



# PD/A CRSP EIGHTEENTH ANNUAL TECHNICAL REPORT

## ON-FARM TRIALS: EVALUATION OF ALTERNATIVE AQUACULTURE TECHNOLOGIES BY LOCAL FARMERS IN KENYA

*Ninth Work Plan, Appropriate Technology Research 1 (9ATR1)  
Progress Report*

Karen L. Veverica  
Department of Fisheries and Allied Aquacultures  
Auburn University  
Auburn, Alabama, USA

Charles Ngugi  
Department of Fisheries  
Moi University  
Eldoret, Kenya

James R. Bowman  
Department of Fisheries and Wildlife  
Oregon State University  
Corvallis, Oregon, USA

### ABSTRACT

Research conducted by the PD/A CRSP at Sagana Fish Farm has begun to identify alternative management practices and technologies that may be suitable in the region, but it should not be assumed that results obtained under controlled experimental conditions at Sagana are directly transferable to farms in the area. On-farm testing is therefore a logical step in transferring research-based technologies to the farm. On-farm testing of various alternatives allows farmers to assess their costs and benefits under local conditions as well as to receive instruction and training in basic pond management skills. Conducting such trials also allows project personnel to work with and train the fisheries extension officers who are involved in the trials at the various locations, which complements the training they receive through "regular" training activities.

Thirty farmers were selected to participate in on-farm trials in five districts of Central Province, Kenya, in 1999–2000. A pre-trial workshop including farmers, extension agents, Kenyan and US CRSP personnel, and students working on research projects at Sagana was held in December 1999 to discuss and select management schemes for testing, agree on how the trials would be conducted, and plan for proper record keeping during the trial period. Fifty-two ponds were stocked with monosex male tilapia (*Oreochromis niloticus*), mixed-sex tilapia, and/or catfish (*Clarias gariepinus*) between January and March 2000. Stocking densities were 2 fish m<sup>-2</sup> for tilapia, 0.2 fish m<sup>-2</sup> for catfish stocked with tilapia, and 1 fish m<sup>-2</sup> for catfish stocked alone. Management schemes being tested include a "no cash expenditure" type of management, which relied on inputs such as manures and leaves found on farms, and a "purchased feed/fertilizer" management scheme, which featured chemical fertilizer and a feed such as bran or maize germ. Ponds are sampled for fish growth at four- to six-week intervals, and farmers keep records of input type and weight, input costs, pond water additions, fish mortality, and fish weight and length. The trials are underway, but harvests were not expected to begin until at least September 2000. A post-trial workshop will be held to summarize and evaluate the results of the trials. A similar set of trials is planned for western Kenya.

### INTRODUCTION

Fish farmers throughout Kenya, as well as the extension agents who serve them, have suffered from a lack of information about good pond management practices and technology alternatives that may be available to them. Some of the major consequences of this are that many current farmers do not achieve good fish production in their ponds, other farmers become "inactive," and potential farmers avoid going into fish culture because its profitability has not been demonstrated to them. These and other factors have combined to result in typically low productivity from Kenyan fish ponds.

Research conducted by the PD/A CRSP at Sagana Fish Farm has begun to identify alternative management

practices and technologies that may be suitable in the region, but it should not be assumed that results obtained under controlled experimental conditions at Sagana are directly transferable to farms in the area. On-farm testing is therefore a logical step in transferring research-based technologies to the farm. On-farm testing of various alternatives allows farmers to assess their costs and benefits under local conditions as well as to receive instruction and training in basic pond management skills. Conducting such trials also provides opportunities for project personnel to work with and train the fisheries extension officers who are involved in the trials at the various locations, which complements the training they receive through the Kenya Project's training activity ("Aquaculture Training for Fisheries Officers in Kenya").

The specific objectives of this activity are:

- 1) To collaborate with local fish farmers to test technologies developed through PD/A CRSP research at Sagana Fish Farm and elsewhere;
- 2) To demonstrate improved management techniques to extension officers and farmers; and
- 3) To teach simple methods for evaluating costs and benefits to farmers and extension agents.

### METHODS AND MATERIALS

Preparatory contacts with farmers in Central Province and organizing activities were begun well before August 1999, but the pre-trial workshop and the beginning of the trials themselves were delayed. Still, contacts with potential participants were maintained, and pond visits and surveys were made during the month of November 1999. Each fisheries officer was asked to interview farmers wishing to participate in the trials and select ponds based on the following criteria:

- 1) The owners are interested in participating in the trials.
- 2) Pond surface areas are 100 m<sup>2</sup> minimum and 1,000 m<sup>2</sup> maximum.
- 3) The ponds are drainable.
- 4) The average water depth of each pond is 80 ± 10 cm.
- 5) The pond is not prone to flooding.
- 6) Seepage from the pond is less than 10 cm wk<sup>-1</sup>.

For each district it was decided to select two focal points that, if possible, would be in areas having different climates or soil types. By December 1999, 30 farmers with 52 ponds had been selected to participate although some farmers needed to renovate some of their ponds prior to beginning the trials. This number is considerably higher than was originally planned. The numbers of farmers, fisheries officers, and extension agents involved in the Central Province trials are shown in Table 1.

Table 1. Numbers of farmers, fisheries officers, and extension agents involved in CRSP-sponsored on-farm trials in Central Province, Kenya, 1999–2000.

District	Number of Farmers	Number of Officers	Number of Extension Agents
Embu	3	1	2
Muranga	8	1	4
Nyeri	7	1	3
Kirinyaga	6	1	3
Kiambu	6	1	3

Table 2. Numbers of ponds, monosex tilapia, mixed-sex tilapia, and *Clarias* stocked in ponds in districts of Central Province, Kenya, for on-farm trials sponsored by the PD/A CRSP, 1999–2000.

District	Number of Ponds	Number of Tilapia—Monosex	Number of Tilapia—Mixed-Sex	Number of <i>Clarias</i>
Embu	7	424	1,250	166
Muranga	11	600	1,848	494
Nyeri	9	662	1,876	255
Kirinyaga	14	1,316	2,706	452
Kiambu	11	1,332	602	276
Total	52	4,334	8,282	1,643

A workshop to discuss pond management options and make stocking and management plans for each farmer's ponds was conducted 14–17 December 1999. Farmers, extension agents, CRSP personnel, and some of the students involved in thesis work at Sagana participated. Farmers elected to practice either a "no cash expenditure" type of management, which relied on inputs such as manures and leaves found on their farm, or a "purchased feed/fertilizer" management scheme, which featured chemical fertilizer and a feed such as bran or maize germ. These options were based on the alternatives proposed in our work plan, which were:

- Treatment 1) Monosex tilapia (*Oreochromis niloticus*) + catfish (*Clarias gariepinus*), with bran + inorganic fertilizer, based on most recent recommendations from Sagana Fish Farm;
- Treatment 2) Same as Treatment 1 except with mixed-sex tilapia;
- Treatment 3) Monosex tilapia and catfish, with weekly additions of manure/organics at 500 kg TS ha<sup>-1</sup> wk<sup>-1</sup>; and
- Treatment 4) Same as Treatment 3, except with mixed-sex tilapia.

Many farmers had more than one pond and elected to try monosex tilapia in one pond and mixed-sex tilapia in another. Most farmers who stocked tilapia also stocked a small number of *Clarias* (about 10%). A few farmers opted for all *Clarias* (stocked at 1 m<sup>-2</sup>) because they had access to meat scraps and manures.

Pond management and record-keeping techniques were also discussed at the pre-trial workshop. Considerable flexibility was allowed with respect to the management schemes that farmers chose to test, provided they agreed to keep good records of their efforts.

Ponds were stocked beginning 15 January 2000 using 10-g sex-reversed male or mixed-sex *O. niloticus*, depending on the treatment selected, and *C. gariepinus* of 5 g. Stocking densities were 2 fish m<sup>-2</sup> for *O. niloticus* and 0.2 fish m<sup>-2</sup> for *C. gariepinus*. All fingerlings came from Sagana Station. Some farmers could not finish renovations in time, and stocking of their ponds had to be delayed until February or March. More than 12,500 tilapia fingerlings and 1,600 *Clarias* fingerlings were stocked, as shown in Table 2.

Farmers are being visited monthly by their extension agent and either monthly or every other month by the area fisheries officer accompanied by the extension agent. Sampling of ponds for fish growth is attempted on a four- to six-week frequency. Water chemistry parameters are not being measured due to lack of personnel, high transport and per

diem costs for fisheries officers, and the lack of electrical power at Sagana. Most travel money was used to pay for fisheries officers and extension agents to visit the farmers. Farmers record the following information when applicable:

- Input type and weight – as added;
- Pond water additions – weekly;
- Mortality – when observed;
- Expenses – weekly; and
- Fish weight and length – at each sampling.

An evaluation workshop will be conducted after the trials to present the results to farmers and discuss probable causes and economic consequences of the differences observed. Farmers' evaluations of the tested management schemes, including both pond productivity and economic aspects of production, will be solicited.

Fisheries officers and Moi University Department of Fisheries personnel are currently selecting farmers and ponds for similar trials in the Western Region (Western and Nyanza Provinces).

### RESULTS

Pond operation is proceeding normally, with frequent visits to ponds by Fisheries Department extension personnel and occasional supporting visits by Sagana personnel (CRSP and/or Fisheries Department) and sometimes by advanced students working at Sagana.

To date no harvests of trial ponds have occurred. The trials are expected to last up to 12 months, depending on when fish reach a size considered marketable by the farmer. Ponds in warmer areas may be ready for harvest as early as September 2000, but most will probably not be ready until November or December.

One of the management problems that stands out continues to be improper water management. Still believing that it is a good management practice, farmers continue to flow water through their ponds. They may be required to stop this practice, however, as Kenya is in the midst of one of the worst droughts it has experienced in recent decades.

### DISCUSSION

There is a severe lack of basic fish farming extension equipment in Kenya, and the lack of training of its personnel is immediately evident, almost overwhelming the good intentions of extension personnel. This activity will help by making available some equipment such as seines, weighing balances, and record sheets, as well as by providing at-the-pond training for some Fisheries Department staff and farmers. Unfortunately, the training provided by this activity touches only a small segment of the fish farming extension service; it does illustrate, however, what can be done and how to do it.

### ANTICIPATED BENEFITS

Farmers are evaluating and comparing alternative technologies by testing them in their own ponds; they will subsequently be able to adopt those technologies that are most appropriate under their specific conditions. Farmers and extension officers are receiving on-the-job training and gaining skills in basic pond management practices. Farmers and extension agents are also learning to keep good records on the operation of their fish ponds so that they can base their evaluations on documented facts. Adoption of some of the technologies tested should result in higher fish production and increased revenues from fish sales for participating farmers although these kinds of impacts are not likely to be seen immediately. Neighboring farmers may also adopt the new technologies or apply the improved management practices they have observed at the trial sites.