Key Words: China, grass carp, soymeal based feed, zero water discharge

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

Zhou Enhua, Zhang Jian and Michael C. Cremer

American Soybean Association-International Marketing

Room 1016, China World Tower 1

No. 1 Jianguomenwai Avenue

Beijing 100004, P.R. China

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 32/31 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.

1The 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.

ACKNOWLEGEMENTS

ASA-IM gratefully acknowledges the cooperation and support from the Heilongjiang Provincial Fishery Technology Extension Center in conducting the grass carp feeding demonstration with soymeal based feed and zero water discharge technology in Harbin, China. The ASA-IM also like to thank Ningbo Techbank Feed Company for producing all demonstration feeds; Chengdu Phoenix Aquafeed Company for producing the vitamin and mineral premix; ADM, Qinhuangdao Goldensea Foodstuff Co.,Ltd and Yihai (Fangchenggang) Soybeans Industries Co., Ltd, Yihai Group for the free contribution of SPC product and; the Novus for the free contribution of antioxidant - Solis Mos.

**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 GrC1 stocking Stocking rate No. days Harvest wt. (g) PG3 (kg/mu) Survival (%) FCR Net income ROI

No. size (g) (fish/mu) fed GrCSiC2 GrC SiC GrC SiC (RMB/mu) (%)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

1GrC = Grass Carp

2SiC = Silver Carp

3PG  = Gross Production