

COMPARISONS OF PRODUCTION COSTS OF JAPONICA RICE BETWEEN CHINA AND KOREA

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Key words: Japonica Production cost Comparison

ABSTRACT

In order to compare the comparative advantage of japonica between China and Korea, the study analyzes the production cost. After comparing the cost and its structure, it is found that the production of Japonica in China has more comparative advantage obviously. But the increasing rate is much higher than that of Korea in recent 10 years. In the long term, the gap between two countries will become smaller, while the inferior advantage of Korea can't be changed during short-mid term. Some measures should be adopted to develop the competitiveness of japonica in Korea, such as, adjusting agricultural structure, enlarging the land scale and making quality differentiation.

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I. Introduction

Rice is one of the main grain crops in both China and Korea, making important role in agricultural production. Because of more large land area and wide climate, there are more species of rice in China, two main kinds of rice are: Indica and Japonica. Indica is the most important rice, which is about 60 percent of whole rice, and the production amount of Japonica is about 29 percent of rice, other kinds of rice is about 11%. But in Korea, Japonica is the main planting kind of rice because of its climate and traditional habit.

With the development of globalization, agriculture is becoming open and open. The trend of free trade is inevitable. Division of the world trade is by the principle of comparative advantage. The trade of two countries will be decided by their comparative advantages. This study will compare the production of japonica between two countries directly by measuring their comparative advantages of rice. There are some kinds of methods to measure comparative advantages, which one of them is to compare production cost. This paper will analyze their competitiveness by comparing domestic production cost to estimate production and trade of future correctly.

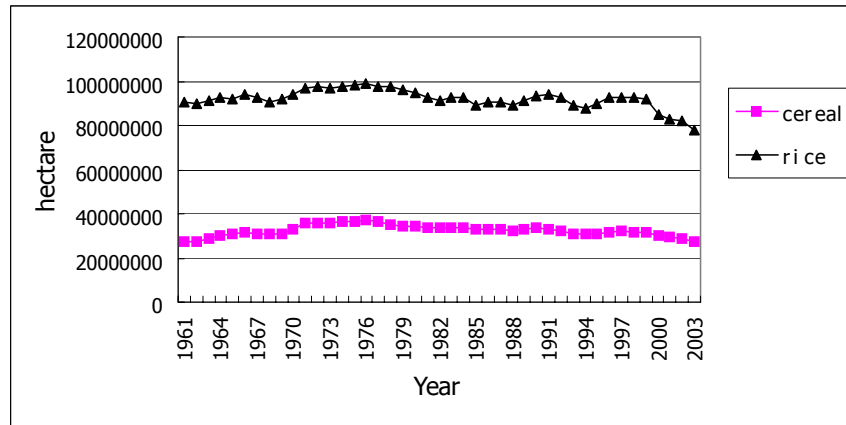
The data of production cost of Korean rice comes from *Agricultural production cost survey report*, the data of china's japonica comes from Collection of Agricultural production cost revenue in China.

II. Rice Production Situation between China and Korea

1. Rice Production Situation in China

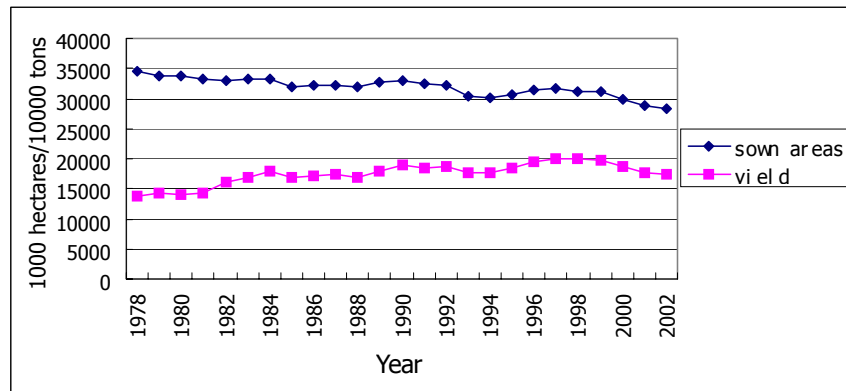
Rice is most important grain in China. So far, production of rice shares big weight in grain production, sown area of rice is about 30% in total sown area of grain, and the production is about 40%. According to FAO statistical data, China's rice production

FIGURE 1. Harvest Area of China's Rice & Cereal



Source: FAO.

FIGURE 2. Sown Areas and Yield of China's Rice



Source: China Statistical Yearbook.

and cereal area has experienced a gradual increasing process from 1960's to 1970's, after that, harvest area is decreasing. In 1961, rice harvest area of China is 27045 thousand hectares, is about 29.9% of total harvest area of cereal, while in 1976, rice harvest area of China is 36969 thousand hectares, is about 37.5% of total harvest area of cereal, and in 2003, rice harvest area of China is

only 27398 thousand hectares.

From sown area of rice, it's the similar to harvest area. after the end of 1970's, sown area is decreasing gradually. In 1978, sown area of rice is 34421 thousand hectares, and the tendency is decreasing. In 2002, it's 28202 thousand hectares.

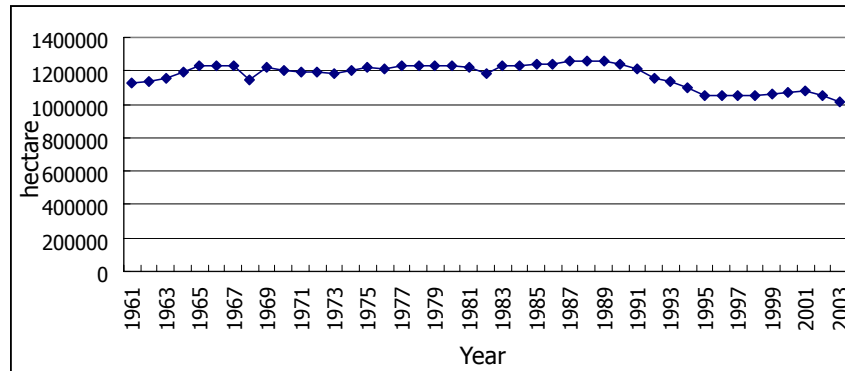
But the production situation is increasing obviously .In 1961, production of cereal is 109 million tons, rice production is 56 million tons, almost 51.2% of total cereal; In 2002, production of cereal is 400 million tons, rice production is 176 million tons, almost 44% of total cereal; (here, the data is from FAO. this data is different from the data coming from 《China statistical yearbook》, that is 175 million tons, lower than that of FAO). The reason of production increasing is because of the increasing of production per unit. From prodution per unit, both of rice and cereal is increasing. In 1961, it's only 2.08 tons per hectare, while in 1998, it gets peak to 6.35 tons per hectare, which is almost three times compared to the level of 1961.In recent years, average production is about 6 tons per hectare. In 2003, it's 6.12 tons per hectare.

2. Rice Production Situation in Korea

Rice is the main food of Korea all the time, so it's the main grain crop historically. To meet the food safety by herself, rice is in the situation of self-sufficient for long time. The rate of rice self-sufficient is decreasing in recent years. According to the "Food demand and supply of 2003" published by Ministry of agriculture & foresty in Korea: The rate of grain sufficient is only 26.9%, which is the lowest since 1996. and the rate of rice sufficient is 97.5%. the rate of other grain sufficient is as following: the rate of potato sufficient is 98.7%,barely is 45.5%, corn is 0.8%,wheat is 0.1%.¹ The income from rice has made great contribution to farmer income. In 2002, the share of farmer income from rice in about 21.6%, rice income is about 21.6% in whole agricultural income.

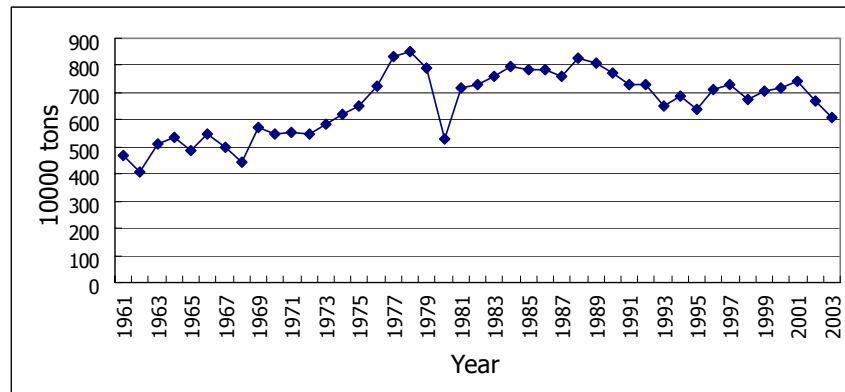
¹ Korea, *The Donga Ilbo*, March 1, 2004.

FIGURE 3. Harvest Areas of Rice in Korea



Source: FAO.

FIGURE 4. Rice Yield in Korea



Source: FAO.

Both planting area and harvest area is stable during 1970's to 1980's, maintaining about 1200 thousand hectares. Obviously, the tendency is getting down from 1990's. In 2003, it becomes a new low point, area is only 1013 thousand hectares. Figure 3 is in detail.

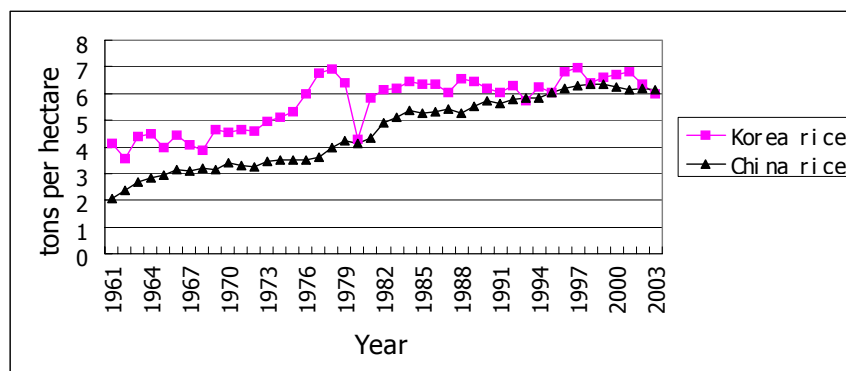
In 1961, rice production is 4680 thousand tons, the highest is in 1978, which is 8530 thousand tons. In 2003, rice production is 6070 thousand tons.

3. Comparison of Production Situation

By comparing the rice weight in cereal production between China and Korea, Korea is much higher than that of China. In 1961, it's 70%, then it's increasing. Since the mid-end of 1980's, the share is above 90%. In 2003, rice production in cereal is 94%.but the wave of production is more larger, and China's increasing rate is more higher than that of Korean.

From per unit production, compared to China, it has comparative advantage from 1960's to 1980's. After that, the gap is reducing. at present, per unit production is similar. In 2003, china is 6.1 tons per hectare, Korea is 6 tons per hectare. The detail is in Figure 5.

FIGURE 5. Comparison of Rice Yield Per Hectare



Source: FAO.

III. Comparison of Japonica Cost Production between China and Korea

Cost production is main factor affecting the price of goods, which is a good method to evaluating the competitiveness among the same commodity. In order to compare the japonica competitiveness between two countries, cost production is firstly considered to evaluate.

1. Comparing Input of per Unit area between Two Countries

In fact, the statistical method of cost production is different. In the cost production of China, two kinds of cost are considered. One is material cost, meaning the expenditure in the process of direct production, which consists of two components: direct production cost and indirect production cost. Direct production cost points that this kind of fee can be counted into crop which produced in the process of production, including cost of seeds, organic fertilizer, chemical fertilizer, pesticide cost, machine cost, irrigation cost and other direct cost. Indirect production cost points the cost relating to the procedure of production, which needs to be shared to count into cost, including fixed capital discount, purchasing and repairing cost of agricultural implement. The other is labor cost, including direct labor cost and indirect labor cost. Production cost of japonica in Korea is separated two parts, direct cost and indirect cost. The former includes seeds, fertilizer, farm implement and labor cost, the latter includes land cost and capital cost, which haven't been showed in china's japonica production cost directly. Here, the analysis is done by each statistical data directly.

TABLE 1. Comparison of Japonica Production Cost between China and Korea

Unit: dollars per hectare

	Item	2000(Year)	2002(Year)
China	Production cost	703.0	709.4
	Material	393.2	428.4
	Labour	309.8	218.0
Korea	Total cost	4,269.5	4,411.9
	Direct production cost	2,119.6	2,201.4
	Indirect production cost	2,149.9	2,210.5

Note: Exchange rate, 1\$=8.28 ¥ (Renminbi), 1\$=1259.7kw(2000-12-30), 1\$=1200.4kw(2002-12-31); Because the data of china's japonica can't be got directly, here, the data is got by calculating the rice cost of 《China Rural Statistical Yearbook 2003》.

To compare inputs directly, two kinds of units is changed into international unit. Production cost in two years is compared separately between two countries. The detail is in Table 1.

From table 1, input of per unit area in China is much lower than that of Korea. In 2000, the Korean cost is almost 6.07 times as that of China; In 2002, it's 6.22 times. If the land cost and capital cost is not included in Korean cost, which is not collected directly in China, it is almost 3 times as that in China. Here, something needed to explain is that, there is some expenditure except production cost in China, which is concluded two kinds of expenditure, one part is tax, meaning agricultural duty. In 2000, it is about 4% of whole fee per area. At present, China is doing some reform in the field of agricultural taxes and fees. It is clear that agricultural taxes will be eliminated during following five years by government. Another kind of expenditure is expenditure outside of production cost, including Tiliu fee of village, Tongchou fee, expenditure for two kinds of labor (work for obligation and accumulated work) and other expenditure except production cost. If two items is added up to production cost, total cost of China's japonica production is 427.72 yuan per mu, equal to 774.9 dollars per hectare in 2000, then total production cost of Korea is 5.51 times compared to that of China.

2. Comparison of production cost per unit production

In 2000, Korean production of rice per 10a is 717kg; it is 654kg in 2002, total cost is 537833kw and 529609kw separately. Rice production per mu of China is 451.10kg in 2000. After exchanged, japonica production cost per ton of China is 98.3 dollars, if adding the taxes and outside production cost, it is 114.5 dollars per ton; Japonica production cost per ton of Korea is 595.5 dollars in 2000, and it is 574.6 dollars in 2002 (Exchange rate, 1\$=1259.7kw, 1\$=1200.4kw). Comparing the rice production cost per ton between China and Korea, we find Korean is from 6.1 times to 5.2 times (including other two items) as that of China.

Therefore, we draw a simple conclusion: Japonica production cost of Korea is about 5-6 times compared to that of China.

3. Comparison of the structure of the production cost

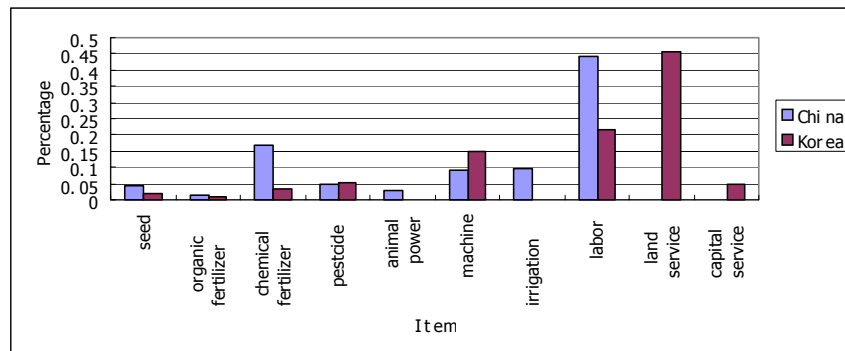
Besides the difference of total cost, the structure of the production cost between two countries is obviously different. The following analysis will compare them in detail.

First, absolute cost of main items are compared from above research, we know the cost of Korea is about 5-6 times as that of China, but the great difference exists among different kinds of cost. The machine cost of Korean is higher than that of average, which is 10 times than machine cost of China. Other kinds of cost are lower than the average times of total cost. The items which are lower compared to that of China are irrigation cost and animal power cost. In 2000, irrigation cost is 0.07 times as that of China, which it is 4.6 dollars per hectare in Korea and 66 dollars per hectare in China.

In 2000, animal power cost of Korea is lower than that of China, which it is only 0.4 dollars per hectare in Korea and 55 dollars per hectare in China. Lower animal power cost and higher machine cost reflects the higher standard of modernization of agriculture in Korea, and the animal power is substitute by

TABLE 2. Comparison of Main Kinds of Cost between China and Korea

	China2000		Korea2000		Korea2002		Ratio	
	Yuan/ Mu	Dollars/ Hectare	KW/10 a	Dollars/ Hectare	KW/10 a	Dollars/ Hectare	Korea/China (2000)	Korea2002 /China2000
Production cost	388.05	703.0	537,833	4269.5	529,609	4411.9	6.1	6.6
Seed	17.42	31.6	9,438	74.9	9,763	81.3	2.4	2.6
Organic fertilizer	6.28	11.4	5,038	40.0	5,681	47.3	3.5	4.2
Chemical fertilizer	65.43	118.5	17,776	141.1	19,161	159.6	1.2	1.4
Pesticide	18.57	33.6	27,887	221.4	22,549	187.8	6.6	5.6
Animal power	11.32	20.5	55	0.4	15	0.1	0.02	0.01
Machine	34.63	62.7	78,993	627.1	80,368	669.5	10.00	10.7
Irrigation	36.45	66.0	583	4.6	667	5.6	0.07	0.08
Labor	171	309.8	115,238	914.8	112,738	939.2	2.95	3.03

FIGURE 6. Comparison of the Structural Ratio between China and Korea

machine. Standard of modernization of agriculture in China is not high compared to Korea, the animal cost verse machine cost is 1:3 in China, while it is 1:1400 in Korea in 2000 and 1:5000 in 2002.

As for fertilizer, cost of Korea is higher, which it took 141.1 dollars per hectare. It is 118.5 dollars per hectare in China, but the ratio of organic fertilizer to chemical fertilizer in Korea is higher than that of China,

Which is 0.096 : 1 in China and 0.283 : 1 in Korea in 2000.

From the structure of cost, the biggest weight of rice cost of China is labor cost, which is about 44.1% of total cost. The second is the cost of fertilizer, which is about 16.9% of total cost, next is irrigation cost and machine cost. In Korea, the biggest weight of rice cost is land cost, which is about 45.6% of total cost, The second is labor cost, which is about 21.4% of total cost, next cost is machine holding 14.7%, and irrigation cost is the lowest part, owning 0.1%. The detail is in FIGURE 6.

Besides, there is capital cost in Korea, which hasn't been collected as one kind of cost item. In 2000, it got 204.9 dollars per hectare in Korea, holding 4.8% of total cost. This part reflects the higher credit for production. In recent year, farm credit is increasing faster, value of credit per farmhouse is 7330535kw, it is 15023841kw (about 12515.7 dollars), which is 2 times than that of 1995.

IV. Variation of Main Cost and Their Tendency

1. Variation of main kinds of cost in China

In order to analyze variation of production cost, we compared the cost in 2000 with the cost in 1990. In general, the value of all kinds of production cost is higher than that of 1990, but the increasing ratio is different.

From table 3, we can find that during 1990-2000, the highest of increasing is the machine cost, which of increasing rate is 297.6%, the next is irrigation and labor cost, pesticide cost, which of increasing rate is 220.6%, 187.6%, 130.7% respectively. After that, they are chemical fertilizer, animal, organic fertilizer, which of increasing rate is 87.7%, 64.5%, 5.4% respectively.

Because the growth rate is different, the ratio of all items in the structure of cost is changing. Among them, the ratio becoming larger is the irrigation cost, machine cost, labor cost and pesticide cost, which of increasing rate is 84.3%, 50.0%, 18.2%, 8.5%. The ratio decreasing is the organic fertilizer, seeds, animal power and chemical fertilizer, which of decreasing rate is 51.4%, 40.5%, 22.5%, 12.3% respectively.

TABLE 3. Percentage & Variation of Main Kinds of Cost in China

	2000	1990	Growth rate
Seed	17.42 (4.7%)	13.5 (7.9%)	29.0%
Organic fertilizer	6.28 (1.7%)	5.96 (3.5%)	5.4%
Chemical fertilizer	65.43(17.8%)	34.85(20.3%)	87.7%
Pesticide	18.57 (5.1%)	8.05 (4.7%)	130.7%
Animal power	11.32 (3.1%)	6.88 (4.0%)	64.5%
Machine	34.63 (9.4%)	8.71 (5.1%)	297.6%
Irrigation	36.45 (9.9%)	11.37 (6.6%)	220.6%
Labor	171.00(40.9%)	59.45(34.6%)	187.6%

Note: () means percentage of structure.

2. Variation of main kinds of cost in Korea

Comparing the cost of 2000 with 1990, it shows whichever direct cost or indirect cost is increasing. Table 4 is in detail.

Comparing the increasing rate, the Korea is lower than with that of China in generally. Among them, the increasing rate of labor cost in China is about 188%. At the same time, the increasing rate is only 22% in Korea. And the increasing rate of irrigation and machine in China is much higher than the increasing rate of labor cost. In Korea, the increasing rate of pesticide is the highest, then is seed cost, capital cost, fertilizer cost, which of rate is 70%, 58%, 47% separately. The increasing rate of labor is the lowest in all items in Korea, which is only 22%. Compared the variation structure of cost with that of China, it is smaller in Korea during 1990-2000, the ratio of direct cost is increasing from 45.6% to 49.6%, and it is 49.9% in 2002. Contrary to variation of direct cost, the ratio of indirect cost is decreasing from 54.4% in 1990 to 50.4% in 2000. In detail, the ratio of seeds, fertilizer, pesticide and capital is increasing, while the ratio of land and labor is little decreasing.

TABLE 4. Production Cost of Rice per 10a

Unite: kw

		1990	2000	Increasing rate	Percentage (1990)	Percentage (2000)
Direct cost	Seed	5,539	9,438	70%	1.4%	1.8%
	Fertilizer	15,531	22,814	47%	4.0%	4.2%
	Pesticide	12,394	27,887	125%	3.2%	5.2%
	Labor	94,159	115,238	22%	24.4%	21.4%
Indirect cost	Land service	193,572	245,009	27%	50.2%	45.6%
	Capital service	16,384	25,816	58%	4.2%	4.8%
Cost		385,851	537,833	39%	100.0%	100.0%

3. Trend of Cost

Obviously, there is a trend in the production cost of two countries. The following figure reflects the cost situation from 1979-2002. Because the data of china's japonica can't be got directly, here, the data is got by calculating the rice cost of 《China Rural Statistical Yearbook 2003》.

A simple time regression model is got by Eviews 3.0 to judge the variation of production cost.

$$KC_t = 142091.1 + 18749.03(t - 1979) \quad (1)$$

(18.20) (29.49)

Above formula (1) is the function of production cost in Korea, which of data is adopted from 1979-2002 and estimated by OLS. Value T is in parentheses. $R^2=0.98$, $F=868.0$.

$$CC_t = 20.10(t - 1979) + \varepsilon_t + 0.95\varepsilon_{t-1} \quad (2)$$

(19.11) (21.00)

Above formula (2) is the function of production cost in China, which of data is adopted from 1979-2000 and estimated by OLS. Value T is in parentheses. $R^2=0.96$.

It is forecasted that japonica production cost in China is 522.6yuan in 2005, and 582.9yuan in 2008. Exchanged by current rate (1\$=8.28yuan), it is 946.7dollars per hectare and 1,056.0 dollars per hectare respectively. Meantime, japonica production cost in Korea is 629,565.88kw in 2005, and 685,812.97kw in 2008, assumed the exchange rate 1\$ equals to 1200kw, production cost is 5,246.4 dollars per hectare and 5,715.1 dollars per hectare separately, which is 5.5 times and 5.4 times separately. Therefore, compared to 6.07 times in 2000, the gap between two countries is becoming smaller. In short-mid term, the rate of decreasing the gap between two countries is much slower, that is to say, compared to Korea, comparative advantage of production cost in China will last quite long period.

FIGURE 7. Production Cost of Japonica in China

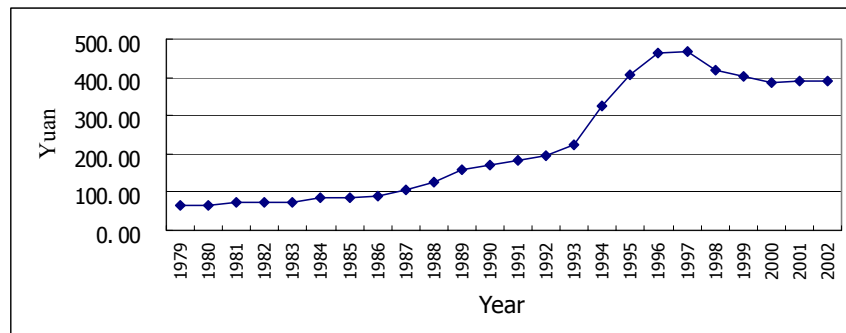
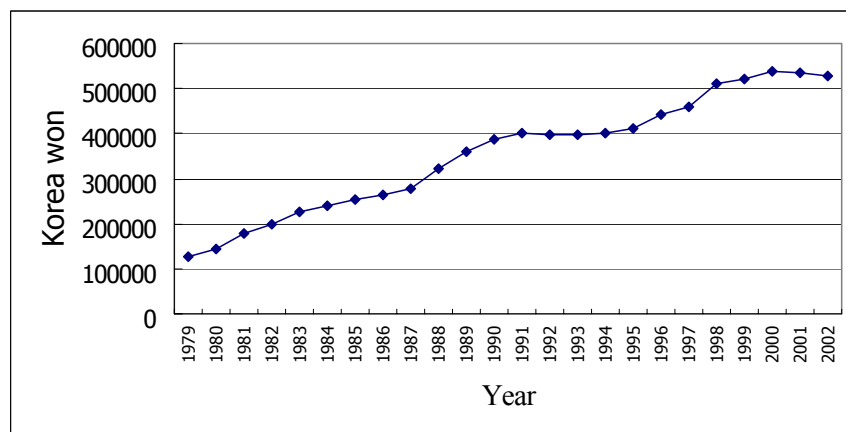


FIGURE 8. Production Cost of Japonica in Korea



V. Conclusions and Policy Implications

[1] Obviously, japonica production of China is in comparative advantage. Currently, japonica production cost of Korea is about 5-6 times than that of China. From short-mid term, the absolute gap between two countries can't be changed. So, if the rice market is opened widely, the domestic common rice will be affected heavily, and price will descend in a degree.

In fact, compared to current price with that of Korea, advantage of China's japonica is obvious. Since 1990, domestic rice price of Korea is increasing. It is 125,2000kw per ton in 1990, and it is 237,500 kw per ton, which the retail price of rice is 47,500kw per 20kg in market (2004.10-4.20), average domestic price is 46,105kw per 20kg.

During the period of Apr.10-Apr.20 in 2004, the wholesale price of japonica in xinfadi market of Beijing city is 2.80yuan per kg, at the same period, Seoul wholesale price of japonica is 44000 kw per 20kg, according to the exchange rate 1RMB=140kw, wholesale price of japonica 15.7yuan/kg, which is 5.6 times of China. This is mated with production cost difference between two countries.

[2] There are some common characters in the cost structure and its variation. Meantime the difference is great. Average land is small, labor input is higher, therefore one common is that labor ratio in cost structure is high. Except land cost, the second larger cost is labor cost. In 2002, the share of land cost in total cost is 45.4%, while labor is 21%. Besides, proportion of machine cost will increase because the progress of modernization.

Meantime, the variation is different, which the increasing rate is much higher than that of Korea. In China, during the time of 1990-2000, all items of cost hold high growth rate. It is estimated that the cost will increase with high rate in the next 20 years because of forecasted increasing rate of economy. According to "Objectives of building a well-off society in an all-round way in China" mentioned in sixteen meeting of Chinese Communist Party, GDP in 2020 will increase 2 times than that of 2000, which will get 3,000 dollars per capita. This aim needs that increasing rate will maintain about 7%, therefore, main cost such as labor cost will keep higher rate of increasing.

[3] In the condition of the open free market, the agricultural structure in Korea is weak. The agricultural structure should adjust towards comparative industry. Meanwhile, difference strategy is necessary to be adopted. So far, degree of adjustment of structure is small in Korea. Production structure is simple, which is relying

on the rice production heavily, and the part income from rice is high all the time. In 1965, it is about 48.3% in agricultural income, and it is 46.9% in 2002. But the rice is weak in international competitiveness, agricultural structure and rice structure should be adjusted positively. For rice, according to the theory of market, improving the species of rice to get differentiation and high added value is important. Such as development of functional nutrition rice, developing the quality of rice and get the consent of consumers, etc., all these will be useful. Apart from that, creating more opportunity work for non-farmer work to reduce the proportion of rice income from rice is important too. Compared to Korea, China has made agricultural structure adjusted positively in recent ten years. In 1990, income of farm house per capita from agriculture is about 50%, it falls to 35% in 2002. This demonstrates that adjustment of agricultural structure and non-farm work has played important role in agriculture.

[4] In order to improve rice competitiveness, some measures should be adopted to reduce production cost. From above comparison, land cost is the largest cost, and the second is labor cost. In the hard condition of labor wage, how to reduce the cost of material inputs becomes the main approach: first, is to enlarge the scale of farmland, which will not only reduce production cost, but also increase the income of farmers. From statistic of Minisitry of Agriculture & Forestry, the farmhouses whose land exceeds 5 hectares the income is 51,087,000kw, it is 2 times than that of common farmhouses, whose farm income is 24475000kw. And the income from agriculture is 3 times than that of normal farmhouses. The second is to develop the general service of government which is permitted under the regulation of WTO because it belongs to green box. Third is to develop the international cooperation by utilizing the international flow of world productive factors, absorbing comparative factor. For instance, it can be tried to use cheaper labor from China to reduce production cost.

[5] Reform rice management system towards the market-oriented economy to meet the tendency of globalization. In a

long term, domestic rice is protected in order to get self-sufficient and increase farmer income in Korea. The situation of high production cost is related to the management of government. Dual price system not only makes the burden of government become heavier, but also makes the agriculture lose the efficient. Under the background of free economy in the world, it is needed to reduce the amount of purchasing by government, and make the grain into market efficiently.

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