Key Words: Common carp, soy-based feed, LVHD cage technology, China

**LVHD Cage Culture of Grass Carp with Soy-Based Feed in the Xintian Reservoir, Chongqing**

Results of ASA-IM/China 2010 Feeding Demo 35-10-513

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**Introduction**

A feeding demonstration was jointly conducted by the American Soybean Association International Marketing (ASA-IM) program and the Wanzhou District Fishery Association, Chongqing, China, to demonstrate the production performance of grass carp in Low Volume High Density (LVHD) cages with the ASA-IM 32/31 soymeal-based growout feed. The objective of the LVHD grass carp feeding demonstration was to demonstrate the production performance of grass carp with the ASA-IM formulated 32/3 extruded soybased feed without any supplementary grass in the Xintian Reservoir, Wanzhou District, Chongqing.

**PROTOCOLS**

Three, 4-m3 LVHD cages, 2-m square x 1-m deep, were constructed and deployed in Wanzhou Xintian Reservoir, Chongqing, for the feeding demonstration. The cages were constructed of nylon netting and outfitted with opaque covers to reduce light and external motion stress. A feed enclosure approximately 1-m square in size was installed inside each cage. The feed enclosure extended sufficiently above and below the water line to contain extruded, floating feed pellets. Cage placement was in a single row, with 2-m spacing between cages to ensure adequate water exchange to each cage.

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.

Grass carp fingerlings were stocked in the three demonstration cages at a density of 175 fish per m3 (700 fish per cage). The average size of grass carp at stocking was 116 g. The grass carp fingerlings for the demonstration were produced locally in the traditional big cages.

The LVHD grass carp feeding demonstration commenced on 6 May 2010. Grass carp were fed to 90% satiation level twice daily for 160 days with the ASA-IM 32/3 soymeal based feed (Tables 1-3). The grass carp growout feed was formulated to contain approximately 20% less energy and 5% more fiber than the standard ASA-IM carp 32/6 growout feed. The grass carp feed is an all-plant protein ration that uses soybean meal and soy hulls as the primarily suppliers of protein and fiber in the diet, respectively. The energy level of the feed is kept low by maintaining fat at 3% in the diet. This lower energy level helps to reduce the cost of the feed. All feed was fed in extruded, floating pellet form. The feed was formulated by ASA-IM and manufactured by the Techbank Feed Mill in Yuyao, Zhejiang Province, China.

The demonstration cages were harvested on 13 October 2010. All fish from each of the demonstration cages were weighed to obtain data on gross and net production and feed conversion efficiency for each cage. Sub-samples of fish were obtained from each cage to determine estimated fish survival and average fish weights. Water quality data was recorded throughout the demonstration, in particular to compare water temperature and visibility in the demonstration reservoir to the same parameters observed in the Three Gorges Reservoir during earlier demonstrations. Data on production input costs was recorded to determine the economic value of the 32/3 feed. Net economic return and return on investment (ROI) were calculated after harvest from production input and fish harvest records.

**RESULTS**

Grass carp grew from 116 g to an average weight of 592 g per fish during the 160-day feeding period (Figure 1, Table 4). Grass carp biomass at harvest averaged 98 kg/m3 (392 kg/cage) for the two demonstration cages because one demonstration cage was lost in a severe storm event during the monsoon season. Average survival rate for the grass carp was 94.9%. Feed conversion ratio (FCR) for grass carp with the 32/3 soymeal based feed averaged 1.85:1 for the two demonstration cages. Harvested fish had good color and body conformation and were uniform in size.

The demonstration yielded an average net economic return to the cooperator of RMB 392 per cage at a market price of RMB 14/kg for grass carp (Table 4). Return on investment (ROI) for the two demonstration cages averaged 27%**.**

**SUMMARY AND CONCLUSIONS**

It was the first time for local farmers in the region to use extruded feed to culture grass carp without any supplementary grass. Grass carp growth in LVHD cages in the environmental conditions in Xintian Reservoir was less than is normally obtained in pond environments, but was acceptable for local market conditions. Grass carp growth, FCR and economic return were significantly better with the extruded soy-based feed than with the traditional combination of a local sinking feed and cut grass.

Average water temperature in Xintian Reservoir during the demonstration period was 5o-6oC higher than in previous demonstrations in the Three Gorges Reservoir, allowing significantly better fish growth performance than can be obtained in the Three Gorges Reservoir.

Although grass carp growth in LVHD cages in this demonstration was poorer than in earlier cage trials in southern China, the economic return obtained in this demonstration indicates there is good potential for LVHD cage culture of grass carp and other Chinese carps using high quality soy-based feed in the many hill reservoirs in this region.

There were no fish distress or disease incidences observed during the demonstration, although one demonstration cage was lost during a severe storm event. No drugs or chemicals were used in the demonstration, allowing the harvest of high quality, uncontaminated fish that met the standard for a “green” product.

**ACKNOWLEDGEMENTS**

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**Chinese Currency and Production Unit Conversions:**

RMB 6.50 = 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 LVHD grass carp feeding demo at Xintian Reservoir, Wanzhou District, Chongqing. The feed is a low energy and high fiber feed fed in extruded, floating form. The demo feed was produced by 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

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Table 2. Calculated nutritional profile of the ASA-IM 32/3, soy-based feed used in the

 2010 LVHD grass carp feeding demo at Xintian Reservoir, Chongqing, 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 LVHD grass carp feeding demo at the Xintian Reservoir, Wanzhou District, Chongqing, 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 grass carp produced in the ASA-IM LVHD cages at Xintian Reservoir, Wanzhou District, Chongqing, China. The Grass carp grew from 116 g to 592 g in 160 days with an average feed conversion ratio of 1.85:1.

Table 4. Results of the 2010 ASA-IM feeding demonstration in Xintian Reservoir, Chongqing, China, that demonstrated growth performance of grass carp in LVHD cages using the ASA-IM 32/3 soymeal based feed fed in extruded, floating pellet form.

Cage Fish stocking Stocking rate No. days Harvest wt. Production Survival FCR Net income ROI

 No. size (g) (fish/m3) fed (g)(kg/m3) (%) (RMB/cage) (%)

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 1 116 175 160 550 93.8 97.4 1.95 947.9 22

 2 116 175 160 634 102.6 92.4 1.75 1,406.6 32

Mean 116 175 160 592 98.2 94.9 1.85 1,177.3 27