

80:20 Pond Growth Performance of Hybrid Tilapia on Soybean Meal-Based Diets

Results of 1997 ASA/China Feed-Based Production Trials

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INTRODUCTION

The American Soybean Association (ASA), in cooperation with the China National Fisheries Extension Center (NEC) and its affiliate provincial agencies, has conducted a series of feeding trials with tilapia in ponds and cages over the past five years. These trials have been conducted on commercial fish farms throughout China, and have tested a variety of feeds and feed formula variations to determine the technical and economic feasibility of culturing tilapia in feed-based pond (80:20 technology) and cage (LVHD technology) production systems with soybean-based aquafeeds. These efforts were continued in 1997 with a feeding trial in Guangzhou that evaluated hybrid tilapia growth performance from fry to market size on soybean-based fingerling and grow-out diets.

MATERIALS AND METHODS

Fish

Hybrid tilapia fry (*Oreochromis niloticus* x *O. aureus*) for the feeding trial were produced by the Guangdong Tilapia Breeding Farm in Guangzhou, Guangdong Province, China. Tilapia fry of size 0.6 g were stocked in ponds at a density of 2,000 fish per mu, together with 100 silver carp fry per mu. Target grow-out size was 400 g.

Feed

Tilapia were fed a 36% crude protein, soybean-based fingerling feed (ASA 'S' diet) from the advanced fry stage to approximately 50 g in weight. Upon reaching 50 g in weight, fish in two of the ponds were switched to ASA 'H' diet feed and fish in the other two ponds were switched to 'J' diet feed. The 'H' and 'J' diets are 32% crude protein grow-out diets with 5% and 0% fish meal, respectively. 'S', 'H' and 'J' diet formulas are shown in Table 1. All three feeds were fed in extruded, floating form. Feeds for the trial were produced by the Shanghai DaJiang aquafeed mill.

Frequency of feeding and daily feed quantity were based on feeding directions contained in the ASA feed table for channel catfish, common carp and Nile tilapia. Where multiple daily feedings were required, the total daily feed ration was divided equally among the multiple feedings. For fingerlings, feed quantity was increased every 10 days using an estimated feed conversion ratio of 1.0:1, and readjusted according to average fish weight

determined at 30-day sampling intervals. For fish > 50 g in weight, feed quantity was increased every 10 days using an estimated feed conversion ratio of 1.5:1, and readjusted according to average fish weight determined at 30-day sampling intervals.

Ponds

Four earthen ponds were used for the trial at the farm in Guangzhou. Each feed treatment was replicated in two ponds. The two 'H' diet ponds were 2.5 mu in area, while the two 'J' diet ponds were 2.3 mu and 2.1 mu in area.

RESULTS

Hybrid tilapia fry stocked at 0.6 g in weight grew to an average weight of 49.5 g in 50 days on the 'S' diet (Table 2). Average FCR for the four test ponds during the 50-day feeding period was 0.67:1.

Hybrid tilapia fingerlings grew from 47 g to 255 g on the 'J' diet and from 52 g to 300 g on the 'H' diet in 89 days (Table 2)(Figure 1). Fingerlings fed the 'J' diet were 10.6% smaller than fingerlings fed the 'H' diet (47 g vs. 52 g) at the start of the trial, and 15% smaller at the end of the trial. Fish in both feed treatments grew at an average daily rate of 5% of initial body weight. Average FCR was 1.47 with the 'H' feed and 1.40 with the 'J' feed. Survival averaged 89% in the 'H' feed ponds and 95% in the 'J' feed ponds.

Net tilapia production was 534 kg/mu (7,919 kg/ha) with the 'H' feed and 486 kg/mu (7,207 kg/ha) with the 'J' feed. Silver carp net production in the 'H' and 'J' feed ponds was 66 kg/mu (983 kg/ha) and 68 kg/mu (1,008 kg/ha), respectively. Combined tilapia and silver carp gross production was 618 kg/mu (9,165 kg/ha) with the 'H' feed and 572 kg/mu (8,483 kg/ha) with the 'J' feed.

Net economic return was RMB 585 per mu for both test feeds. Return to investment was slightly higher for fish fed the 'J' feed, yielding 15.3% in comparison to 13.9% with the 'H' feed.

DISCUSSION

Results of the trial indicate it is not feasible to produce marketable hybrid tilapia of size \geq 400 g in a 139-day production period in the Guangzhou area. Growth to 400 g would require approximately 30 days of additional production time in ponds. This is feasible in the southern latitudes of China if tilapia are spawned early in a controlled environment.

Hybrid tilapia growth from 0.6 g to 400 g is not feasible at the stocking density tested (2,000/mu) and with the 92% average survival rate obtained in this trial. Continued fish growth beyond the 600 kg/mu gross fish weight obtained in this trial would not have been sustainable without significant aeration and water exchange. The required feed input of approximately 13 kg/mu/day (193 kg/ha/day) at this carrying capacity would significantly reduce water quality and impact fish health and growth performance. Fish

populations at these high carrying capacities need to be divided to maintain adequate water quality and a high rate of growth. Water temperature permitting, tilapia in this trial could have been grown to a larger size if the populations had been divided and restocked in additional ponds when carrying capacity reached 350 to 400 kg/mu (approximately day 110 in this trial).

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Chinese Currency & Production Unit Conversions:

RMB 8.26 = US\$1.00
15 mu = 1.0 hectare (ha)
kg/mu x 15 = kg/ha
1.0 kg = 2.2 lb
6 mu = 1.0 acre (ac)
kg/mu x 13.2 = lb/ac

TABLE 1. Composition of the ASA diets tested in the 1997 hybrid tilapia fry to market size grow-out trial at Guangzhou.

Ingredient	Percentage by weight		
	'S' diet	'J' diet	'H' diet
Fish Meal	10.00	0.00	5.00
Soybean Meal (44% CP)	45.00	50.00	40.00
Cottonseed Meal (41% CP)	0.00	5.00	5.00
Rapeseed Meal	5.00	0.00	5.00
Corn Gluten (60% CP)	7.00	10.00	10.70
Corn (extrusion cooked, 8.5% CP)	0.00	20.00	0.00
Rice Bran	11.00	0.00	20.00
Wheat Middlings (12% CP)	18.00	11.60	0.00
Wheat flour	0.00	0.00	10.50
Lysine HCl	0.50	0.50	0.50
Vegetable Oil (soybean)	2.20	1.60	2.00
Mineral Premix	0.10	0.10	0.10
Vitamin Premix	0.05	0.05	0.05
Vitamin C (coated)	0.10	0.10	0.10
Dicalcium Phosphate (18% P)	1.05	1.05	1.05
TOTAL	100.00	100.00	100.00

TABLE 2. Growth performance of hybrid tilapia (*Oreochromis niloticus* x *O. aureus*) in a fry to market grow-out trial with soybean-based feeds at Guangzhou, China, in 1997.

Location	Feed	Stocking density (fish/mu)		Stocking weight (g)	Pond size (mu)	No. days fed	Harvest				Survival (%)	FCR
		Tilapia	SiC*	Tilapia			kg/mu (net)		wt/fish (g)			
							Tilapia	SiC	Tilapia	SiC		
Guangzhou	S-float	2000	100	0.6	2.1-2.5	50			49.5			0.67
Guangzhou	H-float	2000	100	52	2.5	89	534	66	300	800	89	1.47
Guangzhou	J-float	2000	100	47	2.2	89	486	68	255	703	95	1.40

*SiC = silver carp

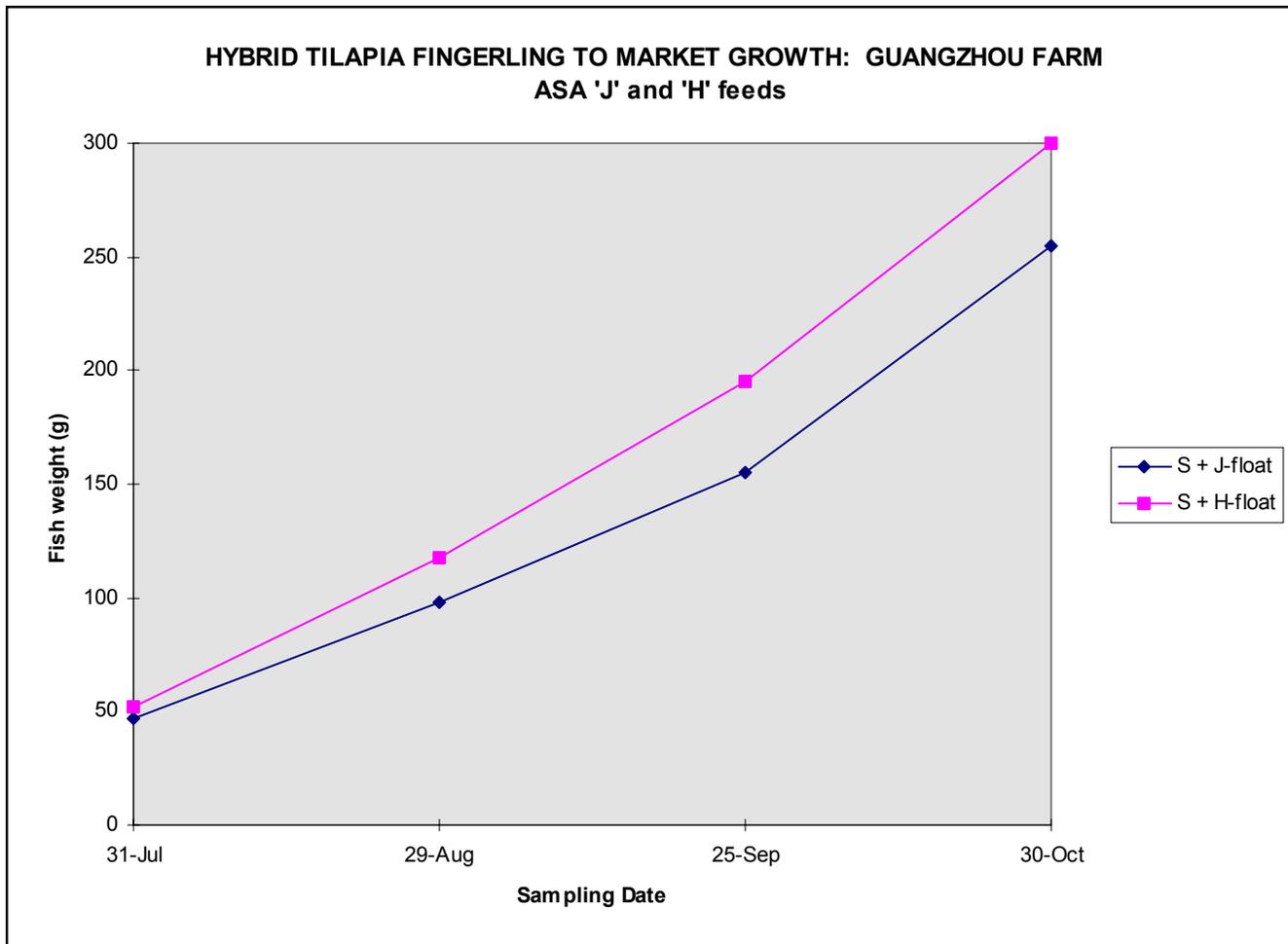


FIGURE 1. Growth performance of hybrid tilapia fed soybean-based diets containing 0% fishmeal (J) and 5% fishmeal (H) in a grow-out trial at Guangzhou, Guangdong Province, China in 1997.