
Feeding Trial Demonstrates Efficiency of Soy-Based, High Protein Feed for Production of 2-Kg Black Carp

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INTRODUCTION

A pond feeding trial conducted cooperatively by the American Soybean Association International Marketing (ASA-IM) program and the Shenyang Municipal Fishery Research Institute in Liaoning Province, China, demonstrated the value of a soy-based, high protein diet for producing black carp >2 kg in size. The feeding trial evaluated third year growth performance of black carp fed a soy-based, 36% crude protein feed and the resulting economic value to fish farmers in the northeastern region of China.

OPTIMAL DIET FOR BLACK CARP

An ASA-IM black carp pond feeding trial conducted in 2006 in Shenyang, Liaoning Province, demonstrated the technical and economic value of the ASA-IM 36/7 soy-based feed for growing black carp from fingerling to sub-market size, two-year old fish. The trial yielded 693-g black carp from 51 g fingerlings in 131 days with an average FCR of 1.32:1 with the 36/7 soy-based feed.

A follow-on trial was conducted in 2007 to determine third year black carp growth efficiency with the 36/7 soy-based diet from 600-g sub-market size to \geq 2-kg market size. The trial was conducted between May and August 2007 in ponds at the Shenyang Municipal Fishery Research Institute Experimental Fish Farm in Shenyang, Liaoning Province, China.

2007 FEEDING TRIAL PROTOCOLS AND RESULTS

Black carp were stocked in three, 2.4-mu (0.16 ha) ponds at the Shenyang Municipal Fishery Research Institute Experimental Fish Farm at a density of 220 fish per mu (3,300/ha), together with 100 silver carp fingerlings per mu (1,500/ha). Average size of the black carp at stocking was 600 g. Average size of the silver carp at stocking was 400 g. Black carp were stocked in the three trial ponds on 28 April 2007. Feeding commenced on 8 May 2007 and continued for 113 days through 28 August 2007. Black

carp were fed to satiation twice daily during this period with the ASA-IM least-cost formulated 36/7 fingerling feed (Tables 1, 2 and 3). All feed was fed in extruded, floating pellet form. The feed was manufactured by the Ningbo Techbank Feed Mill in China. Pond management was based on the ASA-IM 80:20 model. The target harvest weight for black carp was ≥ 2.0 kg.

The trial ponds were harvested on 29 August 2007. All fish from each of the three test ponds were weighed to obtain data on gross and net production and feed conversion efficiency. Sub-samples of fish were obtained in each pond to determine estimated fish survival and average fish weights for black and silver carp. Data on production input costs was recorded throughout the trial to determine the economic value of the 36/7 feed. 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.

Black carp grew from 600 g to an average weight of 2,240 g per fish during the 113-day trial period (Table 4). Black carp biomass at harvest averaged 482.3 kg/mu (7,234.5 kg/ha) and represented 81% of the total harvest biomass of 594 kg/mu (8,910 kg/ha). Silver carp biomass at harvest averaged 111.7 kg/mu (1,675.5 kg/ha) and represented 19% of the total harvested fish biomass. The average survival rates for black carp and silver carp were 97.9% and 100%, respectively. The feed conversion ratio (FCR) for black carp with the soy-based 36/7 feed averaged 1.39:1 for the three trial ponds.

The low FCR and rapid fish growth on the soy-based 36/7 feed yielded an average net economic return to the producer of RMB 1,319 per mu (\$2,638/ha) at market prices of RMB 9.0/kg (\$1.20/kg) for black carp and RMB 3.0/kg (\$0.40/kg) for silver carp. Return on investment (ROI) for the three demonstration ponds averaged 39.3%.

SUMMARY AND CONCLUSIONS

Results from the feeding trial indicate the 36/7 feed is an excellent feed for third year black carp production to a market size of ≥ 2 kg. Third year black carp exhibited rapid growth with the soy-based feed, reaching 2.24 kg in less than four months from an initial size of 600 g. Good feed conversion efficiency was maintained throughout the trial, with the FCR averaging 1.39:1 over the 113-day feeding period. Net economic return and ROI were both higher than for most other crops in the area.

No drugs or chemicals were used in the ASA-IM black carp trial, allowing the harvest of high quality, uncontaminated fish that met the standard for a “green” product. Pond water quality remained good throughout the 2007 trial, with no observed incidences of water quality deterioration or fish disease. Harvested fish had good color and body conformation.

Through a series of ASA-IM supported trials conducted over the past three years, the soy-based 36/7 feed has been proven to be a superior growout feed for black carp at all life stages, including first year fingerling, second year sub-market, and third year market

growout to >2 kg. Fish farmers are recommended to use the ASA-IM soy-based 36/7 feed for sustainable and economically viable feed-based production of black carp in the northeastern region of China.

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Table 1. Formula for the least-cost formulated ASA-IM 36/7 feed used in the 2007 black carp 80:20 pond feeding trial in Shenyang, Liaoning Province, China. The 36/7 feed is a high protein feed typically used for fingerling production, but which has also proved to be a superior growout feed for second and third year black carp production in ponds.

Ingredient	Percent of total
Soybean Meal 46%	42.00
Wheat Flour 11.7%	20.90
Fish Meal, Anchovy 65/7.5	13.50
DDGS 24/12	10.00
Corn Gluten Meal 60%	5.00
Soy Lecithin/Corn Blend	3.00
Fish Oil, Imported	2.60
Ca Phosphate Mono 21%	1.60
Soy Oil	0.50
Vit PMX F-2	0.50
Min PMX F-1	0.25
Mold Inhibitor	0.10
Stay C 35%	0.03
Ethoxyquin, SQ mixture 6	0.02
TOTAL	100.00

Table 2. Calculated nutritional profile of the ASA-IM 36/7, soy-based feed used in the 2007 third year black carp pond feeding trial in Shenyang, Liaoning Province, China.

Nutrient	Value, As Fed
DE Fish (extruded)	2828
NFE	34.78
Starch	18.05
Protein, crude	36.08
Protein, digestible	33.29
DE:DP ratio	8.5:1
Fish Protein	8.78
Soy Protein	19.32
Fat	7.12
W-3 (omega 3 fatty acid)	1.01
W-6 (omega 6 fatty acid)	1.62
Fiber	3.49
Ash	6.99
Calcium	0.93
Phosphorus, available	0.70
Choline	2472
Vitamin C	105.00
Ethoxyquin	147.50
Arginine	2.18
Lysine	2.11
Methionine	0.69
Methionine + Cystine	1.20
Threonine	1.43
Tryptophan	0.40

Table 3. Vitamin and mineral premix formulations for the ASA-IM 36/7, soy-based feed used in the 2007 black carp feeding trial. 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>		
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
<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

Table 4. Results of the 2007 ASA-IM aquaculture trial in Shenyang that demonstrated third year growth performance of black carp in ponds using the ASA-IM 36/7 soy-based feed fed in extruded, floating pellet form.

Pond No.	BkC 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 (%)
				BkC	SiC ²	BkC	SiC	BkC	SiC			
1	600	220	113	2290	1250	490	125	97.3	100	1.36	1428	42.5
2	600	220	113	2242	1100	482	110	97.7	100	1.39	1311	39.0
3	600	220	113	2189	1000	475	100	98.6	100	1.42	1218	36.3
Mean	600	220	113	2240	1117	482	118	97.9	100	1.39	1319	39.3

¹BkC = Black Carp

²SiC = Silver Carp

³P_G = Gross Production