PD/A CRSP Seventeenth Annual Technical Report

Intensification of Tilapia Production: Effects of Feeding at Different Stocking Rates on Pond Water Quality

Eighth Work Plan, Honduras Research 1 (8HR1)
Final Report

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Abstract

Commercial production of tilapia is expanding rapidly in Central America, and hyper-intensive production systems often are being promoted to potential fish farmers. There are few or no sustainable technological packages for profitable tilapia production available to tilapia farmers in Central America. Commercial tilapia farms in Honduras routinely stock 5 to 7 fish m^{-2}. The goals of the proposed research were to develop sustainable pond management practices for small- to medium-scale commercial tilapia farmers in Honduras by evaluating the effect of stocking rate on tilapia yield and production economics and on pond nutrient budgets. Tilapia stocking rates of 2, 5, or 8 fish m^{-2} during a 240-d grow-out were to be tested in 0.1-ha earthen ponds at the Centro Nacional de Investigación Piscícola El Carao, Comayagua, Honduras. A total of 60,000 fish were needed for stocking experimental ponds. Research ponds were not available until 11 June 1998 because the Eighth Work Plan Global Experiment (8FFR1H) had to be extended beyond its programmed duration because fish growth continued. In May 1998 the well at the El Carao station failed, leaving the wet lab and fish transport facilities without water. Water to the wet lab and for fish transport had been restored partially by mid-July. In order to avoid further delays in Eighth Work Plan implementation it was decided to proceed, albeit with some risk, with the transfer of tilapia from nursery ponds to grow-out ponds to begin this experiment. Transfer took place on 21 July 1998. Unfortunately, approximately 40,000 of the more than 60,000 fingerlings in the nursery ponds did not survive the transfer process because of inadequate supply of water to the wet lab. Initiation of this experiment was delayed until December 1998 while a new group of fingerlings were reared to 50 to 100 g. Fortunately, there were adequate fingerlings in inventory at the El Carao station to allow the revised schedule to be met. On 30–31 October 1998 the torrential rains of tropical storm Mitch caused the El Carao station (as well as many other places in Honduras) to flood, which resulted in mass escape of fish in ponds. Thus, it became impossible to complete experiment 8HR1.

Introduction

In order to increase the profitability of tilapia culture, intensification of pond management systems is necessary to produce larger fish for urban markets (450 to 500 g) and export markets (500 to 700 g). Tilapia were stocked at 20,000 fish ha^{-1} in semi-intensive production with fertilizers and/or supplemental feed. Intensification involves increased stocking rates and use of high-quality formulated diets. Tilapia yields of 11,000 to 15,000 kg ha^{-1} in five to eight months were reported in Thailand in fertilized and fed ponds stocked with 3 fish m^{-2} (Diana et al., 1994; Diana et al., 1995a). Stocking rates of 3, 4.5, and 6 tilapia m^{-2} were tested in Thailand; however, low survival complicated data analysis (Diana et al., 1995b). Past Honduras PD/A CRSP tilapia research has concentrated on semi-intensive production practices and response of water quality in fertilized and fed ponds stocked with 2 fish m^{-2} (Teichert-Coddington et al., 1991; Green, 1992; Teichert-Coddington et al., 1992; Teichert-Coddington et al., 1993). The results of those studies were to serve as a point of reference for this study. High feeding rates required for intensive fish production lead to deterioration of pond water quality, which can depress fish growth or result in fish kills (Boyd, 1990; Teichert-Coddington and Green, 1993). However, there is little information available in the literature on the effects of intensive tilapia production strategies on pond nutrient budgets and pond effluents.

Commercial production of tilapia is expanding rapidly in Central America, and hyper-intensive production systems often are being promoted to potential fish farmers. There are few or no sustainable technological packages for profitable tilapia production available to tilapia farmers in Central America. Only 12 of 41 production systems developed during the mid- to late-1980s by the PD/A CRSP were profitable and none yielded the larger-sized fish required by urban and export markets (Green et al., 1994). Commercial tilapia farms in Honduras routinely stock 5 to 7 fish m^{-2}. The goal of the proposed research was to develop sustainable pond management practices for small- to medium-scale commercial tilapia farmers in Honduras. This study was proposed in the Eighth Work Plan. This report describes the circumstances that prevented the study from being completed.

METHODS AND MATERIALS

This research was to be conducted in twelve 0.1-ha earthen ponds located at the Centro Nacional de Investigación Piscícola El Carao, Dirección General de Pesca y Acuacultura, Secretaría de Agricultura y Ganadería, Comayagua, Honduras. The experimental design called for 50- to 100-g male Nile tilapia (*Oreochromis niloticus*) to be stocked into ponds at rates of 2, 5, or 8 fish m^{-2} for a 240-d grow-out period. A total of 60,000 fish were needed for stocking experimental ponds. Fish would be fed to satiation daily with a 25 to 30% protein extruded floating feed. Aeration (propeller-aspirator aerators, 20 HP ha^{-1}) would be used to maintain pond dissolved oxygen concentration in excess of 20% of saturation. Fish were to be sampled by seine net at monthly intervals to measure growth. Early morning dissolved oxygen was to be measured in ponds daily. Total nitrogen, total ammonia nitrogen, nitrate-nitrite nitrogen, total phosphorus, soluble reactive phosphorus, Secchi disk visibility, chlorophyll *a*, and total alkalinity were to be determined biweekly and primary productivity was to be determined weekly according to standard protocol detailed in the PD/A CRSP *Handbook of Analytical Methods* (1992). Weather data were to be collected daily. Ponds were to be harvested by draining upon completion of the trial. Nutrient budgets were to be determined for each stocking rate; nutrients as inputs and outputs were to be measured. Full-cost enterprise budgets were to be developed for each stocking rate.

The null hypotheses to be tested in this completely randomized design experiment were:

1) pond nutrient budgets are not affected by intensification of management system;
2) tilapia growth and yield are not affected by increased stocking rate; and,
3) production economics are not affected by intensification of management system.

Data analysis was to be by regression analysis and ANOVA with treatment differences determined by orthogonal contrasts.

RESULTS AND DISCUSSION

In February 1998, nursery ponds were stocked with approximately 87,000 Nile tilapia fingerlings for growth to 50 to 100 g. Research ponds were not available until 11 June 1998 because the Eighth Work Plan Global Experiment (8FFR1H) had to be extended beyond its programmed duration because fish growth continued. In May 1998 the well at the El Carao station failed, leaving the wet lab and fish transport facilities without water. Water to the wet lab and for fish transport had been restored partially by mid-July. In order to avoid further delays in Eighth Work Plan implementation it was decided to proceed, albeit with some risk, with the transfer of tilapia from nursery ponds to grow-out ponds to begin experiment 8HR1. Transfer took place on 21 July 1998. Unfortunately, approximately 40,000 of the more than 60,000 fingerlings in the nursery ponds did not survive the transfer process because of inadequate supply of water to the wet lab. Initiation of the 8HR1 experiment was delayed until December 1998 while a new group of fingerlings were reared to 50 to 100 g. Fortunately, there were adequate fingerlings in inventory at the El Carao station to permit the revised schedule to be met. On 30–31 October 1998 the torrential rains of tropical storm Mitch caused the El Carao station (as well as many other places in Honduras) to flood, which resulted in mass escape of fish in ponds. Thus, it became impossible to complete experiment 8HR1.

ANTICIPATED BENEFITS

Results of this research would provide information on disposition of nutrients added as feed to intensively managed ponds; quality of pond effluents; growth, survival, and yield of tilapia at different stocking rates; and production economics of intensified pond management strategies.

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