

Dutch agricultural development and its importance to China

Case study: Agriculture in Wujiang - an overview

Tan Xuewen

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This report presents an overview of agriculture (including fishery) in Wujiang, a county in the south-eastern part of Jiangsu Province. Agriculture and its development since the market reform at the end of the 1970s are analysed as part of the local economy. Special attention is paid to the development of the production sectors in agriculture. The supplying and processing industries and the marketing of agricultural products are part of the analysis. The role of the government in agribusiness and the supporting institutions is highlighted.

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Preface

'The Experience of Dutch agricultural development and its importance to China' is a joint research project of the Institute of Agricultural Economics of the Chinese Agricultural Academy of Sciences (IAE-CAAS) in Beijing and the Agricultural Economics Research Institute (LEI) of Wageningen University and Research Centre in The Hague. The Chinese Ministry of Agriculture, the Dutch Ministry of Foreign Affairs (Asian Facility) and the Dutch Ministry of Agriculture, Nature Management and Fisheries are financing the project. The main objectives of the project are:

- to reveal the causes of the large difference in agricultural productivity between China and the Netherlands, and to find ways to improve the efficiency of Chinese agriculture;
- to analyse the developments in Chinese agriculture with special reference to market opportunities for Dutch agribusiness.

This report is one of the results of the project. It presents an overview of the development of agriculture (including fishery) in Wujiang, a county in the south-eastern part of Jiangsu Province. Agriculture is analysed as a part of agribusiness and against the background of the development of the local economy as a whole. Also the role of the government and supporting institutions in the transformation process towards a socialist, market-oriented agricultural sector is highlighted. Tan Xuewen wrote this report. The project was co-ordinated by Professor Li Weimin of the Institute of Agricultural Economics in Beijing, China.

Three related reports have been published: *Mission report: Shanghai, Wujiang and Chongming* (LEI memorandum 00.19, 2000); *Case Study: Agriculture on Chongming Island - an overview* (LEI report); and *Case study: The Evolution of Dutch Greenhouse Horticulture* (LEI report 6.01.11). In this last-mentioned report a comparison is made with horticulture in Wujiang.

The managing director,



Prof. Dr. L.C. Zachariasse

Summary

1. Wujiang county is located east of Taihu Lake in Jiangsu Province. Natural conditions are favourable for agriculture. It is surrounded by rapidly developing cities, such as Shanghai, Suzhou and Hangzhou. The population density is high. GDP per capita is 3.5 times the national average. The share of agriculture in GDP is almost 9%. The industrial sector dominates the local economy (about 54% in GDP). Two of the five major industries are related to agriculture: silk and textile.
2. Most of the population (77%) lives in the rural area. The share of rural income from agriculture is rapidly decreasing (only 11% in 1998). More than 30% of the rural labour force works in agriculture. Many workers in agriculture are part-time farmers. Most agricultural workers are involved in crop production (grains and oilseed). However, only 3% of farm income is from this sector. Income from other agricultural sectors (e.g. horticulture, animal production and fishery) is almost six times as high. The largest part of farm income is from work in Town Village Enterprises (TVEs).
3. Individual farm households are predominant. The average farm size is 0.2 ha, with three labourers. There are more than 10,000 large farm households; most of these are specialised and their income comes mainly from agriculture. The small farm households have to rely on leading agricultural enterprises and middlemen to compensate for a lack of economy of scale. The number of state farms has diminished to eight. An important part of the workers in the farms are employed in industry or services. A new phenomenon is the formation of collective or private farms to promote the concentration of farmland and to enlarge the scale of farming.
4. Agricultural production is characterised by diversification and local specialisation. Many villages and towns specialise in the production of one agricultural product in order to create an economy of scale. The government of Wujiang county plays a leading role in this development. However, also some successful specialised farms have become models for neighbouring farms.
5. Rice, representing about 80% of total grain production, is by far the most important crop in arable farming. Double-harvest rice has now been replaced by single-harvest rice to prevent a shortage of farm labour in busy seasons. The second crop is rape-seed.
6. Land use is gradually changing. The area of arable crops is decreasing, while that of cash crops is increasing. It is expected that in the near future the area of cash crops will exceed that of grains (rice and wheat). Most of the arable land being given another function will become fishponds.

7. Pig production is, with a share of 80% of total animal units, the most important animal sector. Over 500 households have an annual output of more than 100 pigs; between them, they raise 55% of all pigs. A further enlargement in the scale of production and further specialisation is expected. After the lifting of the state monopoly in the marketing of pigs in the early 1990s, production and prices are fluctuating. Most pig feed is purchased outside Wujiang. Many farmers buy raw materials and mix their own feed. A large proportion of live pigs are sent to neighbouring cities for slaughter and marketing.
8. Second in animal production is the poultry sector, which mainly produces duck eggs. Most of these eggs are processed in Wujiang. Furthermore, Wujiang produces various special products, such as ostriches, meat-pigeons, bullfrogs, otters, etc.
9. Vegetable production has become the backbone of the agricultural sector. The total area amounts to 9,000 ha and the area under plastic to 56 ha. Government demonstration centres promote the development of vegetable production. However, there are still many shortcomings and there is a need for new technologies and improved management. Some of the vegetables are produced on the basis of contracts with the processing industry. Vegetables for direct consumption are sold on wholesale and free markets and partly to other provinces.
10. The production of fruit is limited. The production of tangerine underwent a rapid increase and represents more than half of the production of fruit.
11. More important than the production of fruit is that of seedlings and, to some extent, of potted plants (bonsai). Greening programmes and urban expansion have stimulated demand from municipalities and greening companies. The production is in the hands of seedling companies (which grow the young plants) and farmers, who cultivate the plants to final product. Other parts of the floriculture sector (e.g. the production of cut flowers, bulbs, etc.) have only minor significance in Wujiang.
12. Fisheries are more important than animal husbandry for farmers' income. Characteristic is the rapid enlargement of the area of inland fishponds, from 2,400 ha in 1985 to 6,300 ha in 1998. The total area for aquatic breeding is over 20,000 ha. Almost 90% of the production is fish. However, the production of such special products as shrimp and crab is rapidly increasing. Demonstration centres are introducing new technologies and varieties. In the next couple of years, processing enterprises and specific markets will be developed.
13. The cocoon output of Wujiang is five times that of Japan. Silk exports comprise 5% of the total exports of Wujiang. The government plans to improve the production and to concentrate the mulberry area.
14. The Wujiang Agricultural Inputs Company is responsible for the supply of agricultural inputs (excluding seeds). The local government appoints the

management of this company. The government subsidises mechanisation. The degree of mechanisation is relatively high. Wujiang delivers machinery services to neighbouring regions. The use of fertilisers and pesticides is decreasing but still high and causing water pollution, including in Taihu Lake. Since 1998 the supply of seeds has been in the hands of the agricultural technical extension services and its seeds companies. This is to guarantee the use and rapid introduction of high yielding seeds. Farmers are not allowed to use part of their production as seed.

15. Agricultural products (with the exception of rice and cocoon) are now traded directly on the market without direct interference of the government. Almost 90 wholesale and retail markets for agricultural products have been established in Wujiang. There are about 15,000 middlemen dealing in agricultural products in Wujiang, of whom more than 300 have a national certificate. Their share in sales volume of all agricultural products is growing rapidly and already exceeds 30%. The trade between middlemen and farmers on the basis of contracts is increasing.
16. The processing industry is underdeveloped in Wujiang. Few TVEs were engaged in food production. Most processing enterprises were state-owned enterprises (SOEs) mainly involved in low value adding activities such as grain milling and oilseed crushing.
17. A new type of enterprise, which is developing rapidly in Wujiang, integrates the production, processing and marketing of agricultural products. Processing is the major part of their business and the raw material is bought from farmers in neighbouring areas by contracts. As a rule they use advanced technologies and equipment. The products, sometimes with their own trademark, are sold to supermarkets and free markets. Most of these enterprises are set up by large, specialised individual farmers.
18. The Wujiang branch of the China Agricultural Bank and the united rural credit co-operatives play a role in financing the agribusiness of Wujiang. The recent development of the co-operatives makes it easier for individual farmers to get loans; however, this holds only for large farmers. Small farmers often have to borrow money from neighbours or relatives.
19. The delivery of extension services is organised at various administrative levels. Over 250 agronomists are involved in extension work in Wujiang. Some work at the county level and others at the town level in management stations for each important agricultural sector. The task of the extension service is to demonstrate new technologies, provide integrated plant protection management and supply seeds.
20. The role of government has changed from ordering to guiding. The tasks of the government of Wujiang are to 1) invest in agricultural infrastructure, 2) disseminate information, 3) develop and implement local agricultural policies, and 4) participate in experiments and demonstrations of agricultural and rural modernisation.

1. Overview of Wujiang

Wujiang is a county-level city in southern Jiangsu Province. It is located on the fertile Taihu Plain, which for centuries has been famous for its agriculture and silk production. It is the point where Jiangsu Province, Zhejiang Province and Shanghai Municipality meet, and is part of Hang-jia-hu (which means Hangzhou City, Jiaxing City, and Huzhou City) Plain in north Zhejiang. Geographically, it is west of Shanghai, north of Hangzhou City, east of Taihu Lake and south of Suzhou City. Wujiang covers 1,177 square kilometres, excluding the surface of Taihu Lake. Water areas - including rivers (e.g. Taipuhe River), the Grand Canal and smaller lakes - account for 22.7% of the total area. The topography of Wujiang is low and flat. There are no hills. The field altitude is generally 3.2-4.0 metres above sea level, with 5.5 metres being the highest and 1.0 metre being the lowest elevation.

Wujiang has a sub-tropical monsoon climate. Its year-average temperature is 16°C, year-average rainfall is about 1,034-1,100 mm, year-average sunlight is 2,100 hours, and year-average frost-free period is 250 days. 1998 was the warmest year since 1959 in Wujiang, with a year-average temperature of 17.3°C, and a high rainfall of 1,311.4 mm. The natural conditions in Wujiang are favourable for agriculture. It has a long tradition of farming. Since the 1950s, grain production has been the primary aim of agricultural development.



At the end of 1985, the registered population (i.e. excluding temporary migrant workers from other areas) of Wujiang was 733,017; at the end of 1998, this figure was 773,308. The average natural growth rate of the population was 0.412% between 1985 and 1998. The population has begun to slowly decline in recent years as the growth rate has been negative (-0.038%) since 1998. On the other hand, the migrant population can amount to as many as 200,000. In total, the actual number of residents is close to one million. Even excluding migrants, the city's population density is very high: in 1998, there were 657 persons per km², while in the Netherlands in 1994 there were only 434 persons per km².

In 1998, the rural population of Wujiang was 595,325, or 77.0% of the total population. That means its level of urbanisation is still quite low. The total labour force was 449,202. The rural labour force, including workers in the TVEs, was 356,290, which accounts for 79.3% of the total labour force in Wujiang. The non-rural labour force is mainly concentrated in the urban area. In recent years, the number of self-employed and the number of workers employed in private enterprises are increasing quickly.

Located in the coastal area and surrounded by large, prosperous cities such as Shanghai, Suzhou and Hangzhou, Wujiang benefits from their presence and ranks high domestically in terms of economic position. In 1998, Wujiang's total GDP was 17.85 billion yuan, 8.6% higher than the previous year at constant prices of 1996. Per capita GDP amounted to 22,604 yuan (USD 2,730), which was 3.5 times the national average. Added value in the agriculture, industry and services sectors was 1.54 billion yuan, 9.65 billion yuan and 6.66 billion yuan, respectively. Proportions of the three industries were 8.6, 54.1 and 37.3%, respectively. Compared to most developed countries, however, the proportion of the service industry is still quite small. Major manufacturing industries are silk, textiles, machinery, chemicals and building materials.

In agricultural output value, arable crops, animal husbandry and fishery make up almost the same share. The structure of agriculture in Wujiang has shifted from grain production to the comprehensive development of grains, animals, fishery and forestry. In 1999, the gross output value of agriculture (GOVA) was 7,998 million yuan, of which the contribution of 'multi-operations'¹ increased by 9.5% compared to 1998. Total output of major products in 1999 were as follows:

- Grain: 341,975 tons (-11.0%);
- Oilseeds: 42,564 tons (+ 135.9%);
- Fruits: 14,330 tons (+ 91.1%);
- Pigs sold to market: 377,100 heads (+ 0.8%);
- Eggs: 9,166 tons (+ 22.2%);
- Silkworm cocoons: 7,508 tons (-6.0%);
- Aquatic products: 66,416 tons (+0.5%).

Agricultural production in Wujiang is run mainly by individual farm households; the rest is produced by a small number of state-owned farms and nursery gardens. There were 173,150 farm households in 1998. Only 11% of rural income came from agriculture; most came from industry and commerce, catering, construction, etc. The net income of rural

¹ Jiangsu is one of China's major grain producing provinces. Its own statistical breakdowns in agriculture: crop production (mainly grains, cotton and oilseeds), multi-operations and fishery. 'Multi-operations' include pigs, poultry, horticulture, nurseries, silk, etc. see section 2.4.

households was 5,154 yuan per capita in 1998, which was 2.4 times the national average (2,162 yuan).

2. Main features of agricultural and rural development

2.1 Output growth decelerates, structural adjustment continues

Since the early 1980s, the Household Responsibility System (HRS) has greatly promoted agricultural development in rural China. Accordingly, Wujiang saw the rapid growth of agriculture in the 1980s. Total agricultural output value in 1985 was 2.3 times that of 1980, at constant prices. However, when the effect of the HRS faded away in the 1990s, the growth of agricultural output began to slow down. For example, Wujiang's GOVA increased by only 19% between 1990 and 1998 (table 2.1).

A possible explanation for this slowdown is that the rapid development of TVEs and small towns in Wujiang has taken up some of the agricultural resources, especially arable land. For the last two decades, the adjustment of agricultural structure has continued: grain output grew rapidly at first, but then decreased; pig production fluctuates in line with changes in feed supply and meat demand; poultry raising underwent rapid growth, but has now stabilised (a similar trend can be seen in fishery in Wujiang).

Table 2.1 GOVA of Wujiang and output of main products

	GOVA a)	Grain, tons	Pigs sold b)	Poultry sold b)	Fishery, tons
1980	396.15	443,350	45.5	60.52	--
1985	918.31	484,510	42.1	414.66	27,100
1990	1,101.75	533,200	35.6	587.35	47,264
1995	1,295.52	434,900	29.6	750.00	56,314
1997	1,348.43	461,000	40.4	750.00	60,723
1998	1,316.34	384,400	37.4	700.00	66,081

a) GOVA is calculated in constant price, in million yuan. Data for 1980-5 are in 1980 constant prices, and data of and after 1990 are in 1990 constant prices. This applies to all the following tables. GOVA has been used since the 1950s and there is double counting, so is always larger than net income; b) 1,000 head/birds
Source: Wujiang Statistics, various years.

2.2 Rural income increasing rapidly, but farming's share declining

The rural economy has prospered since the 1980s. Total rural income ¹ increased rapidly. By the end of 1998, the total rural income was 34 billion yuan. During the decade between 1990 and 1999, the total rural income in Wujiang increased by 4.4 times, with an average growth rate of 23.4% per year. In 1980, GOVA constituted more than a half of the total

¹ Total rural income includes economic revenue from all three sectors (i.e. agriculture, industry and the service industry), including income from TVEs.

output value in the rural economy. In 1990, the agricultural income was only 20% of total rural income. Most rural income now comes from industry; the proportion from agriculture has dropped to about 9%. Meanwhile, the proportion of income from crop farming (including horticulture) has shrunk: in 1998, it amounted to only 3.3% of total rural income.

Table 2.2 *Income source in rural Wujiang (x million yuan)*

	Total rural economy	Agriculture	%	Crop farming	%
1980	1,744.30	917.90	52.6	233.10	25.4
1990	4,891.08	1,164.72	23.8	429.68	8.8
1995	25,245.32	2,423.90	9.6	986.93	3.9
1997	25,542.21	2,906.74	11.4	1,066.51	4.2
1998	26,339.99	2,890.76	11.0	882.36	3.3

Note: 1. Data in 1980 are output values. 2. All data are in current prices

Source: Wujiang Statistics, various years.

2.3 Number of agricultural workers declines

With the slow process of urbanisation in rural Wujiang, the number of labourers engaged in agriculture declined at a slow rate. In 1998, there were 356,200 such labourers, only 10.1% fewer than in 1985 (396,100). However, the employment structure of the rural labour force has undergone great changes, with more and more people working in services and secondary industries (table 2.3). Since 1995, some employees in TVEs have returned to agriculture because of the declining economic efficiency of TVEs and the tightened government control. In recent years, rural private enterprises in Wujiang sprang up quickly, creating numerous employment opportunities for rural people. But in the agricultural sector, farmers engaged in crop farming constitute the majority of the agricultural labour force, showing that crop farming remains in a leading position in Wujiang agriculture.

Table 2.3 *Changes in the agricultural labour force (x 1,000)*

	Rural Labour (1)	Agricultural Labour (2)	(2)/(1)	Labour in crop production (3)	(3)/(2)
1982	381.9	197.5	51.7%	167.7	84.9%
1985	396.1	177.5	44.8%	--	--
1995	377.7	100.3	26.6%	--	--
1997	360.6	108.0	30.0%	--	--
1998	356.2	115.8	32.5%	89.0	76.9%

Source: Wujiang Statistics, various years.

2.4 Growing importance of 'multi-operations'

There is a general trend in the changes of Wujiang's agricultural structure. The share of crop farming is declining, but at a very slow rate. The output share of animal husbandry has remained stable at 25% for 20 years. The share of forestry is small but increasing, while the share of fishery has increased (in 1998, it surpassed that of animal husbandry). Because of changes in state statistical indicators, the item 'sideline industry' (which was abolished in 1992) has been replaced by 'agricultural multi-operations' in Jiangsu Province, while many kinds of what previously were sideline industries are now included in industry.

Table 2.4 Changes in GOVA and the breakdowns (x million yuan) and their shares

	GOVA	Field crops %	Fishery %	Animal %	Nursery plants %
1980	269.48	69.4	3.0	26.3	1.2
1985	390.67	59.7	8.9	25.5	0.8
1990	1,101.75	47.1	19.5	27.4	0.6
1995	1,295.52	51.6	22.9	25.3	0.2
1997	1,348.43	51.9	23.2	24.7	0.3
1998	1,316.34	48.5	26.4	24.6	0.4

Source: Wujiang Statistics, various years.

According to Wujiang local tradition, agriculture was a synonym for grain and oil production, and most other rural economic activities are now called multi-operations, which include animal husbandry, the cocoon and silk industry, forestry and nursery plants, cash crops (vegetables, melons, fruits, flowers), local industrial and commercial services, etc. This term itself reflects the position of sideline production (livestock production, horticulture, silk and nursery plants, etc.) during the old 'grain-first' years.

If we consider only agricultural items, then rural industry, commerce, construction, etc. should be excluded. In line with this classification, 29% of agricultural income in 1998 came from agriculture (i.e. crop farming), while multi-operations contributed the remaining 71%. Importance of the items in multi-operations in GOVA in 1998 ranked as follows:

- Fishery: 850 million yuan.
- Animal husbandry: 697 million yuan.
- Cash crops (vegetables and flowers): 318 million yuan.
- Nursery plants and fruits: 125 million yuan.
- Cocoons: 120 million yuan.

2.5 Specialised production and economies of scale

Wujiang agriculture is characterised by specialisation in different towns. For example, seedling nurseries are located mainly in the towns of Taoyuan and Tongluo, vegetables in the towns of Miaogang and Qidu, eggs in Bache Town, hogs in Luxu Town, piglets in Tongluo Town, special aquatic production in Badu Town, silk in Zhenze Town, etc.

The regional specialisation is promoted by local markets, leading enterprises and large farm households. In this way, farmers can easily find markets for their products and obtain seeds, feed and technologies, which leads to economies of scale. Vegetable is a leading product in the agricultural economy in Miaogang Town. The sown area of vegetables amounts to 1,000 ha a year, of which 140 ha are potherb mustard. There are three specialised villages and 1,000 specialised households in potherb mustard production in this town. There are four specialised villages and 300 specialised households in egg-duck raising in Bache Town. Its annual production of duck eggs amounts to 1,600 tons. Many large hog producers in Luxu Town sell over 1,000 heads of live animals to the market. Under a normal market conditions, their profit can be 50,000-100,000 yuan a year. To enlarge the scale of agricultural operations, Wujiang has adopted various new ways. The first is to encourage the development of a leading product, town by town or village by village. Reconstruction and the infrastructure have been strengthened, and state-owned breeding farms, nurseries and aquatic farms have been reformed. Wujiang has paid special attention to building new production bases and introducing new varieties. By the end of 1999, they had set up 258 production bases, of which 140 were for aquatic, 73 for livestock, 20 for vegetable and five for seedling nursery. Great achievements can be seen in the construction of hog farms.

3. Agricultural production

3.1 Grains and oilseeds

In 1980, the sown area of grain was 57,000 ha, or 1/3 ha per labourer. The number of crop farmers was 167,700, or 84.9% of the total agricultural labour force, while the latter accounted for around 50% of the rural labour force (see table 3.1). The sown area of grain in 1998 was 53,000 ha, and per capita farmland for each labourer was 0.6 ha - nearly double the figure for 1988.

Determined by its special climate, soil, irrigation and farming traditions, grain and oilseed production used to dominate crop farming in Wujiang, with some melons and hemp. Vegetables were usually planted on mulberry fields. Right after the founding of the People's Republic of China in 1949, people only practised single-harvest rice. In 1951, they tried to grow double-harvest rice, and in 1964 they began to try the triple-harvest pattern. In the 1970s, sown areas were enlarged for wheat, rice, oilseeds and green manure, and two types of cropping system were introduced: the triple-harvest per year and the five harvests in two years. In 1977, the multiple-cropping index in Wujiang reached its historical peak of 2.7 (i.e. 2.7 crops per year on the same plot of land). During the years of the planned economy, Wujiang was one of the most important bases for commodity grain production in Jiangsu Province. Its grain purchase quota was once as high as 450,000 tons. Rice is the most prominent grain in Wujiang. It accounted for 96.3% of total grain output in 1949. Even in 1997, its proportion was as high as 81%.

Table 3.1 Changes in grain crops and oilseeds (1980-98/99)

	Sown area (ha)			Output (tons)		Yield (kg/ha)	
	Total	Grain	Rape-seed	Grain	Rape-seed	Grain	Rape-seed
1980	69,340	57,353	11,987	443,350	18,860	7,730	1,570
1985	81,477	56,527	24,950	484,510	43,040	8,570	1,730
1990	70,866	52,693	18,173	533,200	38,505	10,119	2,120
1995	86,186	66,033	20,153	447,494	45,624	6,777	2,265
1997	83,680	64,180	19,500	461,024	40,971	7,183	2,100
1998	73,990	53,610	20,380	384,400	18,036	7,170	885
1999	--	--	--	341,957	42,564	--	--

Source: Wujiang Statistics, various years.

The multiple-cropping index was too high. With the development of the non-agricultural economy, there was a shortage of labour in the busy seasons. In 1980, Wujiang

began to structurally adjust its agricultural production. The major purpose was to reduce grain areas and develop alternative crops. This occurred in three stages. The first stage (1980-5) focused on reducing the area of double-harvest rice in order to enlarge areas of single-harvest rice or summer oilseeds. By 1987, single-harvest rice had replaced double-harvest rice completely. During the second stage (1985-95), the major measures included shifting from grain to mulberry and fruits, and turning farmland into fishponds. In the third stage (since 1995), Wujiang has continued to reduce its grain area in favour of oilseeds.

Production of grain and oilseeds in Wujiang can be summarised as follows:

- The rice area is shrinking. Grain crops in Wujiang include rice and wheat. In the selected years, the sown area of rape-seed was the largest in 1985, while that of rice was in 1995. That was probably because of the 'Governor's responsibility system'. The area of oilseeds has been stable since 1995, while rice area has begun to decline, with some increase of area for wheat.
- Crop yields rose but are now stable. Table 3.1 shows that the average grain yield was highest in 1990 (>10 tons per ha). Rice yield is calculated according to the physical area rather than the sown area (i.e. not considering double-cropping for a year). The sown area must also include wheat, which has a lower yield than rice. For several years, there was little change in the sown area, yield and output of rape-seed.
- The crop mix has undergone considerable changes. Rape-seed's share in the total output of grain and oilseeds is relatively stable with a trend to increase, while the share of grain tends to decline. Within the grain crops, the share of rice is declining and wheat is rising. The aim of agricultural adjustment in Wujiang is to enhance agricultural efficiency and increase farmers' income. With small-scale household operation, the area devoted less profitable field crops (mainly grain and oil crops) is being reduced. Of the reduced area of these crops, 57% will be turned into fishponds, 14% into nurseries, and 14% will be devoted to vegetables and 14% to other cash crops.

The area devoted to both rice and wheat will continue to shrink in the near future. The reduced area under rice amounted to about 3,200 ha, and the sown area of cash crops (e.g. mulberry garden, seedling nursery and vegetables) will probably exceed that of grain in one or two years. The largest share of changed arable land will become fishponds. Oilseed production will maintain its current level and will not change much due to policy factors.

3.2 Livestock production

Since the 1980s, the people's understanding of 'agriculture' has changed greatly in Wujiang. As mentioned, in the past 'agriculture' in their language was virtually equated with grain and oilseed production, while all other rural economic activities were sidelines, later called multi-operations. Livestock and poultry were of minor importance.

There are two major types of natural resources that contribute to livestock production: the dry land in the south-west - which is a rich source of grass for pig, goat and rabbit - and the plentiful by-product from grain and oilseed production that can be used as

feed. Therefore, Wujiang has a long history of pig raising. In the past, also a lot of cattle were kept as draught animals.

Before the 1990s, pig, poultry and cattle dominated animal husbandry in Wujiang. There were also quite a lot of goats and rabbits. Alternative special animals did not exist, and dairy production was particularly undeveloped. For example, in 1985, the year-end number of pigs was 810,000, cattle 2,500, goats 82,000, rabbits 1.2 million and poultry 4.76 million. If converted to animal units, the proportion of pigs was as high as 80.2%, the proportion of poultry was 11.8%, while cattle was down from 35.4% in 1949 to almost 1.3%.

Poultry production in Wujiang mainly involves the production of egg ducks. In 1998, about 220 million duck eggs were processed. Around 7.5 million birds were sold, with lower profitability than before. Duck egg output was 12,000 tons in 1998, with 300 million eggs processed (preserved eggs).

Special animal breeding in Wujiang now has more varieties, a larger scale and is often operated as a business. For example, the Wujiang Saiyou Ostrich Company (Shengze Town) occupies an area of eight ha, and has 500 ostriches and total assets of 90 million yuan. Taihu Pigeon-meat Company now has 50,000 pairs of breeding pigeons. There are also several large breeding bases for such animals as bullfrogs, otters, etc.

Pig production and market

More than 400,000 pigs were sold to the market in 1997, with more than 100,000 pigs processed in Wujiang. Total revenue from the pig sector amounted to 278.8 million yuan, 40.8% higher than in 1996. That meant a great increase of income for all residents in Wujiang - an increase of revenue 130 yuan per person from pig industry alone in that year. The scale of pig farms has also grown.

By the end of 1999, there were four farms with a yearly output of over 10,000 pigs, 40 farms with an output of over 1,000 pigs, and more than 500 households with an output of over 100 pigs. These farms and households raised 55% of the pigs supplied to market. More than 1,930 farm households sold over 30 pigs a year. All specialised big pig farms accounted for 70% of total pig sales. In addition, 355,000 piglets were sold to the market, almost 30% more than in 1997.

The frequent fluctuation of pig production has been a common phenomenon in China. A changing supply-demand situation often results in fluctuating consumer prices. Producers face double fluctuations in terms of feed price and pig meat price. Price changes have the greatest influence on pig production in Wujiang. The state monopoly on purchasing and marketing pigs was lifted in 1991. With the opening up of the pig market, both production and sales volume increased considerably. This period did not last long because the production growth was not accompanied by expanding marketing channels. Pig supply exceeded demand, which led to a rapid drop in both price and production in 1995. In 1998, the price for feed was fairly high. For example, the price for rice chaff was over 1.2 yuan per kg and for corn over 1.6, while for pork it was only 4.4 yuan per kg - meaning farmers suffered heavy losses. The pork price was at a reasonable level in 2000, and the feed price was comparatively low. Therefore, sales rose and the farmers benefited.

Most pig feed is purchased from outside Wujiang. When the feed price rises, the farmers make their own from raw materials. For example, a farmer in Bache Town

currently keeps over 300 pigs. If all these pigs can be sold at profit, he plans to add up to 1,300 heads. He said that it is too expensive to buy compound feeds (2,000 yuan/ton), so he plans to make compound feed for his pigs according to his own formula (corn: 20-30%; rice bran: 20%; fishmeal: 5-8%; maize by-product: 50%; and some additives). By doing so, he can reduce the cost by 20%.

Table 3.2 Production of pigs, poultry and eggs in Wujiang

	GOVA a)	Pig x 1,000	Poultry x 1,000	Eggs, tons
1980	70.8	455	605	--
1985	99.8	421	4,147	8,756
1990	301.5	356	5,874	8,980
1995	327.6	290	7,500	12,000
1997	332.7	404	7,500	7,500
1998	323.9	374	7,000	7,500
1999	--	377	--	9,166

a) Unit: million yuan

Source: Wujiang Statistics, various years.

There are several trends in animal husbandry in Wujiang. First, pig production will continue to develop, with further enlargement of scale; second, there will be more specialisation so that farmers can benefit from economies of scale; and third, the production of some special animal varieties will increase in tune with market demand.

The main restriction to animal husbandry in Wujiang is its underdeveloped processing capacity. For example, a large number of live pigs have to be sent to neighbouring cities for marketing and slaughtering. The farmers cannot gain the benefit from animal processing. In the future, more efforts will be put into processing animal products (including duck eggs). Wujiang will pay more attention to developing processing capacity and marketing channels.

3.3 Horticulture and seedling nursery

Vegetables

Vegetable production in Wujiang has developed quickly, and marketing channels to other cities and provinces have become wider. There is a very big potential demand for vegetables from neighbouring large cities, like Shanghai and Hangzhou. Based on these demands, vegetable production has become a backbone industry in agriculture in Wujiang.

The total area of vegetables amounted to 9,000 ha in 1998; output was 155,000 tons. The area had been increased by 8.8% since 1997, and output increased by 10.7%. There are 2,600 ha of permanent vegetable area, 5,300 ha under intercropping with other crops and 1,000 ha for 'aquatic' vegetables (those grown in water). Protected cultivation is developing in Wujiang. The area of various plastic tunnels is increasing, and totalled 56 ha.

The new materials like sun-shading nets and insect-proof nets have been introduced in Wujiang, too. The vegetable bases at city and town levels played a demonstration role to show the effects of new establishments and varieties, new farming systems and new management experiences.

Both the area and the scale of plastic tunnels are very small in Wujiang, and the technologies and management also lag behind. The supply of construction materials and other facilities for these vegetable tunnels is at a low level, and more importantly, their management is relatively poor. The land was not prepared properly inside these tunnels, and crop rotation and seed selection was not based on scientific principles, which often resulted in waste of land. Diseases and harmful weeds and insects could mean losses for the farmers. Soil degradation has happened in the tunnels. New technologies, improved management and large-scale investment are necessary to improve productivity.

The marketing network in Wujiang is composed of free markets, wholesale markets, processing factories and an active 'team' of middlemen. These middlemen promote Wujiang's processed vegetables and find markets outside the city or even in other provinces. Qidu Town, for example, has more than 300 middlemen. They sold more than 20,000 tons of pickled potherb mustard in 1998. In Hengshan Town, the vegetable processing factory signed contracts with the farmers to ensure its vegetable supplies, thus increasing the farmers' income. The vegetable wholesale market at Miaogang Town sold 12,000 tons to other provinces.

Fruits

Pear, peach and tangerine were the major types of fruits in Wujiang about 20 years ago. Tangerine production has increased since 1985, while the production of other types has begun to slow down. Tangerine is now the dominant fruit in Wujiang. The average fruit yield exceeded 37.5 tons per ha in Suzhou Agro-technical Demonstration Zone (which is located in Wujiang); average revenue per ha could reach 45,000 yuan.

In 1995, the total output of fruit in Wujiang was 11,000 tons, which was 11 times that in 1985. Gross income from fruit production was 22.47 million yuan, of which 12.60 million yuan came from tangerines. In 1998, low temperatures and heavy rains in the spring and continuous high temperatures in the summer caused a significant reduction of tangerine output, to about 7,500 tons. However, prices rose quickly and farmers' income generally remained unchanged. Tangerine output rebounded to 14,330 tons in 1999.

Seedling nurseries

In recent years, because of strong demand from urban expansion and greening of the environment, seedling nurseries have developed quickly in Wujiang. For example, income from seedlings in 1995 was 50 million yuan, which was 2.6 times that in 1994. It was estimated that gross income from seedling sales was over 100 million yuan in 1997.

The seedling area of Wujiang was 667 ha in 1998, including 255 newly cultivated ha. Other than specialised nurseries and horticultural farms, several specialised villages and specialised households for seedling production have appeared. For example, about 60-70% of the arable land in Taoyuan Town and Tongluo Town is used for raising seedlings. In order to accommodate household operations, there is a division of specialised seedling production in Wujiang. The seedling companies are responsible for introducing fine

varieties and growing young plants. Farmers buy young plants no more than two metres high from the companies for further cultivation. After the seedlings are higher than two metres, they are sold to municipal departments and other greening companies. Generally, the price for young seedlings is three yuan each, while for plants higher than one metre the price is around 15 yuan each. The price for a plant more than three metres high might be as much as 45-50 yuan. In recent years, because of improved planting techniques and marketing channels, and standardised business management, Wujiang seedlings are now exported to Singapore.

There are two types of constraints to seedling production in Wujiang. On the one hand, demand for seedling production mostly comes from municipal departments and other organisations, and their demand is for the woody plant for forestation purposes. On the other hand, there is no tradition of flower production in Wujiang. For example, there is no cut-flower production in Wujiang. A manager of a state seedling farm suggested that the main reason was the lack of funds and the lack of market demand. To start flower production in Wujiang would require an investment of at least 10 million yuan.

3.4 Fishery

Wujiang has plentiful water resources suitable for aquatic production. The county has a long history of fishing, but fish breeding has always been underdeveloped. For example, in 1949 the fish crop from inland fishponds was only 156 tons, whereas the fish catch was 2,132 tons. After liberation, both fishing and especially fish breeding were resumed and they developed very fast. In 1985, the water area for fish breeding was 17,300 ha, of which 2,400 ha were inland fishponds, and the total fish crop was 23,680 tons; in the same year, the fish catch was about 3,400 tons.

In 1990, the water area for fish breeding was 17,700 ha, of which inland fishponds comprised 5,000 ha. The output of aquatic products was 47,260 tons and the output value of fishery was 230 million yuan. The measures the government adopted to encourage fishery in Wujiang included stabilising traditional fish breeding, increasing the ratio of adult-fish ponds, increasing the input of green manure, developing a new method for artificial cultivation of fish and other water products (aquaculture), and continuing the renovation and reconstruction of existing fishponds. In 1990, a cost-benefit analysis of fish breeding was carried out. Assuming the output of fish from one mu (1/15 of a ha) of pond to be 500 kg and an average price of 4.2 yuan/kg, then the output value of fish from one mu of pond would be 2,100 yuan. The gross cost would be 1,441 yuan, of which 450 yuan would be for fish spawn, 640 yuan for feed, 15 yuan for water and electricity, 56 yuan for rent of the pond, and 80 yuan for miscellaneous expenses. The net income from one mu of fishpond would therefore be 659 yuan.

One characteristic of fishery in Wujiang is the rapid enlargement of the area of inland fishponds, from 2,400 ha in 1985 to around 6,300 ha in 1998. The quantity of aquatic products produced in 1998 was four times the amount produced in 1990.

In 1998, the output value of fishery in Wujiang accounted for 26.4% of GOVA. The output of aquatic products was 66,000 tons. Of the total output, only 10% was from catching, while breeding made up 90%. The water area for aquatic breeding was 20,553 ha,

of which 6,300 ha were artificial fishponds. Fish accounted for 88% of all aquatic products; the rest were shrimp and shellfish.

Another characteristic is the rapid development of special aquatic breeding. In 1995, the quantity of special aquatic products was 1,600 tons and the income was 190 million yuan. Just three years later, output had increased to 6,400 tons and income had risen to 340 million yuan, four times and 1.8 times the 1995 figure, respectively. In 1999, the water area for special breeding has increased to about 6,300 ha, and total income amounted to 450 million yuan, or 46.6% of the gross income from aquatic breeding. Major varieties of special breeding in Wujiang were shrimp and crab, which accounted 90% of the total area devoted to special breeding.

One important way to develop aquatic production in Wujiang is to establish aquatic bases, introduce new technologies and new varieties, and disseminate such technologies and varieties and market information to the farmers by means of demonstrations. In 1998, there were 130 aquatic bases whose area exceeded 100 mu, and the total area of the various bases added up to 1,500 ha. The major varieties demonstrated included several varieties of shrimp, soft-shelled turtle, river crabs and high-quality regular fish. The demonstration bases in the towns of Badu, Bache, Luxu, Hengshan, etc. have achieved visible results, and their yield is about 10% higher than regular production.

Table 3.3 *Fishery production in Wujiang*

	Total water area ha	Total output tons	Total output value million yuan	Area for special products ha	Income from special products million yuan
1980	12,700	6,860	7.95	-	-
1985	17,300	27,100	34.62	-	-
1990	17,700	47,260	230.00	-	-
1995	18,500	56,000	296.93	1,667	190
1997	18,900	60,700	312.38	2,880	304
1998	20,553	66,000	348.09	4,077	340
1999	21,648	66,416	-	6,267	-

Source: Wujiang Statistics, various years.

Fishery has continued to develop in Wujiang in recent years, and in 1998 its output value exceeded that of animal husbandry. In the near future, aquatic production in Wujiang will continue to develop in the following aspects. First, the sector will continue to improve the productivity and economic benefit through renewal of varieties and feeding technologies. Second, it will develop processing enterprises for aquatic products to drive the marketing of aquatic products. Third, it will try to market its aquatic products to external markets by establishing specific markets and marketing channels. And fourth, it will strengthen the information service by connecting to the Internet.

3.5 Cocoon production and the silk industry

Since the 1970s, China has been the world's largest producer of raw silk. Taihu Plain, on which Wujiang is located, is a major silk-producing county. The silk industry in Wujiang has undergone rapid development since the 1960s. The silk industry is now a key sector supporting the county's economic development and exports.

Table 3.4 *Silk production in Wujiang*

Year	Mulberry area ha	Cocoon output tons	Silk output tons	Gross output value of silk industry million yuan
1980	3,859	3,351	265	--
1985	5,318	4,710	516	--
1990	5,360	7,985	--	680.3
1995	--	11,625	--	3,126.0
1997	6,832	8,346	1,560	2,766.0
1998	6,490	7,986	1,372	1,826.8
1999	--	7,508	4,183	--

Source: Wujiang Statistics, various years.

In 1998, the mulberry area in Wujiang was 6,490 ha, and cocoon output was 8,000 tons, five times that of Japan¹ in 1995. The gross output value of the silk industry was 1.83 billion yuan. Silk exports amounted to USD 22.7 million, 5% of Wujiang's total exports to foreign countries. Wujiang plans to develop cocoon production by stabilising the mulberry area, improving cocoon yield and quality, and concentrating the production area in order to encourage farmers to specialise.

3.6 Household economy and farms

Farm households

The individual farm household is the main unit of agricultural operation in Wujiang. In the past, the average scale of farming was 'very small but everything'. Before the rapid growth of the rural non-agricultural economy in Wujiang, agriculture provided the major part of the farmers' income. As a result of the reform and the process of opening up, manufacturing and commerce began to develop quickly. The role of agriculture in the rural economy declined dramatically. Income from agriculture accounts for only 10% of total rural income. In the background, many rural workers have shifted to part-time farming. They are employed in rural industries, and return to farming only in the busy agricultural seasons. In order to cope with this situation, it is necessary to reduce the area devoted to double-harvest rice to prevent a shortage of farm labour in the busy seasons.

¹ Japan was once the world's largest producer of silk.

According to a 1998 sampling survey of 60 rural households, the average area of contracted farmland in Wujiang was 0.2 ha per household, there were three labourers per household, and per capita net income was 5,480 yuan. Per capita consumption of major food was 22.7 kg of meat (pork, beef, mutton), 8 kg of fish and shrimp, 5 kg of eggs, and 30 kg of fruit. In comparison with urban households, this food consumption level was not high. Some specialised farm households have become the models for their neighbouring farmers because of their higher benefits. Their experience showed that a larger farm might promote a bigger, specialised production village. For example, Mr Gu Sijin from Jinjiaba Town made a high profit by raising shrimp (180,000 yuan in 1997 and 110,000 yuan in 1998). Following his example, more than 50 households in his and adjacent villages began to raise shrimp. He shared his techniques with his neighbours and organised marketing channels, so that the latecomers also increased their income.

State farms, village and town farms

Some state farms were set up in the 1950s in Wujiang, but their average scale was not large. They underwent frequent changes during various periods, and thus did not develop steadily. There were nine county-level state farms and nine district-level farms in the early 1950s, but these were dismantled in the early 1960s. Currently, Wujiang has eight state farms: a crop farm, two horticultural farms, three aquaculture farms, a silkworm-breeding farm, and an animal-breeding farm. Pangshanhu Farm was established in 1933. Originally it had 580 ha of farmland, but now has only 39 ha, with 340 workers (158 households). Only 56 workers are engaged in agricultural production. Most have changed to industry and commerce. Comparatively, the aquaculture farms have higher profits and their scale is larger. It is expected that they will continue to increase their production.

Besides the state farms, some villages and towns have set up collective or private farms to promote the concentration of farmland and enlarge the farm scale. By the end of 1998, there were 17 village farms and 23 town farms; a year later, there were 31 and 38, respectively. This is a new phenomenon for the area.

To sum up, small farms will dominate in the foreseeable future, and the majority of the labour force will have a non-agricultural job. More new technologies will be adopted in agricultural production to reduce the intensity of physical work and to increase the economic benefits. The various patterns of integrated management of agriculture¹ are intended to link farmers to the market. Because of diseconomies of small scale, these small farm households have to rely on leading agricultural enterprises and the middlemen.

On the other hand, some skilled farmers specialise and enlarge their scale of production. Wujiang now has more than 10,000 large farm households in all types of production. In 1999, for example, there were 2,587 large pig farms, 2,324 in vegetables, 813 in poultry, 1,124 in special animals, 425 in seedling nurseries and 533 in fruits. These households have little time to do off-farm jobs. Their income mainly comes from agricultural production (household operations). Their products depend on special markets, the middlemen, or large export-oriented processing enterprises.

¹ The Chinese term 'Nongye chanyehua' (literally, 'agricultural industrialisation') is quite often heard when one talks with the rural people. Actually, it means integrating production with all chains from the field to the consumer's table, equivalent to 'agribusiness'. Being a verb-noun, this concept includes supplies, processing, marketing, etc.

4. Agribusiness chains

4.1 Supplies of agricultural inputs

Supply and marketing system

The marketing of agricultural inputs in China is mainly managed by the supply and marketing co-operative system. The 'co-operative' is not organised as in the Netherlands: there is no official membership for specific farmers; everybody may buy farm machinery and fertilisers and so on, without any 'privileges'; and the management is not elected, but is appointed by the governmental agency. The supply and marketing system in Wujiang reformed its management in 1997. The Wujiang Agricultural Inputs Company was designated as a leading enterprise, while all other 22 grassroots stores were linked as the chains in 1998. The marketing services are now integrated, but the properties of all original co-operatives remained unchanged.

This system is responsible for providing all services for agricultural machines, fertilisers, pesticides, plastic film, etc., but not seeds. The sale of agricultural inputs increased from 124 million yuan in 1990 to 194 million yuan in 1997. In 1998, however, sales decreased to 131 million yuan, due to the reduced sown area of grain crops, the take-over of seed sales by the agricultural technical extension system, and (to some extent) by sluggish demand in Japan, South Korea and Southeast Asia after the financial crisis in 1997.

Agricultural machinery

Since 1995, the investment in agricultural mechanisation in Wujiang has been 10-30 million yuan per year. Most of this goes on the purchase of medium-sized tractors, combines, corn driers and other associated tools and accessories. In 1997, Pingwang became the fifth town (after Meiyuan, Zhenze, Lili and Shengze) to have enough tractors to do the main farm work. The machine-ploughed area in Wujiang reached 100% of the farmland.

In 1997, Wujiang began to provide cross-regional services for neighbouring regions. The city government helped farmers to obtain necessary information. In the first year, 85 medium-sized tractors and combines were organised to work in Zhejiang, Shanghai and north Jiangsu. They harvested 400 ha of wheat and 1,000 ha of rice, and ploughed 133 ha of land. Their gross income was 1.55 million yuan. These inter-regional machinery services have a positive influence on the development of agricultural mechanisation in Wujiang.

To encourage this investment in new machines, the city government subsidised these towns and, in particular, farmers. Their target is to have farmers own at least 20% of all machinery.

Fertilisers and chemicals

The highest fertilisers sales in Wujiang were recorded in 1995, then went down. The highest sales of carbonate nitrate (NH_4HCO_3) was also in 1995, but was then surpassed by urea. The application of potash (K) reached its peak in 1998, while the use of phosphate (P) has declined since 1990 (table 4.1).

The drop in fertiliser sales is mainly a result of the reduction of the sown area of grains. However, the use of fertilisers and chemicals per ha remains very high in this area, causing pollution in neighbouring rivers and Taihu Lake. Because of this, research institutes are being encouraged to develop highly efficient, low-residue chemicals.

Table 4.1 *Production inputs used in Wujiang, in tons*

	Value, million yuan	Urea	Carbonate N	P	K	Compound fertiliser	Pesticide
1990	124.38	--	12,487 a) --	22,304	6,774		1,899
1995	203.39	60,135	62,904	15,561	6,911		2,005
1996	190.73	83,646	51,384	12,410	17,502		2,610
1997	193.69	66,920	40,743	9,392	23,731	23,885	2,301
1998	131.14	51,601	34,522	6,895	22,159	15,169	1,208

a) Converted to sulphate ammonia

Source: Wujiang Statistics, various years.

4.2 Seeds supply

The agricultural technical extension system is responsible for developing new technologies, seeds and other innovations in research institutions. The reason for this is that many farmers used to suffer greatly from low-quality or fake seeds, which could be identified by most common traders. The introduction and supply of new crop varieties require special expertise in terms of strict quality control and demonstration of planting techniques. Thus it is appropriate that the agricultural technical extension services have this responsibility. Seed marketing is now totally managed and controlled by this system and the seed companies within this system. These seed companies are responsible for introducing and selling the seeds. Other companies or persons are not allowed to do seed business. The centralised seed supply system can be summarised as follows: 1) the city (prefecture) is responsible for the elite seeds; 2) the towns or townships are responsible for the high-yielding seeds; and 3) farmers may not keep back seeds for production.

This supply system is intended to guarantee quality seeds and thus to guarantee high output in agriculture. It can also serve as a basis for the introduction of new varieties and speeding up the renewal of crop varieties. For example, Taihu japonica-2 was adopted in 1995, and abandoned in 1997. The use of improved varieties exceeded 95% in Wujiang in 1998. The sown area of new rice variety 9522 was 20,000 ha, or 54% of total sown area of rice. At the same time, the extension stations made experiments successfully on some new planting techniques for rice.

4.3 Production cost and price

According to a study performed by local officials, in 1990 the increase of net profit of five kinds of products (out of a total of eight farm products) exceeded 10% (see table 4.2).

Table 4.2 *Production costs and profitability (per mu) of selected products in 1990 a)*

	Labour, hours	Physical inputs, yuan	Net profit a), yuan
Grain/oil	25.3	192.36	--
Rice	14.2	115.87	152.59
Winter crops	8.7	71.46	54.44
Wheat	9.3	73.64	29.08
Barley	7.2	60.58	104.94
Oat	8.8	80.81	70.09
Rape-seed	13.1	73.46	80.20
Cocoon	56.2	267.04	580.66
Fish	30.0	1,063.81	616.45

a) This was done by a survey many years ago. Recent data are not available. Physical inputs are chemical fertilisers, pesticides, agricultural machinery, power, land rent, etc. Labour profit is included in the net profit
Source: Wujiang Statistics, various years.

With the step by step opening of agricultural markets, the prices of more and more agricultural products were decided in the market. Currently only two products - grain and cocoon - still have government prices. According to the regulations of the State Council, grains may be purchased only by the state-owned grain companies at protective prices. Grain production in Wujiang cannot become the main source of farmers' income because of the limited production scale. To improve the overall efficiency of agriculture and increase farmers' income, the government encourages farmers to gradually reduce the sown area under grain.

Today, the price of most agricultural products is determined by the market. Price changes influence farmers' income, and result in production fluctuation. For example, the pork price declined remarkably in 1998, and the egg price remained low for a long time. This caused a remarkable decline in sales volume in 1999: there were 500,000 fewer birds and 80,000 fewer pigs. In the following year, the pork price went up while the feed price dropped. Another example is fruits. Because of bad weather in 1998, fruit output decreased a lot; therefore, the fruit price rose, resulting in stability of farm income in 1998. Fruit output increased by 90% in 1999.

4.4 Marketing of agricultural products

In the past, state-run commercial enterprises were the major channels for marketing agricultural products. Only a few types of products (e.g. aquatic products) were traded

directly on the market. Now, the marketing of most products (with the exception of rice and cocoon) has been shifted to the market.

Several agricultural markets have been established in Wujiang. In 2000, there were 89 wholesale and retail markets for agricultural products in Wujiang. The annual sales volume amounted to 17.6 billion yuan. The most important markets include pigs, aquatic products (in Pingwang and Songling), seedlings (in Luxu and Tongluo), fruits (in Wanping), piglets (in Qidu and Luxu), vegetables (in Qidu), etc. The piglet and hog markets in Qidu are growing larger and will soon become a distribution centre for eastern China. For aquatic products, there were 44 aquatic docks for trading in 1998. There were more than 500 stands in Miaogang river-crab market in the busy seasons. Daily sales of crab can be as high as five tons and annual transaction can amount to 500 tons (about 60 million yuan).

The growing army of middlemen is becoming a competitive force in the marketing of agricultural products in Wujiang. There are different relations between middlemen and farmers: there are close contracting relations, whereas others come and buy at any time. The contracted trade is growing. It is reported that by the end of 2000 there were about 15,000 middlemen in Wujiang selling vegetables, aquatic products, eggs, seedlings, pigs, etc. Of these, 319 had a national certificate. The share of agricultural products marketed by the middlemen is growing rapidly. Starting from zero, their sales volume now exceeds 30% of the total.

A large share of agricultural products is sold to the neighbouring cities, especially Shanghai. The demand for pig in Shanghai is 4.5 million heads a year, with a deficit of about 2.5 million heads. This is a tremendous attraction for Wujiang's farmers and middlemen. On the other hand, some agricultural products can be sold to the underdeveloped regions neighbouring the county. For example, some varieties of pigs with high fat content are sold to the mountainous area in southern Zhejiang because local people still use fat pork as a source of nutrients.

There is a new type of enterprise (mostly set up by individual farmers) that integrates the production, processing and marketing of agricultural products. These enterprises, which are developing rapidly in Wujiang, purchase products from farmers in neighbouring areas by means of contracts. Processing is the major business in these new enterprises. As a rule, they have relatively advanced technologies and equipment, and their products enjoy a good price at the market. The business of these enterprises is not confined to their own products. That kind of business is suitable for small-scale production. Some companies have expanded and have a good reputation in the surrounding areas, such as China Huaxin Group, Wujiang Grass Products Group, Wujiang Greening Company, Wujiang Livestock & Poultry Group, Bache Eggs Company, etc.

4.5 Processing industry

The new enterprises put much money into the processing industry because processing in Wujiang is underdeveloped. Most processing enterprises used to be SOEs. Their processed goods had little value added, because the processing mainly involved grain milling and oilseed crushing. In 1998, for example, they processed 49,400 tons of rice, 9.23 million

tons of wheat flour, 16,200 tons of oil, 1,015 tons of feed and 1,645 tons of other food. Their total sales volume was 380 million yuan (USD 46 million). A large part of agricultural products should be processed in other areas, especially in Shanghai. Few TVEs are engaged in food production or agricultural processing.

The Wujiang government has given priority to encouraging large enterprises to develop processing capacities. For example, China Huaxin Group (Wujiang) has become a well-known agricultural company in China. It registered as a collective enterprise group in 1994 and became the first one at state-level in Jiangsu Province. It has a health food company, a feed company, seven animal-raising companies and three research institutes. Its major business includes the processing and marketing of aquatic products as well as aquatic feed production. The nearby farmers benefit greatly from its services.

At present, an increasing number of farmers (mostly large and specialised farmers) have begun processing agricultural products and are becoming more familiar with market situations. Mr Zhou Xueliang, a farmer from Bache Town, has evolved from a duck grower into a businessman and now specialises in processing and marketing duck eggs. He sells six million preserved eggs, six million salted eggs and 20 million fresh eggs a year. His products are sold mainly to large supermarkets (Metro Shanghai, Big Runfa, Ichu Lucky, etc.) and free markets in Shanghai. To meet the market standard, his has own trademarks and products are well packed, with dates of production and bar codes. His products account for about a half of all sales in the above-mentioned supermarkets. He has a plan to co-operate with the French supermarket chain Carrefour to ensure a more stable marketing channel by using its brand for his eggs.

Besides his own production, the eggs Mr Zhou sells come mostly from nearby specialised duck growers. There is a flexible co-operation between Zhou and other farmers by means of purchase and sale contracts. Usually, the contract is renewed every five days, with a predetermined quantity but a flexible price. This guarantees the necessary quantity for the market. This type of co-operation is also profitable for a large number of specialised duck growers in neighbouring towns.

5. Supporting system of agricultural development

5.1 Rural finance

The major financial organisations that support the rural economy are the China Agricultural Bank and the Rural Credit Co-operative (RCC). The former is a state-owned company, and the latter is a co-operative economic organisation (with the same character as the supply and marketing co-operative). In recent years, both the China Agricultural Bank and the RCC have undergone market-oriented institutional reforms.

In 1995, the Wujiang branch of the China Agricultural Bank was reincarnated as a state-owned commercial bank. Based on the requirement to develop highly efficient agriculture, its loans to the agriculture sector totalled 836 million yuan, of which 150 million yuan were for agricultural production. In 1997, the total year-end deposit of the Agricultural Bank was over 1.8 billion yuan, and its loans to agriculture were 730 million yuan. Its major clients were large grain growers, large pig raisers and large aquatic producers. An additional loan of 20 million yuan was allocated to Huaxin Group to support the expansion of its production scale.

The business scope of Wujiang's united rural credit co-operatives was approved by Jiangsu Branch of the People's Bank on 10 December 1995. At first it was under the leadership of the Wujiang branch of the Agricultural Bank, but became independent in March 1996. All the united 23 credit co-operatives have a leadership office in Suzhou City. They have 12 branches, nine deposit points and 15 service stations, and their network extends to 60 points.

By the end of 1996, the total deposit of the co-operatives amounted to 1,271 million yuan. The ratio of loan to deposit of all subordinated credit co-operatives was 78.6%. The year-end loan totalled at 1,186 million yuan. In total, 564 million yuan were poured to agriculture. About 8.59 million yuan of the loans went to large grain growers and special stock raising.

In November 1997, the Jiangsu Branch of the People's Bank of China decided that the city (county) credit co-operative unions should be administered by the People's Bank of the same level, and the operations of the rural credit co-operatives should be regulated according to principles of Cupertino. By the end of 1997, the total network points of the rural credit co-operatives had grown to 66. There were 24 legal-person organisations, 33 branch credit co-operatives and nine saving spots, with a total of 529 employees. The year-end deposit totalled 1.824 billion yuan, which was 553 million yuan more than that of the previous year. The net profit in 1997 was 6.28 million yuan, which was 47.4% higher than in the previous year.

The object of rural credit co-operatives is to serve farmers, agriculture and the rural economy. By the end of 1997, their total loan was 1,393 million yuan, of which 780 million yuan was for agricultural production - especially to support large grain growers and

livestock production - and TVEs. For the TVEs, total loan was 3.37 billion yuan, 500 million yuan more than in 1996.

The loan to support the private economy was 187 million yuan in 1997, and continued to increase in 1998. With the development of rural credit co-operative business, it is much easier for individual farmers to get loans. The procedures at the rural credit co-operative are the same as at the commercial banks. When a farmer plans to borrow a certain amount of money, he must have a clear purpose for the loan and show guarantee documents (such as his bank deposit certificate, or those of his relatives). In fact, therefore, only large farmers get more loans because they have a stronger financial background. Smaller farmers often meet their financial needs by borrowing money from their neighbours or relatives. The interest rate might be zero, but it might be much higher than that charged by the bank or credit co-operatives.

5.2 Technology extension and information

Like most other cities in eastern China, there is an integrated organisation network of agricultural extension and relatively strong manpower for extension in Wujiang. The structure of the extension system is at four levels, as shown in figure 5.1.

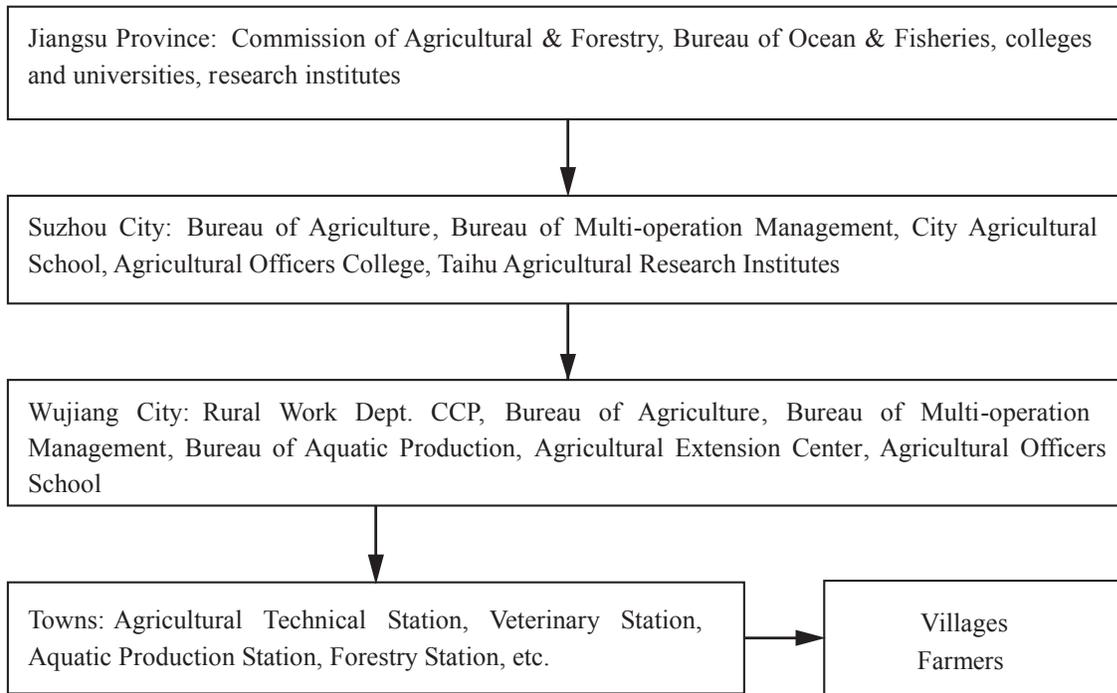


Figure 5.1 Agricultural extension system in Wujiang

Structure and management

In 1997, Wujiang had one state-level agro-technical extension worker, 14 senior agronomists, 89 agronomists and 148 junior agronomists.

Wujiang has established several management stations for each agricultural sector, for example, the Veterinary Station, Aquatic Production Station, Cocoon and Nursery Station. There are also sub-stations in every town for more practical issues. The central station also publishes newsletters or leaflets to introduce new technologies, new policies, new management patterns and market information. For example, The Bureau for Multi-operations periodically publishes *Wujiang Multi-operations, Information Briefings for Multi-operations*. The Rural Work Department under the City Committee of the CCP collects data and publishes *To Increase Farmers Income: 100 Successful Stories, 1999*.

Besides the official governmental extension sectors, agricultural information is also disseminated by implementing the government leaders' demonstration projects. Major officers of the people's government and the party committee have certain pieces of land as 'demonstration plots' with a total area about of 2,900 ha in 1998. These plots of farmland have a standard infrastructure construction, are surrounded by protective forests, and all farm work is done with machinery. The yields of wheat, rape-seed and rice were 38.6%, 46.1 and 8.9% higher than those of common fields, respectively. The purpose of these demonstration projects is to push the realisation of agricultural modernisation in Wujiang, through improved technologies.

Wujiang organised an expert group for high-yielding rice technologies to give lectures in 23 towns in 1998. About 2,500 farmers were trained.

Services

The main tasks of the agricultural extension stations in Wujiang are:

- To supply seeds in a unified way and introduce new high-yielding seeds. The station is responsible for the centralised seed supply system: farmers may not keep back seeds for production (see section 4.2). This has resulted in a high coverage of new high-yielding seeds in Wujiang. Unified supply of rice seeds 9117 and Taihu japonica-2, and rape-seeds Huiyou-50 totalled 5,260,000 kg in 1995, or 98% of the total sown area. In 1997, Taihu japonica-2 was replaced by new varieties, which accounted for over 95% of total area.
- To demonstrate new technologies. New technologies are introduced by these stations by demonstrating their effects. An improved method of growing rice seedlings, as well as new mechanised methods of transplanting the seedlings (it was a very hard job), was introduced in 1995. The new technology covered a total area of rice about 13,700 ha in 1995; two years later, the figure was 28,500 ha, or 66% of total sown area. Other techniques included new ways of crop fertilisation (87.4% of total area), the recycling of rice straw (37,500 ha), etc.
- To provide integrated plant protection. This includes the timely application of pesticides and the introduction of new, highly efficient, low-residue pesticides.

5.3 The government's functions and infrastructure

The governmental agencies related to agriculture and the rural economy in Wujiang include several bureaux: Agriculture, Multi-operations, Fishery, Grains, Water Conservancy and Mechanisation, etc. In addition, there is a Rural Work Department under the Party Committee. In the past, these agencies ordered or required the farmers to grow what the government had planned. This situation has now changed. The government tasks in Wujiang now can be summarised as follows:

- To invest in the agricultural infrastructure, including water conservancy, roads, electric power, subsidies to enable mechanisation and to perform technological demonstration projects, etc. In the period 1949-95, Wujiang spent 64.1 million yuan on irrigation and water conservancy alone. The work included 268 million cubic metres of earthworks for water conservancy projects, 535 sluices, 27 dredged or newly opened canals, 47 km of dikes around Taihu Lake, and 3,562 bridges. In 1997 alone, over 2.57 million man-days and 28.2 million yuan were invested in water projects.
- To manage comprehensively information dissemination and other services.
- To work out local agricultural policies and development programming.
- To participate directly in the demonstration of agricultural modernisation and experiments of rural modernisation.

6. Conclusions

Located in the fertile Taihu plain, Wujiang has undergone three stages of structural adjustment since the 1980s. With the enlargement of the consumption market in neighbouring regions and the development of agriculture in rural Wujiang, its agricultural policy no longer aims at increasing grain output.

Restructuring farm production

The emphasis has shifted to increasing agricultural efficiency and increasing farmers' income. Wujiang will continue to develop multi-operations and gradually reduce the sown area of grains. What is more important is that farmers have benefited from the specialised multi-operations. For example, farmers' net income in 1998 was 5,130 yuan, of which the shares from agriculture, multi-operations and TVEs were 3.3, 18.3, and 78.3%, respectively.

Currently, a large percentage of Wujiang's agricultural products are marketed to its neighbouring regions. Its agricultural export is limited only in a few local products (e.g. silk). Now that China has joined the WTO, the restructuring of agriculture and rural economy will become more pressing. Wujiang must maintain its current comparative advantage in domestic markets and decrease its production costs in order to increase exports to international markets.

Small-scale farming

The small scale of the farms is one major constraint to agriculture in Wujiang. The city leaders have taken many measures, including setting up production bases, developing large 'dragon-head' ('leading') agricultural enterprises, encouraging farmers to specialise, etc.

However, the general situation of small scale will not change essentially in the foreseeable future. Most of the part-time farmers work in TVEs, and they do not want to give up their land or agricultural activities. Thus the farming scale will remain small in Wujiang for some time to come.

The agricultural pattern in Wujiang will probably follow that of Japan, with good irrigation systems, high-yielding varieties, the heavy use of fertilisers, small-scale machinery and other technologies, which can be adapted to small-scale farming.

Strong demand for new technologies

The further development of agriculture in Wujiang calls for strong support from new technologies. The farmers have become more aware of the importance of new technologies and the impact of market changes on their benefits. The extension services have the obligation to introduce and carry out experiments with new varieties and familiarise the farmers with them. Although the extension sector can earn some revenue from its work in order to improve the services and equipment it provides, the government pays for its costs during the initial stage.

The pig growers in Wujiang, for example, need both new feed recipes to reduce their costs and increase their profit, and new hybrid breeds. Feed price is a major factor affecting the cost of pigs. Many farmers in Wujiang mix their own pig feed; however, this cannot guarantee the quality of the feed. In vegetable production, Wujiang plans to develop 'protected land' production, i.e. plastic tunnels or greenhouses. However, such technologies and their management are lacking in Wujiang. Agricultural processing in this city is also a weak link. There is also great potential demand for technologies and facilities to develop a processing industry. Advanced and imported technologies, facilities and management skill must be the priority.

Market-oriented agriculture

There are two domestic markets for agricultural products in Wujiang: the internal market in Wujiang City (with about one million people - including migrant workers - the market is limited) and, a more important market, the neighbouring large cities, such as Shanghai, Suzhou and Hangzhou. A large share of agricultural products are sold to these wealthy regions, especially Shanghai.

The foreign trade in agricultural products is underdeveloped in Wujiang. It is planned to promote foreign trade in the future, mainly to Hong Kong, Japan and South Korea. The export-oriented products include fresh and live farm products, and some processed foods. In turn, Wujiang will import advanced technologies, equipment and new varieties and breeds.