Aquaculture Technology Transfer to Smallholder Farmers in Malawi, Southern Africa

REG P. NOBLE
BRIAN RASHIDI

Reg Noble and Brian Rashidi, fisheries biologists working in Malawi, describe in this article how a large and diverse range of aquaculture technologies can be transferred to farmers through processes that encourage farmer participation and technology adaptation.

Introduction

A major problem facing rural development projects is encouraging farmers to adopt new ideas in their farming system. Projects often present packaged technologies to clients, the subsistence farmers, without assessing their true applicability to the socioeconomic structure of the recipient community. Because agroecosystems are so diverse, it is impossible to develop a technology which is suitable over a wide range of farming systems. Consequently, a technology must be amenable to farmer experimentation and modification for localized agricultural conditions.

The Fisheries Department (FD) and ICLARM in Malawi have attempted to meet these criteria in the collaborative research they have carried out since 1986. This research has been directed towards developing aquaculture technology which is applicable to the rural subsistence farmer in Africa.

In May 1990, the results of on-station research efforts were presented to smallholders involved in aquaculture. The Domasi Experimental Fish Farm, near Zomba, Malawi, was chosen as the venue for presenting a basket of technologies developed by FD and ICLARM. The intention was not only to provide demonstrations, but also to see if such open days are a suitable forum for encouraging farmers to consider adopting new technologies for testing on their farms.

Open days were organized so that farmers would not be passive recipients of information but would take an active role by being encouraged to give constructive criticism about the aquaculture strategies on offer. With this approach, farmers might point out further areas for research relevant to their farming systems, as well as suggesting improvements on the current technology being demonstrated during the open day.

If a new aquaculture tool was adopted, the researchers would then discuss with the farmers the possibility of working alongside them to monitor and evaluate the performance of the technology in the farming situation. FD and ICLARM researchers felt it was very important that the farmers should be leading in this participatory process and freely modify the technology they adopt to suit their circumstances.

A farmer, assisied by an ICLARM staff member, harvest fish from Mr. Chapatula's pond in Zomba, Malawi, using reed fence. (Photos by Reg Noble.)

The real test for the researchers was whether their new aquaculture options would prove relevant to the farmers. The technologies and farmers' reactions are outlined here.

Farmer's Reactions to New Technologies

Napier grass as a pond input

Results of a 150-day growout experiment with *Tilapia rendalli* and *Oreochromis shiranus* were presented to farmers. In one treatment, grass was the only pond input, and in the other, maize bran, the usual input. Ponds receiving grass achieved similar fish growth rates and production to those fed on maize bran. Farmers were initially surprised, then excited. They felt grass was particularly useful as a pond input as maize bran is often in short supply at certain times of the year.

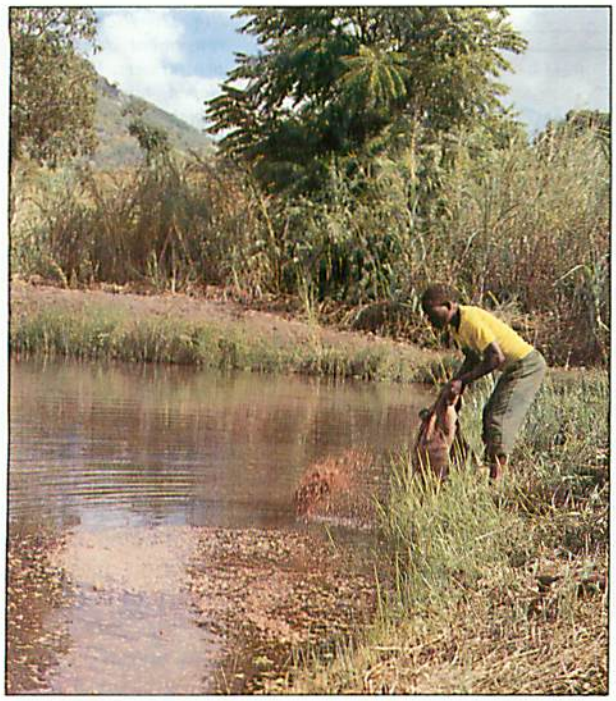
Use of a reed fence for harvesting fish

This demonstration generated the most discussion and controversy. At present, farmers are almost totally reliant on the Fisheries Department for provision of a seine net for batch harvesting. The reed fence demonstrated that a "net" made of cheap, locally-available materials could work just as efficiently as a seine net.

The opinions of farmers varied considerably. A few complained about the size and shape of the fence, and that it took too many people to operate. There was concern that such a fence would make individuals too independent of other fish farmers within their area.

Usually fish farmers belong to a local fish-farmers club and members coordinate their harvesting activities so they are not competing for customers when fish are sold. Some farmers feared that this reciprocity might break down if people could harvest whenever they wished.

However, the majority of farmers found the reed fence a suitable alternative to the seine net. Shouts of "first class" and "number 1" were heard during the fence's demonstration. Farmers saw it as a solution where ponds could not be drained. Suggestions were put forward for modifying the design, and farmers were keen to start building their own fences and operate them at club level. The majority of farmers could see advantages in being able to time exactly when to harvest instead of waiting for a seine net to turn up. These farmers also favored the fence because they felt it was less likely to damage fry and fingerlings.



Farmer applies maize bran into his pond as food for his fish.

Developing a high-quality compost as a pond input

Aquatic composting of plant waste is common in rural Africa, and takes the form of a small compost "crib" in one corner of the pond. There is little evidence that such composting has much fertilizer value. Nearly all fish farmers in Zomba practise this composting but ponds remain nutrient-poor.

Terrestrial composting of maize stovers using the Chinese high-temperature technique was demonstrated to farmers. This composting process uses heaps of alternating layers of soil and organic matter covered with a 15 cm thick skin of mud. Bamboo poles are pushed through the heap to create air channels to improve air flow and increase temperature during decomposition.

Farmers thought that the compost would be an excellent input for ponds, being relatively easy to make, but labor-intensive initially. They offered many ideas about utilizing other kinds of plant wastes and felt that, if managed properly, such composts might prove a more valuable input than grass or maize bran.

Vegetable-pond integration

Cabbage beds receiving pond sediments and those with normal top soil only were shown to the farmers. Vegetable beds were directly adjacent to small ponds, so water could be drawn for irrigation. Cabbages receiving pond sediment grew to almost twice the size of ones on untreated top soil.

The fertilizing effect of pond muds came as a surprise to many farmers. Few of them realized that pond sediments could be useful for improving soil quality. They were particularly excited by the fact that two valuable cash crops, vegetables and fish, could be integrated.

At first, farmers thought that the cabbages had been planted in some special way, but once they realized that the cabbages had been planted normally, they were eager to experiment with their own vegetables. The fish-farmers clubs in the Zomba area are all recommending their members to try and fertilize their vegetables with pond sediments during the dry season.

Chicken-pond integration

Farmers were shown the use of chicken manure for fertilizing ponds. The possibility of integrating chicken and fish production appealed to many farmers. However, there were reservations because of the expense of buying chickens and the difficulty of preventing their theft from ponds sited far from the household.

Smoking kiln

This was a great attraction, particularly as farmers tasted the smoked fish at the lunch prepared for them. The smoking kiln was considered to be a very useful tool for preserving fish for household consumption, and for sale later. The members of one club present at the open day decided to think about building their own kiln using local materials.

Pond stirring

The concept of stirring the pond bottom was a novelty for the farmers and they were intrigued that it might improve water fertility. Some farmers were concerned that stirring might adversely affect fish and also damage the bottom of the pond. However, the general feeling was that if done carefully, stirring would help in recycling nutrients and food, such as maize bran, from the pond bottom back into the water.

Experiments conducted at Domasi have also shown that stirring triggers reproduction in tilapia. This could also be useful for farmers who often suffer shortage of seed to stock their ponds.

Rice-fish integration

The initial construction of one pond with an access hole in the dike to a ricefield, was shown to the farmers on the open day. Several people expressed their interest in trying to implement the technology. These same farmers were invited again in December 1990 to see the harvest of rice and fish. They were asked to comment on the arrangement at Domasi. They suggested low dikes would operate more efficiently in a rice-fish arrangement. They also described different ways to organize the ricefield ridges so fish movement could be controlled. All of their suggestions were a considerable improvement on the organization of the ricefield and fishpond at Domasi.

Testing of Aquaculture Technologies by Farmers

A rapid survey was recently carried out to see if the technologies demonstrated on

Comparison of adoption of new technologies by two groups of farmers.

Type of aquaculture technology	Number of farmers testing a particular technology	
	OP (N = 29)	C (N = 25)
Napier grass inputs	20	3
Poultry manure inputs	17	16
Vegetable-fish integration	13	11
Rice-fish integration	7	1
Terrestrial compost input	6	0
Pond stirring	5	0
Reed fence for harvesting	7	1
Smoking kiln	1	0

Notes: OP = present at open day; C = not present

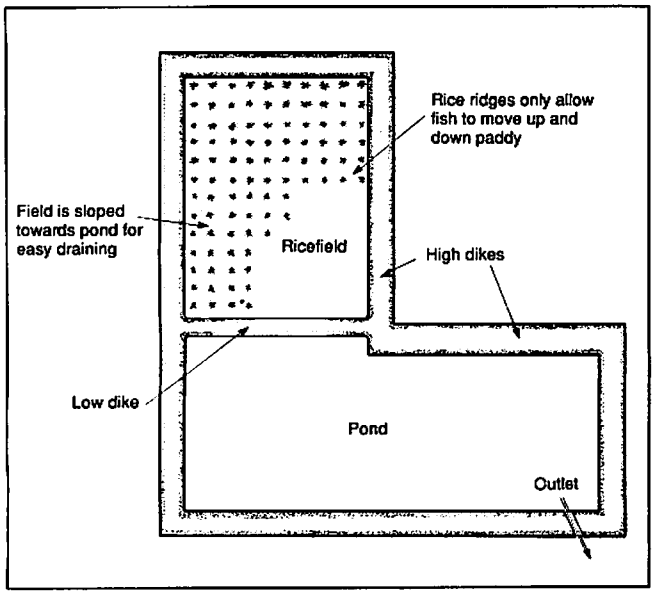


Fig. 1A. Malawian farmers' drawing of a possible rice-fish arrangement (2 farmers composed the drawing).

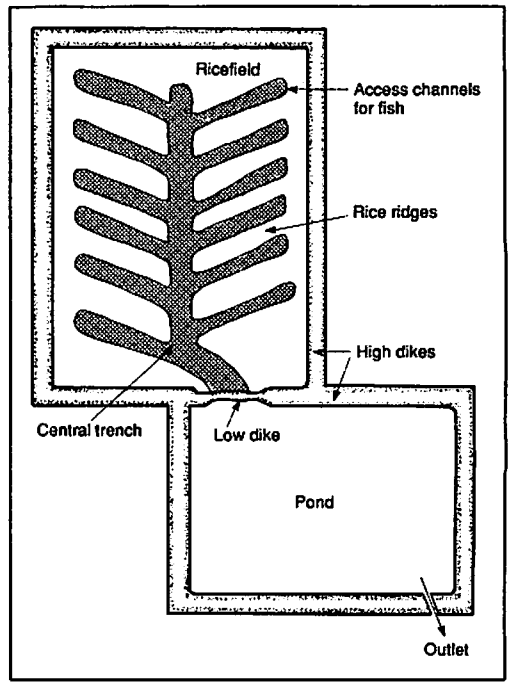


Fig. 2. Rice-pond arrangement designed by two farmers. Ricefield is sloped towards central trench and trench slopes towards pond.

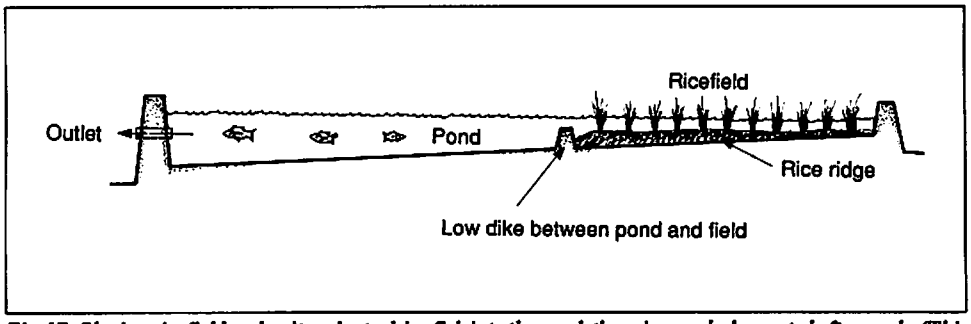


Fig. 1B. Sloping ricefield makes it easier to drive fish into the pond, then rice can be harvested afterwards. (This is the authors' interpretation of farmers' drawing.)

the open day were being tested by farmers. The survey covered all the farmers that had been to the open day and a group who had not. Fifty-four farmers were interviewed over five days in November 1990.

Of the 29 who attended the open day in May 1990, 25 were testing out some of the technologies they had seen. These farmers were also involved in trying out and using a wider range and number of technologies than farmers in the survey who had not attended the open day. Only 32% of the latter were trying more than one innovation, while 76% of the former were doing so.

Some technologies were more interesting than others to farmers as shown in the Table. Using grass and poultry manure and using pond sediments on vegetable plots were the most popular.

Except for the use of poultry manure, all technologies were new to farmers. Over 60% practise some form of vegetable-fish integration. However, only the farmers who attended the open day are utilizing pond mud as fertilizer for their vegetables.

Three farmers have constructed their own reed fences because they do not belong to clubs and are too far from the Fisheries Department for obtaining a seine net. The other farmers tried out the experimental reed fence for harvesting.

It was exciting and impressive to see that without any prior experience, farmers at the open day designed rice-fish arrangements very similar to those in use in Asia (Figs. 1 and 2). Malawian farmers realized that the most efficient system was to be able to easily couple and decouple rice and pond enterprises as needed. This is also the conclusion reached by the research program run by ICLARM and the International Rice Research Institute (IRRI) in the Philippines.

What is clear from this small survey is that farmers are keen on new possibilities of managing their ponds. Demonstration of a range of technologies to farmers in the formal setting of a research station seems to have been successful. This is not just due to the applicability of what was shown, but also to the method of presentation, and the approach of encouraging visitors to look critically at the technologies on offer.

One farmer, a chairman of a local fish-farmers club, said at the open day, "...you have taken our brains out and now we are learning...". The farmers were impressed by the treatment they received and commented that they were particularly pleased that their comments and criticisms were given so much consideration.

Farmers have seen a range of technological options to choose from and are free to decide which to implement, they are willing to accept the risk of a new venture and are eager that researchers help evaluate the effects on their ponds and farms.

Acknowledgements

Thanks go to the Fisheries Department and ICLARM staff who ran the open days so successfully; to Mr. Winston Kadongola who conducted the survey; and to the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH who provided the financial support.

Reg P. Noble is a scientist working with the ICLARM-GTZ Africa Aquaculture Project in Zomba, Malawi, and is a lecturer at the Biology Department, Chancellor College, University of Malawi, P.O. Box 280, Zomba, Malawi. Brian Rashidi is a Senior Fisheries Research Officer at the Malawi Department of Fisheries, Domasi Experimental Research Station, P.O. Box 44, Domasi, Malawi.