Trans. Nat. Acad. Science & Tech. (Phils.)
*1988: **10**: 365-368*

POLYCULTURE OF NILE TILAPIA, GRASS CARP AND COMMON CARP IN FRESHWATER PONDS

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ABSTRACT

The production of a freshwater polyculture system with sex-reversed Nile tilapia, grass carp and common carp was evaluated. Three different feeding/fertilization regimes: commercial diet feeding, paragrass feeding and chicken manure fertilization were tested. Results of the preliminary study showed that the highest total fish production was obtained with paragrass feeding. Production of grass carp was highest in the commercial diet-fed pond while production of common carp was best in the manured pond. Feeding paragrass into the polyculture system gave the least cost for fish production.

Introduction

The mixed farming or polyculture of fishes is considered one of the efficient practices for increasing productivity in freshwater ponds. Fish polyculture, a system wherein the fish food sources are fully utilized, is a common practice in China and other Asian countries. In the system, an herbivorous fish (e.g. grass carp), plankton-feeders (e.g. silver carp, bighead and tilapia), and a bottom-feeder (e.g. common carp) are usually used (Bardach *et al.*, 1972; Diana *et al.*, 1985).

In the Philippines, a number of experiments has been conducted to develop fish and invertebrate polyculture systems in freshwater ponds (Grover, 1973; Grover *et al.*, 1976; Guerrero and Guerrero, 1976; Guerrero and Villanueva, 1979). The species tested include milkfish, common carp, Nile tilapia, the freshwater mussel and shrimps. The studies were designed to determine stocking ratios of the different species in polyculture and the potential yields under fertilization and supplemental feeding conditions.

With the present thrust of the government to alleviate poverty and unemployment in the countryside, there is need for a vigorous program to improve efficiency and increase productivity in small-scale aquaculture farms in the country, particularly for freshwater fishponds. These farms require low-cost and appropriate technologies to become viable and efficient.

From the technical point-of-view, the choice of species in a polyculture system should be based on the following criteria: availability of fish seeds; availability and cost of other inputs such as feeds and/or fertilizers; and the productivity of the system. From the economics side, marketability of the end-produce and profitability of the system need to be considered.

Our preliminary study on the polyculture of the grass carp (*Ctenopharyngodon idella*), Nile tilapia (*Tilapia nilotica*), and common carp (*Cyprinus carpio*) in freshwater ponds with different feeding and fertilization regimes was conducted to ascertain the productivity and economic feasbility of such a system. The study was conducted at the Aquatic Biosystems fishfarm in Bay, Laguna, February to July. 1987.

Materials and Methods

Three 200 m^2 earthen ponds with average water depth of 0.6 m were used for the study. Grass carp, sex-reversed Nile tilapia and common carp fingerlings juveniles were stocked in the ponds at 300/ha, 5,00/ha and 500/ha, respectively. The mean weights of the fishes at stocking were 130 g (grass carp), 1.3 g (Nile tilapi) and 230 g (common carp).

The fishes in one pond (A) were fed with a commercial diet 25% crude protein) in mash form at feeding rates of 3 to 10% of tilapia biomass per day, in two to four feedings, adjusted monthly with fish sampling. In another pond (B), fresh paragrass (*Brachiaria mutica*) was fed to the grass carp daily at the rate of 20% of biomass per day adjusted monthly after fish sampling. The third pond (C) was fertilized with air-dried chicken manure at the rate of 3,000 kg/ha per month applied in four weekly applications.

The culture period of the fishes in the study was 150 days. At the end of the study, the total numbers and weights of fishes harvested in each pond were determined. The total amounts of feeds and fertilizer applied, including costs, were computed. A simple cost/return analysis was made.

Results and Discussion

A greater number of Nile tilapia fingerlings was inavertently stocked in Pond B than what was intended. Instead of only 100 fingerlings as in Ponds A and C, 1,000 were stocked in Pond B.

The net total weights of Nile tilapia, grass carp and common carp harvested were highest in Ponds B, A and C, respectively (Table 1). Survival rates for the species were found to be lowest in Ponds B (grass carp and common carp) and C (Nile tilapia). Reproduction of Nile tilapia was found in all ponds with the greatest number of Pond B. The common carp reproduced in Ponds A and B only with the former having the most number of young. No reproduction of grass carp was found.

The results indicate that while paragrass feeding favored tilapia growth and reproduction, the commercial diet promoted growth of grass carp. Growth and re-

Table 1. Summary of harvest data for polyculture of Nile tilapia, grass carp and common carp

Feed/Fertilizer (Pond)	*Species*	*Mean Wt. (g)*	*Net Total Wt. (kg)*	*Survival %*	*No. of Reproduction*
Commercial diet (A)	C. *idella*	700	2.7	83	0
	T. *nilotica*	130	8.8	100	126
	C. *carpio*	590	5.6	100	100
Paragrass (B)	C. *idella*	517	2.1	67	0
	T. *nilotica*	33	35.4	106	401
	C. *carpio*	472	1.4	90	37
Chicken manure (C)	C. *idella*	560	2.1	83	0
	T. *nilotica*	94	8.5	93	116
	C. *carpio*	975	6.9	100	0

production of common were enhanced by chicken manure fertilization and commercial diet feeding, respectively.

Paragrass feeding apparently benefitted the Nile tilapia through the food chain. With the grass carp directly consuming the vegetation, faeces of the fish are either directly consumed by tilapia and/or serve as fertilization in the pond for bacteria, protozoa and other planktonic organisms (Hickling, 1962). *B. mutica* is a common livestock forage grass in the Philippines that gros abundantly in lowland areas. It contains about 90% dry matter and nine to 12% crude protein (Castillo and Gerpacio, 1976).

The commercial diet appeared to have directly benefitted grass carp which demonstrates that the fish responds well to feeds other than vegetation. The species is described to be a facultative herbivore that accepts other supplementary feeds aside from green vetetable food (Diana *et al.,* 1985).

Common carp, on the other hand, responded well to chicken manure fertilization in terms of growth and to commercial diet feeding for reproduction. The fish derives its sustenance from food organisms available at the pond bottom. Chicken manure is a commonly applied organic fertilizer in the Philippines for growing fish food organisms in ponds.

Taking into account input (feed/fertilizer) costs, the least cost for producing a kilograms of fish was found with paragrass feeding, followed by chicken manure fertilization. Feeding with the commercial diet gave the highest cost (Table 2).

Although tilapia production in the paragrass-fed pond was obviously increased with the unintentional stocking of more fingerlings compared to the other ponds, the low-cost of feeding would still economically favor the system even if the total fish yield in the pond was comparable with those of the other two. The smaller size of tilapia harvested in the paragrass-fed pondwas expected with the higher stocking density.

Table 2. Simple cost/return analysis of Nile tilapia, grass carp and common carp polyculture

Feed/Fertilizer (Cost/kg)	*Total Fish Yield/Pond (kg)*	*Total Amount Feed/Fertilizer (kg)*	*Total Cost of Feed/Fertilizer (₱)*	*Cost/Kg Fish (₱)*
Commercial diet (₱5)	17.2	51.2	255.8	14.8
Paragrass (₱0.25)	38.9	271.1	54.3	1.4
Chicken manure (₱0.30)	17.6	300	90	5.1

The results of our study show the economic feasibility of producing freshwater fishes in a polyculture system supported mainly by paragrass feeding. With such a system, input costs for costly supplemental feeds and unavailable organic and/or inorganic fertilizers required in conventional fishfarming would be minimized. It, however, necessitates the availability of the desired forage feed and fish seeds aside from other requirements such as water supply and farm labor. Further studies to verify our results are recommended.

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