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PROBLEMS CONCERNING GRAIN PRODUCTION AND DISTRIBUTION IN CHINA: THE CASE OF HEILONGJIANG PROVINCE

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I. INTRODUCTION

UNDER its reform and openness policy initiated in 1978, the Peoples' Republic of China has promoted reforms aiming at a transition from a government-led socialist planned economy to a socialist market economy. These reforms began in the agricultural sector and in rural areas with various measures being implemented focusing on decentralization and the further development of a market economy. Decentralization in agriculture included the abolishment of collective farms under the people's commune system, in favor of introducing the household production responsibility system. Farm household subcontracting, which accounted for no more than 1 per cent of total agricultural output in 1979, showed significant increases in 1982 as the result of government announcements that the people's commune system was to be dismantled; and by 1984, almost all agricultural production was carried out under the household production responsibility system. The people's communes, which had dominated agricultural production and agrarian life for some twenty years, were thoroughly dismantled in both name and substance by 1985, thus overcoming the problem of mal-equal income distribution stemming from the communal system. With the introduction of household production responsibility system, farmers were transformed from farm laborers to agricultural managers farming according to their own abilities and economic decisions. These reforms offered agrarian people greater work incentives and encouraged them to adopt new technologies that would lead to long-term growth in the agrarian economy. Between 1978 and 1984, over half of the increase in grain production

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was attributed to increased productivity stemming from these institutional reforms.[1]

Following the above efforts at decentralization, agricultural policy turned to the promotion of "marketization" of the agrarian economy, which means at the onset reforming the distribution system. From the thinking that low purchasing prices for grain would be responsible for lower incentives to produce, the government raised average procurement price of grain by 24.8 per cent in 1979, in order to heighten incentives. This rise in prices along with the introduction of the household production responsibility system brought about a huge jump in grain production, as the annual figure of 300 million tons of output in 1978 increased to 400 million tons by 1984, thus putting an end to the "hunger" problem in China for all intents and purposes.

Grain has been an important wage good in China, grain allocations having comprised 13.0 per cent of urban household expenditures in 1981. By the end of the 1980s, however, that figure declined to 7.6 per cent. As grain consumption reached satiation on a quantitative basis, consumers began to express dissatisfaction with the quality of the grain that was being rationed; and higher-income households began to abandon their rights to such allocations in favor of higher-quality commodities being sold on the free market. Therefore, grain rationing had probably already fulfilled its intended purposes in urban areas by the end of the 1980s.

The government did not raise the rationed retail prices of grain during the early 1980s, even in the face of rising procurement prices. Hence the negative margin between rationed retail and procurement prices widened over time, creating a grain management deficit of 22.7 billion yuan in 1984, an item that put great pressure on the national budget. In order to decrease this huge deficit, a double-track distribution system was introduced in 1985. This grain distribution system, which was directly controlled by the government's administrative mechanism, realized a stable grain supply for urban residents, while relegating any surplus grain to free market distribution and the vagaries of supply and demand. In other words, by reforming the grain distribution system in this way, grain purchased under the contract system was reduced, and the government purchased more grain by paying negotiated prices to meet its total annual requirements. Moreover, against a backdrop of a relative decrease in the importance of grain as a wage good, the government tried to solve its negative retail-procurement price margin problem by raising rationed retail prices to 20.9 per cent in 1991 and 39.2 per cent in 1992.

In 1993 the State Council announced its "Eight-Point Policy for the Production, Purchase, and Sale of Grain," and abolished the institution of rationing to consumers either by the state itself or through mandatory procurement from farms to the state. As a result of this policy, the direct regulation of grain by the state ended, in favor of indirect regulation through such mechanisms as protected purchase pric-

[1] The rest of the production increase has been attributed to the increased application of inputs, especially chemical fertilizer. See Lin (1994, p. 15).

ing, retail price ceilings, and a special storage system. Grain other than that consumed by farm households was transformed from a government-regulated commodity to an object of purchase and sale (Suganuma 1995, p. 95).

As seen above, due to the reforms dealing mainly with political decentralization and marketization, production incentives for farmers were heightened, agricultural technology was improved, and the annual growth rate of grain production increased on a large scale from 2.4 per cent during 1952–78 to 4.1 per cent during 1979–84. Although grain production entered what has been called a stagnation period between 1985 and 1988, that stagnation was overcome beginning in 1989, and production again began to increase, setting the all time record of 500 million tons in 1996. Growth rates in grain production began to outstretch population growth rates from 1978, and per capita consumption increased by leaps and bounds. By carrying out a series of agricultural reforms, China was able to increase agricultural production on such a large scale that today it is capable of miraculously feeding 22 per cent of the world's population on just 7 per cent of its farmland.

However, overall economic growth continuing at annual rates of 9 to 10 per cent over a long period of time both led to a reduction in good farmland and the increasing incidence of part-time farming, leading to the possibility of a hollowing out of the agricultural production base in more and more regions. With increases in rural population, the amount of arable land per farm has decreased to less than that of Japan, resulting in the increasing fragmentation of arable land. Along with the development of township and village enterprises, nonfarm labor markets have been formed in many rural areas, and the proportion of part-time farm households has been increasing. The migratory population has also increased; the agricultural labor force is growing older; and we can observe a growing tendency of women taking over farm tasks. The share of farm income in total farm household income fell 16.3 points from 78.2 per cent in 1980 to 61.9 per cent in 1996 (Ministry of Agriculture, *Zhongguo nongye fazhan*, 1996; *Zhongguo nongye nianjian*, 1997, p. 464). As industrialization proceeds leaving the scale of farming small, many farm households will no doubt be relying more and more on nonfarm income. As a result, a hollowing out of family farm management may continue to a point where the country's whole agricultural productivity base could be weakened.

Domestic farm prices suddenly jumped in 1994 and rose above international prices. Lester Brown warned in his book titled *Who Will Feed China?* (1995) that China would soon be faced with the necessity of having to import large amounts of grain from abroad. Stimulated by these incidents, the world began to focus on the problem of stability in the supply and demand of grain in its most populous country. The Chinese government announced in 1996 that it was committed to maintaining 95 per cent self-sufficiency in grain for the years to come. In order to realize this goal, the development and diffusion of technology through research and extension activities, in addition to more capital investment in land improvement, including

irrigation projects, became indispensable. Moreover, as the paper by Yamamoto (2000) in this issue indicates, it is a crucial, top priority policy issue to overcome problems posed by unduly small-scale farm management and reform production organization in order to realize economies of scale.

Amidst the current situation regarding grain, the limelight has fallen upon agriculture in the three provinces of the northeast, Jilin, Liaoning, and Heilongjiang (especially the third), where much frontier still exists, presenting possibilities for the expansion of arable land in China. Within the trend towards shrinking arable land area throughout the country in the midst of advancing industrialization and urbanization, the arable land in Heilongjiang has in contrast steadily expanded, and the farm community there has been able to realize remarkable increases in agricultural output.[2] When total grain production in China set records for 1996, surpassing the 500 million ton mark, Heilongjiang contributed significantly to that performance, accounting for one-third of the 13.50 million ton increase from the preceding year with a 4.54 million ton output. It is expected that the arable land in Heilongjiang will continue to be expanded and that grain production will increase. In the Ninth Five-Year Plan proposed by the Chinese government, the grain production target to the year 2000, with 1992–94 as the base period, was set at an increase of 11.1 per cent for the country as a whole, while the target for the three provinces of the northeast was set at 25 per cent (Kudō 1998, p. 2).[3] With respect to Heilongjiang Province, a grain production figure of 32.5 million tons has been planned for the year 2000.[4]

In this article, we will investigate the process and present situation of grain production in Heilongjiang Province, which is one of China's most important food supply bases, and then discuss the province's future potential, focusing on rice production. The reason for concentrating on rice production is as follows. Together with rising income and the development of market economy, demand for grain is in a transition marked by preferences for quality over quantity. In the case of rice, demand is shifting away from indica rice to better-tasting japonica rice. Heilongjiang Province happens to be China's largest producer of japonica rice, and as such has become a focal point of demand from higher-income, urban residents in search of better-tasting rice. Reflecting this heightening demand, rice production has been rapidly increasing in Heilongjiang since the mid-1980s. In the following discus-

[2] On the whole, arable land in China decreased from 99.39 million hectares to 95.49 million hectares during 1978–96, a 3.9 per cent decline. During that period arable in Heilongjiang increased by 8.5 per cent; and grain production there doubled from 14.78 million tons in 1978 to 30.46 million tons in 1996 (Heilongjiang Province, *Heilongjiang tongji*, 1997, p. 220).

[3] Grain production in these three provinces is expected to reach 99 million tons by 2005, out of which 45 million tons earmarked for other regions of the country.

[4] Heilongjiang's production figure for 1997 was 31.05 million tons, so already two years after the start of the plan, a 20 per cent increase in output has been realized, thus surpassing the expectations of the Ninth Five-Year Plan.

sion, we will look at the development process of the rice industry there in relation to both decentralization and marketization trends in China, while at the same time examining the present situation of and pressing issues facing rice growers regarding production and distribution, and then offer some suggestions about how policy can be improved in the future.

One more contemporary significance in studying rice industry in Heilongjiang Province is the interest that has arisen in the possibility of Heilongjiang rice being exported to Japan on the occasion of Japan switching to rice tariffication beginning in April 1999. Within the interest that has been increasingly drawn to rice exports to Japan if tariffs barriers are lowered in the future, the most probable candidate for overcoming those barriers is northeastern Chinese rice. It is in this sense that the rice industry in Heilongjiang should be studied with respect to product quality, price, production cost, and future production potential.

II. A GENERAL OVERVIEW OF HEILONGJIANG AGRICULTURE

A. *Characteristic Features*

Heilongjiang, which is as we mentioned a province located in northeastern China, lies on the northern and eastern borders with Russia and meets the Inner Mongolia Autonomous Region to the west. The province is situated in a cold zone between the latitudes of 43°22′ and 53°24′, corresponding laterally to the area from northern Hokkaido, Japan to the southern half of Sakhalin. Winter there is long, lasting five to six months, during which average temperatures range between 5°C and 0°C. The province's total land area measures 45.39 million hectares, an area about 20 per cent larger than that of Japan. Agriculture is based on the expansive Sanjiang and Songnen Plains, with lots of fertile soil of the rich black, black calcium, and prairie varieties. As of 1996, the province was harvesting 30.46 million tons of grain from 8.85 million hectares of arable land, making it the fifth largest producer in China. In 1997 the most important crops in terms of land devoted to them were corn (2.55 million hectares), soybeans (2.39 million hectares), rice (1.4 million hectares), and wheat (1.07 million hectares).[5]

As mentioned previously, the scale and nature of farm management in China can be characterized as mostly "tiny," and self-sufficient. Only 30 per cent of the total output of grain is sold for the market. It is here that Heilongjiang differs, with its larger-scale farms producing as of 1996 64 per cent of its grain (double the national average) being sold for the market. Unlike most of China's provinces, grain is produced here for sale as commodities.

[5] The official definition of "grain" includes rice, corn, wheat, barley, sorghum, millet, soybeans, other coarse grains, and tubers (yam and potatoes). Tubers are converted at a ratio of 5 to 1 kilograms of grain.

TABLE I

NATIONAL COMPARISON OF HEILONGJIANG AGRICULTURE

	Heilongjiong	National Comparison
Gross value of output	57.1 billion yuan	4.1% of total
Agricultural labor force	5.79 million	1.8% of total
Arable land	8.995 million ha	9.5% of total
Arable land per farm household	2.37 ha	National average = 0.62 ha
Average farm household income	15,356 yuan	National average = 13,045 yuan
Large- and medium-size tractors	71,440	10.4% of total
Small tractors	4,500,000	4.3% of total

Source: SSB, *Zhongguo tongji* (1998).
Note: All figures are 1997 data, with the exception of arable land, which is as of 1995.

Table I shows the position occupied by Heilongjiang agriculture among the other provinces of China as of 1997. Its gross value of agricultural output came to 57.1 billion yuan, or 4.1 per cent of the national total; and its agricultural (primary industry) labor force of 5.79 million accounted for 1.8 per cent of the national total. The average farm size is 2.37 hectares and earns a yearly income of 15,356 yuan, ranking eighth nationwide. The reliance on income from agriculture is high at 81.3 per cent, and most farm households are involved exclusively in agricultural production.

In terms of farm mechanization, there are 71,440 large- and medium-size tractors in operation, accounting for 10.4 per cent of the national total. The average value of farm machinery per household in rural areas comes to 2,816 yuan, the highest in China, some 3.2 times the national average. From such figures, it is clear that Heilongjiang is endowed with vast flatland, boasts the largest average farm size, and has mechanized faster than any other province in China (Table I).

Looking at the coefficient of specialization for agricultural production in Heilongjiang as of 1995, we find a high value of 6.8 for beans,[6] stemming from the 4.27 million tons of soybeans produced, accounting for the largest share of the national total at 32 per cent. In addition, the province produces 36 per cent of China's sugar beets, resulting in a high coefficient of specialization of 1.9 for sugar. The coefficient for large animals is 1.6, no doubt related to the province's dairy industry, which produces 1.65 million tons of milk, or 29 per cent of the national total. Its 12.19 million tons of corn accounts for 11 per cent of the national total, and 480,000 tons of sorghum accounts for 10 per cent. Rice production accounted for 2.5 per cent in 1995, but rose to 4.3 per cent two years later. Rice also accounted for 18 per cent of the total grain grown in Heilongjiang during 1995, then that share rose 10 points to 28 per cent in 1997.

[6] Coefficients of specialization have been calculated using the data of *Zhongguo nongye nianjian, 1996* [Agricultural yearbook of China, 1996] (Ministry of Agriculture, 1996, pp. 121–23, 126–27).

III. AN OVERVIEW OF RICE CULTIVATION IN HEILONGJIANG PROVINCE

A. *Rice Production in China*

Between 1978 and 1997, trends in Chinese rice production were marked by the diffusion of high-yielding varieties, increases in the use of chemical fertilizers, and steady improvements in cultivation technology. These trends led to a production figure of 189.33 million tons in 1990. Although a decline was experienced during the following few years, production began to rise again in 1995, and a new high was recorded in 1997 with a 200.74 million ton output.

Both indica and japonica rice varieties are grown in China, with the former enjoying almost an 80 per cent share of the total crop. However, with the recent rise in income, the better-tasting japonica varieties are growing in popularity and occupying a greater share of the rice crop. This is a trend that will no doubt continue into the new millennium.

In China, rice crops are divided for statistical purposes into early rice, middle rice, late rice, single-cropping late rice, double-cropping late rice, and northern rice. As the name implies, northern rice is that cultivated in China's northern provinces and is of the japonica variety. The reason for making the special classification for northern rice is that in recent years there has been a rush by provinces producing northern rice to increase output, a trend that has contributed much to the production increases that have taken place nationwide (Shiraishi 1997, p. 184). Table II shows that while rice production increased 1.4 times nationwide between 1980 and 1997, total northern rice output increased 2.7 times over the same period, with Heilongjiang's northern rice output increasing 10.8 times.

B. *Rice Cultivation in Heilongjiang*

The high-latitude, cold-weather rice cultivation carried out in Heilongjiang is characterized by shortest growing season in China. However, temperatures during

TABLE II

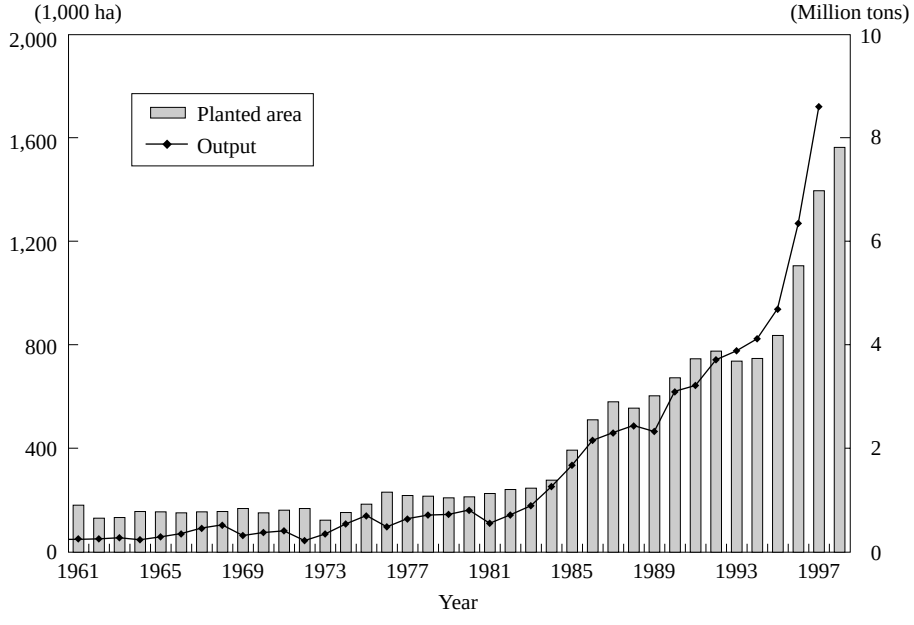
RICE PRODUCTION TRENDS IN CHINA, 1980–97

(1,000 tons of paddy rice)

Year	Nationwide	Northern Rice	Heilongjiang
1980	139,910	9,655	796
1990	189,330	17,240	3,144
1997	200,735	26,454	8,610
1997/1980	1.4	2.7	10.8

Sources: Heilongjiang Provice, *Heilongjiang tongji* (1998); SSB, *Zhongguo nongcun* (1998).

Fig. 1. Rice Planted Area and Output in Heilongjiang, 1961–97



Sources: Heilongjiang Province, *Heilongjiang tongji*, 1985–98 editions.

the rice-growing period are high enough, and there is plenty of sunshine. During August temperatures reach into the 30s°C with lows in the 20s°C, meaning daily temperature differences of from 10°C to 14°C. Yearly rainfall is not plentiful at 400–600 millimeters, and it falls mostly between June and August. Rather, Heilongjiang is blessed with six large river systems that supply sufficient water for rice cultivation on the province's two large plains. Transplanting of seedlings is done between the middle of May and early June, while the harvest is reaped between mid-September and mid-October. From early spring to early June, the soil is too cold for microorganisms to proliferate, nullifying the nutritional effects of organic fertilizer and forcing the use of chemical agents for both the initial and additional fertilizing.[7] Furthermore, since the weather is dry during the growth period, there is little need for pesticides. The major diseases, ear and leaf blast, which occur during July and August, are combated by the use of blast-resistant seed varieties.

Figure 1 shows the trends in rice production in Heilongjiang, indicating an overall gentle rise to the 900,000 tons of output in 1983, although yearly figures rose and fell, then sharp increases were recorded from 1984 on, especially large jumps of 1.67 million tons in 1996 and 2.25 million tons in 1997.

[7] About 40 kilograms of chemical fertilizer is applied per 10 ares.

TABLE III

ANNUAL GROWTH RATES OF RICE PRODUCTION, YIELD PER 10 ARES, AND HARVESTED AREA IN HEILONGJIANG, 1961–97

(%)

Year	Average Annual Growth Rate of Rice Production (1)	Average Annual Growth Rate of Yield per 10 Ares (2)	Average Annual Growth Rate of Harvested Area (3)	[(2)/(1)] × 100	[3]/(1)] × 100
1961–77	5.5	4.2	1.3	76.4	23.6
1978–83	4.9	2.2	2.7	44.9	55.1
1984–97	14.9	2.5	12.4	16.8	83.2

Sources: Heilongjiang Province, *Heilongjiang tongji*, 1985–98 editions.

Table III shows the results of breaking down the increase in rice production into the two factors of yield increase and harvested area increase in Heilongjiang during the period 1961–97.[8] The contribution of these two factors to annual growth rates in rice production were 76.4 per cent and 23.6 per cent respectively during 1961–77, showing the overwhelming contribution of yield increase; however, during 1978–83, the two factors struck a balance, then during 1984–97, harvested area increases assumed the dominant role, indicating the increasing contribution played by this factor over time. During 1984–97, when harvested area increases became the dominant contributor to production growth, harvested area increased by an average of 86,000 hectares per year. In particular, the annual growth rate has been high since 1995, with increases of 32.8 per cent in 1996, 26.0 per cent in 1997, and 12.0 per cent in 1998, bringing the province's total harvested area to 1.562 million hectares.

Although the relative contribution of yield increases to the growth of rice production has steadily declined since 1984, it does not follow that the annual rate of increase was low. During 1984–97 annual rates of increase in yield averaged 2.5 per cent; and while this figure is lower than the 4 per cent figure recorded by the Philippines during its Green Revolution, it surpasses the 2.0 per cent mark recorded during the period 1920–35, when Japan, under a rice production increase plan, transferred its cultivation technology to colonial Taiwan. The Heilongjiang figure also surpassed Japan's average annual growth rate of 0.4 per cent during 1984–97.

C. *The Causes of the Growth of Rice Cultivation*

There are two causes for the rapid expansion of rice cultivation in Heilongjiang Province since the mid-1980s: one technological, the other economic.

[8] The relationship can be expressed as $G(Q) = G(Q/A) + G(A)$, where G is the growth rate, Q rice output, Q/A output per 10 ares, and A harvested area.

1. *Diffusion of the dry field seedling transplantion method*

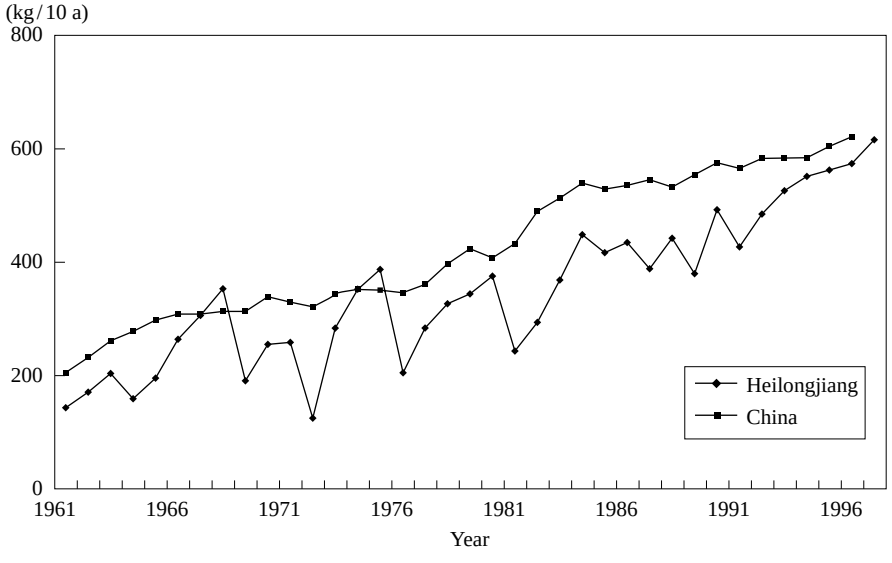
Since Heilongjiang is located in the high-latitude, cold-weather rice production area, the frost-free period is only 120 days and the growth period of rice is the shortest in China. Traditionally, rice planting in this area had been done by direct seeding, resulting in low yield and unstable crops. In order to increase yield and achieve greater stability, the rice transplantation method was introduced during the 1950s. At that time, seedlings were nurtured in paddy before being transplanted to the field. Then in 1982, Shōichi Hara introduced the dry field seedling transplantation method, which was developed in Hokkaido, Japan during the 1940s. This method grows the seedlings in dry fields before transplantation and enables faster blossoming and maturation times than the paddy seedling method. This method contributed greatly to both yield increase and crop stability in colder regions. In 1986 the Agriculture, Animal Husbandry and Fisheries Department of Heilongjiang Province embarked on diffusing this method by designating it as a model of high-yielding technology and calling it "dry growth, spaced planting." The technology spread rapidly, and by 1996 it was being employed on 737,000 hectares of paddy.[9] By overcoming the barriers posed to rice cultivation in cold regions, the dry field seedling transplantation method enabled rapid expansion of rice production from the mid-1980s, and during 1980–97 production was increased by nearly eleven times.

Figure 2 shows trends in paddy rice yield in Heilongjiang and nationwide. Up to the mid-1980s, yields fluctuated greatly, but from that time on more stability was achieved, and yields began to increase rapidly during the 1990s to 616 kilograms per 10 ares in 1997. The coefficient of variation for yield was 0.364 during 1961–83 and declined to 0.276 during 1984–97. The introduction of dry field seedling transplantation method and the diffusion of high-yielding varieties and chemical fertilizer were the major contributors to the increase and stability of rice yield.

While cold-resistant, fast-growing japonica varieties were grown in Heilongjiang, a shift was taking place toward high-quality rice varieties, which have high reputations in the market as the result of increasing income and the growth of the market economy. In 1996 the share enjoyed by such high-quality rice varieties (i.e., better-tasting, high-yielding varieties) in total production surpassed 90 per cent. The most widespread varieties grown in Heilongjiang included Hejiang 19 (249,000 hectares), Dongnong 416 (206,000 hectares), Kendao 6 (61,000 hectares), Hejiang 23 (38,000 hectares), and Tengxi 138 (34,000 hectares) (see Table IV). The high-quality rice being grown there has become very popular among urban consumers in such major cities as Beijing, Shanghai, and Tianjin.

[9] Water conservation and yield-increasing technologies had spread over 452,000 hectares, with the effect of increasing output by 41 kilograms per 10 ares. Other technologies such as improved seedling preparation, bio-fertilizing, and seed disinfecting are also spreading.

Fig. 2. Paddy Rice Yields in Heilongjiang, 1961–96



Sources: Heilongjiang Province, *Heilongjiang tongji*, 1990–97 editions; SSB, *Zhongguo nongcun*, 1990–97 editions

TABLE IV

MAJOR VARIETIES OF RICE GROWN IN HEILONGJIANG PROVINCE ACCORDING TO PLANTED AREA, 1995 AND 1996

(1,000 ha)

Name	1995	1996
Hejiang 19	177	249
Hejiang 23	37	38
Dongnong 416	137	206
Tengxi 138	31	36
Songjing 2	26	
Kendao 6		61

Sources: Heilongjiang Provice, Deparatment of Agriculture, Animal Husbandry and Fisheries, "Heilongjiang sheng nongye ziliao huibian" [Collected agricultural information about Heilongjiang], 1995 and 1996 editions.
Note: This table lists only the varieties grown on more than 20,000 hectares.

2. *The high profitability of rice cultivation*

One more reason behind the recent rapid expansion of rice production area in Heilongjiang is the crop's relatively higher profitability compared to wheat and corn crops, for example. Table V lists production costs, gross revenue, and profit

TABLE V

PRODUCTION COSTS, GROSS REVENUE, AND PROFIT PER 10 ARES IN HEILONGJIANG PROVINCE RICE PRODUCTION, 1983–97

(Yuan)

Year	Production Cost	Gross Revenue	Profit
1983	83	231	147
1984	120	299	179
1985	104	216	112
1986	104	227	123
1987	116	217	101
1988	145	277	132
1989	177	304	126
1990	187	382	195
1991	191	345	154
1992	205	393	188
1993	229	417	188
1994	292	731	439
1995	417	913	496
1996	503	970	467
1997	505	959	412

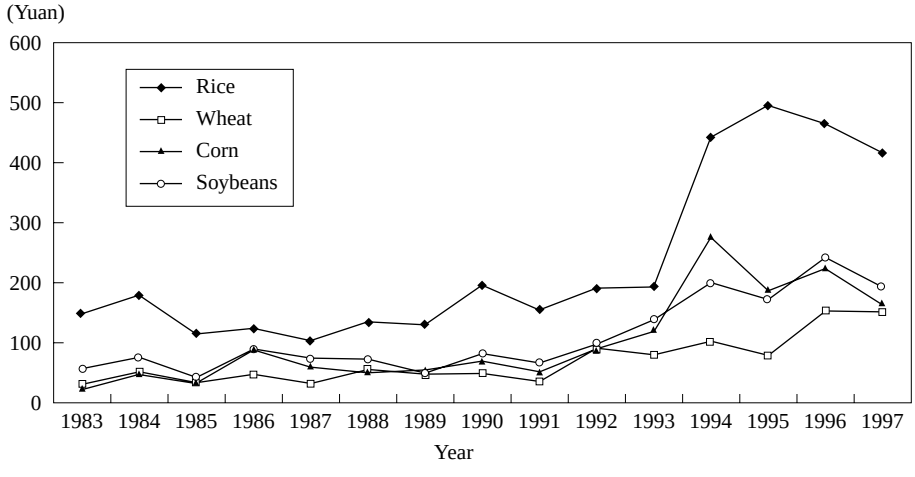
Source: Calculated based on Heilongjiang Province, "*Heilongjiang sheng*" (1998).

from rice per 10 ares in Heilongjiang Province between 1983 and 1997. Production costs began to rise in 1983, and then accelerate during 1994–96. Nevertheless, due to the rapid rise of rice prices during that time, large increases in gross revenue resulted.[10] Since gross revenue exceeded production costs during the period in question, profits during 1994 and 1995 increased significantly, while in 1997 production costs equal to the previous year were met by a drop in gross revenue, leading to a decline in profit to 412 yuan per 10 ares.

Figure 3 shows profits from grains per 10 ares, indicating that profits from rice production are unmistakably higher than that of wheat, soybeans, or corn. Moreover, during 1994–97, with the rapid rise of profits in rice cultivation, its relative superiority over other grain crops grew even more: for example, in 1997 profit per 10 ares of rice came to 412 yuan, compared to only 164 yuan for corn, 193 yuan for soybeans, and 151 yuan for wheat. It is this expanding income earning superiority that has resulted in increased conversion of dry fields to paddy, and the expansion of rice cultivation mainly in the jurisdiction of the Department of Land Reclamation.

[10] The contracted procurement price, which was begun in 1985, was the weighted average of the former quota and above quota prices on a proportion of 3:7. The level of the contracted procurement price was 135 per cent of the former quota price. In order to promote rice production in Heilongjiang, the contracted procurement price was set on a 140 per cent level of the former quota price; and the 5-point gap that occurred between that price and the contracted procurement price at the national level was paid out of provincial coffers.

Fig. 3. Profitability of Grain per 10 Ares in Heilongjiang



Sources: Calculated based on Heilongjiang Province, "Heilongjiang sheng" (1998).

D. *The Possibility of Further Expansion of Rice Cultivation in Heilongjiang*

While Heilongjiang could be expected to continue to expand rice paddy, the upper limit of such expansion lies around 2 million hectares, due to the constraint of water availability. It is possible to increase the supply of irrigation water by digging wells, especially within the jurisdiction of the Department of Land Reclamation, where rice planted area has been expanded rapidly in recent years. But such efforts would soon meet limitations in water circulation. At the present pace of pumping ground water, there is the very real fear that the water level will begin to recede in a few years, thus further expansion of paddy field irrigated by wells is expected to slow down in the very near future. On the other hand, expanding rice paddy by using surface water as a source of irrigation would require a far larger investment of capital than the amount required to dig wells, making any further expansion by that method very difficult.[11]

One additional water problem is related to drainage. There are many places with poor drainage because of high water levels within the jurisdiction of the Jiansanjiang Branch of the Department of Land Reclamation. In order to solve this problem, there are regions promoting the construction of artificial drainage canals. There has not been enough investment in water use facilities up until now in Heilongjiang. Increased investment for both irrigation and drainage is indispensable for further development in rice production.

[11] Recently, a project has been approved to open 66,000 hectares of paddy field utilizing water from the Wusuli River, indicating that the cost of opening rice paddy will be increasing in the future.

IV. RICE CULTIVATION IN JIANSANJIANG

A. *Overview of Rice Production in the Jurisdiction of the Jiansanjiang Branch of the Department of Land Reclamation*

Since the mid-1980s rice production has developed mainly in the jurisdiction of the Department of Land Reclamation (DLR) in Heilongjiang Province.[12] In this section, we will investigate rice production, sale, and some pressing issues using data obtained by field research.

With respect to landownership, there are two types of agricultural land in China: that owned collectively by villagers, and that owned by the state. Within the jurisdiction of DLR, agricultural production is carried out on state farms that have been reclaimed for agricultural purposes. State farms under the jurisdiction of DLR are not administered by autonomous organizations of their cultivators, like village committees, but rather organized in a two-tiered system of the farm and production team. There are 103 state farms under the jurisdiction of the Heilongjiang DLR, 15 of which are located in the Jiansanjiang Branch. The form of agricultural management on these state farms has since the middle of the 1980s been in transition from the collective farm management system to family farming.[13]

The Jiansanjiang Branch of DLR is located in the central part of the Sanjiang Plain with a total land area of 1.24 million hectares, 400,000 hectares of which is under cultivation, while another 390,000 hectares awaits reclamation. The region is enveloped by the Heilong, Songhua, and Wusuli Rivers, and it is all flatland with a grade of 1/10,000. The soil has both a fertile 12-to-20-centimeter black top layer and a lower layer that holds water very well. The winter is bitter cold, and the frost-free season lasts only 120 days. Yearly rainfall measures 550–600 millimeters, about one-third of Japan's annual amount. However, this area is endowed with plentiful water resources; there are a total of six river basins, including canals, under the Jiansanjiang Branch's jurisdiction, providing 27 billion cubic meters of surface water, while the total ground water measures 590,000 cubic meters.[14] The labor force under the branch's jurisdiction totals 186,000, of which 80,000 are involved in agri-

[12] Heilongjiang boasts in terms of size the largest land reclamation projects in China. In 1996 the grain planted area under the jurisdiction of the province's DLR measured 1.732 million hectares, or 51.6 per cent of the total grain planted area of 3.357 million hectares in DLR in China. In terms of grain production, that land is now putting out 46 per cent of the 15.513 million tons produced under DLR in China. In the case of rice, 2.45 million tons was produced in Heilongjian DLR, accounting for 43.0 per cent of 2.45 million tons produced under DLR throughout China. See Ministry of Agriculture, *Zhonggou nongye nianjian* (1997, pp. 384–85).

[13] Twelve of the fifteen state farms under the jurisdiction of the Jiansanjiang Branch have been entirely divided up and leased to farm households. Parts of the remaining three continue under collective farm management, but the major producers are farm households.

[14] The branch of DLR is now using about 160 million cubic meters of water per year.

culture. The average arable land per agricultural labor force is 5 hectares, and it is one of the highest in China. The average farm size is 10 hectares, and agriculture is characterized by labor-intensive production relying on hired seasonal labor.

B. *The Development of Rice Cultivation*

Agriculture was first begun on the Sanjiang Plain in 1956 under regional reclamation projects carried out by retired soldiers. Rice was first cultivated in 1959 in order to fill the demand of farm workers who had migrated from southern China. From that time on, the amount of land devoted to rice cultivation went through four cycles of expansion and contraction, very little expansion was seen until the beginning of the 1980s. Rice production started sustained development since 1983, and rice planted area was expanded greatly. As mentioned previously, it was the dry field seedling transplantation method that made it technologically possible to obtain rapid growth in rice production. Another factor was the migration of rice cultivators with their advanced know-how from more traditional rice production areas of Heilongjiang into this area. Against a backdrop of the high profitability of rice, these traditional rice cultivators, who are called "farm households drawn from outside" (*waiyinhu*) leased land on the state farms and contributed greatly to improved rice-growing techniques throughout the region.[15]

The 1995 rice production area in Jiansanjiang of 47,000 hectares was expanded by an average of 46,000 hectares during each following year, and the figure reached 185,733 hectares in 1998. Almost all of the expansion was carried out in paddy fields which was converted from dry fields.[16] In addition, since paddy constructed directly from prairie land results in poor yields, the Jiansanjiang Branch decided to first build dry fields and convert them to paddy field two or three years later.

Almost all of the paddy field in Jiansanjiang, 98 per cent or 143,800 hectares, is being irrigated by well water in 1997. Digging these wells was initially funded totally under the unified paddy construction plan of the State Farmland Management Department, but any new wells must now be financed by cultivators.[17]

[15] The problems caused by the migration of family labor force of "households drawn to the state farms" in one village at a point of emigration is taken up in Wang, Maruyama, and Kikuchi (2000).

[16] Between 1995 and 1998, the Jiansanjiang Branch of DLR was able to expand rice planted area under its jurisdiction by a rapid average rate of 45.8 per cent, over double the average annual rate of 20.9 per cent for the province as a whole. Moreover, increases in rice planted area under the jurisdiction of the Jiansanjiang Branch accounted for 19 per cent of the total increase in the province in 1997, showing just how important the development of rice production in the Sanjiang Plain has been for the rice industry of Heilongjiang.

On the average, of the 46,000 hectares of paddy opened yearly during this time, 44,466 hectares were converted from dry fields, with the remaining 1,534 hectares constructed from prairie land.

[17] At present, the cost of digging one irrigation well in 859 state farms in the Jiansanjiang Branch is 40,000 yuan. Out of which cultivators are required to have cash on hand of 15,000 yuan in order to receive a loan of 25,000 yuan from the state farm at an annual interest rate of 14.5 per cent. The loan must be paid back in three years. There are already 450 wells functioning on the state farm. One 35-to-45-meter deep well is capable of irrigating 20 to 27 hectares of paddy.

Rice production area under the branch is expected to expand to 207,000 hectares by 1999, and to 267,000 hectares by 2005. That is to say, rice acreage is expected to expand at a rate of 12,000 hectares per year, resulting in a 90,000 hectare expansion between 1998 and 2005. However, this expansion will reach its upper limit around 2005, and further expansion will be difficult due to limits of the existing water supply capabilities for the region. Nevertheless, during the first decade of the new millennium, the land devoted to rice production in Jiansanjiang will have probably surpassed that of California State, the United States (207,200 hectares as of 1996).

The major rice varieties grown in Jiansanjiang are Sui 92-188, Kendao 94-202, Dongnong 416, and Hejiang 19, all high-quality, good-tasting japonica varieties. In 1997 the yield per 10 ares of paddy rice was 780 kilograms, 27 per cent higher than the provincial average of 616 kilograms. In 1997 the branch's total rice output came to 1.21 million tons, and in 1998 it was estimated to be raised by 24 per cent to 1.49 million tons, due to an increase in yield to 804 kilograms.

V. ANALYSIS OF A QUESTIONNAIRE SURVEY OF JIANSANJIANG FARMERS

During January 1999 a questionnaire survey was carried out within the Jiansanjiang Branch's jurisdiction in order to get a better grasp of the present situation and future issues of rice farming there. A sample of 120 farm households was chosen at random from those growing rice exclusively.[18] A total of 102 households, or 85 per cent of the sample, responded to the questionnaire.

A. *Overall Conditions of Rice-Growing Households*

The data contained in Table VI shows the overall conditions of farm households growing rice in Jiansanjiang. The average household size is 3.61 persons, out of which 2.20 persons compose the labor force, indicating that most of the household's labor is engaged in its own farm management. The average farm size of 10.89 hectares is comparatively large: 17.6 times the national average of 0.62 hectares, and 4.6 times the provincial average of 2.37 hectares. Not only are the Jiansanjiang farms large in terms of farmland, but farmland is also concentrated into an average of 1.27 plots per farm. The average farmland devoted to rice is 9.96 hectares, showing the high level of rice specialization in Jiansanjiang. The percentage of full-time farm households is 56.9 per cent, with type-I part-time farm households (which

[18] Drawing the sample was done by randomly choosing three state farms from the fifteen state farms under the branch's jurisdiction (Qixing, Qinglongshang, and Daxing were chosen), then four production teams from each state farm. Finally, ten farm households were selected at random from each of the twelve production teams, bringing the sample to 120 rice-cultivating farm households, or 0.6 per cent of the total farm households on the Jiangsanjiang state farms.

TABLE VI

OVERVIEW OF THE FARM HOUSEHOLD SAMPLE

	Per Household Average
Household members (persons)	3.61
Labor force (persons)	2.20
Household members involved in own farming (persons)	2.16
Total arable land (ha)	10.89
Rice planted area (ha)	9.96
Paddy rice yield per 10 ares (kg)	731.00

earned more from farming than other occupations) accounting for 37.3 per cent, and type-II part-time farm households (which earned less from farming than other occupations) accounting for 2.9 per cent.[19] What this shows is that most rice growers in Jiansanjiang rely greatly on rice as the source of their income. As mentioned previously, the farm households under the jurisdiction of the Jiansanjiang Branch are composed of those that were registered on the original state farms and those "drawn from outside." In our sample of 102 respondents, original households accounted for 49.0 per cent and migrant households for 47.1 per cent. As to the highest degree of education attained by the household member who is the major decision maker in the farm management, 48.0 per cent replied senior high school, 26.5 per cent junior high school, and 13.7 per cent primary school.

The average yield of paddy rice per 10 ares of our sample was 731 kilograms, 19 per cent higher than the 1997 provincial average of 616 kilograms. As the major rice varieties being grown, sixty farms were growing Dongnong 416, thirty-three Sui 92-188, and twenty-one Hejiang 23.

Table VII presents data on farm mechanization. Some 95.1 per cent of the households in the sample own small tractors with either 12 or 15 horsepower engines. These tractors not only serve as cultivators, but also as vehicles for hauling production materials and harvested produce.

Paddy rice is dried naturally in the field by 95.1 per cent of the sample, while 2.0 per cent dried it by the side of roads or in their backyards. No one was using any mechanized drying equipment.

Table VIII concerns the hiring of labor by the farms in our sample. In sum, we observe no system of fully mechanized rice farming here, only specific phases, like plowing, etc., have been partly mechanized. For this reason, the larger-scale farm-

[19] These definitions of full-time and part-time farm households are the same as those used in Japan. Full-time farm households are those in which no household member is engaged in jobs other than farming. Part-time farm households are those in which one or more household members are engaged in jobs other than farming.

TABLE VII

FARM MECHANIZATION

	No. of Households	% of Sample
Agricultural vehicles	12	11.8
Tractors	97	95.1
Roto-tillers	17	16.7
Seed casters	4	3.9
Transplanters	25	24.5
Harvesters	6	5.9
Weeders	3	2.9
Other	2	2.0
No response	1	1.0
No. of sample	102	

TABLE VIII

HIRING OF SEASONAL LABOR DURING 1998

	No. of Households	% of Sample	Workers Hired (Persons)	Duration of Employment (Days)	Wages (Yuan/ 10 Ares)
Transplanting	98	96.1	8.8 (98)	8.8 (97)	71.3 (97)
Harvest	95	93.1	9.6 (95)	9.7 (94)	48.2 (94)
No response	4	3.9	(4)	(5)	(5)
No. of sample	102	100.0	(102)	(102)	(102)

Note: The figures in parentheses indicate the number of households who responded.

ers carry out the labor-intensive aspects of rice cultivation by hiring seasonal labor to assist in the transplanting and harvesting work. The survey results indicate that 10.8 per cent of the households in the sample hire full-time labor and pay average yearly wages of 5,000 yuan per worker. On the other hand, 93.1 per cent of the farms hire labor during the transplantation season, and 96.1 per cent hire labor at harvest time. An average of 8.8 workers are hired during planting and 9.6 during the harvest, for an average of nine days per year per operation. Many of the farms take out loans to pay their seasonal labors.

B. *The Sale of Paddy Rice*

Rainfall in Heilongjiang Province being low, it is essentially an area characterized by dry field agriculture with wheat as its traditional staple crop. However, with the increase in rice production, rice consumption there is also on the increase. As to the place of rice as the staple of the households in our survey sample, 56 per cent of those who responded were eating rice as their main source of grain. Since the aver-

age amount of paddy field devoted to rice production in Jiansanjiang is 9.96 hectares, production clearly surpasses farm household personal consumption. This surplus over self-sufficiency is being sold to state grain enterprises, private merchants, and consumers in the local markets. In the case of the 1997 crop, 62.7 per cent of our sample transacted with state grain enterprises, and 65.7 per cent directly with private merchants. There were twenty-six households (25 per cent of the sample) who sold to both parties. On the other hand, those farmers selling rice directly in local markets totaled no more than 1 per cent.

In the case of direct sale to private merchants, the general practice is to receive payment for paddy rice immediately after delivery. However, in the case of sale to state grain enterprises, we have noticed that there is somewhat of a delay in payment. In our survey, 56.9 per cent of the households answered "yes" to the question of whether state grain enterprises paid upon delivery, while 25.5 per cent replied that payment was made within two to three months after delivery, and 5.9 per cent said that there was a six-month delay. In other words, 31.4 per cent of the respondents experienced some delay in payment after delivery to state grain enterprises,[20] which means a certain amount of economic loss was incurred by those households.

The price of paddy rice sold to state grain enterprises in 1998 averaged 1.21 yuan per kilogram, while the price paid by private merchants was 1.14 yuan, or 0.07 yuan cheaper. In the case of sale to state grain enterprises, most growers must hire someone to transport the rice to the enterprise's storehouse. Transporting costs 0.046 yuan per kilogram, meaning that no matter who the seller is, the net income from the sale of rice for growers does not vary all that much.

C. *Reforms in Rice Sales by Growers*

In June 1998, the Chinese government announced provisions for the state to control temporarily free market grain prices, which had been falling due to bumper crops harvested every year since 1995, in an attempt to reduce losses suffered by state grain enterprises. One of these provisions stated that all surplus grain would be purchased by state enterprises at a protected price set according to the same criteria for determining the quota price; and thus prohibited direct purchases from growers by private merchants.[21]

[20] In view of the general practice of payment delay by the state grain enterprises, the Internal Affairs Agency issued Government Order No. 244, which stated: "Payment for grain purchases by state grain enterprises and grain reserve enterprises is to be made to the seller as quickly as possible."

[21] Due to continuous bumper crops for three years beginning in 1995, the free market prices for grain continued to fall, and fell below the quota prices from 1996. As a result, farm income from the sale of grain declined and problems were incurred in selling state-procured grain. In order to support farm income and maintain production incentive, in July 1997 the central government implemented a policy to buy grain from growers at a protected price determined at the same level as the quota

TABLE IX

REACTION TO THE 1998 BAN ON DIRECT RICE PURCHASES BY PRIVATE MERCHANTS

	No. of Households	% of Sample
It is a good measure	24	23.5
It is acceptable on a interim basis	57	55.9
It is an undesirable anti-market economy measure	17	16.7
No opinion	4	3.9
Total	102	100.0

TABLE X

REACTION TO THE EFFECTIVENESS OF THE 1998 BAN ON DIRECT RICE PURCHASES BY PRIVATE MERCHANTS

	No. of Households	% of Sample
It is being effectively implemented	22	21.6
It has had some effect	41	40.2
Sales practices have not changed as a result	36	35.3
It is meaningless	3	2.9
Total	102	100.0

How rice growers reacted to these measures is shown in Table IX, which records the reaction of households in our sample to the June 1998 provision barring private merchants from purchasing rice directly from growers. Nearly 80 per cent of the respondents indicated acceptance of the measure: 23.5 per cent supporting it outright; 55.9 per cent accepting it as an interim measure.

Table X shows opinions by respondents as to how effectively the implementation of the 1998 measure was going. Some 61.8 per cent recognized at least some effectiveness, while 38.2 per cent said that it had little or no effect.

Table XI shows to whom rice growers intended to sell their 1998 crops. In contrast to 30.4 per cent who replied that they intended to sell all of their rice to state grain enterprises, in line with government policy, those who said that they would

price. Meanwhile, as the result of increases in grain storage costs and selling state-procured grain at low prices, the nation's state grain enterprise sustained losses of 19.7 billion yuan in 1996 and 48 billion yuan in 1997, laying a heavy burden on the national finance. Underlying the situation of being forced to return to such central planning measures lay an impending fiscal crisis arising out of a government bailout of the losses being sustained by state grain enterprises; therefore these measures were taken to eliminate future losses in the interest of reviving the national budget.

TABLE XI

POINTS OF SALE OF THE 1998 RICE CROP OVER AND ABOVE OBLIGATORY SALE

	No. of Households	% of Sample
State-owned grain enterprises	31	30.4
Private merchants	66	64.7
Directly to the market	2	2.0
Other	2	2.0
No response	1	1.0
Total	102	100.0

TABLE XII

PRESENT PROBLEMS IN FARM MANAGEMENT (MULTI-CHOICE)

	No. of Households	% of Sample
Arable land is too limited	3	2.9
Farm prices are too low	97	95.1
Farm prices are too unstable	92	90.2
The cost of production materials is too high	101	99.0
Social services of state farm and production team are underdeveloped	23	22.5
Service fees for commissioning work by individuals are too high	24	23.5
There are no widespread sales practices like cooperative product shipping among individual farms	99	97.1
Seasonal labor is hard to come by	10	9.8
Capital is hard to come by	43	42.2
No. of sample	102	

sell their surplus rice to private merchants number 64.7 per cent, a percentage almost unchanged from the 65.7 per cent responding to the same question for the 1997 crop. However, there were probably those among such respondents who sold their rice to privately operating agents of state grain enterprises. Nevertheless, although 79.4 per cent of the respondents expressed acceptance of the 1998 ban, 64.7 per cent intended to sell their own crops to private merchants, indicating a large gap between outlook and practice.

D. *Problems concerning Farm Management*

Table XII lists problems incurred by respondents in managing their farms. Almost all, or 99 per cent, mentioned that prices of production materials were too high, 95 per cent complained that farm prices were too low, and 90 per cent thought that farm prices were also too unstable. While the price of rice is declining, ironi-

cally the cost of chemical fertilizer, farm machinery, pesticides, etc. are on the rise, resulting in a worsening of farmer's terms of trade.[22]

In addition, 97 per cent of the respondents hope for the establishment of some kind of cooperative organization for selling agricultural products. Although most of the farms in the sample hire farm workers during the planting and harvest seasons, only 9.8 per cent said that a shortage of labor was a problem, suggesting that procuring hired labor when needed is relatively easy. In contrast, 42 per cent decried a shortage of capital. Sufficient capital cannot be obtained through bank loans, and when borrowing from neighboring farmers, usurious interest rate exceeding 36 per cent must be paid, indicating both the shortage and high cost of capital are causing problems in farm management.

Of the forty-three respondents who saw a shortage of capital as a problem for them, 58 per cent said there were limitation on the amount of loans for short-term capital, 51 per cent said that there were also limitations on loans of middle- and long-term capital, while 19 per cent said that interest rate was too high for short-term capital loans. It seems that the most serious financial problem for rice growers in Jiansanjiang is the limited quantities of capital available.

When asked whether they are borrowing capital, 54 per cent of the sample answered that they had acquired debt. As to what kind of capital, 41 per cent replied that they had taken out short-term loans, 31 per cent said that they had borrowed middle- and long-term capital, while 16 per cent said that they had borrowed both kinds. The purposes for borrowing included in the case of short-term loans, purchasing gasoline, fertilizer, pesticide, etc. and paying wages to seasonal workers, while purchasing farm equipment and digging wells were the main purposes of borrowing longer-term capital. Almost all of the respondents wrote 36 per cent as the interest rate they had to pay for their loans, showing that farmers have been forced to borrow very high-cost capital.

As to the source of the capital, 64 per cent replied other farmers, followed by state farms and their production team (35 per cent) and banks (2 per cent), indicating that the absence of a smooth functioning agricultural capital market in Jiansanjiang has forced farmers to borrow capital from the informal sector at usurious costs.

When asked to what extent they were satisfied with their income, 6.9 per cent of the sample were perfectly happy with the amount of income they were receiving, while 51.0 per cent were more or less satisfied, bringing the proportion of households in the sample satisfied with the conditions under which they farm to 57.9 per

[22] Putting the base year for the farm price index at 1990, in 1997 the index for agricultural production materials was 247.5, the index for the purchase price of agricultural products was 210.2, and the index for the procurement price of paddy rice was 188.4, showing that the terms of trade in the agricultural sector have worsened. See Heilongjiang Province, *Heilongjiang tongji* (1998); Ministry of Agriculture, *Zhonggou nongye fazhan* (1997).

TABLE XIII

HOW TO IMPROVE FARM MANAGEMENT IN THE FUTURE (MULTI-CHOICE)

	No. of Households	% of Sample
Modernization through mechanization	21	20.6
Production of higher-priced products	27	26.5
Introduction of new growing technology	78	76.5
Land leasing and farm scale expansion	22	21.6
Commissioning farm tasks	16	15.7
Other	4	3.9
No response	3	2.9
No. of sample	102	

cent. While 10.8 per cent were not quite satisfied and 3.9 per cent were very dissatisfied, 21.6 per cent could not decide whether or not they were satisfied. The high proportion of satisfaction among the households in our sample no doubt stems from the large-scale farming and the high levels of income they enjoy.

Table XIII indicates what the growers in the sample think about how farm management can be improved in the future. As to what the most important measure that should be taken, 76.5 per cent indicated the introduction of new growing technologies. In contrast, such measures as expanding farm size by leasing land, and modernizing through greater mechanization were mentioned by only about 20 per cent. These responses show that the development of rice production since the mid-1980s has relied greatly on improvements in growing technology, introduction of improved seed varieties and chemical fertilizer, and that any further development will come with newer and better technology. Also due the previously mentioned barriers to obtaining credit, it is not surprising that only a few respondents pointed to the necessity of more capital investment as a key to improved farm management.

In response to the question of whether or not they would renew their lease contracts with the state farms, over three-quarters of the sample, 77.5 per cent, replied that they would, while only 8.8 per cent replied that they definitely would not. To the question of what they were planning to do regarding the scale of their farms, 57.8 per cent replied that the present scale was sufficient, while 23.5 per cent expressed a desire to expand their operations, and 2 per cent said they were planning to downsize.

From the above results of our questionnaire, it is clear that the rice growers operating within the jurisdiction of the Jiansangjiang Branch of DLR are, in comparison with rice cultivators in other areas of East Asia, extremely blessed in terms of both land and water, with large-scale farms exceeding 10 hectares, and specializing exclusively in rice production for the market. Each farm is consolidated into one plot of land and is irrigated by wells. There is a supply of cheap labor in the region for

the labor-intensive work that needs to be done during the peak seasons of spring and fall, and the productivity of the land is high at 731 kilograms per 10 ares.

Almost all of the rice produced there, with the exception of that to feed local farm households, is marketed through both state grain enterprises and private merchants, which share in the purchasing equally. The price of paddy rice from the 1998 crop was 1.21 yuan, which comes to about 1,452 yen for 60 kilograms of brown rice, or less than one-tenth of the Japanese government procurement price of 15,805 yen.

The japonica rice varieties grown in Jiansanjiang are acclaimed for their taste by urban consumers in such large cities as Beijing, Shanghai, and Tianjin. The retail price for milled rice in 1998 was 2.0 to 2.2 yuan per kilogram, which is also one-tenth of that in Japan.

The per household income of the respondents to our questionnaire ranged between 40,000 and 60,000 yuan, or about three to four times greater than the average national farm household income of 13,045 yuan, a fact that is reflected by 58 per cent of the households in our sample who expressed satisfaction with their present conditions, as opposed to 14.7 per cent who expressed some degree of dissatisfaction. However, this is not to say that there are no problems facing farm management in the area. For most of the growers the costs of chemical fertilizer, farm equipment, and pesticide are rising, while farm prices are declining and fluctuating, indicating a worsening in terms of trade within the agricultural sector. In addition, over 25 per cent of our sample said that they needed more capital and indicated problems in the functioning of the local financial system. With respect to technology, the moisture content of the paddy rice is high. While almost all of the paddy rice is dried under natural conditions in the field, the moisture content is still high when the paddy rice is purchased from the farms. The sales grade of rice tends to be low because of the high moisture content.

VI. THE POTENTIAL FOR FURTHER DEVELOPMENT OF THE JIANSANJIANG RICE INDUSTRY

As of 1998, within the jurisdiction of the Jiansanjiang Branch of DLR, there are 207,000 hectares of dry fields that could be converted into paddy fields, and 317,000 hectares of fallow land that could be reclaimed to farmland. This implies a high potential for further expansion of rice production. The following should be considered as conditions for the further expansion of the rice industry in the region.

1. *Improvements in rice quality and taste*

Rice farmers in the area are now growing several varieties of rice, and those varieties are mixed in the post-harvest hulling, drying, and polishing processes. Due to the growing demand for better-tasting varieties of rice in the midst of rising

income, it has become necessary to establish a system to ship and market each good-tasting rice variety separately.[23]

2. *Lengthening land lease contract terms*

Since the beginning of the 1990s, cultivators from traditional rice-growing areas in south Heilongjiang have been migrating to the Jiansanjiang area, resulting in marked improvements in the rice production technology there. However, this migration has been marked by both high levels of fluidity and little interest in capital investment. One reason for such problems, especially lack of commitment to investment, may be the fact that the term of land lease contracts with the state farm is only seven years. The extension of the duration of farmland use contracts is a necessary measure for promoting the permanent settlement of migrant rice growers and giving them incentives to invest in local industry.[24]

3. *Distribution problems*

On the occasion of our questionnaire survey in the Jiansanjiang in September 1998, we observed cases of payment for rice purchases by state grain enterprises being delayed from 10–20 days to half a year after delivery. Given a financial situation where interest rates are exceeding 36 per cent, such delays in payments for grain is without a doubt a heavy economic burden on rice growers. Also, at the time of purchase, there were cases in which the rice was being graded lower than its actual quality.[25] The 1993 Agricultural Law states, "The purchasing agencies such as state grain enterprises must render payment to the agricultural production organization or grower at the time of delivery. Neither the grade of the produce nor its price is to be lowered at the time of purchase." Nevertheless, due to insufficient

[23] According to an analysis using data from a 1988 survey on household expenditures in the urban regions of southern China, the elasticity of demand for rice as a whole came to –0.2; however, the figure for low-quality-rationed rice was –0.99 and that for higher-quality rice 1.36. Some 22 per cent of the households surveyed had already abandoned the right to buy rationed rice of their own accord, and instead were purchasing higher-quality brands in the free market. The income of these households was on the average 13.5 per cent higher than households that were buying both rationed rice and market rice, thus indicating that increased income will push up the demand for higher-quality, better-tasting varieties of rice (Lin 1994, p. 19).

[24] Land lease contracts concluded outside of state farms begin with a fifteen-year term, then are extended to thirty years from the time of renewal.

[25] Article 10 of Internal Affairs Agency Government Order No. 244 entitled "Ordinance concerning State Procurement of Grain" (June 1998) states, "State-owned purchasing agencies and grain reserve corporations shall purchase grain at prices corresponding to its quality. Artificially raising or lowering the grade or quality of grain at the time of purchase is strictly forbidden." When state grain enterprises purchase paddy rice from growers, it is divided into five grades according to quality. The prices of 1 kilogram of paddy rice in 1997 according to grade were as follows: first (top) grade 1.38 yuan, second grade 1.34 yuan, third grade 1.30 yuan, fourth grade 1.26 yuan, and fifth grade 1.22 yuan. There were growers in our survey who actually complained that their rice was being evaluated lower than its actual quality.

information about the market for their products and tiny scale of their capital, growers are sometimes at a definite disadvantage when it comes time to sell their products. It is for this reason that the desire for forming a cooperative sales organization that could increase the bargaining power of growers was so strong in the responses to our questionnaire.[26]

In addition, with the recent jump in rice production over the past several years, problems have arisen in the process of transporting the rice to points of consumption, making more efficient, systematized transport a pressing issue to be solved in the future.

4. *Reforming the agricultural financial system*

Rural China is today suffering from capital fund anemia, forcing farmers to turn to the usurious informal sector for credit. Farmers who have to borrow from their neighbors must pay interest of between 36 and 48 per cent. Although one state farm in Jiansanjiang, Qixing farm, provides loans for farm equipment and well construction at a rate of 14.5 per cent, such funds compose only a part of the capital necessary for local growers to run their businesses, forcing them to use the usurious informal sector. The establishment of a total financial system that can provide capital funds at reasonable interest rates is a very pressing issue for future development of the agricultural sector.

5. *Developing agriculture-related industries*

In Jiansanjiang agriculture-related industries, such as grain drying, storage and polishing, warehousing, and food processing, remain underdeveloped. Moreover, other agribusiness areas, such as fertilizer, pesticide, feed, and agricultural equipment manufacturing also lags behind. The promotion of such downstream and upstream industries is very important for the further development of rice production in particular and the local economy in general. Such efforts will require both the introduction of high levels of technology and capital funds from foreign countries. Such large-scale projects as the building of a commercial grain center with capital loaned by the Japanese government and the establishment of a distribution system with World Bank capital are already underway; however, in the future, together with plans to borrow money from the World Bank, the Asian Development Bank, and the governments of foreign countries, action should also be taken to invite overseas businesses to participate in the development of the agricultural sector through joint ventures and the like (Kudō 1998, p. 23).

[26] Delays in the payment for rice by state grain enterprises differ according to region. Payment seems to be delayed when a large amount of funds have to be rendered to growers in large-scale rice production areas. Delays do not seem to be much of a problem in the case of smaller-scale rice production areas.

VII. CONCLUSION

China has achieved large increases in grain production and steady improvement in food consumption since 1978 by carrying out economic reform. In Heilongjiang Province, which is blessed with ample agricultural resources, grain production, lead by rice growing, has increased by leaps and bounds under these reform, and has contributed greatly to the above-mentioned improvement in grain production nationwide. Paddy field was able to be expanded at comparatively low cost mostly within the jurisdiction of DLR, and irrigation water could be supplied by wells. The province's rice planted area rapidly increased from the mid-1980s. Rice growers were able to overcome such disadvantageous conditions as cold weather and short frost-free seasons through the transfer of the dry field seedling transplantation method from Japan, thus succeeding in pushing rice cultivation to its northern limits. In addition, higher profitability of rice production was one of the important reasons for the rapid expansion of rice planted area. Due to income increases nationwide and the spread of market economy, preferences for table rice began shifting towards better-tasting, higher-quality japonica varieties, resulting in incentives to expand paddy field on which such profitable varieties could be grown. Furthermore, the migration of cultivators from traditional rice-growing areas in Heilongjiang to state farms contributed much to improving cultivation technology.

While Heilongjiang possesses a huge amount of land that could be converted to paddy field, there are definite limits to the amount of irrigation water the province can provide. Such a bottleneck will inevitably result in a slowdown of paddy field expansion in the near future.[27] The upper limit is said to be 2 million hectares.[28] We expect the rice acreage in Heilongjiang to surpass Japan's rice acreage by the first decade of the 2000s.

The commercialization of 64 per cent of the grain produced in Heilongjiang is extremely high for a Chinese province. The major purpose of farm management is to sell agricultural products, and not to produce agricultural products for personal home consumption. In Jiansanjiang area, we found large-scale farms of 10 hectares

[27] In the summer of 1998 there was large-scale flooding of the province's Songhua River. In order to alleviate such flooding in the future, the government began a water control project that could result in the utilization of river water for rice paddy irrigation, thus enabling the expansion of paddy fields past the limits of ground water from wells.

[28] In May 1999, the government announced revisions in grain distribution for the purpose of increasing agricultural produce to meet the needs of the market and adjust the production of those agricultural products already in surplus. From the year 2000, such products as spring wheat and southern-grown indica rice will be removed from the list of products that the government will make unlimited purchases of at protected prices (*Renmin ribao*, May 19, 1999). We expect the removal of spring wheat grown in the northeast to induce Heilongjiang Province to convert its wheat fields to rice paddy, and add thus one more incentive to expand rice planted area there.

specializing in rice production hiring large amounts of seasonal workers and carrying out labor-intensive, high-yielding grain production at low cost.[29] The production cost of 60 kilograms of brown rice was 900 yen in 1997, and 1/21.5 of its comparable price in Japan (19,363 yen);[30] the price paid by state grain enterprises to growers for their 1998 crop was about one-eleventh of that paid by the Japanese government. The quality and taste of rice grown in Heilongjiang is not very different from that grown in Japan; in fact it has been exported to Japan for business use under SBS arrangements. For these reasons of quality, price, and quantity, Heilongjiang rice has the strongest potential to be exported to Japan under newly established tarrification measure.

In order for rice industry and the local economy of Jiansanjiang to develop further, however, it will be necessary to develop both upstream and downstream industries and build an industrial infrastructure of roads and other means of transportation. Organizationally speaking, development of agricultural financial institutions and cooperative marketing organization of agricultural produce are sorely needed. Such development will require both transfer of high-level technology and introduction of capital from foreign countries.

[29] To find a rice-growing area in Japan with large-scale rice farming like Jiansanjiang, one would have to go to Ogata Village in Akita Prefecture built on the floor of a drained lagoon. The farms measure on the average 15 hectares, but the total arable there as of 1995 was 8,445 hectares, about 4.5 per cent of that in Heilongjiang in 1998.

[30] Please note that the rice production cost data in China does not include land rent.

REFERENCES

Brown, Lester. 1995. *Who Will Feed China? Wake-up Call for a Small Planet*. London: Earthscan Publications.

Heilongjiang Province, Statistical Bureau. 1998. "Heilongjiang sheng nongchauwu shenchan fei biaoben diaocha jieguo" [Sample survey results of agricultural production costs in Heilongjiang Province].

Heilongjiang Province, Statistical Bureau, ed. Various years. *Heilongjiang tongji nianjian* [Statistical yearbook of Heilongjiang]. Beijing: Zhongguo Tongji Chubanshe.

Ministry of Agriculture. Various years. *Zhongguo nongye fazhan baogae* [Report on agricultural development in China]. Beijing: Zhongguo Nongye Chubanshe.

———. Various years. *Zhongguo nongye nianjian* [Agricultural yearbook of China]. Beijing: Zhongguo Nongye Chubanshe.

Kudō, Akihiko. 1988. "Gendai Chūgoku ni okeru nōgyō kaikaku no kadai to hōkō: Tōhoku sanshō o chūshin ni" [Issues and trends in agricultural reform in contemporary China: The case of the three northeastern provinces]. *Nōgyō keizai kenkyū hōkoku* (Tohoku University, Faculty of Agriculture), no. 30: 1–25.

Lin, Justin Yifu. 1994. "Rural Reform and Policy Changes in China's Grain Economy." A paper presented at the third workshop on Projections and Policy Implications of Medium- and Long-Term Rice Supply and Demand, held in Bangkok, January 24–26.

Shiraishi, Kazuyoshi. 1997. *Chūgoku nōgyō hikkei* [Handbook of agriculture in China]. Tokyo: Rural Culture Association.

State Statistical Bureau (SSB), ed. 1998. *Zhongguo tongji nianjian, 1998* [Statistical yearbook of China, 1998]. Beijing: Zhongguo Tongji Chubanshe.

———. Various years. *Zhongguo nongcun tongji nianjian* [Rural statistical yearbook of China]. Beijing: Zhongguo Tongji Chubanshe.

Suganuma, Keisuke. 1955. "Nōsanbutsu ryūtsū no jiyūka to kōiki ryūtsū no tenkai: Shijōka no naka de katsuyakusuru nōmin" [Evolution of the liberalization of agricultural products and their extensive distribution: Farmers active in the process of marketization]. In *Chūgoku no nōson hatten to shijōka* [Marketization and rural development in China], ed. Hiroyuki Katō. Tokyo: Sekai Shisōsha.

Wang, Tianhong; Atsushi Maruyama; and Masao Kikuchi. 2000. "Rural-Urban Migration and Labor Markets in China: A Case Study in a Northeastern Province." *Developing Economies* 38, no. 1: 80–104.

Yamamoto, Hiromi. 2000. "Marketization of the Chinese Economy and Reform of the Grain Distribution System." *Developing Economies* 38, no. 1: 11–50.