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RICE–FISH CULTURE *in* CHINA

EDITED BY
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INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

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Reforming Rice-Fish Culture Technology in the Wuling Mountains of Eastern Guizhou Province

Chen Guangcheng[16]

In the past, traditional methods of rice-fish culture were used in the Wuling Mountains. Because output was very low, several reforms were undertaken to improve rice-fish culture.

Improving the Environment for Fish

Depending on the type of soil, furrows, wide ditches, or pits were dug to culture fish in flat ricefields. In cold, muddy, fertile fields, rice-fish culture can be carried out in furrows and wing ditches. The ridge of the furrow is normally about 26-cm wide and the ditch about 39-cm wide and 26-33 cm deep. In muddy fields, where it is difficult to make ridges, wing ditches were introduced. The wing is 2-m wide and the ditch about 0.8-m wide and 0.5-m deep. This innovation improves soil structure, light, and temperature and increases rice production.

In 1985, these innovations were tested at 54 sites (13.7 ha). The dry rice yield averaged 6712 kg/ha (18.% more than in flat fields). Ditches help solve problems created by shallow water and variations in water temperature in flat fields because they increase the volume of water by about 100%. In summer, changes in water temperature are 2-3°C lower than in flat fields. This improves the environment for the fish. In these tests, average fish yield was 507 kg/ha. In high-yielding fields that can produce 7500 kg of rice per hectare, fish production is often 750 kg/ha. In 1987, a 1.5-ha field averaged 7605 kg of rice and 825 kg of fish (average weight per fish 0.85 kg).

The farmers are given these instructions to implement the new technology:

> *To culture fish in a field, dig a pit big enough to make up 5-10% of the field. The pit should be 1.5-m deep and it should link to the fish ditch. There is four times more water in this field than in flat fields. This not only benefits fish growth, but increases the quantity of fish and provides the convenience of dry fields, where farmers can apply additional fertilizer and agricultural pesticides.*
>
> *In terraced fields, a big side ditch is dug in the back ridge. The side ditch should be 1-m wide and 1-m deep and should be linked to the fish ditch. This enhances the growth of rice, which benefits from warmth, and the fish,*

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which like the water. These changes provide conditions for high yields in rice-fish culture.

Stocking Large Fingerlings and Late Harvesting

In the past, the fish species were usually breed and cultured by the farmers. Most of the strains have degenerated. A system of elite breeding has now been established based on the district and township fish hatcheries (e.g., there are 104 sites in Yinjiang County).

Instead of small fingerlings, 250–300 large (about 10 cm) fingerlings are stocked in the fields. Fingerlings should be stocked before the seedlings are planted (from February to April). This allows the fish to obtain food when plankton is abundant. Experience has shown that the same-size fingerlings stocked before planting rice seedlings weigh 100 g more than fingerlings stocked after planting.

Keeping water in the fields when the rice is harvested allows the fish to grow for an additional 60 days and to increase their weight (to about 150 g). During this period, the rice that falls into the field and the young rice seedlings that grow from the roots of the rice are good food for fish.

In February 1987, Li Demin, a farmer in Yundu Township, Jiangkou County, put 200 grass carp and 200 common carp, each about 15-cm long, into a 0.2-ha field. In May, he put 1 800 small fingerlings into the same field. On 19 October, he harvested 162 kg of adult fish and 31 kg of fingerlings. The adult fish averaged 0.52 kg and some were as large as 1.6 kg. The average yield was 986 kg of fish and 6 358 kg of dry rice per hectare.

Polyculture and Intensive Culture

In mountainous areas, the fields are poor and weedy; therefore, a polyculture of grass carp, common carp, and silver carp is used in the ratio of 3:6:1. From May to July each year, 15 000 small fingerlings of grass carp and common carp are stocked per hectare of field. By November, the fingerlings reach a length of 12–18 cm and the survival rate is 20–30%. Weeding is not necessary in fields devoted to polyculture.

In intensive culture, a base fertilizer is applied before the fish are stocked into the fields. From April to May, it is not necessary to feed the fish because they are small, water temperature is low, and benthos and weeds are plentiful. From June to September, feed should be applied once a day. After the rice is harvested, the quantity of feed should be reduced.

Scientific Water Management, Proper Irrigation, and Drainage

The basic principal is to consider the needs of both the rice and the fish. When fingerlings are stocked before the rice seedlings are planted, the water level should be maintained to minimize fish deaths. Five to seven days after the rice is planted,

Table 1. Output and value of rice and fish harvests before and after technical reforms.

			Rice (1986)		Rice (1987)		Fish (1987)	
Farmers	Location	Area (ha)	Output (kg)	Value (CNY)	Output (kg)	Value (CNY)	Output (kg)	Value (CNY)
Liu Shu-chen	Tongren	4.4	27 056	16 234	27 571	16 543	3 286	19 717
Yian Zhu-shen	Yuping	1.5	10 545	6 327	10 605	6 363	1 175	7 050
Wu Xiu-shu	Songtao	1.3	8 360	5 016	8 740	5 244	726	4 354
Long Tian-ci	Songtao	0.8	5 350	3 210	5 670	3 420	481	2 886
Li De-ming	Jiangkou	0.2	1 200	720	1 238	743	192	1 155
Huang Xin-tuan	Tongren	0.2	1 260	756	1 462	878	160	959
Total		8.4	53 771	32 263	55 286	33 191	6 020	36 121

the water level should be reduced to promote tillering. In a furrow or ridge system, the water should flood the roots of the rice seedlings. When the rice seedlings begin to turn green, the water level can be reduced. This will not affect the fish because they are still small.

A month after rice seedlings are planted, the flat fields should be drained for weed control. Later, the rice water level should be raised to about 12 cm to control ineffective tillering of rice and to benefit fish growth. After the rice is harvested, the water should be raised to over 50 cm for continuous fish culture.

Economic Benefits

These technical reforms have produced economic benefits (Tables 1–3).

Value of Output

In 1986, 8.6 ha of ricefields produced 53 771 kg of dry rice, valued at CNY32 262 (Table 1), or an average of CNY3 840/ha. In 1987, with rice-fish culture, these fields produced 6 020 kg of fish valued at CNY36 121 and 55 286 kg of rice valued at CNY33 171. The total value of production was CNY69 292, or an average of CNY8 249/ha, which was 2.1 times more than in 1986 without fish culture.

Ratio of Investment to Income

In 1987, CNY7 567 was invested in rice-fish culture, an increase of CNY5 252 from 1986. But in 1987, net income was CNY61 725, which was CNY31 778 more

Table 2. Investments (Invest.) and income before and after rice-fish culture (CNY).

		1986			1987		
	Area (ha)	Net Income	Invest.	Income	Net Income	Invest.	Income
	4.4	15 130	1 104	16 234	31 796	4 464	36 260
	1.5	5 869	458	6 327	12 259	1 154	13 413
	1.3	4 610	406	5 016	8 657	941	9 598
	0.8	2 986	224	3 210	5 768	520	6 288
	0.2	650	70	720	1 628	270	1 898
	0.2	703	53	756	1 619	218	1 837
Total	8.4	29 948	2 315	32 263	61 727	7 567	69 293

Table 3. Achieved value by labour force before and after rice-fish culture (CNY).

		1986			1987		
	Area (ha)	Net Income	Investment	Income	Net Income	Investment	Income
	4.4	15 130	706	21	31 796	1 170	27.18
	1.5	5 869	275	21	12 259	440	27.86
	1.3	4 610	228	20	8 657	349	24.8
	0.8	2 986	137	22	5 768	227	25.41
	0.2	650	27	24	1 628	53	30.71
	0.2	703	30	23	1 619	51	31.74
Total	8.4	29 948	1 403	21	61 726	2 290	26.95

than in 1986 (Table 2). The ratio of investment to income from rice-fish culture was 1:6.

Rate of Return

In 1986, net income was CNY29 947. In total, 1 403 workers were employed and each produced an output value of CNY21.34. In 1987, net income was CNY61 725, which was achieved with 2 290 workers; therefore, each produced an output value of CNY26.95 or CNY5.61 (26%) more (Table 3).

Value of Fish

Before the reforms in rice-fish culture, fish from the fields weighed about 100 g each. Because the species had degenerated, they could only be sold for food for about CNY2/kg. After the technical reforms, 11 780 fish were caught from 8.4 ha of ricefields. Total weight was 6 020 kg, or an average of 0.51 kg/fish. These fish fetched a price of CNY6/kg; therefore, the commodity value of the fish increased three times after the technical innovations.