



Farmers as Scientists
This is a series anchored by M.C. Nandeesh. It describes farmer-driven innovations and experiences.

Cambodian farmers innovate cost-effective variations on Chinese hatcheries to suit local conditions

Dr. M.C.Nandeesh has taken up a new position as Professor and Head of the Department of Aquaculture, College of Fisheries, Central Agricultural University, PO Box No. 120, Agartala-799001, Tripura, India. This is a four-year old institution established to cater to the manpower and research requirements of the Northeastern part of the country in the fisheries sector. He has nearly two decades of experience in teaching, research and development and has worked with Universities, NGOs and multilateral organizations within and outside the country. Email address: mcnraju@yahoo.com.



Fig. 1 (left): Silver barb is popular among fish farmers and can easily be bred in small Chinese hatchery systems. Fig. 2 (right): Silver carp is another popular species. This species has also been bred successfully by farmers using small size breeding pool

Cambodia is making good progress in many spheres, including fisheries. Improvements in the collection and interpretation of catch statistics has revealed that Cambodia is poised to become one of the largest producers of fish in the inland fisheries sector. The total fish production during 1999 was reported to be 284,100 tonnes, while in 1998, it was (likely) under-reported as 122,000 tonnes.

The improvement in catch statistics has been made through a joint research effort between the Department of Fisheries and the Mekong River Commission on capture fisheries. These improved statistics will help the fisheries sector gain the status it deserves in the national economy and demand allocation of adequate resources for the further development of the sector.

Although the improved 1999 catch statistics show substantially higher production, estimates indicate that the actual production could be as high as 430,000 tonnes from the freshwater sector alone. In addition, some of the results of the MRC project suggest that the fish consumption of some of the communities living around the Great Lake could be as high as 71 kg/person/

year, placing Cambodia as one of the major fish consuming countries in the world. Although production has now been shown to be much higher than previously thought, discussion with farmers all across the country, including farmers around the Great lake, clearly indicate that fish catches are declining and that there is a need to explore alternative ways to enhance fish availability.

Aquaculture is considered as one such alternative and attempts have been made by a number of organizations to develop small-scale aquaculture appropriate to the farming systems of the country.

I had an opportunity to work in Cambodia and initiate some of the aquaculture development activities between 1992-1997. Recently, I was in that country for a short period under a World Bank funded fisheries project. This gave me an opportunity not only to assess the sustainability of some of the work initiated by us earlier, but also learn more on the continuing efforts made by farmers to innovate new systems that are economical and appropriate to them. This article focuses on the innovations made by farmers in developing simple and cost-efficient

fish seed production systems essentially based on the principle of Chinese hatcheries.

Small-scale aquaculture systems using the locally available species like silver barb (Fig.1) with tilapia, Chinese and Indian carps have been developed during the past 6-8 years.

The first Chinese hatchery was built during the 1980s with the support of Vietnam in some of the Government stations to cater the seed requirement of farmers. These Chinese hatcheries have breeding pools of 6-9 m diameter and hatching pools of 3-4 m diameter. They are useful for large-scale seed production with a capacity to hold more than 100 kg of brood fish at a time (Fig.2).

However, these centralized hatchery systems have not proved to be useful in ensuring seed availability in rural areas. To procure seed from these hatcheries, farmers generally have to travel a long way and the poor condition of the roads result in high mortality during transportation. To overcome these problems, development agencies have promoted the establishment of small-scale hatcheries in rural areas.



Fig.3 (left) A simple hatchery system designed by Mr Ean Sak for breeding of common carp in Prey Veng district.

Mr Ean Sak

During the late 1990s, Mr Ean Sak, a farmer from Prey Veng Province, initiated breeding of common carp and silver barb using ordinary cement jars as water storage tanks and a polythene-lined pool, erected with the support of bamboo as breeding cum hatching chamber (Fig.3). With the support received from PADEK (Partnership for Development in Kampuchea), he built a circular breeding-cum-hatching pool. The unit established by this farmer was used to train other farmers interested in establishing small scale breeding units. Though the system established by Ean Sak was useful, the height of 0.5 meter was found to be too low, particularly for the species like silver barb due to their jumping habit. However, the facilities established by Mr Ean Sak served as good place to educate other farmers on the opportunities that exists in establishing small-scale seed production units (Fig. 4). This farmer continues to be involved in fish seed production and nursing, though fish culture activities have suffered in his area due to frequent floods during the past two years.



Fig.4. A group of trainees visiting Mr Ean Sak's hatchery as part of the training program on village based seed production.

The case of Mr. Sambot

Mr Sambot from Mesong district of Prey Veng Province took the initiative to build a hatchery with the support provided by MCC (Menonite Central Committee). This hatchery was built on a 2.5 ha plot of land and has four breeding tanks of 1.6 meters diameter and 0.7 meters height. He has also built a water storage tank to ensure continued water supply. This enthusiastic farmer, with a total commitment to the activity, has been successful in developing breeding strategies for carps using hormones and plastic fibres as adhesive material for common carp (Figs 5 and 6). With the continued support provided by MCC, this hatchery has successfully catered to the seed requirements of more than 700 farmers in the district over the past five years. There are more than ten secondary seed producers who buy seed mainly from Sambot's hatchery, nurse the seed and sell to other farmers in the village. The species that he breeds include common carp, silver barb, silver carp and tilapia. The demand for Pangasius seed is very high and during last year, he was able to buy Pangasius fry from traders, nurse and sell them to other farmers at a higher price. According to Sambot, the problems are mainly created by some of the seed nurseries, who are just acting as seed traders, buying seed from the hatchery and distributing them to farmers, instead of nursing them to a good size before selling them to farmers. The survival of small seed is lower and so the supply of small seed to farmers reduces their fish production.

Inspired with the success achieved in Mesong District in fish seed production, initiatives were taken to establish another small scale hatchery in Prey Veng district by Mr Phoung Phun. After gaining experience in fish culture, Mr Phoung Phun moved in to fish seed nursing, and encouraged with his profit and with the demand for fish seed, he built a hatchery (Fig.7). Although he has been able to make good profit for the past five years, he has begun to experience a decline in the sale of carps and tilapia. However, he has been experiencing heavy demand for Pangasius seed (table 1).

Mr Pheng Vy in Prey Veng district has found fish seed nursing to be a profitable

Fig. 5. (Below) Mr Sambot - an enterprising farmer from Mesong district being trained in breeding of fish.

Fig. 6. (Centre) plastic fibres being used as egg collectors for common carp in Sambot's hatchery.

Fig. 7. (Bottom) Chinese circular hatchery being constructed by Mr Phoung Phun in Prey Veng district.





Top to bottom:

Fig. 8. Pheng Vy has constructed an improved version separating breeding and hatching pools.

Fig. 9. Mr Sok Saroon has built a Chinese hatchery system combined water circulation and aeration device.

Fig. 10. Mr. Thien Vanna of Ta Saang Village, Svay Chrum district, has built a modified version of the Chinese hatchery.

Fig. 11. Mr Keo Sim has built a Chinese hatchery complex and uses ground water for hatchery

venture. However, he has had difficulty obtaining spawn for nursing at the right time to meet the market demand. According to him, primary producers tend to capture as much of the existing small market as they can, by delaying seed supply to the nurseries.

To overcome this problem, Mr Vy decided to build his own hatchery last year. He has constructed a small hatchery complex consisting of a water storage tank of about 6m³, a breeding pool of two-meter diameter and 0.8 m height and a hatching pool of 1.5 m diameter and a height of 0.6 m. For breeding of common carp, he has built a rectangular tank with a surface area of 3.75 m², in the available space. He has spent about US\$300 to build these facilities (Fig.8). Although he was able to produce a good number of fingerlings (>50,000) during 2001 breeding season, he was able to sell only 12,000. He says that poor extension support for farmers is one of the reasons for declining seed sales, aside from the poor survival of seed noticed in the pond.

First among trainees: Sok Saroon

Mr Sok Saroon is another successful farmer from Prey Veng district. He was able to establish the hatchery with support provided by a European Union funded project. Mr Saroon stood first among a batch of trainees on fish seed production and he was given construction materials as gift to allow him to build a breeding pool. Currently, he has two breeding pools, a water storage tank and six nursery ponds (Fig. 9). He too has been experiencing declining seed sales since last year.

The Asian Institute of Technology took initiative from the very beginning of their involvement in aquaculture development in Cambodia to promote farmer based small-scale fish seed production systems, particularly for the species like tilapia, common carp and silver barb. Their outreach activities are carried out in three Provinces - Svay Rieng, Takeo and Kompong Speu. Mr Thien Vanna of Ta Saang village of Svay Chrum district of Svay Rieng province is one of the successful fish farmer and seed producer, with whom AIT began working since 1995. He has established a Chinese hatchery (Fig. 10) and supplies several secondary seed producers who are involved in fish nursing activities.

Table 1.

Year	Total national fishery production	Production of inland fishery	Production of freshwater culture	Farm production of common carp
1991	1572.99	562.98	462.59	59.45
1992	1824.46	632.88	533.79	70.81
1993	2152.31	760.33	648.26	89.16
1994	2516.69	916.45	789.66	112.76
1995	2953.04	1091.78	940.76	139.86
1996	3280.72	1269.19	1093.76	159.15
1997	3601.78	1425.36	1236.66	176.13
1998	3906.65	1549.93	1321.91	192.80
1999	4122.43	1650.51	1421.97	205.08

Last year, he sold more than 100,000 fingerlings, but this year he has only sold about 30,000. He says that the drought-flood cycle, which has been prevalent over the past three years, is the main cause for his declining sales.

Looking back at a success story: Mr. Bunthon of Svay Rieng

In the Romeas Hek District of Svay Rieng Province, fish culture was initiated in 1994 by PADEK. Mr and Mrs. Bunthon from the district were chosen as the best family for not only demonstrating highest fish production from their pond of less than 100m², but also for their selfless service to the community in promoting fish culture activity. This farmer has also been successful in producing seed of silver barb, common carp and tilapia and sell to more than 300 farmers in the area. However, since last year, he too has begun experiencing a decline in seed sales. According to him, most farmers are interested in continuing fish culture but wish to switch to hardy species like *Pangasius*. Poor survival and production experienced by farmers has been one of the main reasons for the declining interest of farmers.

Very interesting developments are taking place in Takeo province, where the Asian Institute of Technology is operating an outreach project through the Department of Fisheries. Mr Keo Sim is one of the poor farmers who have benefited largely both from fish culture and fish seed production activities. With the successful results obtained with fish culture, the farmer decided to undertake fish seed nursing in the subsequent year. Recognizing his entrepreneurial nature, a grant of US\$170 was provided by the project to build a hatchery. Combining his own resources with the project support, he has been able to build hatchery facilities (Fig. 11). The farmer has effectively used locally available resource like bamboo to build a hatchery with a plastic lining (Fig. 12) and rectangular tanks for breeding of common carp (Fig. 13).

Mr. Som Hak from the same district has also been successful in breeding fish using the modified Chinese hatchery systems. To meet the high demand for fish seed, he has also dug out the earth and used plastic lining for hatching of carp eggs, particularly for large-scale

production of silver carp (Fig. 14). During 2001, he sold more than 100,000 fingerlings of different species as well as fry to other farmers for nursing. The creativity of these farmers in modifying Chinese fish seed production systems not only indicate their innovative skills, but also indicate the need to develop systems that are appropriate to farmers in different areas, instead of promoting duplicates of systems that work well elsewhere.

Mr Som Hak does not have a refrigerator to store the hormones used for breeding such as LHRH. Instead, he has taken advantage of the temperature differences that exist between different layers of water in the pond. He stores his hormone on the pond bottom where it is cooler (Fig. 15).

The vial with hormone is tied to a rope and attached to a stone to serve as a sinker and is lowered to the pond bottom after usage. For temporary storage of hormone, this method has been found useful and practical. If you need more details on the hatchery design and operational efficiencies some of these hatcheries in AIT project area, contact Mr Hav Viseth, Project Manager, AIT Outreach project, Phnom Penh, Cambodia (e-mail: smallfish@bigpond.com.kh).

There are similar innovations in hatchery devices in other areas where fish culture is gaining popularity. However, the major constraint experienced by farmers is the poor survival of fish seed. This has been shown to be due to the small size of seed stocked by farmers. These seeds are easily eaten by snakehead and other predatory fishes common throughout the country. It is necessary to encourage farmers to stock larger seed or adopt the hapa nursing technology developed by AIT to overcome this poor survival problem. This poor survival is a common problem noticed almost throughout the country. There is an urgent need for different agencies to make a coordinated effort to educate farmers adequately on this to avoid setbacks to the increasing popularity of aquaculture.



Top to bottom:
Fig. 12. Mr Keo Sim uses a bamboo frame as a temporary measure to build a hatchery with polythene lining.

Fig. 13. Rectangular tanks are used for breeding of common carp eggs by Mr Keo Sim.

Fig. 14. Mr Som Hak of Tropheang Kabus Village has developed another version of the Chinese hatchery model by building at the ground level with polythene lining.

Fig. 15. Mr Som Hak of Tropheang Kabus Village, Tromkhot district preserves hormone by storing it in a vial at the bottom of the pond to keep it cool.