How Can Research Best Serve the Needs of Aquaculture in SubSaharan Africa?

RANDALL E. BRUMMETT

Since fish farming seems so simple on the surface, it has been very tempting for development agencies to put together what they feel are sufficiently simple packages of techniques and then provide the means (i.e., vehicles, water test kits and flannel-o-graphs) to implement its extension. Originally, most of these efforts were aimed at what used to be called the "poorest of the poor" because it was widely held that fish, as a source of high-quality protein, could help alleviate rural malnutrition.

A lot of evaluation took place when these projects failed to produce a self-sustaining aquaculture. We learned that most farmers didn't eat the fish they grew, but sold them to buy the carbohydrate which forms the basis of their diet. We learned that the technology available for ameliorating the problems of farming what were mostly exotic species was far too expensive and complex for use in rural subSaharan Africa. We learned that the "poorest of the poor" were a very difficult target group with which to work.

What did we do with this knowledge? Did we carefully examine the sociocultural context in which we were promoting a new technology? No. Did we search for the chemical and biological constraints within which poor farmers must work and find innovative solutions? No. Did we thoroughly study the home economies of these people and find out where our interventions could best be fit? No. What most agencies did was shift their attention to the market-oriented farmer whose decisionmaking criteria are understandable from Western capitalist experience and economic theory. The myth was then created that the industrialization of aquaculture was in the best interest of the poor. They could simply get jobs on commercial farms.

This shift in target groups and philosophy from the poor, to those with capital to adopt conventional 'imported' aquaculture technologies, in turn altered the project assessment process. The forecast total amount of fish to be produced in a region relative to market demand became the principal criterion for development instead of the determination of whether or not the lives of the rural poor would be improved. Just as with other agriculture commodities, lots of fish were assumed to be needed to support export-oriented industrialization, capital growth and job-creation. The problem with this is that intensive commercial agriculture employs far fewer people

Aquaculture development has, at best, a checkered history in subSaharan Africa. Hundreds of millions of dollars have been spent in designing and extending aquaculture systems, to little avail. Much has been written in an effort to explain the failure to take root of what on paper appears to be a perfectly simple technology with demonstrably significant potential to alleviate rural poverty and malnutrition.

than do traditional methods of food production. Unless there is some other industry to absorb the people put out of work when land and resources are allocated to agroindustrial development, landlessness, unemployment and social instability are bound to increase.

That is not to say that large-scale, intensive agriculture in general, and fish farming in particular, is bad. It can play an important role in stabilizing food supplies, increasing the availability of high-quality foods for local consumption, generating foreign exchange for the purchase of essential imports, and creating a tax-base from which can be financed further increases in infrastructure for the benefit of all. These are worthy goals.

In the longer term, commercialization and intensification will naturally proceed from increased capitalization. However, during this transition from extensive to intensive production systems, development efforts must take into consideration the short and medium-term interests of the smallholders, who currently are in the majority. Altering the target group of development efforts towards the market and away from the small producer was not the change in strategy which was needed to make aquaculture a more realistic option for most African farmers and did not spur the uptake of fish farming, intensive or otherwise.

Is Research the Answer?

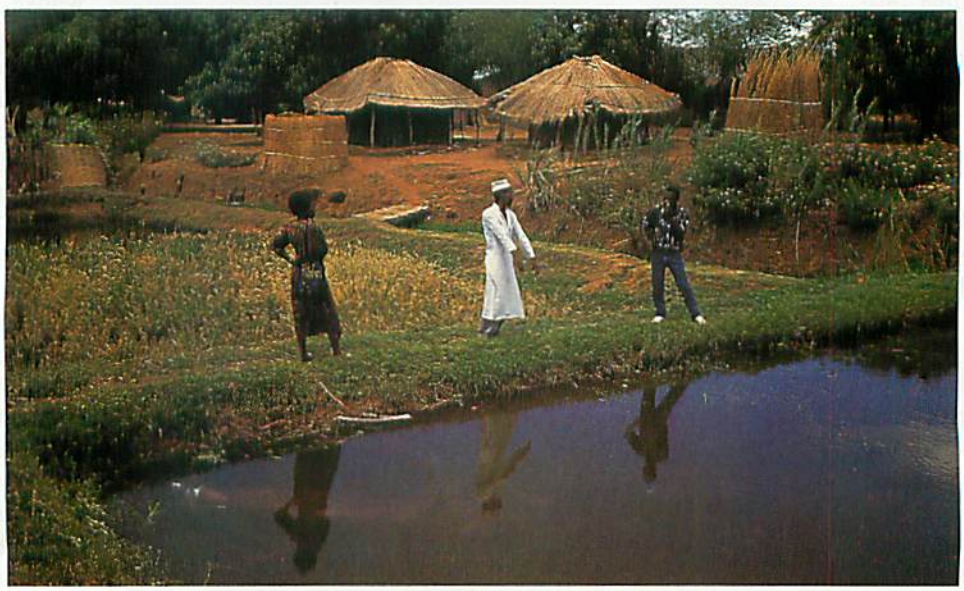
Some of the technology-transfer failures in subSaharan Africa have been blamed on applying research results from the northern hemisphere to substantially different conditions in the tropics. There are cases where such direct technology transfers are clearly inappropriate. Solar water heaters which are positioned in Uganda at the same angle as they would be in Northern Europe tend to boil the water they were supposed to only warm for bathing. Rabbit houses designed for the USA are useful only for heat prostrating rabbits when used in the deserts of Niger.

This is also true for the types of systems which have been promulgated in the developed countries for use by resource-poor farmers in Africa. Technology packages based on species, inputs and management approaches which are unfamiliar and/or unavailable in isolated and underdeveloped rural communities are clearly not going to work in many parts of subSaharan Africa. This is not, however, the case for intensive, high external input fish culture.

Intensive fish farms, unlike the low-input systems of resource-poor farmers, rely very little on the natural ecology of the fishpond. Manufactured feeds, fish hatcheries, and relatively sophisticated management practices (such as the use of nets, scales and a variety of chemicals) and other external inputs and infrastructure have in many ways removed intensive fish farming from the biological context of the natural environment. Only environmental parameters such as water availability and ambient temperature are difficult (but not impossible) to control. These large-scale commercial fish production systems are therefore essentially the same regardless of location. Witness the international expansion, in industrialized and developed countries alike, of commercial shrimp, salmon, trout, catfish, carp and tilapia culture.

As with the production technology, the limitations to the development of commercial fish farming are international and well-known: investment capital; realistic and stable foreign exchange rates; qualified farm managers; legal instruments which guarantee access to land and water; roads, vehicles and other components of transportation; reliable electrical supplies; ready availability of feeds, chemicals, equipment and spare parts; and wholesaling and retailing mechanisms. The general lack of these essential inputs goes farther toward explaining the absence of an African commercial fish farming industry than does a shortage of "appropriate" technology.

There are problems which research might address to the benefit of relatively rich intensive fish farmers, but these are mostly related to the use of species for which no well-defined production technology exists. In fact, of the thousands of species which are indigenous to Africa, only a handful have been tried in fishponds. However, instead of spending money on what might well be the most productive avenue of investigation, millions of dollars have been allocated to the importation of new species and the repetition of well-known experiments on their culture. This does not increase the farmer's ability to produce more and better fish, nor does it enhance the professional capabilities of the scientists and technicians



Incorporating farmers into the research and development process helps researchers identify constraints to aquaculture. Unlike those faced by large-scale commercial fish farming, the problems confronting the rural smallholders may be solvable through affordable research. Here, ICLARM scientists discuss a user-participatory research project with a farmer-cooperator. PHOTO BY R. BRUMMETT

Malawian fish farmers with harvest.

"Working on-farm brings together the research and extension communities, with a shared understanding of the scientific and practical aspects of small-scale production."

involved. At best, it provides demonstrations of available technologies. But to whom are they being demonstrated?

Experimentation and demonstration of low-cost input production systems which are part of the local environment rather than isolated from it, do have an immediate audience: the many smallholders with tiny farm ponds. There is another, broader, benefit of conducting these demonstrations: they provide circumstances for training researchers, technicians, extension personnel and future farm managers. Since the basics of aquaculture are quite similar regardless of the level of intensity at which the technology is applied, the use of experiment stations and hatcheries as training sites might be a way to simultaneously and effectively serve both commercial and subsistence-level fish farming in Africa. One of the major limitations to the commercialization of fish culture in Africa is the lack of experienced farm managers and fish production technicians. Needed by the rural, nonmarket fish farmer are technologies and extension methods which reflect the realities on the small farm.

There is also an economic incentive to targeting less input-intensive aquaculture. No high-tech materials are needed. The basics of fish farming as they apply to the low-input farm (i.e., feeding, manuring or fertilization with locally available materials; systematic monitoring of stocks; careful fish handling of brooders, fry and market fish, regulation of water quality; and disease prophylaxis) can be demonstrated and taught with minimal infrastructure.

An example of a mutually beneficial research program is one involving the testing of local species about which little is known, in systems which simulate those on the small, noncommercial farm.

A New Research Approach

A reorientation of African aquaculture experimentation away from the demonstrably unproductive direct targeting of large-scale intensive fish farming, toward the evaluation of indigenous species and low-cost input systems could provide the approach within which the essential question of technology transfer might be addressed. How are truly appropriate technologies developed and transferred among farms? New methods of user-participatory, on-farm research have been developed and are now being tested by ICLARM and other agencies in Asia and Africa. These, backed-up by controlled studies on experiment stations, could provide answers not only to the biotechnical problems of rural smallholder fish culture, but also the sociocultural problems associated with extension.

Such an approach offers not only the potential bringing together synergistically many of the component parts of a traditional research, development and extension program, but also by studying the farming system *in situ*, the farmer is able to influence directly the final form of the technology and the strategy for intervention. On-farm biological and socioeconomic research can overcome much of the artificiality of the research station environment which has contributed to the generation of unworkable technologies.

Working on-farm brings together the research and extension communities and binds them together with a shared understanding of both the scientific and practical aspects of small-scale production. Using replicated farms as experimental units reduces experimentation costs at the same time as it increases the relevance of the data generated.

If research is going to provide the answers to problems facing the development of aquaculture in subSaharan Africa, it is essential that the research program fit the resources and capabilities of the groups to which the results will be transferred. The best use of limited resources at the present time is to concentrate them on the major, and most needy, existing user-group: the rural smallholders. Not only would this provide for more coherent and less traumatic attempts at rural development than would rapid industrialization (which has not yet succeeded), but it would also produce the experienced technicians and extension personnel needed to overcome the real obstacles to aquaculture expansion and intensification.

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The author currently leads the ICLARM/GTZ Africa Aquaculture Project in Malawi.