Farmers' Irrigation Management Experience in the Central Hilly Area of Hubei Province

Yan Ge and Ou Guanhua[1]

INTRODUCTION

THE CENTRAL HILLY area of Hubei Province is a rice planting region and consists of large, medium and small-sized surface and pump irrigation systems. The management organization is a combination of publicly owned, professional institutions, and farmer organizations. Farmer organizations shoulder the responsibility for irrigation management including the maintenance of the laterals or sub-branches below the main canal. In addition, they also take on the management of the smaller schemes within an irrigation district. The small-scale farmer systems supply about 50 percent of the total irrigation water in the area.

This paper focuses on irrigation management in the Chuandian township of Jiangling county in the irrigation district of the Zhanghe. It analyses the organizational forms, water management, collection of water charges and farmers' ability to pay water charges and the role of farmer irrigation management organizations.

BACKGROUND

Physical Characteristics

The central hilly area of Hubei Province is located at 30.5°-32.5°N and 111.3°-114.5 °E at an elevation of 50-200 m above sea level. The topography is undulating with an average slope of less than 15°. The relative elevation is about 15-20 m. The soils in the region are mostly the yellow and brown loams.

The total area of the region is 34,000 km^2. The cultivated area is 958,000 ha of which, some 621,160 ha (65 percent) are rice fields which are double cropped with rice and wheat.

The average annual precipitation is 850-970 mm, with 503.4-584.6 mm received during the period May-September. The average annual temperature is 15.5°-16.5° C.

Irrigation Sector

There are 24 large reservoirs with a storage capacity over 10^8 m^3 each and 11 irrigation districts with an irrigation area more than 20,000 ha each. The command area of the Zhanghe Reservoir and the Dangling Reservoir [each] exceed[s] 100,000 ha. There are 136 medium-size reservoirs with a storage capacity of 10^7 m^3-10^8 m^3 and 549 small-size-I reservoirs with a storage capacity in the range of 10^6 m^3-10^7 m^3. In addition there are a large number of small-size-II reservoirs and several pumping stations along rivers and lakes and numerous ponds.

Irrigation Management Organizations

The main and secondary canals of the large-size reservoirs and water diversion projects, large pumping stations and the main canals of the medium-size reservoirs in the townships are managed by the public and professional management institutions set up by the water conservancy administration authorities above the county level. At the county level water projects are managed by the irrigation management institutions set up by the prefecture authority. The irrigation projects in the prefectures are managed by institutions set up by the provincial authority.

Public agencies and professional management institutions are responsible for water allocation along the main and secondary canals, water management, collection of water charges and the maintenance of the irrigation projects in the winter and spring seasons (Figure 1).

The water management stations below county level service rural water supply functions under the leadership of the township governments. The management of water and maintenance of the laterals or sub-branches below the main and secondary canals of the large and medium-sized irrigation districts are carried out by farmer organizations. The township water management station is usually staffed by 8 to 13 persons and are paid from the revenue collected from water charges.

[1]Engineer and Senior Engineer, respectively, Water Conservancy Bureau of the Jingzhou Prefecture of Hubei Province, People's Republic of China.

The township water management station mobilizers farmers and village farmers committees to construct small-size reservoirs, ponds and pumping stations within its area of authority, measures irrigation water use and collects water charges. The village farmers committee sends the field water managers to issue water to the fields and to collect water charge from the farmers.

Table 1 shows the data on water supply in the water storage projects in the central hilly area of Hubei Province, the water supply of the water storage projects managed by the public ownership and professional management institutions, and those under farmer-managed organizations.

FARMER IRRIGATION MANAGEMENT IN THE CHUANDIAN TOWNSHIP OF JIANGLING COUNTY

Professional Institutions of the Zhanghe Reservoir Irrigation District-An Overview

The Chuandian township is located at the juncture of the three counties of Jiangling, Dangyang and Jiangmen. It is irrigated by the second main canal of the Zhanghe Reservoir. The Zhanghe Reservoir is a multipurpose (mainly flood control and irrigation) large-size reservoir with a total storage capacity of 20.35×10^8 m^3 and an effective storage capacity of 9.4×10^8 m^3. It supplies irrigation to 173,600 ha farmland of the four counties of Jiangmen, Jiangling, Zhongxiang and Dangyang. The annual total water supplied to these regions amounts to 5×10^8 m^3. The administration zone is located among three prefectures; therefore, the Zhanghe Project Administration Bureau is set up by the Hubei Water Conservancy Bureau. There are four main canal management divisions under the Zhanghe Project Administration Bureau. The second main canal of the Zhanghe Reservoir irrigates 33,340 ha of farmland with an annual water supply of 0.8×10^8 m^3-1.2×10^8 m^3.

Irrigation Projects

The irrigation projects in the region are shown in Figure 2.

The total area of the region is 124 km^2. The cultivated land is 5,133 ha of which, rice fields amount to 4,620 ha. There are 4 small-size-I and 8 small-size-II reservoirs, 3,611 ponds with a water surface of 806 ha, and 89 small-size pumping stations with a total installed capacity of 1186 kw. There are also 10 laterals or subbranches.

Farmer Management Organization

The Management of Laterals or Sub-Branches Groups

The irrigation range of the lateral or sub-branch canals at the village level is managed by a committee. The committee members [are the water management directors of the villages]. Meetings are organized by the township water management station to discuss the irrigation water use and maintenance of canals. Water management groups are established in the laterals or subbranches. The head and the two deputy heads of the group are appointed as water managers for a period of one year. In addition, 2-3 villagers are designated as seasonal water managers for the April to October season.

The Water Managers carry out three major tasks:

* Allocation of irrigating water and measurement.
* Preparation of a schedule for canal maintenance and organizing farmers to maintain the canals.
* The management of the trees along the canals.

The payments to water managers come from the following three sources. First, fees are collected from the irrigated area on the standard rate of 15 yuan/ha (a US$ = ¥6). The fee is collected by the township water management station and paid to every water manager on the standard of 60 yuan/month/person. Second, the village committee allocates 0.24-0.3 ha of land and a small surface fish pond to the water manager for cultivation and fishery. The third source is the income from trees planted along the canals. A Water Manager can usually earn about 1,500-1,800 yuan (¥) a year. This is about the same as the annual income of a local farmer.

The Management of Small-Size-I Reservoirs and Pumping Stations

In villages where there are small-size reservoirs and pumping stations, a management committee is set up to manage these institutions. Meetings are held at the township water management station to discuss the maintenance costs of the irrigation system including the maintenance cost of machinery and electric devices. In addition, the committee decides on the irrigation water price and the labor work days for canal maintenance. The management unit is established in each small-size reservoir and pumping station with 3-5 managers in each unit. The water charge is collected according to the measured irrigation water in small reservoirs, based on the pumping time and includes power fees, manager's payment and maintenance cost, etc.

Besides income from water charges, additional revenue is generated from fishery in the small-sized reservoirs. The village committee also allocates some land to the managers for planting trees and grains. The annual income of the manager of the small-size reservoir and pumping station is about ¥ 2400-2600 a year, which is a little higher than a local farmer's income.

The Management of Small-Size-II Reservoirs

Small-size-II reservoirs, pumping stations and ponds are managed by a village farmer committee. The committee appoints a water manager for irrigation management and project maintenance. The manager is given an annual allowance of ¥ 800 - 1000. In addition, the village committee allocates some farmland or fish pond to the water manager for cultivation or breeding of fish. The income of the fish breeding should be contributed to the village committee.

The small-size pumping stations (15-75 kw) are managed by an electrician, who will pump water in the irrigation season and also manage the power supply lines in the other seasons.

A pond with a surface area of over 3,335 m^2 is called the key pond. There are 533 such ponds in the whole township. The village will assign a specific person to manage the ponds and the income from pond fishing is given to the manager. The annual income from pond fishing is about ¥ 1,500/ha. Repairing and clearing of ponds are done by laborers organized by the village committee.

WATER MANAGEMENT AND COSTS

Crop Water Consumption and Water Allocation

Areas devoted to crops are as follows:

* Early rice = 2333 ha.
* Mid-season rice = 2000 ha.
* Late rice = 2600 ha.

Wheat and rape do not need irrigation in a normal year because there is enough precipitation during the growing season. The water requirements for [steeping field of] rice transplanting is about 80 - 110 mm. Farmers practice shallow irrigation and deep storage irrigation. Farmers try to utilize rainfall as much as possible to decrease irrigation cost.

The township's water management station and the village farmer committee encourage farmers to use the water from ponds and small-size reservoirs first in order to reduce water charges of the large reservoir. As the distance of water transferred in the storage and lift irrigation projects managed by farmers is much short, water losses are much less than in the large-size reservoir. In the Zhanghe Reservoir water losses (15-25 percent) in the laterals and sub-branches are shared by the farmers. Hence, the cost of water amounts to ¥ 0.025-0.028 /m^3. The price of water in the small pumping station within the irrigation district is only ¥ 0.01-0.015 /m^3.

Water issues in the main and secondary canals are usually measured by a flume, gate openings, or by observing the difference in water levels. The water used in every farm is calculated by the village committee, based on the cultivated area of each farm, and the state of irrigation in the water storage and lifting projects. The water fee is collected by the village committee.

Table 2 gives data of irrigation water from the various irrigation projects and the Zhanghe Reservoir in the Chuandian township for the last 3 years.

Water Pricing and the Collection of Water Charges

In 1993, the price of water in schemes (Zhanghe Reservoir) managed by professional institutions were as follows:

i. A charge of ¥ 15 /ha of irrigated area, and

ii. Volumetric pricing set at ¥ 0.021 /m^3.

In the farmer-managed systems, irrigation charges were levied on the following basis:

i. In the case of lateral and sub-branch canal the water fee was determined on the basis of the irrigated area and was set at is ¥ 15 /ha, and

ii. In the township-managed irrigation project, the water fee was set at ¥ 0.021 /m^3 for small-size reservoirs and was determined by the time of operation of the pump set in the pumping stations.

Collection of Water Charges

The water charge in each village is collected in advance by the township water management station according to the land area cultivated. Following this, a water supply contract is signed with the second main canal management division of the Zhanghe Reservoir. The township water management station will settle accounts with the village committee after each irrigation, based on the water measurement record of the water management group of the lateral or subbranch and then pay the water charge to the second main canal management division. The Zhanghe Reservoir will pay 7.5 percent of the collected water charge back to the township management station as irrigation service cost. The projects managed by the township water management station will settle accounts with the village after taking a water release or a pumping.

Maintenance Cost of the Irrigation Projects Managed by the Farmers

The farmers share the maintenance costs and also contribute labor for rehabilitation of the irrigation facilities. The government provides some supplement funds for improving the conditions of laterals and sub-branch canals, small-sized reservoirs and pumping stations. The government has invested in ¥ 1-2 million to the Chuandian township in 1985 and 1990 based on "the construction of the commercial food basis" and "the agriculture comprehensive development, respectively.

Irrigation Costs Paid by Farmers

The irrigation costs paid by farmers vary with the management mode:

* In the publicly owned and professional-managed projects (i.e., the Zhanghe Reservoir) the irrigation fee is handed over to the second main canal management division of the Zhanghe Reservoir. The amount collected is used for paying the staff wages, administration costs and maintenance costs of the main and submain canals.

* Water charges in the farmer-managed schemes are used to pay wages of staff who manage the laterals or sub-branches and also, the wages of managers of irrigation projects managed by the township and villages.

* In the pump schemes, the irrigation costs are used by farmers for pumping water from ponds and canals.

Besides cash payment, farmers contribute 40-50 labor days in winter each year for rehabilitating irrigation projects managed by [nation] township and villages.

Farmer's Capacity to Pay Water Charges

Cost and returns in some typical farms in the Chuandian township in 1992 are given below:

Annual value of production = ¥ 8977.8/ha

Cost of production (including seeds, fertilizer, pesticide, water charge)= ¥ 2933.4/ha

National tax = ¥ 1678.4/ha

Management charges paid to the village committee = ¥ 956.7/ha

Water charge paid to the village committee = ¥ 135/ha

Pumping costs incurred by farmers = ¥ 105.3/ha

Annual water charge = ¥ 240.3/ha

Annual net income = ¥ 6044.4/ha

Farmer's net income= ¥ 4920.3/ha

Ratio of water charges to production value = 2.6%

Ratio of water charges to production cost = 8.19%

Ratio of water charges to annual net income = 3.97%

Ratio water charges to farmer's net income = 4.83%.

Actual Water Charges 1992-1993

Water charges levied in 1992 and 1993 are given below:

	1992	1993
Water charge for unit area	¥ 138/ha	¥ 126.5/ha
Water charge for the Zhanghe Reservoir (0.015 yuan/m^3)	¥ 78/ha	¥ 71.1 /ha
Water charge for farmer management	¥ 60 /ha	¥ 55.35 /ha

The Effects of the Professional Managed Water Price to the Farmer Irrigation Management

The water charge collected was based on the cultivated area in the Zhanghe Reservoir irrigation district before 1980. The price of water was fixed at ¥ 12 /ha and was only 1 percent of the value of rice produced per unit area. It has been estimated that 68 percent of the water supply in the Zhanghe Reservoir is used in rice cultivation. The water price of the Zhanghe Reservoir has been raised gradually from ¥ 0.0035 /m^3 to ¥ 0.021 /m^3. Farmers have been encouraged to participate in water management. The township water management stations organized farmers to repair the deteriorated ponds, to repair the canals and gates of laterals or subbranches, refurbish small-size reservoirs and to construct pumping stations for enhancing the water supply of the small-sized irrigation projects. Farmers have become more aware of water-saving irrigation technology. For example, the farmers would like to use the rain water in the rainy season (180 -241 mm rainfall) from mid-June to mid-July and adopt the shallow irrigation and deep storage irrigation method in the dry season.

Table 3 gives the price of water and actual area irrigated in the Jiangling County. As indicated, the water supplied from the Zhanghe Reservoir has declined from 68 percent in 1966-1979 to 35 percent in 1993. This is because of the increase in the price of water.

COMMENTS

The village farmer committee is a basic organization set up by the government in the rural areas. Its main functions relate to irrigation and drainage, health, education, power supply, drinking water, transportation, public affairs, etc. The township water management station takes the village as a basic unit for irrigation water use measurement. The functions of the small-size irrigation projects within a village can be sufficiently developed by the management system.

Irrigation systems in the central hills of Hubei Province consist of large, medium and small-size storage (or lift irrigation) projects. The large- and medium-sized reservoirs and the main and submain canals are managed by the publicly owned and professional management institutions. The laterals or sub-branch canals and small-sized irrigation projects within the governed area are managed by the farmer organizations.

This multilevel management system can use water pricing as a mechanism to control the water resources allocation and utilization. The large reservoir (or pumping station) can play a very important role in the dry years.

Figure 1.

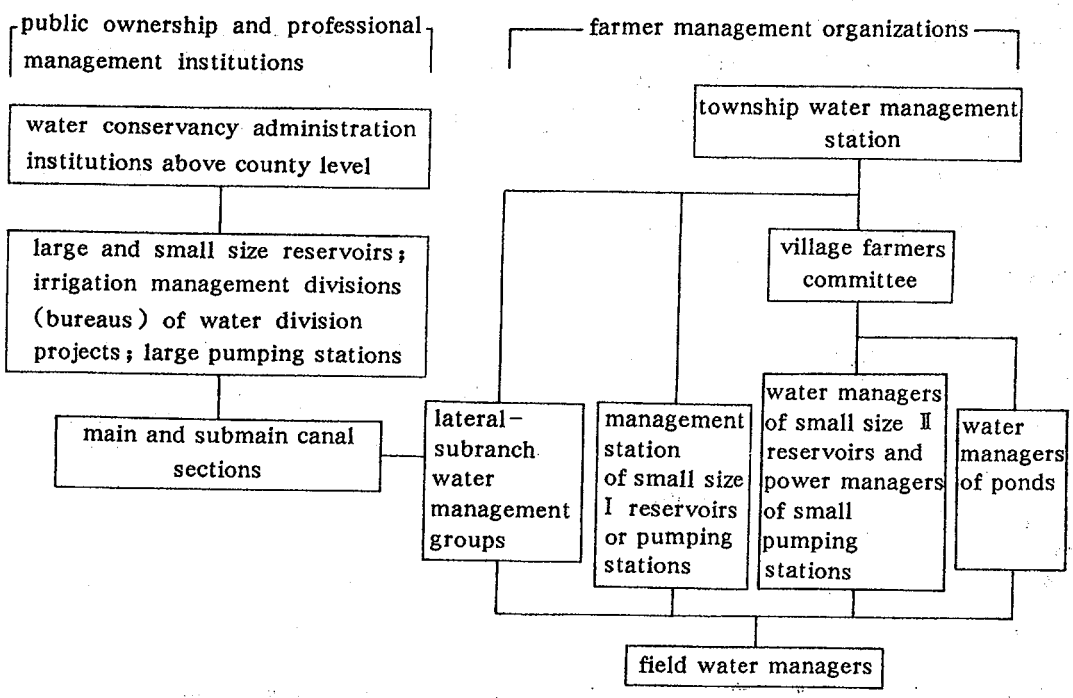

Figure 2..

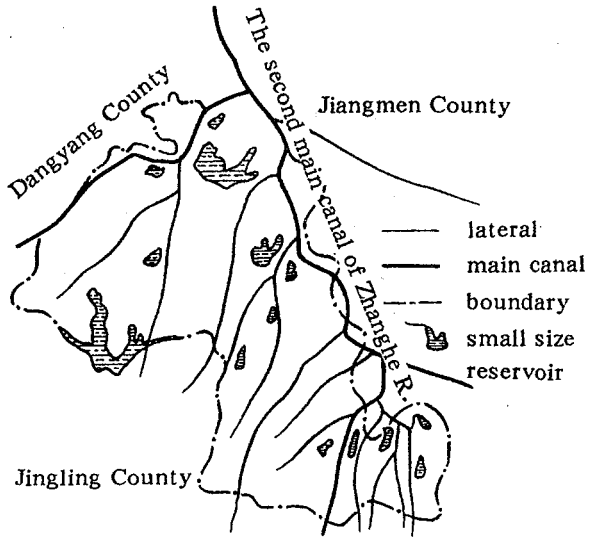

Table 1. Water supply of the water storage projects (75% probability) unit: 10^8 m^3.*

Total water supply	Public ownership and professional management			Farmer management			
	Total	Large-size reservoirs	Medium-size reservoirs	Total	Small-size-I reservoirs	Small-size-II reservoirs	Ponds
38.7131	19.9029	14.0228	5.88	18.8103	4.785	3.0728	10.923
%	51.48	/	/	48.52	/	/	/

* Source: Water Resources Planning of Hubei Province in 1989.

Table 2. Irrigation Water Statistics.

Year	Precipitation in May to Sep (mm)	Irrigation water (10^4 m^3)	Irrigation water of Zhanghe Reservoir (10^4 m^3)	Irrigation water of the Chuandian township (10^4 m^3)			
				Total	Small-size reservoirs	Ponds	Pumping stations
1991	496.3	5645.3	2634.8	3010.5	1190.5	1140	680
1992	611.0	4637.1	1925.6	2711.5	881.5	1200	630
1993	551.3	3531.7	1226.7	2305	445	1240	620

Table 3. Irrigation statistics of the Zhanghe Reservoir irrigation district in the Jiangling County.

Year	Water price	Actual irrigated area	Ratio of the Zhanghe reservoir water supply to the total water use
1966-1979	¥12/ha based on cultivated area	18,666 ha	68%
1980-1983	0.035 yuan/m^3	16,667 ha	58%
1984-1987	0.0077 yuan/m^3	14,000 ha	50%
1988-1992	0.015 yuan/m^3	12,000 ha	42%-48%
1993	0.021 yuan/m^3	8,000 ha	35%