

Integrated Fish Farming in Thailand

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Aquaculture in Thailand is relatively recent. Formerly, there were ample freshwater fish in natural water bodies such as lakes, rivers and canals, but with decreasing catches due to overfishing, pesticide use, and a reduction in the flood plain fishery associated with the construction of irrigation systems, there has been a surge of interest in aquaculture. In contrast to the relatively well defined and stable Chinese system of integrated fish farming, Thai systems are characterized by instability since aquaculture in the country is experiencing a period of rapid evolution. Nevertheless, Thailand has perhaps the greatest range of integrated aquacultural farming systems in the tropics.

The Asian Institute of Technology

The Asian Institute of Technology has been involved in a research program for the past 5 years to develop low-cost, low-energy, aquaculture systems. Integrated farming and waste recycling are the central themes of the program since



Pig and *Pangasius* catfish integration in Pathumthani. Pigsty constructed on pond dike with drainage channels to the pond. Waste food from local factory canteen is added as supplementary feed.

the main aim is to aid the rural poor, many of whom rely on rice growing only. The prime objective is to enable poor rice farmers to raise high protein food products to supplement their diet.

Fish farm survey

We conducted a survey of more than 300 fish farms in Pathumthani Province, central Thailand, to provide baseline data on existing aquacultural activities. Nearly 80% of the farms had less than 5,000-m² water surface, and of these almost 50% had less than 500 m². Clearly in terms of numbers of farms, the rice farmer's family pond is of major importance.

A wide variety of species is cultivated: Chinese carps, common carp, *Puntius*,

Probarbus, *Labeo rohu*, tilapia (*Oreochromis niloticus* = *Tilapia nilotica*), *Channa*, *Pangasius*, *Clarias* and *Macrobrachium*. The most widely raised fish are *Pangasius* and tilapia. In contrast to China, monoculture is widely practiced but an almost infinite variety of limited polyculture systems involving two or three species is employed, seemingly on a trial-and-error basis.

The majority of integrated farming systems involve livestock and fish. Of the farms surveyed, about 50 raised pigs, 100 raised ducks, and 200 farmed chickens; the percentage of farms in which the livestock were integrated with fish, i.e., the manure used as a pond input, were about 80%, 20%, and 10%, respectively. A closer analysis of these data revealed that farms with larger numbers of livestock had a greater tendency to integrate livestock production with aquaculture; poor farmers with few livestock let their animals scavenge for food; the corollary to this, a major constraint to integrated livestock-fish farming systems for poor farmers, is that the confinement of livestock on or near a fishpond to enable the manure to fertilize

Pig and tilapia (*Tilapia nilotica*) integration in Pathumthani. Pigsty constructed over pond.





Chicken and *Clarias* catfish integration in Pathumthani. Chicken coops are constructed above the pond.

the water means that the livestock must be fed with relatively expensive, supplementary feed.

Integrated crop-fish farming systems are not common in Thailand. A few farmers raise fish in irrigation ditches, in orchards or vegetable farms, but pesticides are a constraint. Some vegetable farmers maintain separate fishponds and feed the fish with vegetable waste, but the latter are generally sold to other fish farms as supplementary feed. Green fodder is not usually cultivated on pond dikes as in China, although some duck weed, water spinach, and grass may be collected on the farm and fed to fish. The removal of pond mud to fertilize crops is not generally practiced.

Village duck-fish ponds

Four, small-scale, family-level, integrated duck-fish pond systems have been developed by AIT in village 10, Khlong (Canal) 5, Pathumthani Province, and monitored for more than 2 years. Similar systems have recently been set up in two villages in northeastern Thailand. The 200-m² ponds, containing a monoculture of *Oreochromis niloticus* (*Tilapia nilotica*), receive only manure and waste feed from 30 ducks (equivalent to 1,500 ducks/ha) confined to the ponds. Although extrapolated fish yields up to 7,000 kg/ha/yr were obtained, the integrated system is essentially an intensive livestock-rearing operation, largely due to

the cost of the duck feed, and as such may not be feasible for many rice farmers with limited capital.

AIT campus integrated farm

A small-scale integrated farm, about 0.3 ha in area, has recently been established on the AIT campus, and is being run by a farmer and his family. The concept, developed by Kamchai Iamsuri, involves the alternation of vegetables and fish in two equal-sized areas separated by the livestock quarters and farm house. Livestock manure is the main pond input, and the vegetable and fishpond areas are alternated between successive harvests so that pond mud, rich in organic matter, may fertilize the next vegetable crop.

AIT pilot-scale village, duck and tilapia (*Tilapia nilotica*) integrated system in Pathumthani. The ducks are confined to the pond and duck coop over the pond which receives manure and spilled feed.



Furthermore, the incidence of both plant and fish diseases should be reduced by the alternation. The relative benefits of integrating vegetables, livestock and fish on this small scale will be assessed by monitoring the farming activities.

Compost in integrated agriculture-aquaculture systems

Recent research at AIT has shown that significant yields of tilapia may be obtained by the addition of compost to ponds. Although compost is a poor fertilizer with a low nutrient content, tilapia consume it as feed. It is now known that the low pH values of the tilapia stomach dissolve not only microbial biomass, a rich source of protein, but also non-living detrital particles, which apparently provide the fish with its main source of energy. Early experiments at AIT involved the use of composted water hyacinth and nightsoil as pond inputs. However, the use of nightsoil as a compost ingredient is not necessary since the carbon/nitrogen (C/N) ratio of water hyacinth itself is suitable for rapid aerobic composting. Recently, it has been found that rice straw, with an initial C/N ratio of 100-110, will produce compost with a suitable C/N ratio in a few months, provided that a fairly high moisture content is maintained. Trials are now underway with these novel fishpond inputs; should they prove successful, they may provide the low-energy inputs urgently needed to involve poor rice farmers in integrated agriculture-aquaculture farming systems.