Key Words: **China, grass carp, soymeal based feed, zero water discharge, 80:20 pond technology**

Pond Production of Three-year Old Grass Carp with a Soymeal Based Extruded Feed and Zero Water Discharge Technology

Results of ASA-IM/China 2010 Feeding Demo 35-10-515

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INTRODUCTION

The American Soybean Association-International Marketing (ASA-IM), in cooperation with the Heilongjiang Provincial Fishery Technology Extension Center conducted a grass carp feeding demonstration with the zero water discharge technology. The objective of the feeding demo was to evaluate the technical and economic feasibilities of producing over 2.0-kg grass carp using the ASA-IM formulated 32/3[1] extruded soymeal-based feed.

PROTOCOLS

Three earthen ponds of size 5.0-mu each at the Demo Farm of the Heilongjiang Provincial Fishery Technology Extension Center were used for the feeding demonstration. The water depth of demo ponds averaged approximately 1.5 m. All ponds were equipped with water exchange and stand-by aeration.

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[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.

Fish were two-year old, 850-g grass carp produced from the ASA-IM pond feeding demo in 2009. Grass carp were stocked in the three demonstration ponds at a density of 150 fish per mu (2,250/ha), together with 100 silver carp per mu (1,500/ha). Fish in all three demonstration ponds were of uniform size and age at stocking. Target market size for the grass carp was >2.0 kg per fish.

Grass carp were fed the ASA-IM formulated all-plant protein, soymeal-based grass carp feed containing 32% crude protein and 3% crude lipid (Table 1-3). This feed was formulated to have 20% less energy than the standard ASA 32% protein carp growout feed, and an 8% fiber level. The 32/3 grass carp growout feed contained over 50% soybean products. The feed was fed in extruded, floating pellet form. Fish were fed to satiation twice daily, with fish in the three replicate ponds receiving an identical amount of feed at each feeding every day. The feeds were formulated by the ASA-IM and produced with the ASA-IM technical support at the Ningbo Techbank Feed Company in Yuyao, Zhejiang Province.

The pond demo management was based on the ASA-IM 80:20 production model, with grass carp as the fed species (80%of target fish harvest biomass) and silver carp as the service species (20% of fish biomass at harvest). Fish in all ponds were sampled once per month on approximately the same date each month. At the conclusion of the demonstration, all ponds were drained and the grass carp and silver carp in each pond were counted and weighed to determine average fish weight, gross and net production, feed conversion ratio (FCR) and survival. Production input costs were recorded throughout the demonstration and net income and ROI were calculated at the end of the demonstration.

RESULTS

Grass carp grew from 850 g to an average weight of 2,229 g per fish during the 112-day demonstration period (Table 4 and Figure 1). Grass carp biomass at harvest averaged 321 kg/mu (4,815 kg/ha) and silver carp biomass at harvest averaged 176 kg/mu (2,640 kg/ha). The average survival rates for grass carp and silver carp were 96% and 94.7%, respectively. The feed conversion ratio (FCR) for grass carp with the soy-based 32/3 feed averaged 1.58:1.0 for the three demonstration ponds.

The low FCR and rapid fish growth on the soy-based 32/3 feed yielded an average net economic return to the fish producer of RMB 1,524 per mu ($3,437/ha) at market prices of RMB 12.0/kg ($1.80/kg) for grass carp and RMB 3.0/kg ($0.45/kg) for silver carp. Return on investment (ROI) for the three demonstration ponds averaged 50.2%**.**

SUMMARY AND CONCLUSIONS

Grass carp exhibited good growth performance and efficient feed conversion with the ASA-IM formulated 32/3 extruded soybased feed. The 1.13:1 FCR indicated excellent feed conversion efficiency with the all-plant protein, soymeal based feed that was formulated to maximize soy product use. Grass carp in this demonstration exhibited lower FCR than the previous grass carp demonstration in Hefei in 2003. Grass carp remained healthy, without incidence of disease, and water quality remained good, with no water exchange required, throughout the demonstration.

The 3rd year grass carp demonstration results have further proved that pond aquaculture can be operated without any water discharge through proper management of water quality, fish stock and feeding operation.

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Chinese Currency and Production Unit Conversions:

RMB 6.5 = 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, soymeal-based feed used in the 2010 grass carp pond feeding demo in Harbin, Heilongjiang Province, China. The feed is a low energy and high fiber feed fed in extruded, floating form. The demo feed was produced in Ningbo Techbank Feed Company, Zhejiang Province.

Ingredients	Percent of total	
Soybean Meal 46%		*45.00*
Wheat Midds		*30.00*
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 demo in Harbin, Heilongjiang 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, soymeal-based feed used in the 2010 grass carp feeding demo at the Heilongjiang Provincial Fishery Technology Extension Center Demonstration Farm, China. Quantities of vitamins and minerals are per kilogram of premix. Both premixes were produced at the Chengdu Phoenix Feed Company, Sichuan Province.

Ingredient	Unit	Amount
Vitamin Premix F-2		
Vitamin A	*IU/kg*	*1,200,000*
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
Mineral Premix F-1		
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 the 3rd year grass carp produced in Harbin, Heilongjiang Province, China, in zero water exchange ponds with ASA-IM formulated 32/3 soy-based feeds. Grass carp grew from 850 g to 2,229 g in 112 days with an average feed conversion ratio of 1.58:1.

Table 4. Results of the 2010 ASA-IM aquaculture feeding demonstration in Harbin, Heilongjiang Province, China that demonstrated growth performance of grass carp in ponds using the ASA-IM 32/3 soymeal based feed fed in extruded, floating pellet form, and the ASA-IM Zero Water Discharge Technology.

Pond No.	GrC[1] stocking size (g)	Stocking rate (fish/mu)	No. days fed	Harvest wt. (g)		P_G[3] (kg/mu)		Survival (%)		FCR	Net income (RMB/mu)	ROI (%)
				GrC	SiC[2]	GrC	SiC	GrC	SiC			
1	850	150	112	2290	1750	330.2	165	96.1	94	1.50	1590.1	52.4
2	850	150	112	2233	1875	322.9	176	96.4	94	1.56	1546.5	51.0
3	850	150	112	2165	1950	310.0	187	95.5	96	1.67	1434.1	47.3
Mean	**850**	**150**	**112**	**2229**	**1858**	**321.0**	**176**	**96.0**	**94.7**	**1.58**	**1523.6**	**50.2**

[1]GrC = Grass Carp

[2]SiC = Silver Carp

[3]P_G = Gross Production