The Effects of Pond Management Strategies on Nutrient Budgets: A Comparison of Mono-sex Swansea GMT and Mixed-sex GIFT Nile Tilapia (*Oreochromis niloticus*)

Interim Work Plan, Study 2 and Global Experiment, Philippines

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Introduction

PD/A CRSP pond management strategies have primarily used fertilizers to increase pond productivity. However, as countries develop, there is often a desire for larger fish, which are more difficult to produce in a short time if feeds are not used. This experiment aimed to contribute to PD/A CRSP information on the relative importance of various nutrient sources and to continue studies of the relative growth responses of different strains of *Oreochromis niloticus* under heavy fertilization and feeding regimes.

Materials and Methods

Four treatments compared the growth performance of two strains of Nile tilapia under two pond management regimes in a 2 x 2 factorial design. Each of the four treatments was represented by triplicate ponds, requiring use of 12 ponds in all. The strains were 1) mixed sex GIFT fish (Pullin et al., 1991) and 2) Swansea GMT fish (Capili, 1995). GIFT fish are *O. niloticus* that have been selectively bred by ICLARM (International Center for Living Aquatic Resources Management) and are typically cultured in mixed-sex groups. Swansea GMT fish are *O. niloticus* males produced by breeding YY male tilapia with normal females. All ponds were stocked with tilapia fingerlings of 4-7 g/fish individual weight at a density of 3 fish/m^2; all ponds were also stocked with fingerling African catfish (*Clarias gariepinus*), of weights ranging from 2.2 to 3.1 g/fish at 0.3 fish/m^2, for predatory control of tilapia reproduction.

The pond management regimes consisted of 1) weekly fertilization with urea and 16-20-0 organic fertilizer at a rate of 4 kg N/ha/day with an N:P ratio of 5:1 by weight; and 2) fertilization at the above rate through the first 2.5 months, followed by discontinuation of fertilizer inputs and initiation of feeding twice daily with commercial feed (27% protein content) at 5% body weight per day (BWD) for the next 1.5 months, and then feeding at 3% BWD for the last 1.0 month.

Water depth was measured and adjusted weekly to 0.9 to 1.0 m. Column-integrated water samples were taken between 0600 and 0900 hours once every two weeks for analysis of concentrations of total ammonia, soluble reactive phosphorus, and total alkalinity (APHA, 1989). As well, Secchi depth, and top, middle, and bottom (25, 50, 75 cm) depth determinations of dissolved oxygen concentration (DO, by polarographic probe in situ), in situ temperature, and pH of samples

Table 1. Summary of extrapolated harvest data (kg/ha/yr).

Oreochromis niloticus Strain & Nutrient Input	Replicate	Stocked Tilapia Only	Total Yield*
GMT w/ Fertilizer	1	5420	6534
	2	6661	9122
	3	5621	7235
	Mean ± s.e.	5900 ± 385	7630 ± 773
GMT w/ Fertilizer then Feed	1	10928	15527
	2	9512	11953
	3	8659	14041
	Mean ± s.e.	9700 ± 662	13840 ± 1037
GIFT w/ Fertilizer	1	4726	7436
	2	5124	8353
	3	5078	8316
	Mean ± s.e.	4976 ± 126	8035 ± 300
GIFT w/ Fertilizer then Feed	1	7356	12931
	2	6437	12644
	3	6705	9309
	Mean ± s.e.	6833 ± 273	11628 ± 1162

* Includes tilapia catfish and reproduction

returned to the laboratory (by combination electrode) were measured. The 3-depth samples were repeated the same afternoons between 1330 and 1600 hours.

Fish were sampled monthly for measurements of individual length and bulk weight—a sample of 25 fish taken without pattern from a seine haul. Fed ponds were sampled twice monthly so that rations could be adjusted for growth. Ponds were harvested by seining and complete draining after 150 days. Statistical comparisons were made.

Results

When fish of either strain were fed, growth and yield were significantly greater than in comparable unfed treatments. Yields of the stocked tilapia were greater for GMT than for GIFT fish in the fed treatment and in the fertilizer-only treatment (Table 1). Average weight of individual fish (pond means) did not differ significantly between strains in either feed regime, which implies that yield differences were mediated through survival differences. Survival was generally good (81-97% by pond), and in general better than was typical for earlier trials with other strains on this site, with the exception of one of 12 ponds with a low survival rate of 58%. GMT fish exhibited significantly better survival than GIFT fish in the unfed treatments; differences were smaller in the fed treatments, and non-significant if the single low value noted above is ignored.

Tilapia reproduction and catfish contributed significantly to total fish yields (Table 1). Catfish yields showed no significant difference when stocked with either tilapia strain, either by absolute amount or as percent of total pond yield.

Catfish yields were significantly greater in fed ponds, constituting 14.0 to 27.8% of total crop, compared with 10.5 to 14.3% in unfed ponds. All of these percentages exceeded the proportion in which catfish were stocked by numbers (10%) and biomass (5%).

In unfed ponds, GIFT fish produced significantly greater yields from reproduction than did GMT fish, as expected given that GIFT fish were not sex-reversed. This result was expected and complicated the comparison of the strains, but GIFT fish are usually not available as sex-reversed fingerlings. Within the fed ponds, the species comparison was further complicated by the presence of a few large offspring fish in some ponds.

Literature Cited

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