

The Improvement and Production of Rice in Taiwan¹

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Introduction

Taiwan is an island with a total area of 35,966 km². The length from north to south is 386 km and the width from east to west is 145 km. The Central Mountain Range running from north-northeast to south-southwest forms the backbone of Taiwan island and cover about two-thirds of the total area. It divides the island into two parts, western and eastern lowlands, which are geographically different. Agriculture flourishes in the lowland of the west region. Over two-thirds of the island (table 1) are hilly and slope lands and more than 100 m above sea level. In recent

Table 1. Classification of land area by altitude

Altitude (m)	Area (km ²)	Total (%)
0-100	10,800	30
100-1000	13,660	38
1000-1500	4,370	12
Above 1500	7,130	20

years, the Government of Rep. of China has been directing its efforts to the development of agriculture on the slope lands and to the reclamation of tidal lands. As a result, the total area available for crops, forestry, fishery and animal husbandry has increased by 35% as compared to the 1946 level (table 2). Only

Table 2. The hectareage of arable land and their usage

unit:ha

Year	Total	Agriculture	Forestry	Fishery	Animal husbandry
1946	1,103,893	831,951	260,748	10,431	763
1956	1,203,398	875,791	311,261	15,545	801
1951	1,203,994	871,759	314,536	17,274	425
1966	1,234,354	896,347	317,989	18,496	1,522
1971	1,413,047	902,617	485,589	22,145	2,696
1976	1,488,116	919,680	536,989	28,863	2,809
1978	1,492,754	918,143	541,014	30,383	3,214

¹ Paper presented at the workshop of "Technology Diffusion among Rice Farmers" held at Seoul, Korea on 5th to 13th Sept., 1980. Sponsored by Asian Productivity Organization.

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less than one-thirds or 10,800 km² are flat lands, which is intensively used for agriculture and industry purpose. The area of agricultural production was around 920,000 ha in 1978. Of the arable land, the rice paddy is about 517,000 ha or 56.32%, and the upland field 401,000 ha or 43.68%.

Since the island is located in the subtropical zone, summer is long and hot while winter is short and mild. The annual mean temperature is 21 C. July is the hottest month with a temperature of over 26.6 C island-wide, and January or February the coldest at about 15.5 C. Frost is rare on the plain. Rainfall in Taiwan is abundant with an average of over 2,500 mm in many areas. In addition, typhoon often occurs several times a year, sometimes causing severe damage to the crops and sometimes bringing timely rainfall. Generally, a high relative humidity of over 80% exists throughout the island. Crops can be grown all year around, except in the high mountainous areas.

The total population of Taiwan is over 17 million people. Those engaged in agriculture was about 30% of the total population. Because of small farming and rapid industrialization in urban districts, the farm population may be expected to be continuously reduced in the future. Taiwan's economy has changed from a predominantly agricultural to a basically industrial character.

Agricultural Policy and Rice Production

Taiwan's agricultural policy is embodied in the following articles of the Constitution of the Republic of China:

“Article 142. National economy shall be based on the principle of People's Livelihood and shall seek to effect equalization of landownership and restriction of private capital in order to attain a well-balanced sufficiency in national wealth and people's livelihood.....”

“Article 146. The state shall, by the use of scientific techniques, develop water conservancy, increase the productivity of land, improve agricultural conditions, plan for the utilization of land, develop agricultural resources, and hasten the industrialization of agriculture.

In pursuance of this policy, the Chinese Government has endeavored to promote agricultural production, water conservancy and land utilization. The purpose of this policy is twofold. First, it aims to uplift the living standard of rural people through the increasing of capital investment and the improving of agricultural techniques by which to raise production and netincome. Second, it aims to strengthen the nation's economy through the development of agricultural resources.

Among various crop productions, rice is the most essential one in national agricultural development. Paddy rice always ranks first in both production value and production hectareage (table 3). About one half of agricultural land was used for rice production in 1978 and its output represented more than 41% of the total crop production value. The rice farmers constituted 75% of Taiwan's farm households. Although the nutrition condition of Chinese people has been improved greatly in recent years, the rice grain still remained as main staple food of out daily consumption

Table 3. Production values and hectareage of rice and other crops.

Year	Production Value (million NT\$)		Production Ares (X1000 ha)	
	Rice	Other crops	Rice	Other crops
1940	1255 (52.9%)	1119 (47.1%)	770.2 (51.9%)	712.8 (48.1%)
1978	30386 (41.2%)	43420 (58.8%)	752.3 (48.6%)	797.0 (51.4%)

Table 4. Food consumption of chinese people

unit: person/kg/year

Year	Rice	Wheat	Sweet potato	Vegetables	Fruits	Pork	Poultry	Mile	Eggs
1946	132.6	16.6	64.2	58.4	14.5	15.3	1.4	1.1	1.6
1978	114.0	23.9	6.0	114.9	54.3	23.4	11.5	5.4	7.6

(table 4). As rice is the staple food in Taiwan, its production is of great importance to the national economy. Improving the rice production is the primary task of Taiwan's agricultural development.

According to Taiwan Agriculture Statistics, during the period of 1951-1979, the annual hectareage of rice was average around 771,300 ha with the exception of 720,000 ha in 1973 (table 5). In general, two rice crops can be grown with seasons varying on regions and localities. The

Table 5. Cultivated area and production of paddy rice

Year	Area (ha)	Yield (kg/ha)	%	Total production (M. T.)	%
1949	546,016	1,585	84.21	894,021	60.21
1951	789,075	1,882	100	1,484,792	100
1956	783,629	2,284	121.36	1,789,829	120.54
1961	782,510	2,577	136.92	2,016,276	135.79
1966	788,635	3,017	160.30	2,379,661	160.26
1971	753,451	3,071	163.17	2,313,802	155.83
1976	787,516	3,450	183.31	2,712,984	182.71
1977	779,487	3,385	179.86	2,648,870	178.40
1978	752,851	3,249	172.63	2,444,490	164.63
1979	722,161	3,373	179.22	2,435,342	164.01

area of first and second rice crops in the past 29 years were 339,873 ha and 431,419 ha, respectively, with a difference of about 21% in favor of the latter. The average brown rice yield per hectare during the period of 1951-1979 was 3,062kg and 2,496kg for the first and second crop, respectively. The first crop outyields the second one by 22.6%. Based on 1951, rice production was only 60.21% in 1946 and the amount had increased to 2,712,984 M.T. or 182.71% in 1976 arrived the highest peak. Its production has increased more than 3.5 times in the past 34 years. Due te the overproduction of rice grain in Taiwan, the government changed its policy to reduce the production by decreasing the rice hectareage which resulted in the reduction of total brown rice production to 2,435,342 M.T. in 1979.

Two type of rice are grown in Taiwan. The hectareage of japonica rice in 1951-1979 was averageed 227,826 ha and 298,431 ha for first and second crop. The hectareage of indica rice in the past 29 years was 99,587 ha and 109,972 ha for the first and second crop. The hectareage difference of japonica and indica rice has been steadily increasing in recent years. This trend indicates that farmers are more interested in grown japonica rice. The higher price and consumption habit of Chinese people are the major factors causing rice farmers more favor in japonica rice cultivation.

Contributive Factors to the Improvement of Rice Production

Taiwan's rice production has made a remarkable progress in the last three decades due to the government's sound policy and quidance, the improvement of cultivated varieties and cultural techniques, the effective pest control and the proper fertilizer usage. Other factors also responsible for the progress are the establishment of farm extension network through farmers' or ganizations and research stations, the further improvement of irrigation and drainage system, and implementation of farm mechanization.

1. Rural land reform

This project included two approaches:37.5% land rent reduction and land-to-the-tiller. The first approach was to reduce the farm rent from tranditional 50% or more to less han 37.5% of the annual main crop value. This approach was succeed in 1949. It covered a area of 256,556 ha with 296,043 houtholds at that time. The unit rice yield increased 43% from 3,894 kg/ha to 4,248 kg/ha.

The second approach of the project was the sale of public and private farm-land to tenants under the "Land-to-tiller Act" , which was first introduced in 1951. The sales of exceded land took in installment plan over a period of 10 years. Altogether, 138,443 ha and 139,251 ha of public and pricated farm land had been sold to 285,667 households, respectively, in 1951 to 1975. In such a way, the tenants had become landowners, and they were much willing to put more effort on his own field. And the result is a higher crop yield and a better farm family income.

2. Farm land consolidation

For the purpose of improving paddy rice production, a Farm Land Consolidation Program was launched in 1962. The first 10-year project was completed in 1971 with 259,324 ha consolidated. This project has being carried out continuously under the Accelerated Rural Development Program initiated by the Government since 1972. The second 5-year project has been prepared by the Government and a total of N.T.\$16.4 billions

Table 6. A comparison of benefits before and after farm land consolidation

	Farm land consolidation into one place	Plots connected with road	Plots directly irrigated	Plots directly drainable	Average area of each plot
Before consolidation	42%	20%	20%	19%	0.07ha
After consolidation	86%	100%	100%	100%	0.25ha

will be offered to finish the farm land consolidation of the remaining 186,462 ha. The project will be completed in 1985. Benefits after the first 10-year land consolidation are summarized as shown in table 6.

3. Varietal improvement

The rice breeding work in Taiwan has been worldwidely known. A number of new rice varieties of both japonica and indica type, have been developed (Table 7) through various breeding programs at different agricultural institutions in the last 20 years. The common characteristics of

Table 7. Number of officially registered rice varieties

Station	Variety
Taiwan Agricultural Research Institute (TARI)	Tainung Selection 3 Tainung 60, 61 & 67
Chiayi Agricultural Experiment Station (Chiayi)	Kwangfu 1 Chianung 242 & 247 Chianung Sen 6, 8, 11 & 12 Tainung 62
Taipei District Agricultural Improvement Station (DAIS)	Taipei 305, 306, 307, 308, 309, 310 & 311
Hsinchu DAIS	Hsinchu 56, 57, 58, 59, 60, 61, 62 & 63
Taichung DAIS	Taichung 170, 171, 172, 173, 174, 175, 176, 178, 179, 180, 181, 184, 186, 187 & 188 Kwangfu 401 Todoroke wase Taichung Native 1 Taichung Sen 2, 3, 5 & 10
Tainan DAIS	Tainan 1, 2, 3, 4, 5 & 6 Tainan Sen 15
Kaohsiung DAIS	Kaohsiung 22, 24, 25, 27, 41, 42, 44, 53, 64, 68, 116, 117, 122, 135, 136, 137, 139 & 140 Kaohsiung Sen 2 & 7
Taitung DAIS	Taitung 1, 16, 24, 25, 26, 27, 28 & 29
Hualien DAIS	Hualien 5, 17 & 18

the improved cultivars are: (1) high yield, (2) good grain quality, (3) lodging and pest resistance, (4) wide adaptation, and (5) better plant type. At present, the most widely planted japonica varieties are Tainan 5 and Tainung 67. In the case of indica rice, Taichung sen 3 is the most popularly grown. In the early days, grain yield was considered to be the first priority in our breeding programs. In recent years, we also considered the grain quality in addition. Therefore, both rice grain yield and quality have been greatly improved in our newly developed varieties.

4. Improvement of cultivation methods

The improvement of cultural methods to increase rice yield has been proved practical and fruitful. Unfortunately, these improved measures had never been recommended and adapted by farmers as a whole in rice cultivation, and the gain is very limited from the improvement of one single factor but significant from the improvement of several or all the factors. This due to the effect of their interaction. During the practice of field operations, however, farmers often overlook the significance of multiple interaction. The aim of integrated cultivation is to emphasize a multi-

idisciplinary approach. The approaches include: (1) adapting newly recommended varieties, (2) renewing all seeds to ensure higher production, (3) improving the application of fertilizers in both methods and rates according to the results of soil and plant analysis, (4) using herbicides to replace hand-weeding, (5) stressing cooperatively pest controls according to warnings by field pest forecasting system, (6) encouraging the use of farm machines to promote work efficiency and reduce production cost, (7) eliminating barnyard grass and off-types, and (8) encouraging grouping operation to reduce labor output.

In order to evaluate the effect of combined application of all improved measures on the increase of rice yields, as well as to explore the productivity of the fields to the fullest extent, a small scale "integrated demonstration" on improved rice cultivation techniques has been carried out in the island since the second rice crop of 1963. From the 1963 second crop to the 1965 first crop in 116 townships had proved that the existing rice industry of Taiwan definitely possesses potential for yield increase of more than 30% and gave 45% more net income to the participating farmers. In order to popularize the integrated techniques of rice cultivation among local farmers, an expanded program has been carried out through well-organized unit since the second crop of 1965. The recent results (table 8) indicated that the unit yield of rice crop was increased 7.84% and the

Table 8. The result of integrated cultivation extension field

Crop season	Hectareage (ha)	Yield (kg/ha)			Net income (ha/NT dollar)		
		Extension plot	CK	% increase	Extension plot	CK	% increase
II 1975	108,074	3,692	3,309	12.00	16,180	11,469	41.00
I 1976	92,440	5,144	4,760	8.10	31,816	26,619	19.50
II 1976	107,391	3,492	3,333	18.27	17,793	10,253	73.54
I 1977	93,751	4,920	4,654	5.72	15,789	12,584	25.48
II 1977	76,405	3,866	3,418	13.11	8,072	3,393	137.90
I 1978	64,659	4,752	4,551	4.42	13,748	10,805	27.24
II 1978	71,957	3,498	3,111	12.44	7,312	1,945	274.21
I 1979	57,214	4,288	4,070	5.36	15,049	11,829	27.22
Total Mean	671,891	4,207	3,901	7.84	15,720	11,113	41.46

net income of rice farmer was 41.46%. So, it was decided that this program should be handled as a regular rice improvement project from 1969 on ward.

5. Usage of fertilizers and pesticides

The use of chemical fertilizers and pesticides are two major factors of the increasement of unit rice yield. The use of fertilizer was increased from 529,518 tons in 1961 to 788,016 tons in 1977 (table 9). In spite of the general shortage of fertilizers in many countries following the oil crisis, there has been no significant shortage of fertilizer supplies in Taiwan. For improving the efficiency of the fertilizer application, a series of research and field demonstration has been done. This led to a 10% yield increase on an average of 120 lacations in 1976.

Table 9. Annual quantity of chemical fertilizers all ocated for rice

Year	Total quantity	Nitrogen (N)	Phosphate (P ₂ O ₅)	Potassium (K ₂ O)
1941	—	34,672	13,722	1,801
1961	529,518	80,023	28,190	22,896
1966	672,371	117,643	28,463	34,529
1971	503,606	84,421	18,049	19,794
1976	710,011	114,598	32,923	41,096
1977	788,016	127,259	36,555	49,350
1978	683,407	115,923	29,540	39,653

Chemical pesticides have always played a major role in the control rice pests in Taiwan. An estimate of NT\$ 2,118,260,000 or 31,849 tons of the pesticides was used for agricultural production. Embodied in the rice crop protection are joint pest control programs, such as aerial sprays of pesticides, using chemical herbicides, area wide rodent control and mechanization cooperative pest control, according to the warning of pest forecasting system. In addition to that, the sale and usage of various pestides is stricter managed and controled.

6. Farm mechanization

The rapid industrialization of Taiwan has led its agriculture to a new phase which marks an end of labor slack. In the 1950's farm mechanization placed emphasis on the rice crop, encouraging the replacement of draft animals by power tillers for land preparation. Later, accelerative efforts were directed at extending the use of such labor-saving machines as rice transplanters, rice combines and grain dryers. Since 1973, government agencies and banks had provided low-interest loans to farmers in addition to subsidies for purchase of farm machines a total of NT\$ 4.2 billion in a period of seven years (1973-1980). By the end of February 1980 (table 10), 152,075 sets of different farm machines have been purchased and used by farmers. Rice

Table 10. Kind of farm machines used in agriculture

Kind of machine	1960	1971	1980	% of local made
Power tiller	3,708	32,030	51,492	94.8
Tractor	487	554	3,005	3.3
Transplanter	—	454	26,914	80.7
Power thresher	—	—	10,981	97.5
Rice combine	—	75	10,607	33.5
Grain dryer	—	214	25,420	98.1
Draft cattle	—	245,109	—	—

farming operations are mechanized to an extend of 90.62% for land preparation, 63.31% for ltransplanting, 44.72% for harvesing and 19.62% for drying. Inspite of that, an agricultural mechanization fund has recently been set up with the Central Government to provide a yearly

amount of NT\$ 1 billion in 1979-82. An equal amount of counterpart money is contributed by the loaning banks and farmers' associations. Part of the fund's loan interest is used for supporting such projects as pertain to the research, training and extension of farm machinery.

7. Use and control of water

Proper flood prevention and adequate irrigation/drainage are major factors for increasing Taiwan's agricultural production, because of its topographical limitations, uneven distribution of rainfall and typhoons. The annual rainfall provides it with 88,800,000,000 cubic meters of water. Of which, about four-fifth is lost and one-fifth harnessed for agriculture, industry and livelihood (table 11). The percentage of water resources for agricultural use decreased from 96.8% in 1950 to

Table 11. The utilization of water resources unit: 1,000,000 M³

	1950		1960		1970	
	amount	%	amount	%	amount	%
Agriculture	5,924	96.8	7,044	94.2	9,415	86.1
Industry	31	0.5	123	1.7	807	7.4
Livelihood	167	2.7	308	4.1	707	6.5

86.1% in 1970. The total amount, however, still increased from 5,924 million M³ in 1950 to 9,415 million M³ in 1970. The total irrigated area increased from 298,765 ha in 1945 to 538,790 ha in 1975, mostly paddy field. All these were made possible by the construction of reservoirs, the improvement of irrigation and drainage systems and the development of ground water. During the period of Japanese occupation, Taiwan had only seven reservoirs with a total storage capacity of 329,020,000 cubic meters. Right now, there are 24, among them, the Shihmen and Tsengwen reservoirs have a water storage capacity of 316,000,000 and 708,000,000 cubic meters, respectively.

8. Agricultural extension

The extension work is a kind of farmer education. The recent feature of educational development is a rapid increase in schools of various levels. The expansion of school education has led to the development of human resources which are great assets for both agricultural and industrial development on the island.

According to an economic evaluation made by Joint Commission on Rural Reconstruction, approximately two-thirds of the total agricultural production increase in Taiwan can be contributed to technological improvements and one-third to the use of large agricultural resources, particularly capital and labor input. Much of this progress is due to the efforts of extension workers scattered around the whole island. By the end of 1979, there were 1,478 extension advisers of farmers' associations. With the assistance of 13,578 voluntary local leaders, they provided technical services and conducted educational activities for 486,524 farmers. The extension was conducted through 13,845 farming study groups, 8,234 technical study meetings and many field travels or demonstrations. In addition, TV, radio, newspapers, magazines and

technical bulletins, etc. were employed. It was closely coordinated with the other activities of farmers' association in order to ensure that the farmers are really benefited. From 1953 to 1970, a sum of NT\$ 1,225 million had been disbursed for the agricultural extension work. Of this sum 43% was subsidized by the government and the remaining 57% were contributed by farmers' associations.

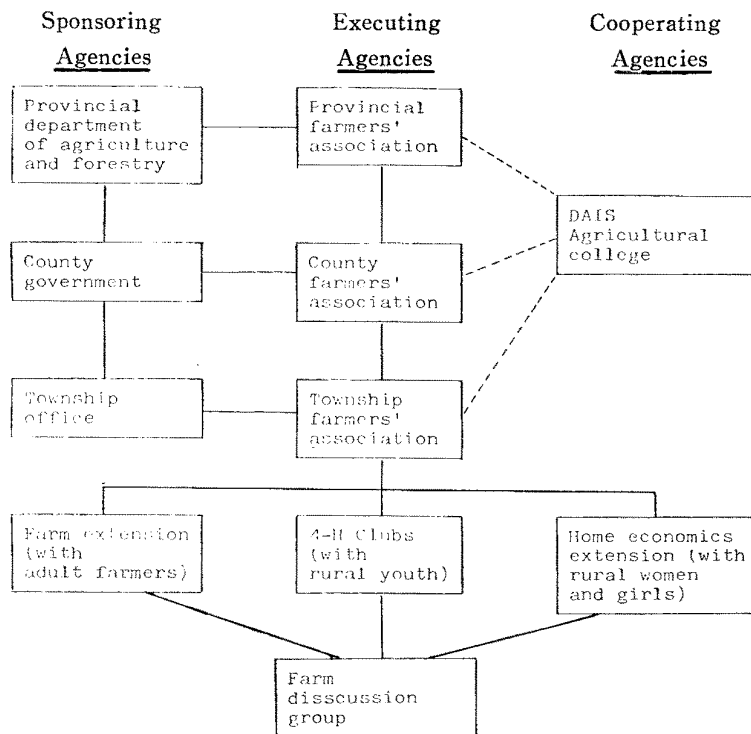
Major activities of extension work

The agricultural extension work in Taiwan is well organized. It is carried on mainly by the provincial, county and township farmers' associations under the sponsorship of the Provincial Department of Agriculture and Forestry and the county governments. Their relationships are shown in Fig. 1. The DAIS give technical assistance and cooperates with other agencies in promoting the extension programs at all levels. The work of extension activities are including: (1) Farm extension, (2) 4-H club programs and (3) home economics, etc.

1. Farm discussion group

Among all the farm extension activities, the farm discussion groups have been the most successful, influential and unique in several aspects. As each farm adviser almost had to care for 500 farm families and more subjects to teach than he could handle. The farm extension authorities in 1967 began to encourage the establishment of discussion groups in every township farmers' association. Owing to the farmers' keen interest in those discussions and related activities, the number of discussion groups and their members have increased to 13,845 groups and 247,204 members.

Figure 1. Working Relationship Among Agricultural Extension Agencies



A farm discussion group in Taiwan is composed of approximately 20 adults over 25 years of age. In general, they meet once a month to study, discuss, carry on agricultural activities and receive instructions and advices from advisers. Subjects for the discussion group also include production techniques and experiences, management problems of farm family, group members; problems relating to joint operation, concerning joint marketing and procurements problems of mutual assistance and cooperative service, and training in good citizenship.

2. Technical consolidation group

Seven agricultural technical consolidation groups were established in 1976 on different agricultural production district for the purpose of solving farmers' technical problems and understanding the difficulties of farm operation in order to search further answers. This group is to be considered as bridge between farmers and research workers. The members of consolidation group are including professors of agricultural college, specialists of research institutions and extension workers of farmers' association. A total of 120 man/time had spent at 32 townships and the benefitted key farmers were around 3,500 people in 1979.

3. Training and education

The training and education of rural people is mainly through such activities as field demonstration, research station visiting and training courses offered by various agricultural agencies. A total of 8,334 times such activities was carried out and the benefitted farms was accounted to 342,428 people in 1979.

4. Extension publications

To supply current information to farmers on agricultural and related subjects, a total of 185,000 booklets of extension bulletin, circular, leaflet and poster were published by provincial Department of Agriculture and Forestry, various research stations and farmers' associations in 1979. Some agricultural magazines are also published. They has own a rapid growing readership and is moving steadily toward self-support.

5. TV and radio broadcasting

The farm radio program was initiated in 1951 by lending of 6,000 small receiving sets to farmers' organizations, rural health units and chiefs of small agricultural units. Followed up the wide distribution of radio sets in mid-1950's, two radio broadcasting programs named "Good Farm" and "Happy Farm" have been setting to meet the growing demand of rural radio audiences. In addition, three TV programs have been also carrying on during noon time each day.

Problems and Solution

Owing to a rapid economic development in the past 30 years, Taiwan has moved from a predominantly agricultural economy into a semi-industrial one. Farmers and rural youngsters have easier access to off-farm jobs, and the agricultural economy now is changing. First, there has been a shortage in rural labor, and the hectareage of individual farms averaging, 1.1 ha, is too small for mechanization. Second, the productivity of farm labor is relatively low as compared with that of industrial labor. The combined results of these changes are low farm incomes and more part-time farmers. About 82% of 870,000 farm households are now part-time farmers, and the average farm

income has declined from 48.1% of their total incomes in 1974 to 33.4% in 1978. As for those who own less than 0.3 ha each, numbering around 200,000 farm households, only 15% of their total incomes come from farming. In order to offset the rural labor shortage and to increase the farmer family's income, a number of measures have been taken for rice cultivation.

Rice fields in Taiwan are small and fragmented, constituting a handicap to the efficient utilization of farm machinery and to the development of other agricultural resources. To overcome this difficulty, a joint farming system was developed in 1963. Rice transplanting and harvesting have since been carried out by group action. Its primary purpose is to have crops planted and harvested in time. Another, a new kind of group action encouraged by the government is to enlarge the scale of farm operation through contract farming while maintaining individual land ownerships. In view of the deep-rooted land ownership tradition, however, it appears that not much can be done to enlarge the size of farms in a very short period of time. Group action is merely a solution to the problem in a transition period during the course of economic development. The basic policy is still to maintain the family farm system and to enable the farmers to enlarge their farm sizes. Joint rice farming in Taiwan may be divided into three stages: (1) initial stage (1963-1969); (2) demonstration stage (1970-1978); (3) extension stage (beginning in 1979). In 1963, joint farming was carried out in three localities only. By the end of 1979, 878 joint farming groups had been organized. Their primary purpose was to improve labor efficiency and reduce production costs. In 1970, a joint farming program was specifically implemented with 121 groups organized on a year-round basis in 76 townships. Since then, joint farming has been conducted under various programs which include: (1) extension of integrated techniques for rice cultivation, (2) demonstration of model villages for integrated development, (3) Improvement of cropping patterns in line with the regional agricultural development, and (4) enlargement of farm operation scale through joint and contract farming. In some areas where land consolidation has been completed, the joint farming groups score more success than the others, due mainly to the following factors:

1. carefulness and experience of extension workers.
2. availability of good farmer leaders and dedicated group officers.
3. high degree of cooperation among group members.
4. availability of off-farm job opportunities.
5. consolidation of lands in the area.
6. joint investment in farm improvement and group sideline project.
7. building-up of group funds.
8. government support and supervision.
9. production incentives.
10. well-written general agreements and well-planned joint operational schedules.

As a whole, joint farming does demonstrate a way to enlarge the scale of farm operation for improve labor efficiency and reduced production costs. It should be noted again that group action is not the ultimate policy objective, and that joint and contract farming is a provisional scheme in the process toward the goal of optimum-scale family farms.

本省水稻生產概況

邱建中¹

水稻一直是本省農業生產的核心作物，對國計民生有舉足輕重的影響，故稻作生產甚受各界的重視，過去30年來，總產量增加了三倍有餘，主要仍因單位面積產量，由光復之初的1,585公斤/公頃增為1979年之3,375公斤/公頃，分析導致增產之因素：

- 1.實施土地改革政策之成功，促使農民增產之意願；
- 2.農地重劃，提高土地利用效率；
- 3.優良品種之育成，改善了稻米的產量與品質；
- 4.栽培技術改善與其綜合利用；
- 5.大量施用化學肥料與農藥，並配合適宜的施用技術；
- 6.稻作栽培一貫機械化作業，節省大量的勞力支出；
- 7.水資源的開發與利用；
- 8.高效率的農業推廣系統。

近年來，由於工商業的急速發展，農業成長相對的遲緩，鑑於本省稻農平均耕重面積僅1公頃左右，經營面積過小，不合企業經營原則為有效的提高稻農收益，農政當局仍推動第二次土地改革措施，運用共同經營與委託經營，以及其他配合措施，以期擴大稻農經營面積，培植專業農，增加其收益。

¹臺中區農業改良場技正兼課長