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Recent Achievement of Rice Cultivation in Hokkaido

Jiro OKAMOTO

Institute of Geography, Hokkaido University of Education at Asahikawa

Character of the rice cultivation in Hokkaido

Rice cultivation has held a preeminent position in agriculture in Hokkaido, the coolest region of Japan. In 1969, when it was at its peak, the planted area reached 266,200 hectares. Although the rice production adjustment policy has been carried out since 1970 to decrease of the surplus of rice and the deficit of Food Accounting managed by the government, and although the planted area declined sharply to 175,200 hectares in 1978, rice still comprises nearly one-third of the gross agricultural products of Hokkaido. Especially in its central part, which means here the region under the jurisdiction of the Ishikari, Sorachi, Kamikawa, and Rumoi branch offices of Hokkaido Prefecture, concentration on rice production has continued. This is also the district that experienced a typical development in the formation of upper classes of farmers, and surpassed the best rice producing districts in Yamagata and Niigata Prefectures in agricultural mechanization and in the use of related productivity-raising equipment. As early as 1967, farm households which were productive enough to sell more than 12 tons of rice occupied 43% of this region, compared with 10% in Yamagata Pref. and 4% in Niigata Pref.¹⁾

The level of yield per unit area was, in years of good harvest, among the highest in whole Japan. For example, in 1974 the average rice yield per 10 ares in Hokkaido was 503 kg, which was much higher than the national average (455 kg), surpassed by the yields of only three prefectures, Yamagata (566 kg), Aomori (561 kg), and Akita (556 kg).

Rice cultivation in Hokkaido began with the adaptation of the traditional farming methods to the natural conditions of more northerly latitudes. At first, cool summers and the unstable yields that Hokkaido had long suffered from were the greatest problems rice cultivation confronted. After the war as well, cool summers attacked Hokkaido in 1954 and 1956, giving fatal blows to its agriculture; not a few towns and villages had practically no harvest.

By the 1970's, however, none of the districts was afflicted with this formerly perennial problem, because Hokkaido, a single region where the government agricultural policies based on the Agricultural Basic Law were successfully enforced, had undergone typical structural changes in the 1960's. As the new system of developed agricultural techniques became widely diffused, rice cultivation, at least in the central region, escaped damage, bringing stable and abundant

yields. In addition, rice farming became a safe and profitable enterprise because of the steady progress in farm enlargement and the acquisition of capital equipment, thanks to the government-supported high price of rice. Yet even the high level of yield and the increase in stability attained so far have not succeeded in overcoming completely the agricultural weak points, such as variable yields in the marginal lands and inferior quality. Consequently, it is almost inevitable that rice-cultivation-reduction rate has become quite high under the rice production adjustment policy. A new problem has thus arisen as a result of the very character of rice cultivation in Hokkaido, which has been forced to be carried out within the cultural boundaries.

Fluctuation in the planted area and the retreat of the cultivation front

Trial rice farming was carried out in the 1880's in the Ishikari plain ; afterwards, the front line was gradually pushed northward, until at last the area reached 198,000 hectares in 1932, which was the maximum attained in the pre-war period. From this peak it showed a decline owing to the damaging blows given by successive cool summers in 1931, 1932, 1934, and 1935, to the shortage of labour in the war time, and to the suspension of public fund for rice field construction, finally falling down in 132,000 hectares in 1948. From this year onwards, however, it began to increase again because of the successful enforcement of national policies for increasing the yield of rice just after the war.²⁾

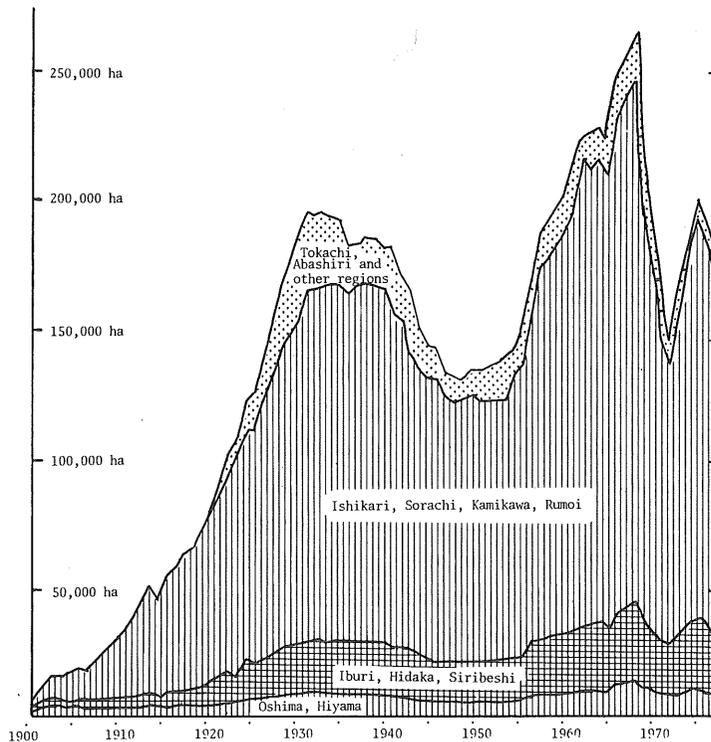


Fig. 1 Fluctuations in the acreage of rice-planted fields.

In the 1950's, intensive cultural techniques for the increase of yield by the heavy and wide-spread application of chemical fertilizers on the basis of land improvement ensured that the yield level was raised with a leap. It was during this period that the level rose as high as or higher than the national level. Especially the increase in the area of rice fields made from the late 1950's equalled the increase in the 1920's, which was so rapid as to double the area within ten years. In 1960 it gained on the maximum area in the pre-war period, and ultimately established a new record of 266,000 hectares by having added more than 67,000 hectares by 1969.

The decrease from 1970 onwards, when the rice production adjustment policy was started, was also abrupt and excessive; the acreage, having lost 45% of it, precipitated to 145,000 hectares after only three or four years, equal to the minimum immediately after the war. The drastic fluctuation in the scale of the rice-planted areas during this period is very surprising (Fig.1).

Except in the marginal lands, most of the upland fields which had been used as paddy fields before are thought to have been converted again into paddy fields by around 1960. For this reason, the increase in the rice-planted area in the 1960's, generally speaking, was brought about chiefly by the development of new rice fields converted from upland fields or constructed in uncultivated areas. Undoubtedly the factor which stimulated the rapid progress in the construction of new rice fields was the relative profitability of the rice price supported by the government food control system; but what made it possible to realize the construction of the fields was the development of irrigation water resources, land improvement and the improvement of rice field construction techniques. The land improvement works in this period focussed on peat bogs with the drainage of the Ishikari river, for which reason, the increased ratio of rice fields per branch administrative unit (shicho) gave Sorachi 38%, while Kamikawa and Ishikari also showed high ratios. With respect to construction techniques, bulldozers were widely used in the 1960's, and the work became easier to carry out not only by using these machines but also by entrusting them to private construction corporations. It goes without saying that the high-level economic growth of the 1960's supported such a rapid expansion of rice field acreage.

During the abrupt increase of the 1920's there was large-scale rice field construction in the Abashiri area where no rice had ever been cultivated, pushing forward the rice cultivation front. In contrast, the sharp increase in the 1960's was not brought about by the enlargement of rice growing areas. This was one of the characteristics of the increase in this period. There were no newly-constructed fields in towns and villages where no rice had been cultivated in the 1950's, although the construction was carried out to some degree in north Kamikawa and Abashiri, both of which belong to the marginal rice farming lands. As the agricultural mutual aid insurance system has been one of the con-

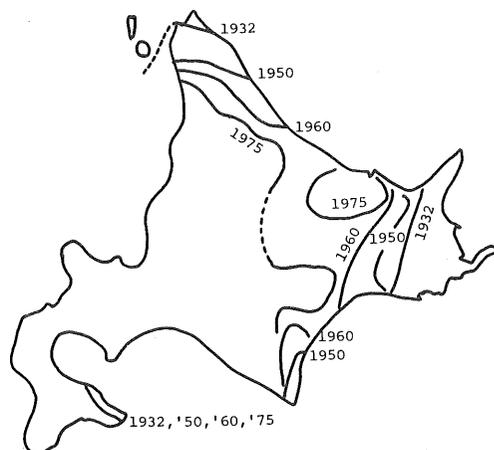


Fig. 2 Retreat of rice-farm areas.

ditions making possible rice cultivation in the marginal region in the post-war period, the regional expansion of rice farming in this area was limited in this respect.

The decrease in the 1970's under the rice cultivation reduction policy was excessive, especially in the marginal lands. Not a few towns and villages with only a small area of rice fields completely abandoned cultivation, forcing the rice farming areas to retreat (Fig. 2). The winning-back observed in 1974—1976 can be attributed to the increase made when the policy was executed more mildly.

New stage of rice farming productivity

During the 1960's, which was under the agricultural administration based on the Agricultural Basic Law, the above-mentioned enlargement of rice field acreage was in progress on the one hand, while at the same time the decrease in labour continued on the other. Especially in villages in Hokkaido where there were very few opportunities for farmers to engage in non-agricultural employment in their neighborhood, as is the custom in Honshu, part-time cultivation was quite impossible, so that whole families, not one or some members, had to leave their home villages.

Between 1960 and 1976 the number of farm households showed only a 20% decrease in Japan proper, or Japan except Hokkaido, compared with Hokkaido's 45%. In Japan proper the ratio of part-time farm households mainly engaged in other jobs to households totally engaged in farming more than doubled from 32% in 1960 to 76% in 1976; in contrast, the ratios showed some 27% in both the years in Hokkaido. With respect to the number of rice farming households Japan proper exhibited a 15% decrease as opposed to Hokkaido's 40% from 1965 to 1976, while the ratio of part-time farm households mainly engaged in other jobs to total farm households in 1977 was only 13.9% in Hokkaido in contrast with 68.7% in Japan proper. In 1977, of the total acreage of rice growing fields, 50.8% was cultivated by the farm households of the same type in Japan proper compared with only 3.7% in Hokkaido. In Japan proper rice farming is shared half and half between full-time farm households, or farm households deriving their income mainly from agriculture itself, and part-time farm households mainly engaged in other jobs, while it is carried out solely by full-time farm households in Hokkaido. This can be regarded as another characteristic of rice cultivation in Hokkaido.

During the above-mentioned process rice field acreage per household grew larger, and the enlargement owing to the construction of new rice fields referred to already also helped to strengthen this tendency. The average planted acreage per rice-cultivating households in 1976 was 0.63 hectare in Japan proper, compared with 3.2 hectares in Hokkaido, brought about by the addition of around 0.1 hectare every year. When there is continuing shortage of labour, large-scale management is impossible without raising efficiency by mechanization. Land improvement in the 1950's was focussed on the works which would rise the yield directly, such as irrigation and drainage including under-drainage, and soil mixing with earth from other places, and so forth. In the 1960's, however, a large-scale rearrangement of the rice fields so as to make a more efficient use of machinery was boosted by a government subsidy.

Mechanization of rice farming in the 1960's began with the use of power tractors by way of

small, handy cultivators introduced after a long period of ploughing by horse and reaping by hand. Tractors were owned and used only by individual households in the 1960's, and their use was limited mainly to the tilling process of rice farming. In the 1970's, however, mechanization covered almost all the farming processes, especially harvesting works markedly mechanized. First, rice-plant-binding machines spread rapidly and widely ; these were then replaced by combine harvesters, which diffused at so remarkable speed as to harvest rice in 85% of the rice fields in 1978 (Fig. 3).

The diffusion of power-driven harvesters was accompanied by that of artificial drying machines, while rice centres and country elevators were also introduced. Lately, the harvesting process has completely been mechanized. As to drying, 90% is artificially dried, 20% being dried jointly at rice centres, representing higher ratios in Hokkaido than in Japan proper.

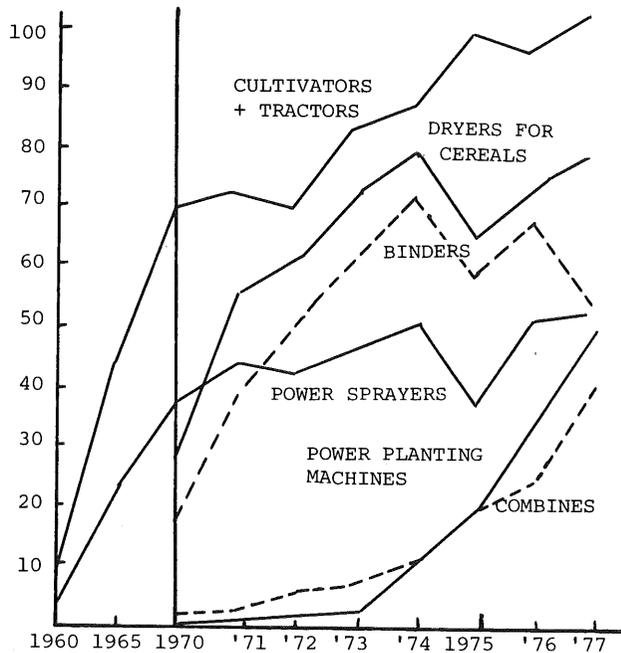


Fig. 3 Farm machines diffused.
Numbers of machines are those per 100 households.

Rice-planting machines were introduced around 1972, later than in Japan proper, but spread at such a quick tempo that they came to be used in more than 90% of all the rice field area by 1978. Most of the machines used are of the four-row type, but new ones able to transplant rice seedlings simultaneously in more rows - in more than six - are now increasing in number. The enlargement of management scale and the employment of mechanized planting have made it necessary to transplant seedlings at the earlier time. This, in turn, has encouraged field-bed-preparation to be concentrated in a very short time. Besides, the introduction of combine harvesters has made field soils harder, demanding higher-powered tractors for ploughing the hardened soils. In this

way mechanization has grown more intense in degree; machines larger in size, with more specific utilization objects, aim at higher efficiency and better performance. However, farm enlargement and higher-degree mechanization cannot always progress in parallel with each other. The expenses for agricultural equipment has already occupied 26% of the rice production cost, suggesting that they are oppressing farmers as a heavy burden, leaving no remaining resources in individual households to introduce large-sized, highly efficient machines. Consequently, joint use of heavy machines becomes inevitable.

Farm households managing large farms, which owned low-powered tractors individually, have begun to step out on the road to the joint ownership of heavy machines. The joint use of high-powered tractors made a remarkable progress in the early 1970's; in the rice farming district of Sorachi, the use was adopted not only by one-third of all the farming families but also by 77% of the households which had used over 50 Hp tractors in 1974.

As rice cultivation in Hokkaido is carried out by full-time farm households, as we saw, there has seldom been any contract rice production; cooperative groups for agricultural production fulfill their function mainly by this joint use of machines. Especially in northern Sorachi, one of the areas with higher rice yields, where the acreage of rice field per household is 5 hectares, and in the Asahikawa district which organized cooperative groups for production by municipal regulations, there are such groups in almost all the rice farming settlements. With the development of mechanized transplanting, joint nursing is now in progress as well.

In this way mechanization of the entire processes of rice farming had been almost completely attained by the 1970's. According to the Report on the Production Costs concerning Agricultural and Livestock Products, labour hours per 10 ares decreased remarkably from about 150 hours in 1960 to 90 hours in 1970 and then to 60 hours in 1976. Between 1960 and 1970 there was a marked labour-time reduction in rice farming processes, such as ploughing, soil preparation for transplanting, weeding, and irrigation water management, and a far more notable decrease from 1970 to 1976 in such processes as transplanting, weeding, harvesting, ploughing, and soil preparation. As to seeding culture, there was no reduction in working hours. Labour-saving made a remarkable progress, establishing not only the condition necessary for farm enlargement but being also a prerequisite to the adoption of more intensive agricultural techniques. Rice fields were ploughed and prepared for transplanting first by using small power cultivators, and then by using power tractors. As a result efficiency was raised to a high degree, and the remaining labour was employed especially for the thoroughgoing management of seedling culture³⁾. In this period rice cultivation underwent a great development of nursing techniques; seeding time was set earlier in response to the demand for earlier harvest assuring more yields by avoiding the decrease due to the cold autumn. Nurseries were also improved upon; in the 1950's the nurseries used natural seeding beds or seeding beds heated by the sun with covering such as sheets of oiled paper to protect them from the cold, followed by those warmed artificially by buried heat sources, but in the 1960's the seeding beds were effectively protected with vinyl plastic coverings, and later located indoors to grow seedlings in the air-conditioned vinyl houses. For preventing damages by blight and insects mists were widely employed in the 1950's, replaced by high-powered insecticide sprayers, which succeeded in controlling thoroughly the frequent damage caused by the

heavy application of chemical fertilizers. Cropping in the autumn, which was carried out by hand in the earlier period, has now been mechanized; the way of drying has also been changed from natural to artificial with the introduction of highly efficient power threshing and drying machines. The mechanization of the cropping and drying processes has secured timely harvesting, especially in Hokkaido, contributing greatly to stabilizing the yields of rice.

The techniques for stable and heavy yield, which had been tried out in the 1950's were extensively developed amid the structural changes brought about by the labour-saving of the 1960's. As a result, land productivity has made progress side by side with labour productivity.

The raised level of yield in the 1950's is clearly shown in Fig. 4. Rice cultivation in Hokkaido is said to be decidedly influenced even by very slight fluctuations in the average summer temperature of as little as 1°C. For this reason, yield-temperature relationships are given in the figure. It is notable that step-like differences in the yield level can be observed between the periods pre-1951 and post-1957. Even in the years damaged by cool summers, the yield doubles in the latter period at temperatures almost as low as those in the former; especially in the central region, the core district of rice farming, resistance to low summer temperatures has become higher. In 1967 and 1971 also the levels can be observed to rise. The development of land improvement and the techniques for inducing a large quantity of yield by heavy application of fertilizers associated with the improvement is thought to have been responsible for such a wonderful increase in the yields.

In the case of the yields in the 1970's, however, the yield-temperature relationships are not so close as in the other periods. This can be interpreted as a consequence of the following unfavorable conditions. In 1975 there was flood and typhoon damage in addition to a lack of sunshine in July; in 1971, the Sorachi and Kamikawa districts suffered from blight and noxious insects besides cool summer temperatures, producing rice of inferior quality, black in colour. Furthermore, in 1976 much severer blight and harmful insects attacked almost all

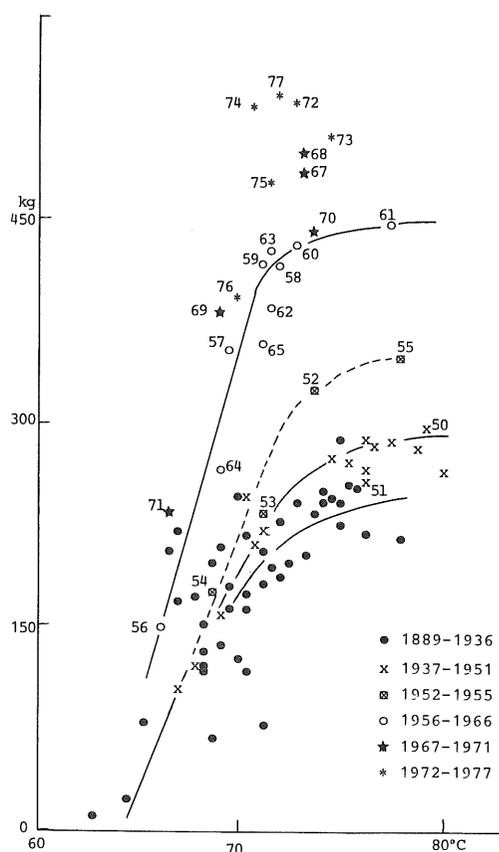


Fig. 4 Rice yield per 10 ares in the relationships to integrated monthly average maximum temperature in June, July, August.

Temperature : at Sapporo
Yields : in whole Hokkaido
The dots till 1964 and curves are after H. Fukui.

the rice farming regions. The reason was that in the 1970's, under the Synthetic Agricultural Administration, the production adjustment policy, which required quite a considerable decrease in the area of rice fields, drove such a great number of farmers away from their homes to engage in non-agricultural employment that rice growing management could not be intensive enough.⁴⁾

The total acreage allotted for reduction under the rice production adjustment policy from the 1970 fiscal year onwards has amounted to 89,000 hectares, comprising as much as 35% of all the rice-producing fields. Rice cultivation in Hokkaido has therefore been forced to face new situations, including the urgent problem of how to carry out a full-scale conversion from the single rice cropping to a different type of farm management such as multiple farming.

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