Evaluating Technology Adoption by the Small-Scale Aquaculture Operations in Developing Countries for Improved Productivity and Profitability

By Stephanie Ichien and Hillary Egna

The Aquaculture & Fisheries Collaborative Research Support Program
www..aquafishcrsp.oregonstate.edu
aquafish@oregonstate.edu

The Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) fosters the development of technological innovations in aquaculture and fisheries to provide direct results for increased production and decreased environmental impacts in host countries. Ensuring the availability and accessibility of successful technologies through inventive dissemination techniques is a high priority for AquaFish CRSP researchers. In order to provide the greatest impact, focused efforts on increased adoption rates are key to success. Some of the technologies that AquaFish CRSP researchers have developed and disseminated to target communities include:

Feautred:
- Rice-fish culture
- Internet-based tilapia podcasts
- Cage-cum-pond culture

Other technologies:
- Methyl testosterone (MT): weaning for the all male tilapia fry production industry off MT
- Alternative feeding regimes and feed formulations
- Cage within cage designs
- Pond fertilization protocols

With involvement from 20 countries and 21 US universities, AquaFish CRSP researchers have successfully fostered the adoption of these technologies in communities around the world and have also enabled the transfer of technology between participating host countries (i.e. from China to Mali and from Kenya to Mali). The program encourages research that results in a better understanding of factors and practices that set the stage for near-term technology implementation and that contribute to the development of successful extension tools and methods. Areas of inquiry include institutional efforts to improve extension related to aquaculture and aquatic resources management; science-based policy recommendations targeting poor subpopulations within a project area, or more broadly; methods of improving access to fish for vulnerable populations including children; strategies for integrating aquaculture with other water uses to improve wellbeing, such as linkages with clean drinking water and improved sanitation. This poster features three technologies that AquaFish CRSP researchers have helped to introduce into target communities in Africa, Asia, and Latin America: internet-based tilapia podcosts, rice-fish culture, and cage-cum-pond culture.


Harvesting tilapia in the Philippines.


Tilapia grown n the Philippines.


Cage Culture in Mexico.


Cage Culture in Ghana.


Cage Culture in Guyana.

Internet-Based Tilapia Podcasts

Podcasting is an internet-based communication method that is increasing in popularity. In 2009 AquaFish CRSP produced and uploaded the first Tilapia Podcast to a traceable server at North Carolina State University (NCSU). Interest in the podcasts has been excellent with 285 downloads and 444 hits on the NCSU iTunes server over a 2-month period, indicating they are an effective tool for disseminating tilapia culture technologies worldwide. The first podcast was also played to 120 participants from the tilapia farming, aquafeeds, government, and academic communities through two workshops on tilapia feeding strategies and feed manufacturing held in two regions of Central Luzon, Philippines. Participants were highly receptive to this mode of disseminating information, which included podcasts translated into the local language. CLSU recognizes this medium as an effective and low-cost means of sharing news and technical information and consider it a technologically advanced process in which CLSU is an innovator. The use of podcasts is not restricted to owners or users of iPods, and neither an iPod nor any other MP3 player is actually necessary as podcasts can be accessed from desktop computers with internet access. Podcasts can be distributed at practically no cost to end users worldwide, and applications of this technology as a means of communication are growing.

CRSP researchers have generated a range of practical improvements in culture methods of tilapia, many of which have increased the potential profitability for farmers. New feeding paradigms have already been widely recognized as having practical utility for Luzon area fish farmers and have been demonstrated to reduce costs for growout of Nile tilapia. These techniques have been shown to improve incomes of farmers with little impact on fish yield. The AquaFish teams at NCSU and CLSU have produced 6 internet-based tilapia podcasts that convey these feeding practices in order to increase dissemintation, promote further adoption, and benefit a wider range of the target population.

Rice-Fish Culture


One of two Malians, who had traveled to China to learn rice-fish culture techniques from AquaFish CRSP researchers.


One of the two pilot rice-fish farms in the AquaFish CRSP trials.

Rice-fish culture, which can be traced as far back as 2,000 years ago in China, is still practiced today throughout Asia. The rice-fish system is an integration of fish culture and paddy-based rice production, often (but not always) in irrigated areas. Each system is a modification of an existing rice field to accommodate the additional requirements of a crop of fish. Due to the potential of rice-fish culture to provide new opportunities to farmers and improve local diets, the AquaFish CRSP Mali project transferred rice-fish techniques from China to selected areas in Mali. The addition of fish to the rice fields not only provides a new source of income and nutrition for farmers and their communities, but it can also benefit rice production through the reduction of weeds, improved insect control, loosening of the soil, and direct fertilization from fish excreta.

IIn June 2009, the process of converting two rice fields in the Baguineda irrigation area for rice-fish culture began with the modification of the fields to provide a sump and access channels for the fish. After a five-month culture period, the farmers harvested both rice and fish. A combination of tilapia and Clarias catfish provided a total of over 140 kg of fish between the two sites. Budget analyses show that the addition of fish to the field produced CFA 60,720 extra income for the farmers. The experience of the two involved farmers generated interest among other farmers in the Baguineda area; some are already modifying their systems so they can add fish during the next rice production cycle.

Cage-Cum-Pond Culture

In the recent past, integrated cage-cum-pond culture systems have been developed and practiced using combinations of catfish-tilapia and tilapia-tilapia. Integrated cage-cum-pond culture is a system in which fish are fed in cages suspended in ponds, while the same species or others are stocked in open pond water. The technique uses the niche optimization concept for feeding; the fish in cages are fed while those in open waters are either fed at lower rates or not fed at all. Pond fish, therefore, derive their nutrients from uneaten foods from the cages or from autotrophic and heterotrophic food chains. The nutrient utilization efficiency could reach more than 50%, compared to about 30% in most intensive culture systems, providing small-scale farmers an opportunity to use their limited resources to increase fish yield, and generate more income.

Rural pond culture in Kenya is moving from subsistence to small-scale commercial culture of fish. Small-scale commercial farmers are utilizing improved management practices for stocking densities, feeding regimens, and pond nutrients to enhance their economic returns. Currently, a common production system utilizes 400m2 stocked with Nile tilapia (*Oreocrhomis niloticus*) and the African catfish (*Clarias gariepinus*). Studies in Southeast Asia have suggested improvements in growth and yields of Nile Tilapia in integrated cage-cum-pond systems. Therefore, a study in Kenya analyzed the effects of three different stocking densities of tilapia in cages on growth and yield in an integrated cage-pond system and compared alternate feeding regimens on growth. The results from this study indicated that a cage-cum-pond culture system of *O. niloticus* with stocking density of 50 fish/m3 for larger size of fish in a short period and 100 fish/m3 provide the highest production and return. Integration of cage and pond culture therefore increases yield and thus farmers stand a chance of benefiting from two crops in the same facility.

In Ghana, the AquaFish CRSP team has worked to identify constraints to the widespread adoption of cage-cum-pond culture in order to create more opportunities for rural fish farmers. What they found was that the main constraint in cage aquaculture in Ghana is the lack of capital to purchase input such as feed. In addition, it seems farmers' knowledge is inadequate and they could use more extension services.

USAID FROM THE AMERICAN PEOPLE

AQUAFISH COLLABORATIVE RESEARCH SUPPORT PROGRAM

Oregon State UNIVERSITY OSU