Problem Perceptions, Production Practices, and Economic Incentives for Tilapia Producers in Four PD/A CRSP Countries

Work Plan 7, Socioeconomic Study

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Introduction

Much of the work of the PD/A CRSP has been directed to specifying optimum ways farmers can fertilize their ponds to increase fish yields. The PD/A CRSP program has identified many of the needed parameters that apply across diverse environments. As a synopsis of the three main aspects of a larger study conducted under the aegis of the Pond Dynamics/Aquaculture CRSP, this article summarizes the main findings of a larger report that establishes how and to what extent the research processes are affecting institutions serving farmers in PD/A CRSP countries and whether they in turn are better able to influence fish farming practices. An economic analysis of experiments featuring various combinations of inputs made in wet and dry seasons are presented. The primary contours of farmer practices and perception related to feeding, fertilizing, and marketing tilapia are summarized. The institutional connections of the PD/A CRSP to universities, government agencies, private industry, and grassroots organizations are many and complex. For numerical results and detailed analyses of these data, the reader is referred to the more comprehensive technical publication that documents this work (Molnar, Hanson, and Lovshin 1995).

Method

Economic Analysis

One objective of this study was to determine the costs and returns associated with alternative production regimes specified by the PD/A CRSP workplan to establish a baseline profile of financial profitability per system per country. The economic analysis utilizes the survey data and other information obtained from PD/A CRSP publications, interviews with participating scientists, and others to examine the economic viability of various experimental outcomes associated with several years of parallel experimentation. Economic viability was assessed with primary data obtained from PD/A CRSP scientists according to their 1983-92 workplan and nutrient input regime testing.

Farmer Surveys

Interviews were conducted with tilapia farmers in four PD/A CRSP countries; Rwanda, Honduras, Thailand, and the Philippines. In Rwanda, 21 active Rwanda fish farmers in eight local administrative districts (communes) were interviewed in the Kinyarwanda language during the Winter and early Spring of 1992. Data were obtained in Spanish from a sample of 51 active Honduran fish farmers in nine of 15 Honduras departments during the Fall 1993. Data were obtained from a sample of Philippine fish farmers in four of 15 provinces on the main island of Luzon during Winter 1994. The survey was revised and adapted in English; some interviews were conducted in the Tagalog language. Data were obtained from a sample of 51 active Thai fish farmers in three of 75 Thai provinces during Winter 1994. All interviews were conducted in Thai.

Institutional Analysis

The institutional connections of the PD/A CRSP were profiled using information obtained in published documents and from interviews and other fieldwork conducted during visits to each country. Based on information obtained from PD/A CRSP scientists, host country counterparts, and other knowledgeables, the institutional context and connections of the research program is portrayed. Though only the main findings are summarized here, the larger report details the main pathways of information exchange and direction that connect the PD/A CRSP to larger organizational systems and the farm level.

Results

Economic Analysis

The economic analysis portrays the relative profitability of various combinations of feeds, fertilizers, and production strategies. Of central interest are the trials with the highest production and those with the highest profitability; they are often not the same.

Rwanda PD/A CRSP Cycle I experiments included chemical fertilization and triple super-phosphate (TSP) trials during the dry and wet seasons. There were no Cycle II experiments. In Rwanda, Cycle III experiments included dried chicken manure (CM) treatments during the dry and wet seasons. In nearly every case, dry season yields exceed wet season yields. Dry season production which increased partially because the wet season trials which improved the pond soils by partially buffering the heavy clay soils of these newly constructed ponds. Partial net returns revealed that chemical and organic fertilization to be economical, but both were difficult to obtain or redirect from crop agriculture toward aquaculture.

Honduras CRSP Cycle I research included TSP trials during the dry and wet seasons. Cycle II trials included using chicken manure, cow manure and urea-TSP combinations during the dry and wet seasons. Cycle III trials used layer chicken manure at 125, 250, 500, and 1,000 kg/ha/wk rates during the dry and wet seasons. The highest partial net returns resulted from the use of chicken manure at 1,000 kg/ha/week in the dry and wet seasons. There was no apparent seasonal effect. The 500 kg/ha/wk CM treatment rate similarly had no seasonal effect. However, the next highest production and partial net return was obtained by the 575 kg/ha/wk CM treatment during the dry season, but the same treatment for the wet season had much lower production and returns. When comparing TSP alone or TSP plus urea, the combination of urea and TSP increased production and profitability.

Philippine PD/A CRSP Cycle I research included TSP trials during the dry and wet seasons. Cycle II trials included a) no feeding or b) feeding with supplemental chicken manure or c) feeding with supplemental inorganic fertilizer (16-20-0). Wet season chicken manure fertilization trials were conducted at 125, 250, 500, and 1,000 kg/ha/wk rates. No dry season replication of these treatments occurred. Dry and wet season TSP trials and wet season trials varying chicken manure produced good yields, and were viable financially. Treatments combining chicken manure with inorganic fertilizer (16-20-0) were also economically viable in both seasons. However, when feed was added to chicken manure, negative partial net returns resulted.

When triple inorganic fertilizer (16-20-0) was added to a schedule of feed and chicken manure, production soared above all other nutrient regime treatments. Nonetheless, three out of five treatments resulted in negative net return. The negative returns are caused by the high cost of commercial feeds which is not balanced by sufficient additional income from the additional fish produced. The highest yields were not the most economically viable.

Thailand PD/A CRSP Cycle I experiments used inorganic TSP fertilizer at 8 kg/ha/month during the dry and wet seasons. Cycle II experiments included trials using chicken manure and urea plus TSP during the dry and wet seasons. Cycle III research included chicken manure trials during the dry and wet seasons. The economically viable enterprises involved only chicken manure. Production was good for all chicken litter treatments. However, no treatments using TSP alone or with urea were economically viable. The low price paid for tilapia in Thailand and relatively higher cost of chemical fertilizers in relation to chicken manure led the partial net returns for the chemical fertilizer treatments to be negative even though production was good. The treatment with the highest production is not the most profitable here.

Survey Findings

Fish Feeding

Farmers in the four countries fed their tilapia a variety of different items reflecting differences in the intensity of aquaculture practice in each nation. Feeding and fertilization represent overlapping activities for the tilapia farmer; unconsumed feed fertilizes the pond water and some part of organic inputs are directly consumed by the fish. In Rwanda, respondents primarily understood questions about feeding in terms of the amount and kind of organic materials they put in their ponds. In the other sites, farmers primarily understood feeding to refer to the use of commercial, purchased feeds.

Commercial feed was not used in Rwanda; two-thirds of the Hondurans did not use commercial feed; and about half the Philippine respondents did not use commercial feed. Thai farmers were most dependent on commercial inputs to raise their tilapia crops. They also used the most diverse variety of feeds, reflecting the high level of availability of different feed types and a greater willingness to use feeds for other animals for the fish as well.

Fertilization

In Rwanda, commercial fertilizer represents a cash outlay that subsistence farmers prefer to avoid and is generally not applied to fish ponds. Hondurans typically use cattle and chicken manure as fertilizer for their ponds. Chicken manure is the most frequent pond fertilizer in Thailand and the Philippines. Many Rwandan farmers indicated a passive approach to fish farming, as only about half said the ponds were visited every day. Philippine farmers spent the most time with their ponds when they visited them; Thai farmers the least.

Fingerlings

Rwandan farmers are dependent on government hatcheries for fingerlings, although farmers frequently sell fingerlings to one another. Similarly, few private fingerling dealers have evolved in Honduras. The private sector provided fingerlings to more than 80 percent of the Thai farmers and about 37 percent of the Philippine operators. In each country, most farmers were using the *Oreochromis niloticus* species. Thai and Philippine farmers tend to densely stock the smallest fingerlings available. Honduran farmers tended to stock somewhat larger fingerlings. All-male tilapia were stocked in each country, although Rwanda tended toward more mixed-sex production.

Stocking and Grow-Out Practices

Most farmers are growing but a single crop of tilapia each year in Rwanda and Thailand. In Honduras, almost half reported two or more crops, but in the Philippines two-thirds obtained two crops per year.

In Rwanda, cooler water and poor quality inputs slow fish growth and lengthen the crop cycle to eight months or more. Warmer water in Honduras allowed more than a quarter of the sample to report growing tilapia in less than 180 days. Polyculture, or raising more than one species of fish in the same pond, was practiced by nearly all the Thai farmers in the study.

Marketing Problems

Philippine farmers indicated no trouble marketing their fish. Marketing difficulties of some kind were reported by about a third of the Thai respondents, and around 20 percent of the Honduran and Rwandan respondents. Over half the Thai farmers reported difficulties securing the price they wanted for their tilapia. Honduran farmers were the most confident about being able to sell their tilapia at some price, even if it was not what they originally asked.

About a third of the Rwanda sample said that there were many people in their area that did not like tilapia. Around 15 percent of the Honduras and Thai respondents felt this way, but no Philippine respondent said so. Of the four countries, the Philippines seems to have the highest consumer acceptance of tilapia.

Impacts on Households

About 78 percent of the Philippine farmers thought that there were points in the annual farm cycle when the pond was too much work, 40 percent said so in Thailand. Few of the other respondents thought so. Previous work suggests that Rwandan women are much more likely to report these difficulties. About 80 percent of the Philippine, Thailand, and Rwanda respondents felt that tilapia fit well with other farm activities, but only 64 percent of the Honduran farmers thought so.

Three quarters or more of the respondents in the Philippines, Honduras, and Thailand noted the benefits of additional cash for their households as something associated with the tilapia crop. Only 5 percent of the Rwandans agreed with this statement, as the limited amount of cash produced by tilapia tended to be used mainly by men for other purposes.

Pond Conflicts

Thai farmers were most likely to note problems over water resources emanating from the tilapia crop (57 percent), an issue noted by only a few of the other respondents. Philippine operators had few problems with predators eating their fish, but this was an issue

for farmers in each of the other countries. Theft was a concern for 44 percent of the Honduran farmers, but only 20 percent or so of the other respondents noted this as an issue; 11 percent in the Philippines. Thai farmers were most likely to agree that tilapia were easier to steal, though a third of the Honduran respondents thought so as well.

Prospects for the Pond

Most respondents thought their fish pond produced enough to be worth the work they put into it, though Rwandans were slightly more skeptical. A third of the Hondurans questioned the fit of tilapia with the other activities of their farm household. About 60 percent of the Hondurans thought that tilapia was less profitable than their other activities.

Most respondents thought tilapia was the best use of the land it occupied. Hondurans were more likely to report themselves as planning to build new ponds (39 percent). In land-short Rwanda only 11 percent thought so. Only 54 percent of the Rwandans were happy with tilapia as a type of fish to grow; they desired a larger, faster growing fish even though water temperature and a shortage of quality inputs were the main constraints. More than 90 percent of respondents in the other nations were happy with tilapia as a type of fish to grow. The perceived profitability of tilapia relative to other farm activities was highest in the Philippines, where 90 percent thought it was more profitable than other crops. Overall Hondurans were least happy with the returns from tilapia, though Thai farmers were less convinced that tilapia ponds were the best use of the land. Lowland Thai farmers with irrigation in the far reaches of the Bangkok marketing area have many enterprise choices and marketing opportunities.

Most fish farmers surveyed in Rwanda, Thailand, Philippines and Honduras felt that the tilapia pond was the best use of the land it occupied on their farm. As the Thailand respondent's pond area increased, a smaller percentage replied that the pond was the best use of the land occupied. All Philippine owners, regardless of pond category agreed aquaculture was the best use of the land. All pond size owners in the Philippines felt very positive about aquaculture in relation to other farm activities. In Thailand, small and medium pond size owners shared a similar high degree of enthusiasm about tilapia culture, but only about half the large size pond owners in Thailand agreed that tilapia was more profitable than other farm activities.

Institutional Networks

One common pattern across the four PD/A CRSP sites considered here is the upstream nature of the PD/A CRSP contribution to technology transfer. Although farmer trials have been conducted at one time or another in each site, these efforts largely have been singular or specialized events and not part of a systematic program. In none of the countries do farmers have a regular pattern of contact with a private or governmental technology transfer agent of whatever stripe. What limited efforts are underway tend to have only sporadic and indirect communication ties to PD/A CRSP researchers and host institutions.

Farmers rely heavily on word-of-mouth and a melange of information sources and experiences most of which have little connection to the PD/A CRSP. Most of the farm-level impact of PD/A CRSP activities is second order; that is, PD/A CRSP research information is absorbed, integrated with other messages, and retransmitted by private firms and national institutions. The messages are received by innovator farmers, private managers, hatchery personnel, trainers, consultants, and others who will use the information to make decisions about growing fish. The messages also affect what these individuals tell others who want to or already are raising tilapia.

The most immediate impacts of PD/A CRSP activities are manifested primarily in the training experiences of degree candidates at institutions of higher learning such as the Asian Institute of Technology, University of Rwanda, Zamarono University, or CLSU. PD/A CRSP personnel serve as thesis advisors or consultants for faculty and students conducting aquacultural research or have other ties with these institutions. The insights, paradigms, organizing frameworks, and scientific technique communicated during these activities represent a major technology transfer impact of the PD/A CRSP.

In each country, PD/A CRSP researchers have direct contacts with extension or outreach staff working in fish culture. The collegial relationships, information exchanges, mutual assistance, and other forms of mutual influence also are a means for furthering the influence of PD/A CRSP research. Often diffuse and subtle, but occasionally direct and focused, PD/A CRSP research operations and research findings contribute to the information milieu surrounding each nation's aquaculture industry.

Extension programs and the training of extension personnel are only indirectly influenced by the PD/A CRSP. In the Philippines, village-level extension in aquaculture does not exist. It is at best highly variable in the other nations. Even in Thailand, with the largest and best-developed network of personnel and facilities devoted to fish culture, PD/A CRSP ties to extensionists are infrequent and weak.

The many institutional actors working in aquaculture perhaps should be considered the primary audience for a global research project such as the PD/A CRSP. Although some level of direct farmer contact and training is necessary for keeping PD/A CRSP scientists in touch with the direct experiences and problems of fish farmers, the impacts and influence of the PD/A CRSP may be greater if institutions and industry are understood to be the primary consumers of PD/A CRSP outcomes.

Thus, seminars for NGOs that maintain extensive and long-term relationships with villages and small-scale farmers may be the most important mechanism for reaching this constituency than direct intervention by the PD/A CRSP. As long as small- and medium-scale farmers remain a central target segment for PD/A CRSP research impacts, the development of a continuing network of contacts with representatives of these groups will be a significant objective for the PD/A CRSP. The nongovernmental organizations (NGOs) may be more effective at stimulating interest and reaching small-scale farmers than governmental organizations or the limited and sporadic activities of PD/A CRSP personnel.

To gain greater leverage for PD/A CRSP activities, a number of strategies might be consciously highlighted for PD/A CRSP scientists. These include; training trainers, encouraging NGOs to adopt aquaculture as part of their repertoire of assistance activities, and helping national institutions with seminars and training programs for NGOs. These and other means may be used for wholesaling PD/A CRSP technology to actors closer to village life who will be there when PD/A CRSP is not.

In terms of changes in national aquaculture industries, the impacts of the PD/A CRSP are manifold. The larger report details the institutional context of each nation and portrays the role of the PD/A CRSP in the nation's technical-knowledge system for aquacultural development. Many of the advances that take place in an aquaculture industry are facilitated by the formal and informal consulting of PD/A CRSP scientists with private sector firms that grow fish or manufacture and sell inputs to farmers. The presentations at meetings, visits to laboratories and facilities, and personal communications with industry scientists and managers remain a continuing nexus of impact for the PD/A CRSP.

Conclusion

Tilapia growers in each of the countries face vastly different institutional systems supporting tilapia production. The impacts of the PD/A CRSP are muffled by the inherent characteristics of the research process, the nature of institutional functioning in each country, and the dynamism of the information environment for aquacultural technologies.

The communication process linking experimental pond to farm practice involves several layers of translation and transmission. Many factors interact to affect the extent and degree of impact of PD/A CRSP scientists and research programs on national aquacultural institutions and farm practice. Experimental findings are at base experimental; they reflect controlled conditions and careful measurement of a focused set of factors. Farm conditions reflect variable physical and managerial situations that often mitigate the impact of effects identified by repeated experimental trial. That is, experimental findings often must be cumulated from many studies and modified in certain ways to generate a robust field recommendation. In essence, an internal process of recognition and acceptance must take place within national research and extension systems before the findings become farm-level practice. In some cases, farmers undertake new approaches independently of national systems and scientists and extension personnel learn from innovative farmers.

Where PD/A CRSP activities have the opportunity to influence host country governmental assistance to aquaculture, efforts should emphasize infrastructure and improved functioning of the private sector. Poorly organized fish product markets and input distribution systems often hinder aquaculture development. As markets for tilapia expand, production and support services demand will also expand. Development of private sector marketing services for both production inputs and fish outputs are needed for sustained aquacultural

development. Weak connections to the farm level characterize the institutional context in each PD/A CRSP country. Thus efforts to enhance the transfer and utilization of PD/A CRSP research results will require greater attention to actual and potential pathways of influence and information flow to the farm and village. Better understanding of these relationships will facilitate the conduct of a research program that meets farm-level needs in an environmentally and socially sustainable way.

Reference

Molnar, J., L. Lovshin, and T. Hanson. 1995. Social, Economic, and Institutional Impacts of PD/A CRSP Aquacultural Research on Tilapia in Rwanda, The Philippines, Thailand, and Honduras. Research and Development Series 45. International Center for Aquaculture and Aquatic Environments, Auburn University, Alabama.