Economics of Culture

Operational cost (per ha)		Rs.*
a.	Lime	375.00
b.	Fertilizers	63.00
c.	Seed	6 000.00
d.	Feed @ Rs. 20 per kg	22 563.00
e.	Fuel for pump	1 875.00
f.	Chemicals for water analyses	250.00
g.	Nets and feed trays	500.00
h.	Labor	
	1. Technician	6 000.00
	2. Laborer and watchman - one each @ Rs 750/mo. for 6 months	9 000.00
		46 626.00
Income		
Total production of prawns - head on		964.25 kg
Total production of prawns - headless		231.42 kg
Gross income @ Rs. 330 kg for headless		Rs. 76 368.60
Net income		Rs. 29 742.60

*US$1 = Rs 35

suffered losses due to white spot disease.

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M. Srinivasan, S. Ajmal Khan *and* S. Rajagopal *are from the Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai - 608 502, Tamil Nadu, India.*

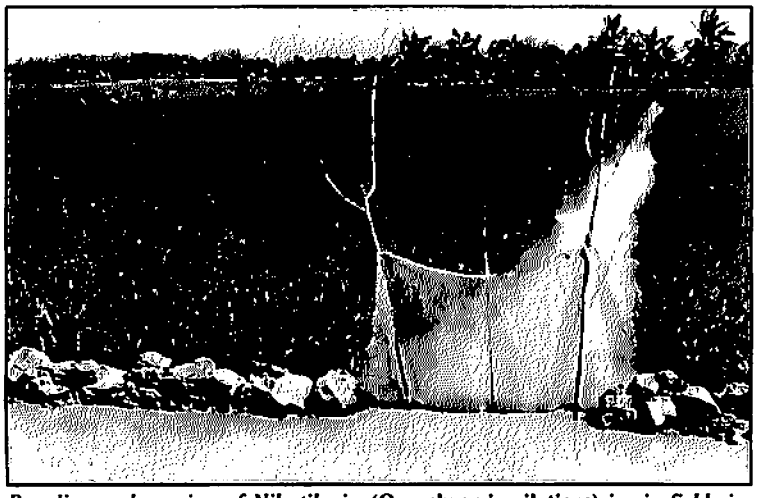
Tilapia Breeding in Ricefields in Vietnam

Nguyen Cong Dan, Tran Mai Thien and Dinh Van Trung

Fish culture in ricefields has been in practice for over a thousand years (Khoo and Tan 1980) and is most developed in Southeast Asia. Various types of rice-fish farming systems such as rearing of fry and fingerlings, and production of marketable size fish, are practised (Chapman 1992; Li and Pan 1992; Yunus et al. 1992). Costa-Pierce (1992) indicated that raising fingerlings in ricefields in Indonesia was more profitable than growout, and that shallow ricefields might be better suited to nursery systems. In Vietnam, the common carp (*Cyprinus carpio*) is known to breed and grow naturally in ricefields, but the use of ricefields as hatcheries and nurseries for tilapia is not known. Results of studies undertaken for breeding and nursing Nile tilapia (*Oreochromis niloticus*) in ricefields in Thai Binh province in Vietnam during the years 1995-96 are briefly presented in this paper.

Study Area

The study was undertaken at Duyen Hai commune, Hung Ha district, Thai Binh province, 120 km southeast of Hanoi. The commune has an area of 479 ha, of which 350 ha are ricefields and 15 ha are ponds. The land is very fertile with a controlled irrigation system which makes it suitable for integrated rice-fish farming. In addition, the commune has an underground source of warm water with temperatures between 52 and 72°C depending on the depth of the aquifer. The aquifers are generally located at a depth of 70-170 m and come up naturally at ground level. This is a very convenient source of warm water for overwintering and conditioning tilapia broodfish



Breeding and nursing of Nile tilapia* (Oreochromis niloticus) *in ricefields in Thai Binh, Vietnam. The use of rice fields as hatcheries and nurseries for tilapia is new. In the study location, the broodstock was selected twelve days after the rice was transplanted. With careful water management, application of organic fertilizers and supplementary feed, the first swim-up fry appeared after two weeks. The rice crop harvested after several months was not significantly less than monoculture rice, and, in fact, the integrated plots were found to have fewer weeds and rice pests.

to allow stocking and spawning in ricefields during the ambient cool season in north Vietnam when water temperature is normally around 20°C.

Design

A ricefield of 3 600 m^2 was divided into 4 plots of 900 m^2 each. A trench of 0.8 m wide and 0.6 m deep was excavated surrounding the four plots. The total area of the trench accounted for 10.9% of the total field area. The fields were located near an irrigation canal from where adequate water could be supplied and drained. The supply and drainage canals were fitted with bamboo screens to prevent entry of wild fish and escape of cultured fish.

Traditional Farming Practices

In the study area, two crops of rice and one crop of maize are often farmed. The fields are prepared for transplanting rice seedlings by ploughing and harrowing twice. During the preparation of the seed bed, 350 kg of pig manure, 3 kg urea and 10 kg phosphate were applied per sao (1 sao = 360 m^2) as the first fertilization. Transplanting was done on 6 March with a density of 3 per hill and 30 hills per m^2 with 20-22 cm distance between rows.

Stocking of Broodstock into Ricefields

Twelve days after transplanting the rice seedlings, the broodstock was selected. The *O. niloticus* broodstock used for this experiment was the Chitralada strain which had been transported from Hanoi on 25 January to warm ponds in Hung Ha for overwintering and conditioning. Under warm water condition (the lowest temperature in warm water pond was 22-23°C compared to 11-12°C in Hanoi during winter season), broodfish accepted feed normally and matured early, compared to the fish kept in cold water ponds, and they were ready to spawn in ricefields when the water temperature in the ricefields was over 20°C. The broodstock density was kept at 300 fish per 900 m^2 (0.3/m^2) with an average weight of 96.7 g and sex ratio of 1 male: females.

Management

The water level in trenches was always maintained at about 10 cm above the rice bed (65-70 cm in the trench) and organic fertilizers were regularly applied in the trenches. In addition, supplementary feed consisting of rice bran was given daily at 1-2% of body weight.

About 2 weeks after stocking the breeders in the ricefields, swim-up fry appeared and were reared there for over a month. The first batch of fry was collected on 7 May. From 14 May onwards, fry of 1.5-2.0 cm length were collected once every week using small mesh sized net. Subsequently, they were reared in earthen ponds and hapas until fingerling size with body weight of 1.0-1.5 g.

Results

The summer rice crop was harvested on 26 June (110 days after transplantation) and the first stage of tilapia breeding together with rice also ended on the same day. A total of 124 800 fry weighing 62.4 kg were harvested, with an average productivity of 34 fry per m^2 in 50 days of rearing. After 98 days of stocking in ricefields, the mean body weight of broodstock increased from 96.7 g to 185 g, with an average growth of 0.89 g/day.

Effect on Rice Grain Yield

Rice production from integrated rice-fish plots and from monoculture rice plots differed only slightly: 7 562 and 7 500 kg/ha, respectively. In spite of the fact that 10.9% of the land in the integrated rice-fish plots was being used for trenches, production of rice did not decrease significantly compared to monoculture rice. Hence, it could be considered that integration had a positive effect on rice production. In addition, monoculture rice plots had higher costs for weeding and pesticides.

Effect on Control of Rice Pests, Disease and Weeds

Observations indicated that the integration is effective in suppressing weeds and rice pests and minimizing rice disease incidence. In integrated rice-fish plots, there were fewer weeds

and the plots needed only a single weeding as compared to 2-3 weedings in monoculture rice. While monoculture rice plots needed 1-2 applications of pesticides, none was necessary in integrated plots.

Economic Benefits

The economic viability of breeding *O. niloticus* in ricefields was assessed. Additional costs for integrating fish breeding in ricefields included costs of trench construction, broodfish, fertilizers, feed, irrigation, nets and hapas, and labor costs for management of broodstock, collection, and rearing of fry. Costs and returns are presented in Table 1.

Preliminary results from these trials are encouraging the fish farmers in the region to integrate breeding of *O. niloticus* with rice farming. On-farm trials in other areas of the country should be conducted to ensure that the simple techniques of tilapia breeding in ricefields can be followed by farmers on a large scale. The success of tilapia breeding in ricefields will contribute significantly to solving the shortage of tilapia seed in north Vietnam.

Table 1. Costs (VND '000*) and benefits of integrating *O. niloticus* breeding with rice farming.

Item	3 600 m² rice-fish plot	3 600 m² monoculture rice plot
Inputs:		
Capital costs		
- Land use tax	360	360
- Trench construction (20% of total trench construction cost)	300	-
Operating costs		
- Rice seedlings	30	30
- Fertilizers	690	750
- Pesticides	-	160
- Labor	1 650	900
- Irrigation	150	75
- Broodfish	1 100	-
- Feed	600	-
Total capital and operating cost	4 880	2 275
Gross income		
- Rice	4 900	4 860
- Fry and fingerlings	2 496	-
- Broodfish as table fish	1 850	-
Total	9 246	4 860
Net profit	4 366	2 585

* US$1 = VND 11 000

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NGUYEN CONG DAN, TRAN MAI TIHEN *and* DINH VAN TRUNG *are from the Research Institute for Aquaculture No. 1, Dinh Bang, Tien Son, Ha Bac, Vietnam.*

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