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RICE–FISH CULTURE *in* CHINA

EDITED BY
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INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

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Development of Rice-Fish Farming in Jiangsu Province

Xu Guozhen[18]

Jiangsu Province is located along the coast of the Yellow Sea and is situated in the lower reaches of the Yangtze and Huai He rivers. Its mild climate and abundant rainfall make this region ideal for growing rice and fish. Jiangsu Province has 2.4 million ha of land for rice cultivation and about 670 000 ha of water surface for fish production, which makes it one of the important rice and fish producers in China. There have been substantial developments in rice-fish farming in Jiangsu Province and farmers are becoming more familiar with the new practices.

Current Situation

Since 1982, rural economic reforms have spread and the industrial structure has been readjusted. Rice-fish farming in Jiangsu Province grew rapidly during this period. In 1983, the area for rice-fish culture was 1 000 ha; by 1987, 13 000 ha of ricefields were devoted to fish farming. The practice was adopted mostly in the Lixiahe region in North Jiangsu and in the hilly country in the centre of South Jiangsu.

Most farmers incorporated fish farming with midseason or hybrid rice; a few rotated rice and fish or cultivated them in succession. Farmers also developed their own ways of raising fish to suit the local conditions, topography, traditions, and fish species. These included digging fixed fish pits, connecting ricefields to out-field ditches and ponds, polyculturing different species, breeding summer fry in ricefields, and cultivating rice with fish and freshwater mussel.

The extension of new farming techniques brought vitality to the development of rice-fish farming in the whole province and upgraded the level of intensive farming. The average yield of fresh fish increased from 150 kg/ha in 1984 to 300 kg/ha in 1987. Yields were even higher in some areas. In 1985, 190 ha of ricefields produced 750 kg of fish per hectare; whereas, in 1986, a similar demonstration area of 270 ha produced the same yield of fish.

In 1987, high production demonstration farms were established in Funin, Jianhu, and Hai'an counties. Each farm was 670 ha and produced an average fish yield of 705 kg/ha. From 1984 to 1987, the area for rice-fish culture in the province rose to 40 000 ha with a total commercial fish yield of 1 630 tonnes, plus a fry yield of 6 140 tonnes that could be used to produce 2 400 tonnes of commercial fish. The total value of fish production was over CNY100 million.

[18] Bureau of Aquatic Products, Nanjing, Jiangsu Province.

However, in comparison with other provinces, rice-fish farming in Jiangsu has developed slowly. The area for rice-fish culture decreased from about 13 000 ha in 1987 to 6 000 ha in 1988. The main reasons for this decrease were:

- The high-yielding techniques for rice-fish farming were not adequately extended or widely adopted, which resulted in poor management. In rice-fish farming, extra care is needed in pesticide application and drying of the ricefield because these can adversely affect fish growth. Other factors that can affect rice growth must also be considered carefully: fish species, fish size, size of water body, and the type of ditches and pits. However, in practice, some farmers found it hard to change their cultivation traditions, found themselves short of labour at the time of planting and harvesting, or did not take sufficient care. Because of poor management, high-yielding techniques could not be fully applied and this reduced unit yield.
- The actual recovery rate was low. At present, the mechanization level in grain production is low and irrigation facilities in many areas are poor. In addition, under the current household-management system, management of a piece of land often involves several households. This creates difficulties and weakens the ability of the farmers to deal with natural disasters such as drought or flood. From 1984 to 1987 only 67–70% of the rice-fish farming areas were harvested.
- Production and extension services were not well organized and there was a lack of channels to provide farmers with inputs such as fry and chemical fertilizers. Some farmers could not sell their fry, which were produced too early to be used to stock ponds and reservoirs. Furthermore, because reproduction quantity and output value were low, benefits from fish farming were not significant. At the current yield level of 300–375 kg/ha, unit income is CNY1 200–1 500/ha. A farmer household normally only has up to 0.7 ha for fish farming, which would yield only a few hundred yuan. This is not attractive, particularly in regions where there are many other economic options.

Ways to Further Develop Rice-Fish Farming

Introduce Appropriate-Scale Management

Economic benefits from rice-fish farming should be improved. Because the rural economy is developing rapidly, employment opportunities are increasing and some farmers opt to leave their land for other undertakings. Improved productivity allows other farmers to farm larger areas and to produce much more grain. This new kind of farmer provides the basis for larger-scale management and makes it possible for farmers to make long-term plans. This, in, turn enhances their ability to cope with nature-induced difficulties and to mass-produce products, which improves the supply to city markets. Appropriate-scale management is conducive

to specialization and commercialization in the rural economy, brings economic benefits to farmers, can lead to ecological benefits by improving soil fertility, and can help reduce pesticide application and pollution.

There are two types of management in fish farming. In one type, specialized households or individuals raise fish, while individual households plant rice. In this case, specialized fish-raisers take care of water management and fish farming, while other farmers plant and manage rice. The fish pits and ditches are dug by the rice-planters. A village committee takes charge of the general production arrangement. The income from fish farming is distributed among the fish-raisers, the rice-planters, and the committee in the proportion of 7:2:1. This system makes management easy, allows for a large area (10–30 ha) for raising fish, and provides satisfactory benefits to those concerned. A specialized fish-raiser can earn several thousand yuan each year.

The second type of management concentrates fish farming and rice growing in a single household and depends on available labour, mechanization level, and the farmland arrangement of the household. Generally, the farms cannot be too big (about 2 ha per household). About 10 tonnes of grain and CNY2 000 from fish farming can be produced each year.

Improve Production Conditions and Facilities

Adequate construction work and facilities are essential not only for fish survival in ricefields but for bumper harvests of fish and rice. Given the precondition of not affecting rice yields, the better the construction work, the higher the fish production. With good construction, conditions it is also easier to resolve the contradictions between rice growing and fish farming and to tackle natural difficulties.

Various types of constructions are made for fish farming in different rice-farming systems. In high-yielding areas of Jiangsu Province, several practices are adopted:

- Farmland is rearranged to expand the fish-farming water surface and increase fish-carrying capacity while trying to reduce the area for fish ditches and pits. This can be done by combining in-field with out-field construction. For example, in-field fish ditches can be connected to out-field water inlet–outlet ditches, natural pits, and ditches beside roads and tractor paths. To better use in-field ditches, multiple uses can be made of ditches and pits in rice and wheat fields.
- Appropriate pits and ditches are made in ricefields. These pits and ditches should be simple in form and relatively close to each other. The surface proportions of the pits and ditches are 7:3 or 6:4 and the pits are 1.2–1.5 m deep; the ditches 0.45–0.06 m deep. This increases the size of the water body and its fish-carrying capacity. Normally, pit and ditch surfaces occupy 10% of the ricefield.

- Fish pits and major ditches are dug in a single operation before rice is planted. The advantages are: much of the work can be done during slack seasons in connection with other projects such as irrigation system construction, road construction, and house building. This not only saves labour, but also reduces labour shortages during the busy season. Furthermore, these larger pits can be used for early season fry and late season fish.

Adopt Comprehensive Measures to Prevent Escape of Fish

The key to better economic benefits from rice-fish farming is to increase the actual catching rate. Fish escape in several ways: because of floods and overflow of water, through damaged or poorly placed fish screens, and through holes dug by rats and eels.

To prevent fish from escaping: dikes should be high enough to keep fish-farming fields from flooding, ricefields should be well equipped with irrigation and drainage facilities, fish screens should be firm and durable and be placed appropriately in water exits and entrances, field ridges should be 0.4–0.6 m high and not leak, and strict management should be practiced to ensure that prompt action can be taken when problems arise.

Adopt Intensive Farming Measures

Technical guidelines for high-yielding rice-fish farming need to be developed and promoted using some of the experiences gained from pond-fish rearing:

- Fish species adapted to the specific needs of different areas must be selected and used. In Jiangsu, several options could be considered. Farmers with large areas of water and large numbers of fingerlings can: mainly breed fingerlings of grass carp and common carp, and aim for a fingerling yield of 600 kg/ha; or mainly breed fingerlings of grass carp and common carp, plus 1-year-old fingerlings of a fast-growing species (e.g., tilapia or hybrid common carp). The target yield for fingerling and commercial fish is 750 kg/ha. When the area for fish breeding is small, when breeding is for producing commercial fish, or when there is no temporary pond for fingerlings, farmers can: mainly breed *Megalobrama amblycephala*, plus a small number of fingerlings (yield could reach 750 kg/ha); or mainly breed mature carp with a target yield of 750 kg/ha. Fish growth should be enhanced with supplemental feeding. To gain better results, additional weeds, duckweed, and commercial feed are needed to improve fish growth. Frequent water renewal is also needed to improve water quality, particularly after land baking and pesticide application, when the water body for fish is small, and when organic matter content is high. The added water increases oxygen, improves feed consumption, and reduces the concentration of pesticides. Daily field monitoring is also needed to raise the

survival rate by preventing problems such as pollution, and loss of fish by escape, theft, of attacks by natural enemies.

- Increase the number of species that are raised. Currently, only commonly bred fish species are raised in ricefields, although some farmers are exploring ways of breeding specialty aquacultural products such as clams, shrimp, and mandarin fish. These measures may help improve economic results; however, the farming techniques must still be developed and are experimental.