

# **FORMATION AND OPERATION OF PADDY FIELDS AGRICULTURE AT THE SANJIANG PLAIN A PRE-RESEARCH OF FARM HOUSEHOLDS BOOKKEEPING ANALYSIS**

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## **1 .INTRODUCTION: FRAMEWORK AND ISSUES**

This paper focuses on the development of paddy fields and the management of rice farming and a brief establishment of land use order in Sanjiang Plain, which is a large wetland area formed with the Amur River, the Songhua River and the Ussuri River. The study area is concentrated on X State Farm that mainly exports rice to Japan and the location is relatively close to a base area of Jiamusi City in Heilongjiang Province.

Research have been conducting in this area since 1997(Park et al., 1999, 2001), and it was found out that paddy fields have been decreased from 1999 to 2002 and the large areas have been changed to dry fields. But the drastic conditions found in 2003(Sakashita et al., 2004). The main reasons were that drop in market rice price has been decreased by natural disasters and overproduction of rice (excess of supply). However, the rice price has been increased again from 2004. Therefore, it is necessary to conduct further studies to reinvestigate the recent trends and the actual situation of rice farming. It is because the management stability of rice farming is a key determinant for the succession of land use.

Primary data and case studies are used in this study. The data were collected from 10 farm households of one production group (PG) those who belongs to different farm scales. The 10 farm households kept their farm-records (cash revenue and expenditure, work diary

and interview records) separately for one year from spring of 2007 to 2008. As a pre-research, this study has been conducted on top officers of the production group to hearing their personal opinions and the 10 farm households, and arranged the trends of rice farming management with a focus on the paddy fields development history.

## **2. DEVELOPMENT OF PADDY FIELDS AND POSITION OF FOCUS AREA AT X STATE FARM**

### **2.1 Development of paddy fields at X State Farm**

The Songhua River and its five tributary rivers (Fuerji River, Shitou River, Heli River, Alingda River and Wulong River) run within the boundaries of X State Farm. Annual rainfall is 550-600mm, mainly concentrated in the months of July and August [Note 1]. The farm can be generally divided in three regions, namely West region, East region and Southwest region.

The West region has elevated areas with Alingda River and Yuanbaoshan Dam and almost all the areas outside the dam were used for field crop farming (the dam is used by external institutions). The East region lies between Fuerji River, flowing in east-west direction, and the Heli River. Paddy field farming is the major use of land, supported by two irrigation areas; a groundwater well irrigation adopted in 1989, and the Fuerji River dam irrigation (PG No. 18). Part of PG No. 16 and No. 18 are involved in field farming. The Southeast region is also supported by two irrigation systems; an irrigation area of reservoir (dam, dam No. 1- 5 and satellite dam) from the low wetland along the Heli River (PG No. 12), and a groundwater well irrigation area, adopted in 1993 (PG No. 17).

The oldest irrigation facilities project in the farm is the enclosing bund of Heli River in the Southeast region, originally designed by Japanese immigrants using willow trees. The enclosing bund was reconstructed into a fixed concrete dam in 1988 now irrigating 1000ha including Hegang City of Tangyuan Prefecture. The irrigation areas in the farm are 300ha. It provides irrigation to PG No.12, through Dam No.2 and 3. The second part is Fuerji River dam in the east, the dam was completed in 1982. It was designed to provide irrigation for 400 ha, but it actually provided water for 667 ha for PG No. 18. Part of the PG No. 20, 21 and 27 utilized the water from this dam from 1982. In addition, since this dam was built, a dam of PG No. 16 was built in 1999 and has been irrigating 133 ha.

Nowadays, new areas developed the barren and dry fields under paddy cultivation are irrigated by a groundwater well constructed from 1989. This is part of a program called the 'Sanjiang Plain Agriculture Multidiscipline Development Plan' planned by the Baoquanling Management Bureau in 1987 with construction work starting in 1989. X State Farm is under control of this bureau. Until 1991, 10 production groups, mainly PG No. 29, of East region irrigated 4,667ha. From 1992 to 1993, 5 production groups but mainly PG No.17 opened up another 4,000ha for farming in the Southeast Region (PG No.13 and east). Then PG No. 15, 16, 24, 25 and part of 27 started farming in another 4,000ha from 1996 to 1997. It is standard that one groundwater well pumps up 10ha worth of water for irrigation. In order to increase the water temperature, 4% of the irrigation area, 40a, was installed with water storage pond. Generally, one farm household owns one groundwater well.

As a result, a groundwater well irrigation covered an area of 12,666 ha, dam irrigation

2,000 ha, and the rest of the 13,333 ha were fields. The percentage of paddy fields in the West region was 6%, the East region 55%, and the Southeast region 93 %. The following study is about PG No. 17 from the Southeast region that only produces paddy fields from 1993, and has high percentage of groundwater well irrigation.

## **2.2 Characteristics of Production Group No. 17**

The PG No. 17 is located in the Southeast region, and until 1990 its irrigation source was mainly provided by the Songhua River. However, in 1991, irrigation from the river was suspended, and since then the dam has mainly played drainage functions rather than irrigation. The reasons for the change are because of its difficulty to pump water, as there was a lack of water supply from the river, and the repeated flooding during the rainy season.

Since 1992, there has been planned promotion of a groundwater well irrigation. In 1992 and 1993, the production group started the well-digging project. The digging was conducted by contract with construction companies; the farm households would be responsible for the cost where 50 % of the cost could be financed loan by the state farm. The two finance loan periods are one-year and three-years, and the repayment of the loan is either by cash or by commodities.

With construction of groundwater wells, many areas rapidly changed into rice farming. In 1994, out of 673.7ha, 552.6ha (82%) had been changed into rice farming. The 121.1ha areas left along the rivers are lent to the surrounding villages as field farms, since conditions in these areas were unsuitable for rice farming [Note 2]. PG No. 17 has specialized in rice farming since 1994. As shown in Figure 2, Table 1, the paddy fields are composed of 15 blocks, and the small blocks are areas rent out to farms. There are 65 households, and one an average, each household has 8.5ha land.

There were 70 groundwater wells and one groundwater well irrigates 7.9ha of farmland. One an average, every farm household has one groundwater well. The farmland were less than 5ha for 9 households, 5-7.5 ha for 19 households, 7.5-10ha for 18 households, 10-12.5ha for 11 households, 12.5-15ha for 4 households, and more than 15ha for 4 households. The number of farm households within different operation scales will be illustrated later. Groundwater wells irrigate 37 households, which are 57% of the total number, due to the groundwater wells' irrigation ability, and other very small scale and large scale households are irrigation by groundwater wells.

The farm households were selected in this study are as follows: two large scale farm households for more than 10ha (No.7, 14.4ha; No. 2, 12.0ha); three upper-medium scale farm households for 7.5-10ha (No.4, 9.9ha; No.3, 9.0ha; No.6, 8.0ha); three lower-medium scale farm households for 5-7.5ha (No.8, 7.2ha; No.9, 6.5ha; No.5, 5.0ha); one small scale farm households for less than 5ha (No.10, 4.1ha) were selected for focusing of this study.

In addition, from 2003, there had been selected by XM Fine Rice Processing Co. Ltd., about 90%'s area has been cultivated on contract. Also, on the during production process, it has to follow all the instructions by XMFRP Co, such as species, fertilizers, pesticides etc. The organization of top officials of the Production Group composed of one chief, one secretary, one assistant chief (one of them would do the statistics), one accountant (do the

accounting of management area as groundwater well) and three technicians.

The responsibility of the Production Group has a big change since the adoption of the ‘Liangfeizili’ policy. The ‘Liangfeizili’ policy is that farm households have to be responsible for both production and daily lives related cost. Due to the policy, the Production Group is not involved in services of transporting production resources to farm households’ yard, guarantee for funding, adjustment for crop rotation during field crops era; but concentrate on farm policies, transmission of orders and collect money by deputy.

### **3. KEY FEATURES OF PADDY FIELDS DEVELOPMENT BY PRODUCTION GROUP NO. 17**

#### **3.1 History of rice farming and a situation of direct management era in Production Group No.17**

The history of PG No. 17 can be traced back in 1930. In the past, the area of Manchuria-Mongolia Pioneer Group conducted large scale rice farming only until the 1940s.

The channel, called ‘Wuzhixian’, developed by the pioneer group is still being used today. After the pioneer group has withdrawn the area, a lot of the paddy fields farming areas were abandoned. However, with the establishment of the Helihe Farm (rehabilitation farm for imprisoned criminals) in 1952, after liberalization, the remaining paddy fields and those abandoned, were restored for rice production, and were transformed as paddy field farms, which was unusual during that time. In 1968, the Cultural Revolution Periods, educated young people were forced to work in farms, replacing the criminals. With no sophisticated knowledge about rice farming, these young people gradually converted the paddies into fields. However, most of the paddy fields in No. 2-2 block (27.9ha) and No. 5 block (61.7ha) were kept. In 1979, part of Helihe farm was merged by X State Farm (PG No. 12, 13, 14, 17, 22, 34 and 35). The PG No. 5 of Helihe Farm became PG No. 17 of X State Farm.

Until 1982, the farm was nationally operated, and therefore the workers remained as manual labor. Under a group-oriented working structure, workers were divided into four different teams: cultivators, mechanics, stockbreeding, and architecture. The first two teams held by far the largest number of workers; up to two thirds of the whole workforce. The workers in the mechanics team were in charge of fixing and maintaining the machineries necessary for farming, and had the most technical knowledge among all. Therefore, these workers were relatively highly educated and were considered as “specialists” in the farm.

#### **3.2 Conversion of the government-run farm system to farm households’ contract system**

In 1982 and 83, the contract system, already used in general farm villages, was introduced to the State Farms. At this point, the number of farm households were 86, cultivated acreage of 483.1 ha. Of them, 400 ha is dry field and a mere 83.1 ha is paddy field. For heavy machinery, they possessed 8 tractors (one 54 ps and one 75ps) and 2 combine harvesters. The contract system was separate for field farming and rice farming.

As for dry field farming, several members of the mechanic’s team shared machineries and operated in large scales during 1982-83. However, the Production Team later on changed their strategies where cultivators (39 households) were each given 2ha of land, and former

mechanic teams would receive contract for cultivation with their machineries. Although, cooperative operation still remained as the majority for former mechanic team. 35 members of the mechanic team were divided into several groups, 6-14 members each, who shared about 1-2 machineries within their group.

For field crops (main products were wheat, bean, and corn), a rotation of one year wheat – two years soy beans – one year corn was suggested. However, the low yield and low buying prices of wheat and the troublesome labor of growing corn, made these two crops unappealing to most farmers, causing continuous cropping of high value soy beans (Table 3). Thus, a strengthening of the overseeing system was introduced by the administrators of the Production Group to reinforce rotation cropping in order to restore soil capabilities.

For paddy farming, 2 ha for one household was distributed to 12 households. The remaining areas were left as extra, and were able to be utilized upon request.

### **3.3 History of paddy fields development**

The paddy fields development can be divided in two periods: the incentive measures to switch from dry field to paddy fields from 1985, and planned full-scale switch to rice farming in 1993. During that time, here was special attention to 'invited farm households' which is farm households from the outside of the State Farm that have the know-how of rice farming [Note 3]. The PG No.17 introduced the 'invited farm households' proactively from 1989. In the first year, only six households have joined, after that three to five households have joined every year. It becomes stable after latter part of 1990s, and terminated in 2001. Currently, within the 65 households of the Group 17, there are 36 laborers in the farm (first generation laborers are 33, second generation laborers are 3), the remaining 29 people are employed laborers (invited farmers).

From 1985, there was a promotion period for switching into rice farming, but there was limitation for the increase of paddy farming areas, mainly because of techniques of cultivation. Within the case studies, 3 households developed paddy fields during this period. For case No.2 in 1985, a case of existing farm households, 4 people cooperatively undertook an area of 15ha (Block 5). At that point, it was a wheat field, but the four converted 10ha into paddy fields, with an average of 2.5ha per person. This was a successful case. For the case No.1 in 1989, a case of invited farm households, 6 households have emigrated from Hua-Nan Prefecture with introduction by friends. In terms of the Production Group, 16ha in 8-3 blocks were evenly divided among 6 households, 2.7ha each. The Farm constructed two new groundwater wells (diameter 20cm, depth 20cm) to be shared among the 6 households. Total cost of groundwater wells for 6 households was 20,000Yuan and per household was 3,333Yuan, and the cost should be returned within three years. However, the initial year turned out to be unsuccessful, and this led two out of the 6 new households, dropped out and returned to Hua-Nan. The 5.4ha of land initially owned by the 2 households that left was divided by the rest, adding 1.35ha to their original size. Each farm household had 4.05ha of land. In 1991, another 2 households dropped out, and today only 2 households are left. This situation shows that the starting period of rice farming was very difficult.

Although the second stage started from 1993, basically all areas have converted into rice

farming in 1994 because the rice price recovered, and the government effort to improve the land, etc. An additional reason was that the PG No. 17 had relatively low topographical features that it was easier to have rice farming from the water resource management point of view. Although X State Farm started rice farming in 1985, which was mentioned earlier, they prioritized the PG No.22 which had the lowest topographical features among all, and therefore delayed the transition of PG No. 17 for 10 years.

With the transition to rice farming, the land use rights were distributed to the farm households who had been doing joint operation till then in 1993. As a result, the farm households were forced to operate individually. The restored paddy fields work in 1993 was uniformly done in the production group. And the costs for the works was 15,000Yuan per ha, and most of the costs was used for groundwater wells and seedling houses. The groundwater wells and seedling houses were constructed uniformly in 1993-94 and 1996 respectively.

As preferential treatment to the transition of dry fields to paddy fields, the agricultural tax and rent for the initial year was exempt. On the other hand, the heavy machineries for dry field farming were no longer used, and a gradual shift to paddy field machinery was observed. However, the finance loans from the farm were abolished.

#### **4. CHARACTERISTICS OF RICE FARMING MANAGEMENT AND ECONOMICS OF FARM HOUSEHOLDS**

##### **4.1 Mobility of workers at farm households and change of scale**

First, the retention rate and scale changes of farm household can be clarified with Table 4. The table was created from a series of data on cultivated land area for each farm households between the years 1994-2006. Most of all, the 73 households in 1994 dropped to 65 households in 2006, a decrease of 8 households. However, from 1994 to 2006, out of 52 households, 21 households migrated, 13 households immigrated. In 1994, the migration rate was 29%. At that point, in 1994, there were already numerous numbers of invited farmers, and the rate of existing farms was only 55.4%. It was found that mobilization of some areas were very high. According to Table 5, migration happens after decrease in rice farming income, especially in 2003 during which rice farming area dropped dramatically throughout the farm. Following are the changes of the hierarchy of scale.

As mentioned earlier, management scale was mainly medium that range from 5 to 10ha, but the highest migration rate was seen in the group that owned less than 5ha (40%), which illustrates the larger impact of drop in rice prices on relatively small scale farmers. On the other hand, immigration concentrated in the medium scale class, with the largest scale not exceeding the 10-12.5 ha range. Out of the 19 large scale households, 6 households have actually increased their scale during this time. Therefore, even though there was fluctuation of rice price, certain stock of rice was available exclusively in these large scale farm households. We should investigate the details of scale expansion. Following is the study of ten households that had scale-increase. The basic information is shown in Table 6.

The composition of family is relatively small, from three to five family members; half of the main operator's age was less than 40 years, which is quite young. The range of scale is

from 4.1ha to 18.3ha. Most of the large scale farm is invited farm households, and small scale farms are immigrants or farms with other subsidiary work.

According to the changes of farmlands in Table 7, all the five large scale farm households (until 9ha) have scale increase. No.1 and No.2 developed their paddy fields during the first period, and moreover, they returned their initial fields in return for another with better conditions. In this process, they also increase their scale by further borrowing groundwater well conditioned fields. In the case of No.8, already mentioned earlier, this farm is stuck with the initial paddy field with bad conditions, unlike the case with No.1 and No.2 who traded them with better fields. They were unable to take advantage of the opportunities to increase their farmlands. Unlike normal farming villages where increase of farmland will involve payment of land prices, this nationally owned farm does not require this. Instead, however, the new incoming farmer is obligated to pay beneficial expenses for the use of existing facilities, such as groundwater wells, etc. It is obvious that it is necessary to have the renewal fee of groundwater well, and investment of machineries and facilities that can meet the scale increase. Following are the characteristic of machineries at different production scale and, income and expenditure.

#### **4.2 Characteristics of rice farming management in different scales, revenue and expenditure**

The above-mentioned scale increase was bolstered by the advance in agricultural machinery. Table 10 explains the adoption and renewal of machineries and facilities situations. As for tractors, the Rotary Tiller stage was between the mid 80's to mid 90's. No.1, one of the largest scale households, introduced 25ps in 1998, followed by an introduction of 40ps in 2004. In the middle scale range, 30ps was introduced in the 2000's. In the smallest scale range, contract (200Yuan/ha for both plowing and rotary) has been the main means of farming.

The earliest introduction of rice planter was by No.1 in 1993, mid 90's in the upper-middle scale class, and 2000's in the lower-middle scale class. The machine was a six-row planter made in Yanbian, and the quick spread was partly due to the fact that it was affordable (10,000 Yuan each). Although they had seedling houses, the smallest scale class had to rely this as groundwater well, on contracts. The seedling houses are introduced in every farm households, transformed from its initial brick structure, largely with the help of finance loans from the farm. In the 2000's, expansion of houses has been done, corresponding to its scale. This was financed through individual funds or resources.

For combine harvesters, only No.1, 7, and 3 own this large machinery. These 3 households have established a large machinery system. Since all farm households financed this 50,000-60,000 Yuan investment with their personal funds, it is fair to state that these farm households possess considerable amount of savings. For other farm households, most of them, except for No.5, switched from hand harvesting to contracts (500-750 Yuan/ha) between the years 1999-2004. No.5 still continues to harvest with man-power. No.3 (9ha), who introduced the combine harvester in 2006 is willing to accept a consignment contract, and with the payment, it wishes to pay off the initial investment. As conclusion, mechanization in the harvesting stage shows the greatest disparity between the operation scales.

In the past, the large scale production in Sanjiang Plain mainly depended on hiring contract laborers during planting and harvest time. Now tractors, the rice planting machine, four-lines combine, ordinary combine harvesters are available for planting and harvesting. There is a clear relationship between operation scale and mechanization. The large scale farmers have advancement in machineries, however, the small scale farmers still harvest partly by hands and partly by contracting machines. The contract fee is relatively high and contractors can use this as part of repayment for the large machineries.

Table 11 shows the income and expenditures of different operation scale. 2004 data is used instead of 2005, an outbreak year of the rice blast. In terms of total income, there is a rule of certain production amount from each ha. Unit crop differs from 7.5 tons to 9.9 tons, and obviously small scale farmers have low production amounts. In the case of expenditures, the rent is about 30 percents to 50 percents. This high percentage of land rent limits the income of farm households. In addition, it is found out that hiring fees range from a few percentages to close to nearly 25 percent. Even though there is advancement in machineries, the cost for temporary contract is high. The results also showed that the net income does not always correspond to scale.

In all cases, the gross income is 100,000-200,000 Yuan, and net income is 60,000-10,000 Yuan which implies that rice farming operation has higher stability, both technologically and economically.

## **5. CONCLUSIONS:**

### **Objectives about Farm Households Bookkeeping Analysis**

This study has arranged with regard to the history of paddy fields development and the current conditions of rice farming by the hearing survey from the production group and its 10 farm households in Sanjiang Plain.

The findings of the study concluded that a certain degree of stability as well as scale expansion in a group of farm households despite of most of the farm households have the highly mobile characteristics in this area. In comparison to the late 1990s, it can be understood that the mechanization level has been upgraded greatly, and that the technical basis of large-scale management has been strengthened.

However, it will lead to the situations of the farm economy unclear, if only according to the hearing survey. Therefore it is necessary to analyze elaborately, especially regarding the land rent-bearing capacity and the ratio of employment expenses to production cost in the large scale operation of farm households.

Therefore, as mentioned earlier, farm households kept farm records for one year. After this, the present study resolves this remaining task.



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## NOTES

1. There is a waterworks department in X State Farm, initially designed to control flooding. Total extension of the levee is 110km. Three drain pump (15 m<sup>2</sup>/sec) are installed in the Songhua River, the Heli River, and PG No.19.
2. The operation team decides the tenancy rate. However, rates have risen from its initial 300 Yuan in 1994, up to 1,500 Yuan today. Exceptions hold in case the farmer receives damage from flooding; the fees are exempt.
3. For details, see Park *et al.*, 1999, p.226

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