65	106	4
Joint Commission on Rural Reconstruction <u>3</u> /..	148	46	74	73	75

1/ The Provincial Department of Agriculture conducted administrative work on Taiwan's agriculture for the Government.

2/ Taiwan Provincial Chung Hsing University (College of Agriculture) conducted agricultural education on Taiwan.

3/ Joint Commission on Rural Reconstruction (JCRR) assisted various levels of Government and nongovernment organizations in carrying out agricultural programs, and administered financial aid and technical assistance.

The factors contributing to the successful adoption of technological innovations in Taiwan are summarized below:

1. The acquisition of new agricultural techniques followed the pattern of first identifying and extending the best varieties and techniques in use by the best farmers; second, adapting and adopting practices, animal breeds, and plant varieties from foreign sources; and third, starting and maintaining a continuous adaptation and basic-research effort designed to supply new technology on a continuing long-term basis.

2. The acceleration of basic and adaptive research was achieved by the introduction of a substantial number of agriculturists trained outside the country.

3. The development of technology was conducted, supervised, and coordinated by the Taiwan Government.

4. Technology was extensively demonstrated to a population interested in accumulating assets and, therefore, responsive to money incentives.

RELATION OF NEEDS TO DEVELOPMENT ACTIVITY

The analysis above indicates that even if land and labor are entered as the factors most directly affecting output increases, there are still qualitative changes in these and other factors which must be explained to understand why agricultural production and productivity increased in Taiwan.

There is evidence of causality in the fact that production increases followed changes in and increased use of physical inputs; but there is also evidence of causality in the fact that output increases followed statements of intent by successive controlling governments to increase production. Therefore, the question of why production and productivity increased in Taiwan can be answered by saying that the physiological requirements for increased output were recognized and understood by government planners who intended that output would in fact increase.

The problem of systematically exploring matters of motivation, valuation, and innovation behind the Taiwan experience is approached by recognizing the needs of people, both individually and as a group. In this process, it is assumed that all activity is purposeful, including inaction.

Taiwan underwent successive changes in the needs imposed on its agriculture. These needs progressed from the remote tribute and defense demands of the Ching Imperial Court to the more narrow food and sugar needs of Japan, culminating in the wartime demands of Japan. After retrocession to China, the needs of a rapidly expanding population had to be met along with the possibilities of expansion of agricultural exports in the world market.

These needs and the policies derived to meet them were of paramount importance in Taiwan's agricultural development. The fact remains, however, that farm production is achieved largely by the efforts of individuals acting in response to their own needs. Often governmental needs are not recognized as such by individual producers; instead they respond to the demands of their families, their peers, local tax collectors, and to market opportunities.

In the period 1945-48, food shortages in Taiwan led to immediate steps to restore production of major food crops. This, in turn, led to efforts to restore irrigation services and fertilizer supplies. The need to stabilize the price of basic foods led to a program to increase the production of food crops, especially rice. Rice was needed to feed the army and for payments-in-kind as wages to civil servants and teachers. This, in turn, led to the compulsory sale of rice to the Food Bureau, rice-fertilizer barter programs, and tax payments-in-kind through which the Government obtained 30 percent of the rice crop.

The need to earn foreign exchange led to increased production of export crops such as pineapples and tea, and adjustment of sugar production to world demand. The need to conserve foreign exchange led to programs to produce or increase the production of import-replacing crops such as wheat, soybeans, jute and fish.

INCENTIVE FORCES

The following is a discussion of three principal sets of factors that acted to determine action choices by Taiwan farmers: (1) the market mechanism, (2) allocations by the Government, and (3) nonmarket Government action in the form of subsidies, selective use of credit, and tax strategy.

The mechanism of market demand acted as an incentive force in shifting farmer-values and, thus, farmer-action choices toward adopting those practices which resulted in increased agricultural output and productivity. For example, when knowledge of the creation of a new demand for an export crop was passed to the producer via market channels and price mechanisms, the producer responded by supplying the product.

In the post-World War II period, the allocation of inputs to major crops was directly controlled by the Government. For example, supplies of essential inputs, such as water and fertilizer, were controlled by the Government and allotted to specific crops, such as rice and sugar, to encourage increased output of these crops.

Important nonmarket pressures that influenced farmer-decisions in Taiwan included subsidies, selective credit, and tax strategy. These, however, acted primarily through the marketplace. That is, the Government used the various tax, barter, and subsidy devices to manipulate and set prices. Also, since there was an effective land tax, even subsistence farmers had to sell some of their output to pay the tax. While indirect control of major crops was also achieved by creating public or Government-owned processing corporations, strategically placed allocations and non-market pressures were the prime mechanisms of Government control.

By 1950, prewar peak per capita consumption levels for calories and protein were regained for a much larger population. The manner in which output was increased to permit this level of consumption established patterns of nonmarket demand influences that still exist. These programs are discussed in the following paragraphs.

Choices by farmers in the 1945-52 recovery and rehabilitation period were largely conditioned by their access to such key resources as water and fertilizer. The market for rice was brought under increasing control as a result of inflation in 1948, and by 1952 had become the basis for the Taiwan currency.

Extreme shifts in fertilizer allocation between sugarcane and other food crops began in 1947 when the impact of the refugees, inflation, and the need to feed 600,000 soldiers was felt by Taiwan's farmers (table 5).

Table 5.--Fertilizer distribution to main crops 1935-52

Year	Rice	Sugarcane	Others	Total
-----Metric tons-----				
1935	320,954	111,239	102,731	534,924
1936	362,523	124,244	117,439	604,206
1937	373,265	164,699	84,145	622,109
1938	389,334	176,100	83,456	648,890
1939	351,088	179,923	54,137	585,148
1940	297,110	116,546	81,528	495,184
1941	269,739	88,323	91,504	449,566
1942	226,843	67,557	83,672	378,702
1943	227,991	63,661	34,050	325,702
1944	77,047	11,127	21,894	110,068
1945	1,958	3,831	-----	5,789
1946	4,181	21,821	4,63	30,639
1947	59,446	47,415	27,163	134,024
1948	64,000	62,559	2,225	128,784
1949	100,962	49,692	2,616	153,270
1950	231,765	53,971	3,793	289,529
1951	279,857	73,812	14,842	368,511
1952	362,117	84,262	24,060	470,439

Source: P. I. D., JCRR.

Two practices established in the 1946-48 period and formalized by the Provincial Food Bureau in 1949 had important effects on farmers choices between alternative crop plans. First, the Provincial Government assumed control of all fertilizer supplies imported by the Provincial Government, United Nations Relief and Rehabilitation Administration (UNRRA) and United States Economic Cooperation Administration. Later, the entire domestic output of new and rehabilitated fertilizer plants was channeled to Government-owned corporations such as the Taiwan Sugar Company, or to the Food Bureau.

Second, as a credit and anti-inflation measure, initial fertilizer supplies were bartered for paddy (unhulled rice). Under the Food Bureau, the rice-fertilizer barter continued at fixed rates that undervalued rice. Through mandatory selling at Government prices, controlling fertilizer sales, and requiring taxes on rice paddy land to be paid in rice, the Government acquired ownership each year of 30 percent of the rice supply. What started as a rationing device became a tax. Water supplies were quickly restored and control of water supplies remained in the control of the irrigation associations.

In general, the demand mechanism in the postwar period was essentially a free market system except for Government manipulation of fertilizer and water--essential inputs for efficient production of the main staple, rice. The rice-fertilizer barter scheme was the heart of this extra-market control. Beyond this, the primary constraint up to 1952 was the availability of resources, especially working capital.

The problems of restoring food production and meeting existing export demands were largely solved by 1952. From this time, the focus shifted to reorganizing agriculture to meet three general targets: adequate food supplies to stabilize prices; expansion of production-export crops; and expansion of import-substitution crops, especially for livestock and fishery imports.

A full range of farm supplies, improved marketing services, and expanded credit were becoming available through farmer associations. Hence, relative prices between inputs and outputs, stabilized by supply contracts, were the main factors that determined the relative profits from alternative production plans. In the periods 1911-15 to 1956-60 except for fertilizer, prices of farm production supplies and interest rates advanced more rapidly than wages and rental rates of land (table 6). The price ratio between capital and labor was such that it did not provide incentive to substitute capital for labor. Although land reform by reducing rental rates provided a price incentive to substitute land for capital, this possibility was greatly limited by the relatively fixed quantity of cultivable land and small sizes of farms.

Table 6.--Indices of real prices of major inputs in Taiwan agriculture

Period	Fertilizer	Soybean cake	Wage	Interest rate <u>1/</u>	Rental rate of land <u>2/</u>
1911-15 ..:	100	100	100	100	<u>3/</u> 100
1916-20 ..:	106	90	90	93	115
1921-25 ..:	95	89	84	111	122
1926-30 ..:	103	88	115	94	129
1931-35 ..:	89	78	111	85	150
1936-40 ..:	94	93	147	65	157
1941-45 ..:	59	64	123	55	135
1946-50 ..:	197	194	82	670	135
1951-55 ..:	75	148	100	393	110
1956-60 ..:	77	159	111	215	108

- 1/ Interest rate of bank loan.
2/ Rental rate representing the quantity of paddy rice per hectare of paddy land actually paid by tenants to landowners.
3/ For the period of 1914-15 only.

Source: Chinese-American Joint Commission on Rural Reconstruction.

It is clear that the upward trend of agricultural efficiency in the post-World War II period was a result of increased crop yields. Additional economic incentives encouraged farmers to adopt new technology and increase capital investments. These incentives included shifts in the price ratio of farm products to industrial goods. Farm-income increases associated with changes in the income distribution which followed the land reform program also functioned as an incentive to farmers to increase their output. The share of gross income that went to labor increased from about 44 to 54 percent as a result of the reduced rental rates of farm land (table 7). The estimated real farm income increased by an average annual rate of 7.7 percent in this period and the real income shared by farm family labor rose by more than 30 percent after the land reform programs. The significant increases in farm labor income resulted from favorable prices, the higher ratio of labor to land income, and increased productivity. This, in turn, provided an incentive for farmers to adopt new cultural methods and to employ more capital and labor, which resulted in a higher level of agricultural efficiency.

The pattern of governmental action in directing productive activity was to first use market mechanisms as much as possible and, if necessary, to resort to nonmarket devices to bend activity in the proper direction

Table 7.--The percentage of farm income distribution in Taiwan before and after land reform program

Time period	Year	Land income	Capital income	Labor income
		Percent		
Before land reform program...	1941	52.20	11.48	36.32
	1942	51.99	11.44	36.57
	1943	45.65	10.04	44.31
After land reform program...	1953	37.39	8.23	54.38
	1954	38.05	8.37	53.58
	1955	38.19	8.40	53.41
	1956	36.28	7.98	55.74

to meet production targets. The main levers of control by the Government were the use of indirect taxes levied through profits of publicly owned corporations and the high dependence of agriculture on fertilizer and water supplies, both of which were kept under the supervision of government or quasi-governmental agencies. In the colonial period, an effective land tax and indirect taxes on salt, opium, and public facilities forced farmers to sell at least some of their production. In the post-World War II period, the rice-fertilizer barter system based on government control of all sources of fertilizer, was an effective means for arresting inflation. The redistribution of income following land reform was also an important incentive to Taiwanese farmers to expand farm output.

STRUCTURAL CHANGES

The facility with which the Taiwan Government formed organizations to meet agricultural needs and carry out commitments to reach goals and expectations was an important factor in the development of Taiwan agriculture. Taiwan's service system included Government agencies; public and private corporations and businesses; agricultural financial institutions; agricultural colleges and vocational schools; farmers organizations and associations; irrigation associations; local government offices; cooperatives providing marketing, farm-supply, and credit services; and farm-production units. Each individual involved in agricultural production belonged to one or more organizations. The number of these organizations is presented in the following tabulation.

Organizations of Farmers and Fishermen in Taiwan

Farmers Associations.....	345
Provincial Farmers Association.....	1
Hsien (Prefecture) and City Farmers Associations.....	22
Township Farmers Associations.....	322
Farm Irrigation Associations.....	26
Fishermen Associations.....	77
Provincial Fishermen Association.....	1
District Fishermen Associations.....	76
Sugarcane Farmers Service Associations.....	27
Tobacco (Cultural Improvement Associations).....	3
Cooperatives.....	2,118
Agricultural Production.....	130
Industrial Production.....	133
Marketing.....	24
Supply.....	9
Utilization.....	59
Labor.....	50
Transportation.....	11
Consumption.....	1,583
Public Utility.....	54
Credit.....	64
Insurance.....	1

In 1949, the Chinese-American Joint Commission on Rural Reconstruction (JCRR) became the agency through which direct United States assistance was given to Taiwan agriculture. The greater part of the JCRR effort came after the National Government transferred to Taipei and the outbreak of the Korean War. The net effect of JCRR upon the combined National and Provincial Governments was to establish extra-governmental communication lines which could inject new technology from the West, determine needs at the local level, and channel funds to strategic areas in development projects. These efforts were coordinated under the Committee for United States Agency for International Development (CUSA) and the Committee for International Economic Cooperation and Development (CIECD). There was a

substantial interchange of personnel between the colleges and universities in Taiwan and other countries. Additional new technology also entered with the establishment of joint Chinese and foreign business ventures in drugs, machinery, and pesticides.

It was a policy of JCRR to fund only those projects which were proposed to meet local needs and which could obtain matching funds, materials, or labor from the local sponsor. It was intended that such proposals be screened by the Provincial Department of Agriculture and Forestry (PDAF) before reaching JCRR. In practice, few proposals were eliminated by PDAF, and many were submitted directly to JCRR. In addition to this, JCRR staff members were active in identifying local needs and either promoting local support or, in a few instances, persuading the Commission to start a project on its own initiative. It was a further policy of JCRR to withdraw from any project when its function could be taken over by a local unit of the Provincial Government.

JCRR acted as a catalyst with respect to the system of information and control in Taiwan. It participated in and supported reorganization and expansion of the structure of Taiwan agriculture without becoming an integral part of government. By maintaining a policy of constant withdrawal from competition with new or existing governmental units, it remained beyond the reach of most political manipulation. This was further achieved by the personal stature of the Chinese Commissioner. Chairman Chiang-Mon-Lin, in particular, had sufficient prestige to prevent distortion of JCRR purposes. The presence of JCRR also had the effect of concentrating scientific talent in Taiwan and lending continuity to agricultural development.

During the period 1952 through 1956, the structure of Taiwan agriculture underwent a fundamental change. The land-to-the-tiller program, reorganization of the farmers associations, reorganization of the irrigation associations, and the establishment of a central economic planning board changed the colonial structure of Taiwan agriculture to an organization capable of meeting the more diverse demands of modern independent economic growth.

While land reform will be dealt with in greater detail later, it is useful here to note the effect of land reform on the information and control structure in Taiwan development. There have been two land reforms in Taiwan since 1895. The first, in 1900, removed the feudal rent receiver and established the tenant class as landlords. The Colonial Administration then assembled the newly created landlord class into agricultural associations and used these to channel new technology into agricultural activity. Landlords at the time of retrocession in 1945 were descendants of this group.

The land-to-the-tiller program in 1953 reduced the land holdings of individual landlords to 3 hectares of paddy land, and shifted many of them from positions as holders of land to that of holders of stocks in industrial firms. This was accompanied by changes in the farmers associations that removed absentee landlords and nonfarmers from voting membership, from positions on boards of directors, and from majority positions on the boards of supervisors (business management). This, in turn, was followed by increased credit services within the farmers associations. Shorn of his extensive land holdings, his policy-making position in the farm-supply and marketing organizations, and having a competitor in his money-lending activity, the old rural landlord was effectively removed from his position of power in rural Taiwan. These changes put the Government and the improvement stations into direct contact with the tiller via the farmers association's economic, extension, and credit divisions (figs. 11 and 12).

Agricultural production credit was traditionally associated with the purchaser of the product. This, in turn, led to restriction of the producer's market choices. Before the farmers associations were reorganized, it was not uncommon for the landlord, money-lender, and the purchaser to be the same person or in the same family firm. Processors and other buyers often advanced funds to producers in order to secure the product at harvest time. Reorganization of the farmers associations placed effective credit organizations under farmer control, backed by the Government-operated Central Bank for Cooperatives. In this situation, farmers were able to get production credit based on their contracts with processors using the financial resources of the community and the Central Bank for Cooperatives. This system was strengthened by the initiation of the unified credit program of the Credit Division of JCRR. The JCRR program instituted uniform credit procedures among credit departments of the farmers associations participating in the plan.

Beginning in 1951, JCRR supplied substantial funds for credit programs. The JCRR allocation for agricultural credit and research was from \$100,000 to \$200,000 per year from 1951-55; \$300,000 to \$400,000 per year from 1956-58; and over \$1,000,000 per year from 1959-63. The total allocation from 1950-63 was \$9,144,000.

Interest rates fell sharply from 7.5 percent per month in 1948, and 10.02 percent per month in 1949, to 2.55 percent per month in 1953. The growing credit program of the farmers associations led to further improvement in terms of credit. Traditional money-lenders were not done away with, but were encouraged through competition to change their practices.

The reorganization of agriculture in the 1952-56 period also changed the nature of the adjudication and allocation processes. Prior to this period, committees were set up to deal with land disputes. The system was landlord controlled primarily because the Japanese used the landlord

Relationship Between Government And
Farmers Association

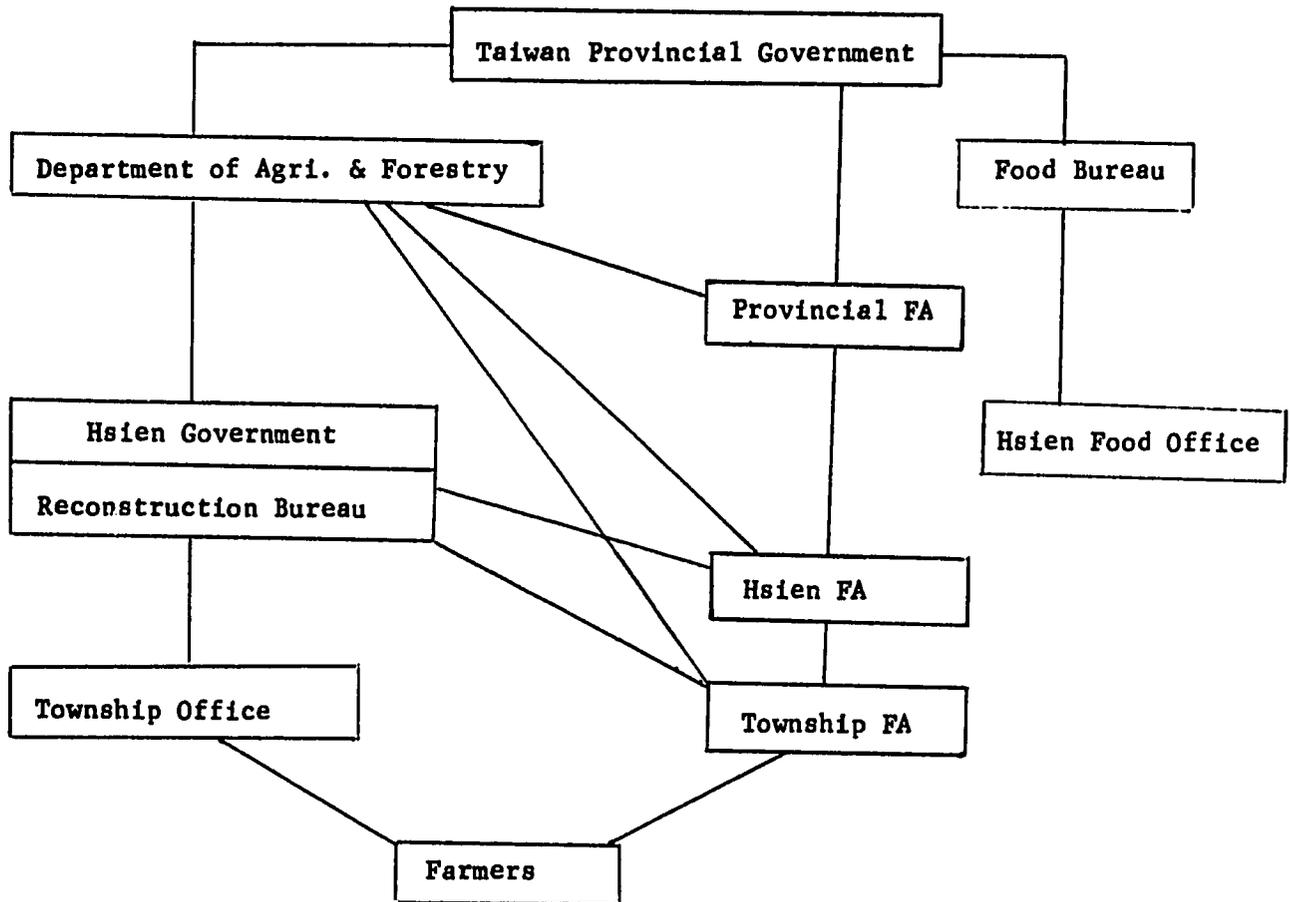


Figure 11

The Organization of Township
Farmers Associations on Taiwan

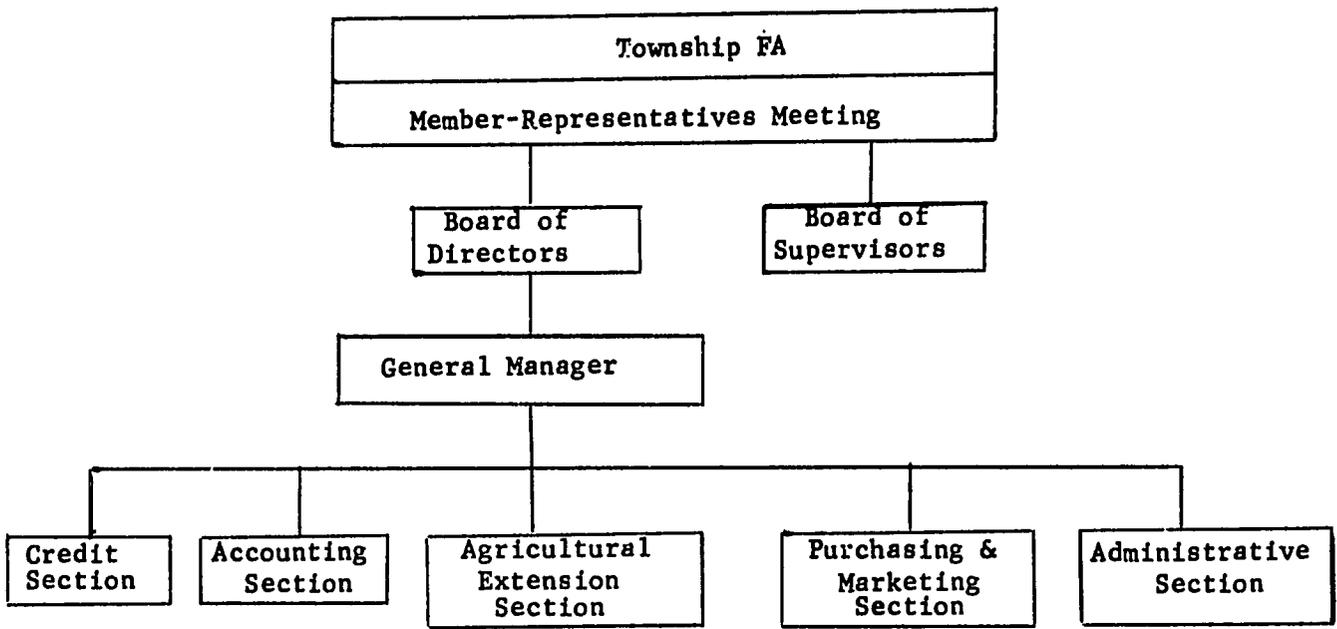


Figure 12

as both the instrument of control and route of innovation to improve the performance of Taiwan's agriculture. When the Japanese were withdrawn, tenancy committees and written leases vanished. The increased demand for food strengthened the hand of the landowners and disputes tended to be settled in their favor.

Recognition of the danger in this situation led to the land reform program carried out under jurisdiction of the Land Bureau of the Taiwan Provincial Government. A system was established in March 1951 whereby supervisors were sent out to offer guidance and assistance in implementing rent reductions and forestalling possible disputes between landlords and tenants. In 1952, a farm tenancy committee was created in each county, city, village, and township, which consisted of representatives elected by and from landlords, tenant farmers, and owner farmers. For the first time, the landlord was not in the majority position in settling disputes.

The change in the judicial procedure operated through the Land Bureau's influence upon rental rates rather than through rearrangement of land tenancy. Expectation of an increased share of output, in turn, increased the amounts of labor and working capital that the tenant was willing to apply to land resources.

The reorganization of the farmers associations had a similar indirect impact on allocation. The reorganization placed the owner-tiller in policy-making positions. The operating force with respect to reallocation of resources was the effect of availability of new supplies and services and knowledge of their use, plus lowered relative prices for inputs where operating efficiency of farmers associations was improved.

A second important change in the structure of agriculture during the 1952-56 period was the formation of an economic planning unit for agriculture within the framework of the National Government. ^{1/} This group brought together men who were part of the top policy-making group, heads of those agencies instrumental in carrying out national plans, and reporting units gathering statistics on the performance of agriculture. Differences between actual production and planned production were small (table 8).

^{1/} This unit was known as Committee D of the Economic Stabilization Board, under the Ministry of Economic Affairs (MOEA), Executive Yuan (Branch of Government). Its members included the Chief of the Agriculture Department of the Ministry of Economic Affairs (MOEA), Commissioner of the Provincial Department of Agriculture and Forestry (PDAF), Director of the Provincial Food Bureau (PFB), Director of the PWCB, JCRR Commissioners, the President of the Taiwan Sugar Corporation, and the Dean of the Agricultural College of the National Taiwan University. The Governor was JCRR Commissioner T. H. Shen.

(Continued)

Table 8.--Average annual difference between planned and actual agricultural production 1/

Sector	1953-56 August	1957-60 August
	-----Percent-----	
All Agriculture	-0.9	1.1
Crops	-1.8	-0.2
Livestock	1.0	9.7
Fishery	9.5	15.5
Forestry	-15.8	-11.0

1/ Minus sign indicates actual production below that planned; positive sign indicates actual production exceeded planned production.

Source: Shen, T. H., Agricultural Development on Taiwan since World War II, Cornell University Press, Ithaca, New York, 1964.

1/ Continued--

By reorganizing the farmer associations into a farmer-controlled link between the top planning groups and the farmer, it was possible to resolve many incompatibilities between projects and assess the realism of plan targets. S. C. Hsieh, Secretary-General, JCRR, describes this process as follows:

"A provincial conference is held at the start of each year by PDAF and PFB jointly for the discussion to problems and exchange of views concerning the county production goals and plans by the representatives of county/city governments and farmers associations and by local specialists. Similarly, county/city meetings are held each year, which are attended by representatives of provincial agencies, county/city assemblies, and township offices and farmers associations to discuss the township production goals and projects and the steps to be taken by their implementation. Finally, there are township meetings to allow village chiefs and heads of small agricultural units of township farmers associations a chance to express their opinions on the village production goals and projects. Their decisions and recommendations are forwarded through the county/city governments to PDAF and PFB for consideration and adoption.

By such linear coordination and by means of the two-way communication from the Agricultural Production Committee down to townships and then from townships back to the Committee, the annual agricultural production plans of Taiwan are finalized by February. Later on, pamphlets printed by the Committee giving details of the goals, policies and projects for all items of production are distributed to provincial, county/city and township agricultural workers."

A significant development was the emergence of orderly market procedures for agricultural exports. In the late fifties, with JCRR assistance, programs were developed to strengthen fruit- and vegetable-marketing cooperatives, coordination was secured among pineapple canning firms, and mushroom output was brought under supply control. Through these various measures it was possible to actively seek and supply foreign markets. Output of these crops was encouraged through the setting of forward prices. The developing marketing function of the farmers associations, plus the specialized marketing cooperatives, in effect served as pipelines from consumer to producer--focusing market needs at a point where producers, planners (via the FA and township offices), and credit officers had common access to market information. The effect of this forward pricing was to shift the market feedback closer to those charged with exploring foreign markets and away from private firms.

Two general conclusions can be drawn from the institution of inter-related service systems in Taiwan economic development: (1) An economy is better able to function in a unified fashion when the people affected combine in organizations to meet a common goal, (2) an important, if more obscure, point is that goals appropriate to such organizations are derived from specific (but repetitive) needs with broad implications. This means that some persons or subgroup must be able to recognize the scope of the needs and to persuade others to join in the effort to meet them. Otherwise, it is necessary for some group or individuals outside the population to identify these needs and to establish the required service system of people and supporting facilities. The Taiwan experience illustrates both approaches; however, those organizations created by the Government were the primary instruments of growth. Therefore, the principal observation to be derived from the experience with formation of organizations in Taiwan is that the political, social, and economic role of the farmer was not left to accidental arrangement. Organization was pervasive and designed to align the role expectations of the farmer with national policy. Where problems of organization or technical skills became barriers to increased agricultural output, other organizations--such as training classes for land tenure committees--were formed to cope with the problems.

Another notable feature of the Taiwan experience was the ability to establish organizations rapidly and in such a manner that they were able to complete tasks that were started.

As noted earlier, increased productivity necessarily involves changes in physiological input-output relations, changes in the level or combination of inputs, or improvements in the environment of the production processes. Certain factors such as temperature and rainfall are, as yet, generally unpredictable for field crops, but many other factors are controllable

to varying degrees. Agricultural output in Taiwan was increased by (1) increasing the number of plants per hectare, (2) multiple-crop land use, (3) better combinations of water, aeration, light exposure, temperature, and nutrients with respect to the genetic capacity of the plants or animals, and (4) encouraging scientific breeding of plants and animals for increased productive capacity. However, to exploit all possible technical innovations, farmers had to be encouraged to do things differently than before. The adoption of new practices resulted from a shift in the value placed on traditional alternatives, and the acquisition of knowledge of other more technically advanced alternatives.

It is explicitly assumed in this study that all human activity is purposeful and, therefore, development takes place only if someone wants it to occur and is both willing and capable to make the changes necessary for development.

The principal body of beliefs bearing on economic motivation in Taiwan related to familial obligations. While each household was a production and consumption unit, loyalties embraced an extended family. Motivation to produce came from the imperative to contribute to the needs of the household unit, and the obligation of the head of the household to preserve and pass on to male heirs an increased accumulation of assets. 2/

Acknowledgement of societal beliefs and imperatives and recognition of their contribution toward an industrious rural population responsive

2/ The family was the basic unit of both consumption and production. This unit was forged in the poverty-ridden hills of South China. Its basic imperatives were stability, continuity, and perpetuation. Departed ancestors were conceptualized as beings with human needs in another world. Bowls of rice were kept on the family ancestral shrine or shelf in the main room of the home, and paper representations of money were burned before the shrine to provide for the needs of the departed. The gods--the kitchen god, the soil god, the sea goddess--were similarly perceived in human form and similarly provided for. Hence, in its basic aspects the Chinese world, as perceived at the turn of the century, was an interpersonal world composed of consumers--past, present, and future--visible and invisible. The mandate was to provide for one's ancestors, increase the family's assets, and produce male heirs to provide for one's own needs in the hereafter. One did this with diligence, thrift, and maintenance of harmonious relations within the household; and one avoided trouble with outside officials if at all possible.

to monetary incentives, created a favorable climate for the service organizations to effectively introduce and adopt improved practices. 3/

Communications

If a government is to promote a successful program to increase agricultural production, there must be a line of communication from the government to the tiller with a bias-free channel back to the government so that the effect of its policies can be evaluated. The Colonial Government in Taiwan unified the precolonial structure into an island-wide economy by using the poa-chia and police systems plus the internal structure of the Japanese sugar companies. The farmers associations augmented the system after 1920. These institutions in turn were coordinated primarily through the Colonial Office of Civil Administration.

Following World War II, the first effective communication system between farmers and the Government was provided through the Provincial Food Bureau when this agency set up the information system to control rice production and fertilizer distribution. An effective communication system already existed in the agricultural associations. In 1953, these associations were reorganized to create a link to the new owner-tiller group (with nonfarmers excluded). Good statistical feedback did not develop, however, until the period of the second 4-year agricultural development plan, 1956-60.

After World War II, there was a need not only to identify problems, but to draw out local knowledge of problems and their possible solutions for coordination with United States aid resources. JCRR served as a two-way communication channel that could not be controlled or influenced by local political forces to assure that external assistance to the tiller was administered through the local irrigation or farmers associations and through the local units of government. JCRR performed this function for the Provincial Government until it was sufficiently organized to take over these activities.

Allocation System

The most recent problem of allocation facing Taiwan agriculture was that of maintaining a food supply adequate to stabilize prices and for export to earn foreign exchange. Taiwan developed a system of allocation

3/ To further illustrate the role of organizational change, increases in irrigation services beyond the limits of local storage ponds required the organization and construction of the huge Chia-nan irrigation system. Likewise, increase in fertilizer use beyond that possible with the traditional use of organic manures led successively to import and then to the manufacture of chemical fertilizers in Taiwan.

that was both unique and effective. In this system, the objective was to maximize foreign exchange without allowing food grain supplies to fall enough to disrupt food prices. The first decision directed to this objective was the establishment of the necessary rice acreage, which was the responsibility of the Food Bureau. Next, the market for sugar was estimated since it is a dominant export for which there is a world-market quota system. Adjustment of sugar production to market-demand estimates was the responsibility of the Government-owned Taiwan Sugar Corporation (through its own farms and through contract operations).

Heavy reliance was placed on market mechanisms for some of the canned vegetables such as mushrooms for which the growing season is short or the commitment of land area is minor. Both banana and canned mushroom export contracts were established, with the necessary quantities secured by means of quotas and forward pricing through cooperative marketing associations. Minor crops, such as tobacco and jute, were similarly handled. Tobacco was contracted by the Tobacco and Wine Monopoly Bureau directly with the farmer. Jute supplies were controlled by advance announcement of prices based on supply-response estimates. The estimates of need and prices were established by the Joint Commission on Jute Extension and Procurement which included representatives of the major users, local governments, the Provincial Governments, and JCRR. Canned pineapple, a major export, was marketed in an orderly way through an association of packers under an effective quality-control program.

The remaining demand for domestic and foreign markets was met through the market mechanism, which was increasingly drawn into the jurisdiction of farmer and fisherman associations.

The market system and farmers associations matured under the owner-tiller policy to become flexible instruments to transmit demands to farmers with a minimal waste of resources. The heart of the system was forward pricing by planning bodies who were skilled at estimating supply response, and whose estimates were linked to Government policy with respect to foreign exchange and inflation control. The general policy was to maintain the greatest control over rice and sugar. Control of rice was achieved by control of fertilizer supplies and control of sugar through Government ownership of manufacturing facilities. With crop plans established, orderly marketing procedures were then established for principal export crops. The remaining domestic demand was left to market mechanisms, which were increasingly drawn into cooperative marketing.

An important change in allocation occurred in reaction to the establishment of JCRR as the channel for United States economic aid to Taiwan agriculture. Beyond the fact that introduction of materials added to the

total resources to be allocated, JCRR insistence on the use of aid money and materials on an approved-project basis acted to strategically place these materials in the recovery and development program. The fact that the JCRR commissioners were included in the top policy-making bodies kept the overall effort of the JCRR aligned with Government objectives.

Land Reform

As noted above, land itself is not an input in a physiological sense. It is an input in the sense that the producer must somehow acquire the right to use it along with rights to the output resulting from the physiological process. These rights are the substance of what is meant by land tenure. Land tenure, therefore, has to do with the stabilization of expectations which, in turn, are what motivate people to produce. Since agricultural production requires that farmers carry out the physiological process on land, the person or group holding the rights to land usually determines the allocation of other inputs to the land.

Taiwan has been subjected to two land tenure reforms since 1895 and each has had a profound influence on the conduct of agricultural production. The tenure pattern just prior to 1895 was one in which tenants had usurped the rights of feudal landlords and leased these to subtenants who tilled the land. Under this system, no one knew exactly who owned what and the transfer of land ownership had become nearly impossible. Controls on the choice of crops grown were imposed in part by the degree to which landlords demanded payments-in-kind and the extent to which these demands could not be met by commodities obtained in the marketplace. The usual basis for payments was either rice or monetary silver.

The Colonial Administration wanted rice and sugar for export to Japan, but also needed to earn foreign exchange to balance subsidies and budget deficits in Taiwan's external account. To achieve these ends, they had to attain control of the land resource without disrupting the family production unit.

The first step in gaining such control was a detailed cadastral survey to identify each piece of land with an owner, Chinese or Colonial. The second step was to buy out the rights of the feudal rent receiver, who was paid off in bonds and cash which ultimately came from Taiwan tax revenues. Land ownership and land tax liability, therefore, were transferred to the former tenants, elevating them to the status of landlords, and at the same time making them directly subject to tax demands on agriculture.

The cadastral survey revealed that there were 1,535,163 acres in cultivation, or about 50 percent more than originally estimated. Further, the land reform was more than self-financing since annual land tax receipts, due to increased enforcement, jumped from 860,706 yen in 1903 to 2,989,287 yen in 1905, and it cost 4,080,485 yen to buy out the feudal rights. The revenue was further increased by a considerable increase in land tax rates, after completion of the land registration in 1905.

Land reform is often a disrupting force, but to increase agricultural output in Taiwan a stable environment within which family units could operate was required. Therefore, once land reform was completed, tax levels and the status of the landlord were not subject to frequent change. Tax rates on paddy land in western Taiwan remained unchanged from 1905-55 (tax changes in 1916 and 1922 involved previously untaxed land). Although the Japanese used land taxes to force agricultural surplus into the market, their main source of revenue was profits from Government enterprises.

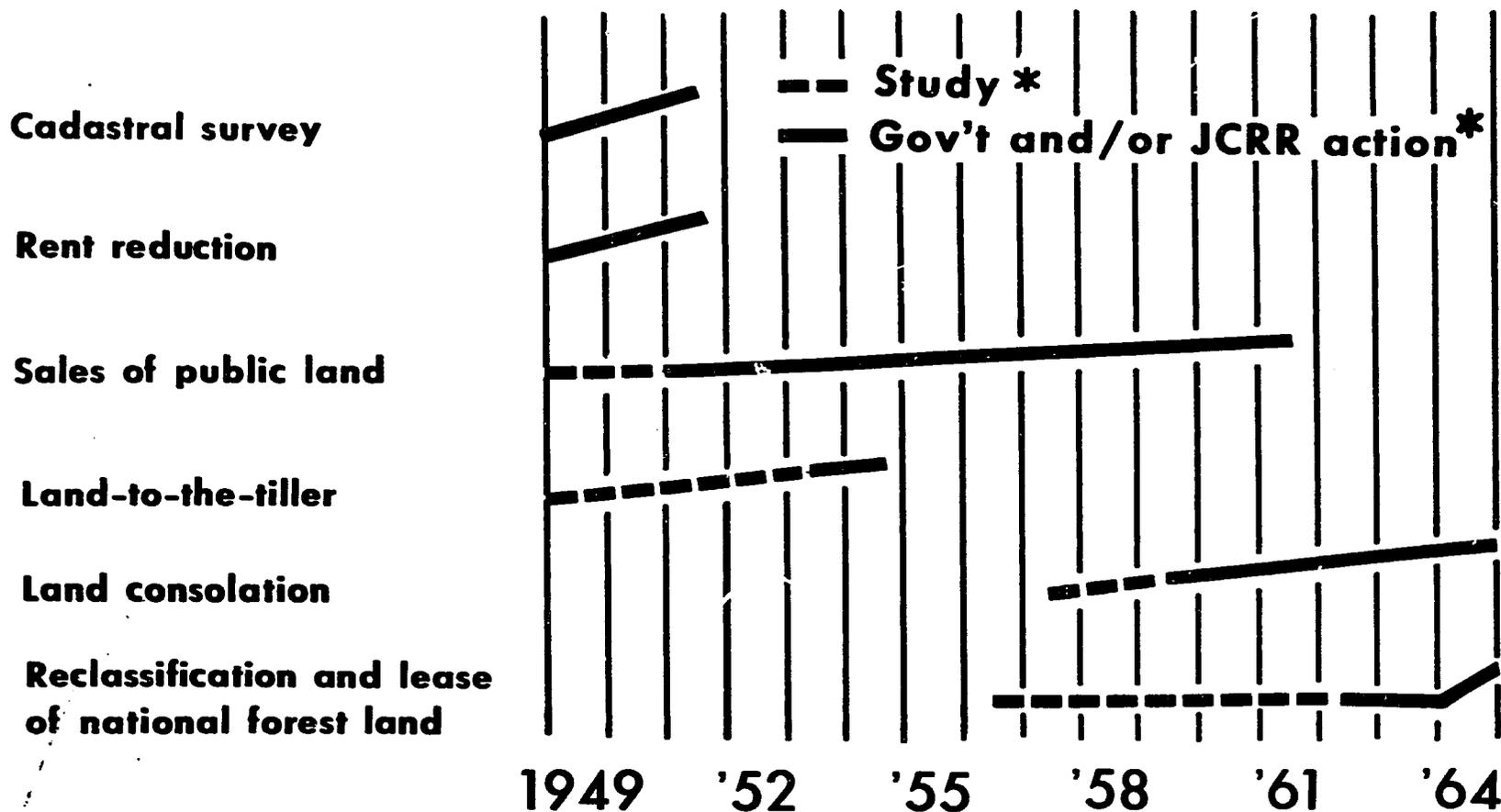
With the establishment of the new landlord class and with their participation in agricultural associations, the Colonial Administration could bring tax and market forces to bear, through which new technology could be channeled to the tiller.

The land tenure reform of the post-World War II Chinese Central Government, from 1949-53, was a move to stabilize an increasingly difficult situation. With the withdrawal of the Colonial Administration and the influx of Mainland refugees, controls were removed as pressures on the system mounted. Landlords demanded fixed rents averaging 50 percent of the main crop in kind and advanced rent payments. Leases were short and verbal disputes arose, but the landlord--as money-lender, buyer and community leader--was for the most part in control.

The first steps in the Chinese Government land reform program were rent reduction and elimination of the worst abuses, which steps helped to reduce land values while raising tenant income. These encouraged and resulted in the voluntary sale of land to tenants by absentee landlords. The next step was the sale to tenants of public lands formerly held by the Japanese. These sales not only yielded revenues for subsequent reform activity, but also demonstrated to the landlord and tenant the mechanism of transfer to be used in the last phase of reform--the land-to-the-tiller program (fig. 11).

The land-to-the-tiller program started with a cadastral survey, land classification, and land registration. The next step went beyond the 1904 reform in that it restricted land holdings to 3 hectares of paddy land or 6 of dry land. In addition, the existing tiller was given the first option

SCHEMATIC REPRESENTATION OF TIMING AND INTENSITY OF TAIWAN LAND REFORM PROGRAMS



- 39 -

* UPWARD SLOPE INDICATES INCREASING EFFORT, BUT HAS NO QUANTITATIVE VALUE.

Figure 11

to purchase the land. In operation, the Government purchased the excess holdings, paying the landlord 70 percent of the purchase price in the form of bonds redeemable in rice over a 10-year period. The remaining 30 percent was paid in the form of stock in public corporations. The tenants, in turn, bought the land from the Government, payments being made in rice in 20 semiannual installments over the 10-year period of bond maturity. Administrative costs were paid out of the proceeds of the sale of public lands and out of United States aid supplied through JCRR.

The colonial and post-World War II land reforms differed in initial objectives. The former was for organization and tax purposes, the latter to stabilize the rural power structure and to place it in the hands of a new group. They also differed in that the latter was more thoroughgoing, to the point of establishing the tiller as owner. Before 1949, 39 percent of the farm families in Taiwan were tenant farmers. This proportion was reduced to 17 percent by 1957. The change in number of owner farmers was accompanied by a change in the acreage of owner-cultivated land. Of a total area of 680,000 hectares of privately cultivated land, the proportion cultivated by owner farmers was increased from 61 percent to 85 percent over the same period.

The land reform program in Taiwan had widespread impact not only because it changed basic property rights in a rural society, but also because a great number of people were directly involved in its implementation. By 1952, 302,277 farm families had signed farm-lease contracts. A total of 577,617 qualified voters elected 20,169 representatives in hamlet and section elections to establish farm-tenancy committees. In the land-to-the-tiller program, the personnel in the various hsien and cities who participated directly in the program for the compulsory purchase of land and its resale to the cultivators totalled over 32,000, including Government officials and local helpers, but excluding PFB and Land Bank personnel. Training of the temporary personnel was a major task as was the training of the members of the farm-tenancy committees.

Other major role changes were those of the tenants, landlords, and new owner operators. Reports indicated that collusion of landlord and tenant to evade the rent reduction law was frequent. Not that tenants did not want to obey the law; they simply were afraid to disobey the landlord. After tenants saw some of their neighbors actually realizing approximately 750 kg. gain in their rice receipts per year by complying with the law, the secret agreements between landlord and tenants became less frequent and fear of landlord reprisal ended. Hui-Sun Tang, Chief of the Land Reform Division, JCRR, noted that in 1949 the two largest categories of irregularities were failure to sign lease contracts (binding landlords for 6 years) and wrong calculation of farm rentals.

The most extreme change in roles resulted from the transfer of large landowners to holders of small tracts and owners of bonds and stocks in formerly Government-owned corporations. Similarly, the newly created owner operators rose to a status position of great esteem in the community. This drastic shift in the power structure of rural Taiwan was aided by farmers associations and credit organizations serving farmers.

The points of similarity between the two reform programs have major implications for influencing agricultural output. Each focused the tax liability on the person actually making production decisions. Each reform was followed by formation of associations of decision-makers, which served as farm-supply and marketing cooperatives and as links to the experiment and improvement station system.

The relationship between land tenure reform and agricultural output in Taiwan was affected by the redistribution of income in favor of the tillers which functioned as an incentive to increase output. Land reform stabilized the outcome of agricultural activity by extending the length of leases and by increasing the number of owners. Land reform led to the formation of service organizations which not only served as channels for new technology, but also reduced the prices of inputs. Finally, land reform placed the tiller in direct contact with tax strategy.

The post-World War II land reform went beyond merely identifying landowners, setting limits on land holdings, and implementing policy that established tillers as owners. The postwar land reform was tightly linked to the reorganization of the farmers associations. The land-to-the-tiller policy eliminated the absentee landlord as an intermediary in the rural communication process and placed the now-literate tiller into direct contact with research facilities, Government policy, and credit sources as a member of the farmer-controlled farmers associations. With marketing services both supplied and coordinated by the farmers associations, the tiller was placed in primary contact with the information necessary to increase output, with the materials and credit required, and with a stable system of insurance and sales contracts. His change in status to that of landlord and the accompanying redistribution of farm income in favor of the tiller supplied the motivation to produce more and to invest for future production.

As noted above, land reform can also be disruptive. It is suggested, therefore, that if the benefits of land reform are to be maximum, the reform program should proceed along predictable, well publicized, and well understood lines to redefine the property rights of individuals. The major steps in the land reform program in Taiwan after World War II

were completed over a 5-year period and were accompanied by an intensive publicity program during which each new move was explained and demonstrated. The firm control of the island by a centralized government was a necessary factor.

It should be pointed out that in Taiwan, land reform did not involve relocation of the tiller or substantial retraining to transform tillers into competent farm operators. When relocation of tillers is involved, even greater attention must be given to the types and routes of information and control that are needed.

Monetary Policy

The intimate involvement of agriculture in the monetary policy of Taiwan came with the establishment of the Taiwan Food Bureau in 1949. The main problem leading to its formation was the runaway inflation in 1948 and the necessity to obtain rice to feed the armed forces which were arriving in increasing numbers during Communist successes on the Mainland.

The Food Bureau, an agency of the Provincial Government, was authorized to collect land taxes in kind on paddy land, to make mandatory purchases of rice at fixed prices, and to obtain rice by barter using its monopoly position for all fertilizer not used by the publicly-owned agricultural producers (such as the Taiwan Sugar Corporation). The collected rice was sold by the Food Bureau to the armed forces, export markets, and domestic markets in sufficient quantities to offset market price fluctuations. All rice merchants were registered and kept under surveillance to prevent speculation. Each civil servant, military dependent, and school teacher received a rice ration. This was issued in the form of certificates which could be redeemed for a specific grade of rice at a specific store. In practice, these certificates were exchanged as currency for the desired grade of rice or even for food other than rice.

The effect of this arrangement was to establish rice as the currency base. This was true not only in the sense that a large part of the rice crop was used as payment of wages-in-kind in the urban areas, but also because upward movements in the price of rice triggered moves of a counter-inflationary nature in Government policy.

SUMMARY

This study of agricultural development in Taiwan has emphasized the roles and actions of people in planning and bringing about changes--physical and organizational--required for an increase in production and sustained growth of an agricultural economy.

In Taiwan, the major objectives of individual farmers were to provide basic necessities and to accumulate wealth. These values and objectives were encouraged to provide incentives for the individual farmer to make changes, and to be receptive to the new technology necessary to implement changes.

Technological innovation and research, combined with known methods, contributed to increased agricultural production and productivity in Taiwan. Increased water supplies and irrigation, the increased use of fertilizers and pesticides, multiple-cropping procedures, and the development of improved varieties of crops and livestock of higher genetic quality were discussed in this report in terms of the specific techniques developed and the statistics of production increases. The study emphasized the organizing process required to successfully bring about these changes.

The Government played a major role in Taiwan's agricultural growth by forming organizations, stabilizing rights through land reform, and seeking new technology to increase agricultural output. Methods of Government guidance and control of agriculture included the allocation of key inputs of fertilizer and water among major crops to secure the production of crops assigned highest priority, and the use of market mechanisms to influence farmer production by manipulation of prices through taxes, bartering, and subsidies. Within this system of Government guidance and control, however, a high degree of decision-making was retained by the individual farmer. Government policies and programs were largely intended to align private with public objectives.

JCRR was established as a specialized agency responsible for enacting the initial measures in rural development. The planners and program administrators of Taiwan, recognizing the importance of balance, coordination, and good scheduling, gained skill in assessing those elements and assumed JCRR responsibilities whenever possible.

The changes made in Taiwan agriculture stimulated new sets of needs which, in turn, created new market demands to stimulate increased production. Domestic markets expanded both in terms of income and population; export markets were sought and action was taken to supply those markets. The requirements to meet old needs precipitated new needs, and the established machinery for change was able to meet new needs and to sustain continued agricultural growth.

Planners and administrators who need to increase agricultural production in other countries can benefit from a study of the successful experience in Taiwan. This report does not suggest that the same institutions and policies can be transplanted in other countries; but rather suggests that a study of the role of organization and an understanding of the rationality of human actions and motives are of highest importance in relation to planning for development.

APPENDIX

Appendix table 1.--Indices of economic changes in Taiwan
(Base 1952=100)

Year	Real national income	Per capita real income	Agricultural production	Industrial production	Real Wage
----- Percent -----					
1952	100	100	100	100	100
1953	115	111	110	124	110
1954	120	112	111	133	128
1955	127	114	114	148	132
1956	134	116	122	156	135
1957	143	121	133	177	138
1958	151	123	141	190	145
1959	162	128	144	215	142
1960	174	133	144	245	140
1961	188	139	158	270	163
1962	199	143	158	305	175
1963	212	148	161	336	177
<u>Average annual</u> :					
<u>growth rate</u> ...:					
1953-63	7.1	3.7	4.4	11.6	5.3
1957-63	6.8	3.5	4.1	11.6	3.9

Source: Taiwan Statistical Data Book 1964, Council for International Cooperation and Development, Executive Yuan (CIECD).

Appendix table 2.--Indices of production efficiency in Taiwan agriculture
1935-63 (1935-37=100)

Year	Aggregate output index	Aggregate input index	Production efficiency (index of input per unit of output)
	<u>Percent</u>		
1935	98	99	101
1936	101	101	100
1937	101	100	99
1938	106	99	94
1939	106	101	95
1940	93	101	109
1941	92	98	106
1942	94	96	101
1943	90	94	104
1944	79	85	109
1945	48	78	160
1946	56	77	138
1947	68	84	122
1948	77	91	117
1949	91	97	106
1950	103	102	99
1951	105	104	99
1952	113	109	96
1953	126	112	89
1954	127	115	91
1955	125	114	91
1956	137	118	86
1957	145	122	84
1958	154	127	82
1959	154	126	82
1960	155	124	80
1961	166	128	77
1962	168	130	77
1963	164	133	81

Appendix table 3.--Indices of agricultural inputs in Taiwan, 1935-63
(1935-37=100)

Year	Agricultural worker	Labor input	Land area	Crop area	Working capital	Fixed capital	Aggregate input
-----Percent-----							
1935 ...:	98	100	98	100	97	104	99
1936 ...:	100	102	100	101	103	106	101
1937 ...:	102	98	101	99	100	91	100
1938 ...:	104	99	102	97	98	83	99
1939 ...:	106	104	102	101	100	82	101
1940 ...:	106	106	102	104	97	86	101
1941 ...:	---	104	102	104	83	83	98
1942 ...:	---	103	101	102	70	94	96
1943 ...:	---	102	100	100	68	86	94
1944 ...:	---	98	96	99	43	76	85
1945 ...:	---	79	97	80	26	68	78
1946 ...:	117	75	99	87	24	68	77
1947 ...:	123	86	99	105	41	73	84
1948 ...:	126	103	102	119	46	77	91
1949 ...:	130	115	102	127	59	83	97
1950 ...:	131	118	103	131	81	87	102
1951 ...:	131	119	103	131	89	92	104
1952 ...:	131	126	104	133	107	91	109
1953 ...:	133	128	103	133	121	93	112
1954 ...:	133	128	104	134	135	93	115
1955 ...:	131	126	103	132	134	91	114
1956 ...:	130	131	104	136	144	93	118
1957 ...:	129	140	103	138	154	101	122
1958 ...:	129	143	105	140	166	119	127
1959 ...:	131	143	104	141	163	127	126
1960 ...:	133	140	103	141	158	122	124
1961 ...:	135	142	103	143	173	138	128
1962 ...:	136	144	103	143	182	119	130
1963 ...:	139	146	103	144	190	149	133

Appendix table 4.--Percentage distribution of input categories
in Taiwan agriculture, 1935-63

Year	Land area	Labor input	Working capital	Fixed capital	Total
----- Percent -----					
1935 ..:	52	25	18	5	100
1936 ..:	51	25	19	5	100
1937 ..:	52	25	19	4	100
1938 ..:	52	25	19	4	100
1939 ..:	51	26	19	4	100
1940 ..:	52	26	18	4	100
1941 ..:	54	26	16	4	100
1942 ..:	54	27	14	5	100
1943 ..:	55	27	14	4	100
1944 ..:	58	29	9	4	100
1945 ..:	64	26	6	4	100
1946 ..:	66	24	6	4	100
1947 ..:	61	26	9	4	100
1948 ..:	58	28	10	4	100
1949 ..:	55	30	11	4	100
1950 ..:	52	29	15	4	100
1951 ..:	51	29	16	4	100
1952 ..:	49	29	18	4	100
1953 ..:	47	29	20	4	100
1954 ..:	46	28	22	4	100
1955 ..:	46	28	22	4	100
1956 ..:	45	28	23	4	100
1957 ..:	43	29	24	4	100
1958 ..:	42	28	25	5	100
1959 ..:	43	28	24	5	100
1960 ..:	43	28	24	5	100
1961 ..:	42	28	25	5	100
1962 ..:	41	28	26	5	100
1963 ..:	40	27	27	6	100

Appendix table 5.--Indices of resource productivities in Taiwan's agriculture, 1935-63
(1935-37=100)

Year	Aggregate resource productivity (output per unit of input)	Land productivity per unit land area	Land productivity per unit crop area	Labor productivity per agricultural worker	Labor productivity per man-day labor input	Capital productivity
----- Percent -----						
1935 ..:	99	99	98	100	98	99
1936 ..:	100	101	100	101	100	98
1937 ..:	101	100	102	99	103	103
1938 ..:	106	104	109	101	107	111
1939 ..:	105	105	105	100	102	111
1940 ..:	92	91	89	87	88	97
1941 ..:	94	91	88	---	89	111
1942 ..:	99	93	92	---	91	125
1943 ..:	96	90	91	---	88	135
1944 ..:	92	82	76	---	80	161
1945 ..:	62	50	61	----	61	153
1946 ..:	72	56	64	47	74	156
1947 ..:	82	69	65	56	79	130
1948 ..:	85	75	65	61	74	136
1949 ..:	94	89	72	70	79	143
1950 ..:	101	99	78	78	87	125
1951 ..:	101	101	64	80	88	117
1952 ..:	100	109	85	86	90	109
1953 ..:	112	122	95	95	98	110
1954 ..:	110	123	95	96	99	101
1955 ..:	110	121	95	95	99	100
1956 ..:	116	132	101	105	104	103
1957 ..:	119	141	105	112	104	101
1958 ..:	122	147	110	120	108	98
1959 ..:	122	148	109	117	108	99
1960 ..:	125	150	110	117	110	103
1961 ..:	130	160	116	123	116	100
1962 ..:	129	162	117	123	116	97
1963 ..:	124	159	115	118	112	91

Appendix table 6 .--Percentage distribution by value of Taiwan exports
1952-63

Year	Agricultural products	Processed agricultural products	Industrial products	Others	Total
----- Percent -----					
1952 ..:	27.4	68.2	3.9	0.5	100.0
1953 ..:	13.3	79.6	6.4	0.7	100.0
1954 ..:	15.0	77.3	6.9	0.8	100.0
1955 ..:	29.8	62.6	5.5	2.1	100.0
1956 ..:	15.1	71.8	11.9	1.2	100.0
1957 ..:	16.7	74.7	7.3	1.3	100.0
1958 ..:	23.8	63.1	11.4	1.7	100.0
1959 ..:	24.0	53.6	21.2	1.2	100.0
1960 ..:	11.8	55.8	30.5	1.9	100.0
1961 ..:	15.3	42.7	39.7	2.3	100.0
1962 ..:	13.9	36.0	47.1	3.0	100.0
1963 ..:	14.3	43.1	39.5	3.1	100.0

Source: Taiwan Statistical Data Book, 1964, Council for International Cooperation and Development, Executive Yuan (CIECD), p. 109.