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Second Year Production of Common Carp in Ponds with Extruded Soybased Feed and Zero Water Discharge Technology

Results of ASA-IM 2010 Feeding Demonstration U-35-10-511

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INTRODUCTION

The second year of a three-year cooperative pond feeding demonstration series was jointly conducted in 2010 by the American Soybean Association International Marketing (ASA-IM) program, the Shanxi Provincial Fishery Extension Center and the Datong Municipal Fishery Extension Center Demonstration Farm in Shanxi Province, China. The objective was to demonstrate the production performance of common carp in ponds with the ASA-IM 32/6¹soymeal-based growout feed and to evaluate the technical feasibility of using the same pond water for the continued operation of fish production for three years with the ASA-IM 80:20 pond production model and zero water discharge technology as a water conservation technique.

PROTOCOLS

Three, 10-mu (0.67-ha) ponds at the Datong Municipal Fishery Technology Extension Center, Shanxi Province were used for the feeding demonstration. Common carp fingerlings were produced on the farm and stocked at a density of 600 fish per mu (9,000

¹ The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 32/6 indicates 32% crude protein and 6% crude fat.

fish/ha), together with 100 silver carp per mu (1,500/ha) on April 21, 2010. Average size of the common carp and silver carp at stocking was 116 g and 361 g, respectively. All the fingerlings for the feeding demonstration were healthy, disease free and of uniform size, age and genotype at stocking.

The feeding demonstration lasted 130 days from May 9 until September 15, 2010. Common carp were fed to 90% satiation twice daily with the ASA-IM 32/6 soymeal based feed (Tables 1-3). The feed was least-cost formulated and contained dehulled soybean meal (46% crude protein) at an inclusion level of 43% of total feed ingredients by weight. All feed was fed in extruded, floating pellet form. The feed was produced by the Ningbo Techbank Feed Company in Ningbo, Zhejiang Province, China, with ASA-IM technical support.

Demonstration pond management was based on the ASA-IM 80:20 model, with common carp as the fed species (80% of target fish harvest biomass) and silver carp as the service species (20% of target fish biomass at harvest). Target average fish weight and average pond biomass at harvest for common carp were 650 g and 390 kg/mu (6.75 mt/ha), respectively.

The water source for the three demonstration ponds was water that was recycled from the three ASA-IM feeding demonstration ponds used in 2009. Water replacement in the three demonstration ponds during the course of the 2010 demonstration was restricted to replacement of seepage and evaporation water losses only. No flushing or other water discharge was conducted during the demonstration from any of the demonstration ponds. At the end of the demonstration, water from the three demonstration ponds was recycled on farm for continued use in fish culture activities next year.

The demonstration ponds were harvested on 16 September 2010. All fish from each of the three demonstration ponds were weighed to obtain data on gross and net production and feed conversion efficiency. Sub-samples of fish were obtained from each pond to determine estimated fish survival and average fish weights for common and silver carp. Data on production input costs was recorded throughout the demonstration to determine the economic value of the combination of 32/6 feed and zero water discharge technology. Net economic return and return on investment (ROI) were calculated after harvest from production input and sales records. ROI was calculated by dividing net income by total cost for each pond.

RESULTS

Common carp grew from 116 g to an average weight of 628 g per fish during the 130-day feeding period (Figure 1 and Table 4). Common carp biomass at harvest averaged 362 kg/mu (5,430 kg/ha) from the three 10-mu ponds and represented 78.7% of the total harvest biomass of 460 kg/mu (6,900 kg/ha). The average survival rates for common carp was 96%; while silver carp biomass at harvest averaged 98 kg/mu (1,470 kg/ha) and represented 21.3% of the total harvested fish biomass. The average survival rates for silver carp was 97.5 in Pond 1 and 2. The silver carp were killed by oxygen depletion

from sudden weather change in Pond 3. The feed conversion ratio (FCR) for common carp with the 32/6 soymeal based feed averaged 1.45:1 for the three demonstration ponds.

The demonstration yielded an average net economic return to the producer of RMB 622 per mu (\$1,403/ha) at market prices of RMB 10/kg (\$1.50/kg) for common carp and RMB 5/kg (\$0.75/kg) for silver carp. Return on investment (ROI) for the three demonstration ponds averaged 19%.

SUMMARY AND CONCLUSIONS

Common carp exhibited excellent growth and feed conversion efficiency using the ASA-IM soy-based 32/6 growout feed and zero water discharge technology. The common carp demonstration yielded very similar results to the 2009 demonstration in terms of growth, FCR and production performance.

The common carp grew uniformly in size and had good body color and conformation at harvest because all the fingerlings were hand selected at stocking. No disease problems were encountered during the demonstration. No drugs or chemicals were used in the demonstration, providing a healthy, “green” market product for consumers. There were no observed water quality problems or incidences of fish distress or disease. Use of the extruded soy feed and zero water discharge technology resulted in good water quality and reduced labor and energy costs for the minimal impact on the environment and sustainable aquaculture in the future. It is technically feasible to culture fish with such eco-friendly aquaculture technologies to minimize the negative impact on the environment in China.

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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 32/6 feed used in the 2010 common carp 80:20 pond feeding demonstration with zero water discharge technology in Datong, Shanxi Province, China. The 32/6 plant protein based fish feed was developed by ASA-IM, and has proven to be an outstanding growout feed for common carp and other omnivorous freshwater fish species.

Ingredient	Percent of total
<i>Soybean Meal 46%</i>	<i>43.00</i>
<i>Wheat Flour 13.2%</i>	<i>10.00</i>
<i>Wheat Midds 16%</i>	<i>31.30</i>
<i>Corn Gluten Meal 61%</i>	<i>4.00</i>
Blood Meal, Spray Dried 90	2.00
Soy Oil	1.80
Calcium Phosphate Mono – 21%P	1.92
<i>Fish Meal, Anchovy 64</i>	<i>2.50</i>
Fish Oil	1.00
Soy Lecithin	1.50
Vit PMX F-2	0.50
Min PMX F-1	0.25
DL-Methionine 99%	0.13
Choline Chloride 50%	0.03
Stay C 35%	0.03
Antioxidant	0.02
Mycotoxin Binder	0.01
Mold Inhibitor	0.01
TOTAL	100.00

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Table 2. Calculated nutritional profile of the ASA-IM 32/6, soybean meal based feed used in the 2010 common carp pond feeding demonstration in Datong, Shanxi Province, China.

Nutrient	Amount	Unit
<i>DE Fish</i>	2554.36	<i>kcal/kg</i>
<i>NFE</i>	39.25	%
<i>Starch</i>	19.89	%
<i>*Protein</i>	32.02	%
<i>Protein, dig.</i>	30.01	%
<i>Fish Protein</i>	1.61	%
<i>Soy Protein</i>	19.78	%
<i>*Fat</i>	5.99	%
<i>W 3</i>	0.64	%
<i>W 6</i>	2.39	%
<i>Fiber</i>	4.65	%
<i>*Ash</i>	6.53	%
<i>Calcium</i>	0.56	%
<i>Phos Avail</i>	0.60	%
<i>Iron</i>	516.97	%
<i>Copper</i>	33.11	%
<i>Zinc</i>	131.03	<i>ppm</i>
<i>Selenium</i>	0.87	<i>ppm</i>
<i>Moisture</i>	10.10	<i>ppm</i>
<i>Vitamin C</i>	105.00	<i>ppm</i>
<i>Choline</i>	2459.77	%
<i>Ethoxyquin</i>	134.50	<i>mg/kg</i>
<i>Arginine</i>	2.00	<i>mg/kg</i>
<i>Lysine</i>	1.85	<i>mg/kg</i>
<i>Methionine</i>	0.60	%
<i>Meth+Cyst</i>	1.06	%
<i>Threonine</i>	1.25	%
<i>Tryptophan</i>	0.38	%

Table 3. Vitamin and mineral premix formulations for the ASA-IM 32/6, soy-based feed used in the 2010 common carp feeding demonstration at Datong, Shanxi Province, China. Quantities of vitamins and minerals are per kilogram of premix. Both premixes were produced at the Phoenix Feed Mill premix plant in Chengdu, Sichuan Province.

Ingredient	Unit	Amount
<u>Vitamin Premix F-2</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 the common carp produced in Datong, Shanxi Province, China, in zero water exchange ponds with ASA-IM formulated 32/6 soy-based feeds. Common carp grew from 116 g to 628 g in 130 days with an average feed conversion ratio of 1.45:1.

Table 4. Results of the 2010 ASA-IM aquaculture feeding demonstration in Datong, Shanxi Province, China that demonstrated growth performance of common carp in ponds using the ASA-IM 32/6 soymeal based feed fed in extruded, floating pellet form, and the ASA-IM Zero Water Discharge Technology.

Pond No.	CoC ¹ stocking size (g)	Stocking rate (CoC/mu)	No. days fed	Harvest wt. (g)		P _G ³ (kg/mu)		Survival (%)		FCR	Net income (RMB/mu)	ROI (%)
				CoC	SiC ²	CoC	SiC	CoC	SiC			
1	116	600	130	635	1000	366.0	98	96	98	1.43	829.2	25
2	116	600	130	629	1000	358.8	97	95	97	1.47	752.2	23
3	116	600	130	619	866	360.5	0	97	0 ⁴	1.46	284.2	8.6
Mean	116	600	130	628	834	361.8	65	96	65	1.45	622	18.9

¹CoC = Common Carp

²SiC = Silver Carp

³P_G = Gross Production

⁴ Silver carp in pond 3 were killed due to oxygen depletion by sudden weather change.