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Comparison of the Production Performance of Grass Carp fed an Extruded Soy-based Feed and a Pelleted Sinking Feed

Results of ASA-IM/China 2010 Feeding Demo U-35-10-514

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INTRODUCTION

A pond feeding demonstration was jointly conducted by the American Soybean Association International Marketing (ASA-IM) program, the Jiangsu Provincial Fishery Technology Extension Center, and the Pingwang State Fish Farm, Jiangsu Province, in collaboration with the Nanjing Institute of Environmental Science (NIES) to demonstrate the productivity, economic, and environmental advantages of the ASA-IM 80:20 pond technology with ASA-IM formulated extruded soybased feed in comparison to a local sinking feed. The feeding trial was conducted on the Demonstration Farm of Wujiang Aquaculture Co. Ltd., Jiangsu Province, China.

PROTOCOLS

Six, 6.0-mu (0.4-ha) ponds at the Demonstration Farm of Wujiang Aquaculture Co. Ltd., Suzhou City, Jiangsu Province were used for the comparison feeding demonstration. The six ponds were identically prepared and treated for the demonstration.

The demonstration fish were 75-g grass carp purchased from the market. Grass carp were stocked in the six demonstration ponds at a density of 500 fish per mu (7,500/ha), together with 100 silver carp per mu (1,500/ha) according to the ASA-IM 80:20 pond production model. Fish in all six demonstration ponds were of uniform size and age at stocking. Target market size for the grass carp was >1.0 kg per fish.

Grass carp in three of the ponds were fed to 90% satiation twice daily with the ASA-IM 32/3¹ grass carp feed (Tables 1-3). This feed is a low energy, high fiber feed that is designed to closely mimic the natural food intake of grass carp. Soybean meal is used as the primary protein source in the feed, and soy hulls as a primary fiber source. All feed was fed in extruded, floating pellet form. The feed was produced by the Ningbo Techbank Feed Mill in Ningbo, Zhejiang Province, China, and least-cost formulated based on ASA-IM formulation specifications and with ASA-IM technical support.

Grass carp in the other three ponds were fed with a locally manufactured sinking pellet feed with a protein level of 28%. The local feed was fed twice daily based on the estimated biomass of the feed-taking species correlated with a locally developed feeding table. Fish in the three control ponds were fed the same amount of local feed at each feeding.

The comparison feeding demonstration was conducted over a 6.5-month period. At the end of the feeding demonstration, all ponds were drained and the fish from each pond harvested and weighed independently. Sub-samples of each species of fish were taken from each pond population to determine average fish weight for the species. Data on fish survival, gross and net production, average fish weight, and feed conversion efficiency were calculated for all ponds. Data on production input costs was recorded throughout the demonstration to determine the economic return from each pond and the average for the three ponds for each feed.

RESULTS

Grass carp in the Pingwang feeding demonstration were fed for 196 days between 10 May and 23 November 2010. Grass carp fed the ASA-IM 32/3 extruded soybased feed grew from 75 g to an average weight of 1,798 g, while grass carp fed the local sinking pellet grew from 75 g to an average weight of 877 g (Table 4, Figure 1). Average FCR with the two feeds was 1.56:1 with the 32/3 soybased feed and 3.17:1 with the local

¹ The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 32/3 indicates 32% crude protein and 3% crude fat.

sinking feed (Table 4). There were significant differences in fish growth and FCR between the two feeds.

Fish biomass at harvest averaged 533 kg/mu (7,995 kg/ha) with the ASA-IM extruded soybased feed and 266 kg/mu (3,990 kg/ha) with the local sinking feed. The higher biomass production with the 32/3 soybased feed was the result of faster growth and larger fish size at harvest.

Survival rates for grass carp fed the 32/3 extruded soy-based feed and the local sinking pelleted feed were 60.2% and 61.1% respectively. There was no significant difference in survival between these two feed treatments. Net income and return to investment (ROI) for the three ponds with 32/3 extruded soybased feed averaged RMB 1,429/mu (\$3,233/ha) and 26.2%, respectively, while the net income and return to investment (ROI) for the three ponds with the local sinking pelleted feed averaged RMB 504/mu (\$1,140/ha) and -12%, respectively.

SUMMARY AND CONCLUSIONS

The ASA-IM 32/3 extruded soy-based feed significantly out-performed the local sinking feed in every aspect evaluated. Grass carp production with 32/3 soybased feed was 100% higher than that with the local sinking feed. Average grass carp size at harvest was 105% larger in the ponds with 32/3 extruded soy-based feed than in the ponds with the local sinking feed.

FCR with the ASA-IM extruded soybased feed (1.56:1) was half that obtained with the sinking pelleted feed (3.17:1). As result, the average net income of the three ponds with the ASA-IM 32/3 soy-based feed (RMB 1,429) was 2.8 times higher than the three ponds with local sinking feed (RMB 504/mu).

In conclusion, the ASA-IM formulated 32/2 soy-based feed yielded rapid growth, a high economic return, and a sustainable harvest biomass of 8 mt/ha with the ASA-IM 80:20 technology. In comparison, the local sinking feed yielded a significant economic loss. The ASA-IM encourages the fish farming industry to adopt the extruded soybased feeds as a method to improve fish production, economic return and industry sustainability in China and elsewhere in the world.

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products used in some of the ASA-IM feeds, and Novus for the contribution of their feed antioxidant product Solis Mos.

Chinese Currency and Production Unit Conversions:

RMB 6.60 = 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. Formula for the ASA-IM 32/3, all-plant protein, soy-based feed used in the 2010 grass carp pond feeding demonstration conducted at the Wujiang Aquaculture Co. Ltd. Demonstration Farm in Jiangsu Province, China. The feed is a low energy and high fiber feed fed in extruded, floating form. The demonstration feed was produced by Ningbo Techbank Feed Company, Zhejiang Province.

Ingredients	Percent of total
<i>Soybean Meal 46%</i>	<i>45.00</i>
<i>Wheat Midds</i>	<i>30.00</i>
Wheat Flour	9.00
Soy Hulls	5.00
Corn Gluten Meal 60%	5.00
Blood Meal, spray dried	2.00
Ca Phosphate Mono 21%P	1.90
Fish Oil	1.00
Vit PMX-F2	0.50
Min PMX F-1	0.25
DL-Methionie 99%	0.15
Choline Chloride 50%	0.13
Stay C 35%	0.03
Antioxidant	0.02
Mycotoxin Binder	0.01
Mild Inhibitor	0.01
TOTAL	100.00

Table 2. Calculated nutritional profile of the ASA-IM 32/3, soy-based feed used in the 2010 grass carp feeding demonstration conducted at the Wujiang Aquaculture Co. Ltd. Demo Farm, Jiangsu Province, China

Nutrient	Amount	Unit
DE Fish	2319.60	kcal/kg
NFE	40.90	%
Starch	19.36	%
*Protein	32.05	%
Protein, dig.	30.00	%
Fish Protein	0.00	%
Soy Protein	21.19	%
*Fat	3.04	%
W 3	0.39	%
W 6	0.98	%
Fiber	6.22	%
*Ash	6.38	%
Calcium	0.50	%
Phos Avail	0.55	%
Iron	515.63	%
Copper	34.26	%
Zinc	131.27	ppm
Selenium	0.83	ppm
Moisture	9.89	ppm
Vitamin C	105.00	ppm
Choline	2485.04	%
Ethoxyquin	134.50	mg/kg
Arginine	2.01	mg/kg
Lysine	1.81	mg/kg
Methionine	0.60	%
Meth+Cyst	1.07	%
Threonine	1.25	%
Tryptophan	0.38	%

Table 3. Vitamin and mineral premix formulations for the ASA-IM 32/3, soybased feed used in the 2010 grass carp feeding demonstration at the Wujiang Aquaculture Co. Ltd. Demonstration Farm, Jiangsu Province, China. Quantities of vitamins and minerals are per kilogram of premix. Both premixes were produced by Chengdu Phoenix Feed Company, Sichuan Province.

Ingredient	Unit	Amount
<u><i>Vitamin Premix F-2</i></u>		
<i>Vitamin A</i>	<i>IU/kg</i>	<i>1,200,000</i>
Vitamin D3	IU/kg	200,000
Vitamin E	IU/kg	20,000
Vitamin K	mg/kg	0
Vitamin C	mg/kg	0
Biotin	mg/kg	40
Choline	mg/kg	0
Folic Acid	mg/kg	1,800
Inositol	mg/kg	0
Niacin	mg/kg	40,000
Pantothenate	mg/kg	20,000
Pyridoxine (B6)	mg/kg	5,000
Riboflavin (B2)	mg/kg	8,000
Thiamin (B1)	mg/kg	8,000
Vitamin B12	mcg/kg	2,000
Ethoxyquin	mg/kg	500
<u>Mineral Premix F-1</u>		
Iron	ppm	40,000
Manganese	ppm	10,000
Copper	ppm	4,000
Zinc	ppm	40,000
Iodine	ppm	1,800
Cobalt	ppm	20
Selenium	ppm	200

Figure 1. Growth curve for grass carp fed the ASA-IM formulated extruded soy-based feed and a local sinking pelleted feed. Grass carp fed the ASA-IM 32/3 extruded soy-based feed grew from 70 g to 1,798 g with an average FCR of 1.56:1,; while grass carp fed the local sinking feed grew from 75 g to 877 g with an average FCR of 3.17:1 in 196 days.

Table 4. Results of the 2010 ASA-IM grass carp feeding demonstration at the Wujiang Aquaculture Co. Ltd. Demonstration Farm, Jiangsu Province, China, that demonstrated production performance of grass carp fed the ASA-IM 32/3 extruded soy-based feed and a 28% protein sinking pelleted feed.

Pond No. ¹	GrC ¹ stocking size (g)	Stocking rate (GrC/mu)	No. days fed	<u>Harvest wt. (g)</u>		<u>P_G⁴ (kg/mu)</u>		<u>Survival (%)</u>		FCR	Net income (RMB/mu)	ROI (%)
				GrC ²	SiC ³	GrC	SiC	GrC	SiC			
1	75	500	196	1,998	1,264	514.4	97.5	51.5	77.1	1.61	1,207.3	22.1
2	75	500	196	1,494	1,334	524.7	99.5	70.3	77.6	1.60	1,341.8	24.6
3	75	500	196	1,903	1,255	559.8	94.5	58.8	75.3	1.48	1,737.9	31.9
Mean	75	500	196	1,798	1,284	533.0	97.2	60.2	75.7	1.56	1,429.0	26.2
4	75	500	196	765	1,003	244.6	91.8	65	91.5	3.47	-806.4	-19.2
5	75	500	196	897	1,104	268.0	99.8	60	90.4	3.11	-474.4	-11.3
6	75	500	196	970	1,294	283.2	114	58.3	88.2	2.93	-231.3	-5.5
Mean	75	500	196	877	1,134	265.6	101.9	61.1	90.0	3.17	-504.0	-12.0

¹Grass carp in ponds 1-3 were fed the ASA-IM formulated 32/3 extruded soy-based feed; grass carp in ponds 4-6 were fed a local sinking pelleted feed

²GrC = Grass Carp

³SiC = Silver Carp

⁴P_G = Gross Production