

Farmers feed fish and fish feed the farmers

Cambodia is well known for one of the most productive lakes in Asia, the Great Lake. This lake provides nearly 60% of the country's freshwater fish production which is estimated to be about 70,000 tonnes per year. However, changing environmental conditions coupled with increasing population have resulted in the declined availability of fish from about 25 kg/person/year in the 1960s to less than 11 kg/person/year today. Still, the basic diet of Cambodians continues to be rice and fish. In order to fill this gap of requirement and availability, aquaculture is recognised and recommended as an important sector to be developed.

MC Nandeesh, So Nam, Ouk Vibol, Hav Viseth and Heang Hanglomomg

Cambodians are skilled in catching fish from the wild, but pond fish culture is new to them. People in areas with abundant fish still believe that fish should feed man and not man feed fish. Recent experimental introduction of small scale aquaculture in areas where there is decline in natural availability of fish has shown positive results in changing people's attitude. This article describes the increased flow of bioresources within the farm as a result of the introduction of aquaculture in Southeastern parts of the country.

Community needs assessment studies showed that food security is the key issue. Since 1990, this has led PADEK (Partnership for Development in Kampuchea) to initiate programmes in sustainable agricultural practices including aquaculture mainly in Southeastern parts of the country (Prey Veng and Svay Rieng Provinces). As part of these programmes, a Cambodian delegation visited various farms and organisations in the Philippines with a view to understand the strategies adopted in that country. Based on this visit, where they could see the bioresource flow drawings of Philippine farms, the delegation started drawing the nutrient cycling process that existed in Cambodian farms. Both these maps were used to show farmers how rice yield could be improved by effective use of resources.

Influenced by the success of tilapia culture in Philippines and by the farmers' need to grow fish for consumption, PADEK initiated their aquaculture programme in 1990 with tilapia as the principal species. Efforts were made to increase rice yield by the use of organic matter including the use of green manure from

Sesbania. Owing to a number of constraints ranging from pond preparation to pond management, most farmers ended up with negative results in aquaculture. However, owing to the persistent interest of farmers in this new activity, aquaculture was restarted again by PADEK with renewed interest with a group of 77 farmers in 1993. In view of the initial negative results, adequate care was taken in initiating the activity again in terms of selection of farmers and ponds. These farmers were brought to a training centre to learn about all aspects of fish culture. They were shown various ingredients which could be used to feed fish.



Photo: MC Nandeesh

After explaining positive and negative aspects of different fish species, combinations and densities were worked out together with the farmers. Instead of monoculture, most farmers tried a polyculture of different species. A mixture of fingerlings consisting of silver barb (*Puntius gonionotus*), silver striped catfish (*Pangasius hypophthalmus*), common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*) and Nile tilapia (*Oreochromis niloticus*) were set out in the first year trials in various combinations and densities, aiming to develop technologies suitable for the areas as well as the resources of the farmers.

Following the basic guidelines provided, most of the farmers were able to prepare the ponds for fish culture by using lime, a local variety of green manure (*Eupatorium odoratum*), coupled with cow/buffalo dung and a small amount of inorganic fertiliser, mostly consisting of urea and Di-ammonium phosphate (DAP). Fingerling supply was ensured after the pond water turned green (a sign of good water quality).

Farmers innovate

Farmers were given recommendations on the practices to be followed to obtain good production. However, they were not compelled to adopt any of the practices, but were requested to keep records on inputs and the output obtained in terms of fish as well as other benefits.

As they progressed, farmers became more and more innovative in many ways and they used several of the resources other than those recommended, based on their traditional knowledge of fish behaviour. After the fish harvest, the farmers were again brought together in farmer meetings. This provided them with an opportunity to exchange both positive and negative results. A bioresource map was drawn with the help of farmers after the first harvest of fish in 1994 (see next pages). As can be seen in this map, farmers use over 20 different types of ingredients as pond input.

Moderate success

To begin with, farmers did not have confidence in rice-fish as they had no confidence of raising fish in closed ponds. However, the good success of five enthusiastic farmers in the 1994-95 season has led to over 40 farmers trying out the fish culture system in the next season. Farmers from other areas are now encouraged to visit and see the rice-fish culture being attempted in their own country by other farmers.

In order to create sustainability for the system, village level seed production and nursing has been encouraged. In 1993 and 1994, most of the seed required was nursed at the central station, but in 1995, over 50% of the seed was nursed by farmers themselves. In this year, three local small scale hatcheries and over 20 nursers have ventured into fish seed production, nursing and distribution.

The moderate success in small scale aquaculture has been possible through the active participation of women in most activities related to post stocking operation, mainly feeding and fertilisation. As the ponds were located close to the home, women were found to be active in taking care of the fish on a daily basis as the men were always away. Women would therefore be the crucial link making fish culture a success. In Cambodia women constitute the majority, owing to the huge loss of men in the two decades of continuous war. Yet only one woman out of 30 progressive farmers was brought to the training centre. Village level training and demonstrations are used to increase women participation in such educational activities.

MC Nandeesh, So Nam, Ouk Vibol, Hav Viseth and Heang Hanglomomg, Bati Fish Seed Production and Research Centre, c/o PADEK, PO Box 554, Phnom Penh, Cambodia.

Bioresource flows in small scale

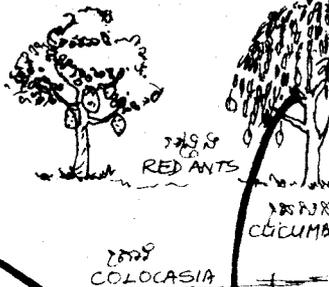
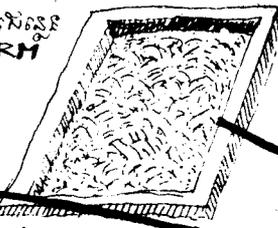
Slaughter house waste is used when available. However, it should be recognised that very little waste is generated from the slaughter house since most parts of the animal are used for consumption or other purposes. However, the visceral waste is commonly used for feeding fish.

Earthworms are another source of fish feed. During the rainy season, they are collected from the paddy field. However, farmers are not encouraged to exploit these worms which are useful in many ways to maintain the soil quality.

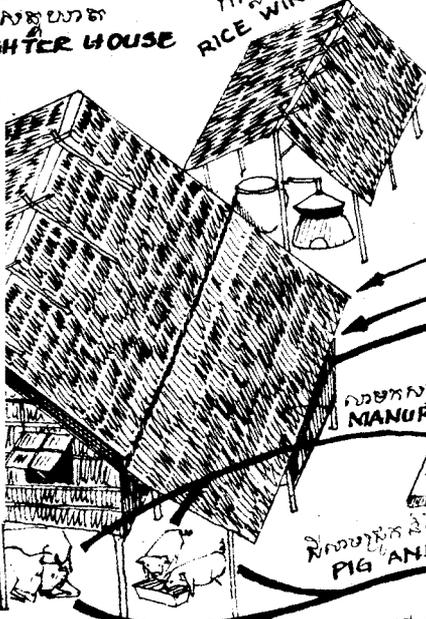
Some of the innovative farmers have now developed simple techniques to produce worms in small pits filled with productive manure and inoculated with worms.



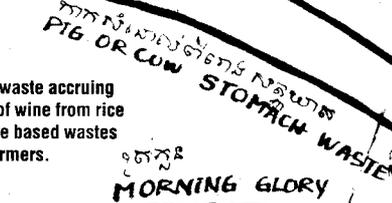
EARTHWORM



Most of the farmers who undertook fish culture own a cow or buffalo. The wastes from these animals are used as pond input to serve both as fertiliser. Pigs are raised by several families as an income source. They are popularly called "the walking bank" eating various wastes and earning good income annually. Pigs are let loose to graze in the wild and feed (kitchen waste and rice bran) is provided only as supplementary. This method of raising pigs brings good benefits to farmers, if pigs don't die of diseases. At the end of the fish culture period, when farmers were asked to compare pig and fish cultivation, they recognised fish culture as easy and less risky. As part of the project activity, efforts were made to keep pigs and ducks on pond, but this was not appreciated by farmers nor animals. Pigs ended up with severe arthritis disease or poor growth due to heavy mosquito bite, while ducks laid no eggs.



Broken rice and waste accruing after extraction of wine from rice are two other rice based wastes used by some farmers.



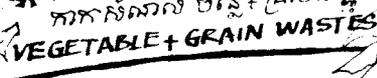
Kitchen waste is also fed to fish particularly by those families with no pigs and ponds stocked with *Pangasius*.



Ducks and chicken are grown as family food and/or income source and their wastes serve as fertiliser and/or feed.



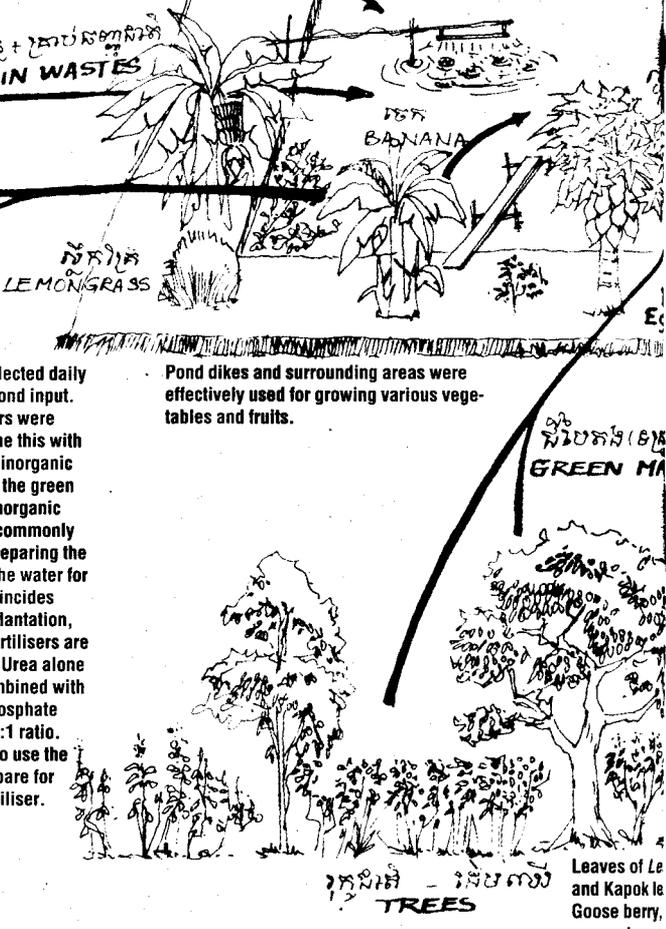
Often pig dung, combined with rice bran is fed to fish, particularly catfish.



Fresh manure collected daily is often used as pond input. Though the farmers were advised to combine this with small amounts of inorganic fertiliser to retain the green colour of water, inorganic fertilisers are not commonly used except for preparing the pond. Preparing the water for fish cultivation coincides with paddy transplantation, when inorganic fertilisers are commonly found. Urea alone or sometimes combined with Di-ammonium phosphatic (DAP) is used at 2:1 ratio. Some farmers also use the compost they prepare for crops as pond fertiliser.

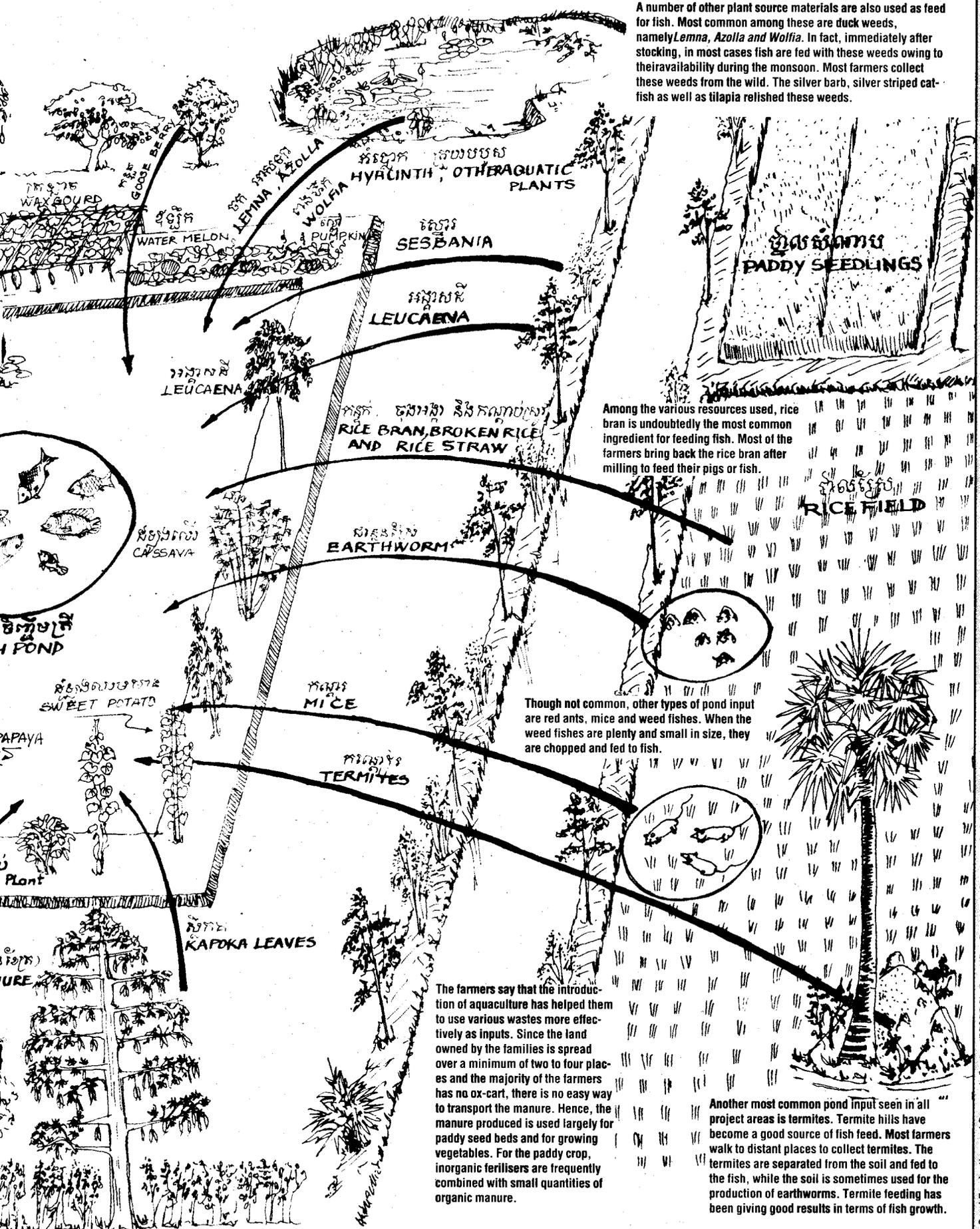
Pond dikes and surrounding areas were effectively used for growing various vegetables and fruits.

Some farmers, particularly those close to towns, grow vegetables when marketing opportunities exist. In fact, apart from growing a variety of vegetables in specially prepared plots, pond dikes are also effectively used for growing various crops like beans, cucumbers, chilly, papaya, banana, egg plants, sweet potato, etc. Vegetables, though not uncommon, are not as important in the Cambodian diet as fish and other wild animals. With the increasing interest in fish cultivation, use of pond water for growing vegetable has been on the decline. Still, whenever vegetables are grown, waste leaves are fed to the fish, like the scrapings of the banana stumps mixed with rice bran.



Leaves of Le and Kapok le Goose berry, encounter ga

fish culture systems in Cambodia



A number of other plant source materials are also used as feed for fish. Most common among these are duck weeds, namely *Lemna*, *Azolla* and *Wolfia*. In fact, immediately after stocking, in most cases fish are fed with these weeds owing to their availability during the monsoon. Most farmers collect these weeds from the wild. The silver barb, silver striped catfish as well as tilapia relished these weeds.

Among the various resources used, rice bran is undoubtedly the most common ingredient for feeding fish. Most of the farmers bring back the rice bran after milling to feed their pigs or fish.

Though not common, other types of pond input are red ants, mice and weed fishes. When the weed fishes are plenty and small in size, they are chopped and fed to fish.

The farmers say that the introduction of aquaculture has helped them to use various wastes more effectively as inputs. Since the land owned by the families is spread over a minimum of two to four places and the majority of the farmers has no ox-cart, there is no easy way to transport the manure. Hence, the manure produced is used largely for paddy seed beds and for growing vegetables. For the paddy crop, inorganic fertilisers are frequently combined with small quantities of organic manure.

Another most common pond input seen in all project areas is termites. Termite hills have become a good source of fish feed. Most farmers walk to distant places to collect termites. The termites are separated from the soil and fed to the fish, while the soil is sometimes used for the production of earthworms. Termite feeding has been giving good results in terms of fish growth.

Sesbania, *Sesbania*, tender leaves of water hyacinth, morning glory (silk cotton tree) are also cooked with rice bran and fed to fish. Papaya, a fruit rich in vitamin C is fed to fish, particularly when they are in a state of voracious feeding silver striped catfish.

In Cambodia, most families comprise of six members and own about 1.5 ha of land, usually spread in two to four places. Paddy is the main crop grown with an average yield of about one tonne/ha.

Source: Bati Fish Seed Production and Research Centre (BFSPRC), Pearm Ro, Prey Veng Province, PADEK 1995.