
Comparison of Channel Catfish Production in 4-m³ LVHD Cages with an ASA-IM Soy-Based Feed and a Local Chinese Feed

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INTRODUCTION

A feeding trial was jointly conducted by the American Soybean Association International Marketing (ASA-IM) program and the Jiangxi Provincial Fishery Extension Center to demonstrate channel catfish production in 4-m³ cages with an ASA-IM soy-based feed and the ASA-IM Low Volume High Density (LVHD) cage technology. The feeding trial was conducted at the Wanan County Fishery Bureau cage fish farm in Wanan Reservoir, Jiangxi Province, China. The Wanan County Fishery Bureau independently compared catfish production in the 4-m³ LVHD cages using the ASA-IM feed and a locally produced Chinese fish feed.

FEEDING TRIAL PROTOCOLS

Three, 4-m³ LVHD cages were used in the feeding trial to demonstrate the productivity and economic return of channel catfish cage culture using the ASA-IM LVHD cage technology and soy-based feed. Locally produced channel catfish fingerlings were stocked in the three LVHD cages at a density of 200 fish per m³ of cage volume, or 800 fish per cage. The average stocking size of catfish was 94 g.

Channel catfish were stocked in the three trial cages on 26 April 2007 and fed for 179 days with the ASA-IM 32/6 growout feed¹ (Tables 1-3). The ASA-IM 32/6 feed is an all or primarily plant protein feed that derives the majority of protein from soybean meal. Fish in the three cages were fed to satiation twice daily using the ASA-IM 90% satiation techniques. Fish in the three ASA-IM feed cages received the same amount of feed at each feeding. All feed was fed in extruded, floating pellet form.

¹The 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.

The local fishery bureau stocked catfish in three adjoining 4-m³ LVHD cages to compare production using a locally produced and lower cost fish feed. Average fish size at stocking in these cages was 98 g. Catfish in these three LVHD cages were fed a locally produced feed having a similar protein profile to the ASA-IM 32/6 feed. Catfish were fed the local feed twice daily, following the same protocols and receiving the same quantity of feed as the fish receiving the ASA-IM feed.

The target harvest size for channel catfish from all cages was 750 g per fish, representing a fish biomass at harvest of 150 kg/m³ of cage volume, or 600 kg per cage.

The trial was conducted over a 6-month period. Data on fish survival, gross and net production, average fish weight, and feed conversion efficiency were obtained at harvest for all cages. All fish from each cage were counted and weighed at harvest to obtain this data. Data on production input costs was recorded throughout the trial to determine the economic return of the ASA-IM and local feeds.

FEEDING TRIAL RESULTS

Channel catfish fed the ASA-IM 32/6 soy-based feed performed significantly better ($P < 0.05$) than catfish fed the local feed in fish growth, feed conversion efficiency, survival and economic return. Channel catfish fed the ASA-IM 32/6 feed grew from 94 g to an average weight of 919 g in 179 days of feeding (Table 4). Catfish in each of the three ASA-IM cages were fed a total of 779 kg of feed, which yielded an average of 576 kg of net fish growth per cage and an average FCR of 1.35:1. Catfish survival averaged 88.6% for the three trial cages. Catfish production with the 32/6 feed and LVHD technology yielded a net profit of RMB 1,912 per cage and a return on investment (ROI) of 41.5%.

In comparison, channel catfish fed the local feed grew from 98 g to an average weight of 823 g in 179 days of feeding (Table 4). Catfish were fed a total of 779 kg of local feed per cage, which yielded an average of 416 kg of net fish growth per cage and an average FCR of 1.90:1. Catfish survival in the local feed cages averaged 75.2%. Net profit with the local feed averaged RMB 851 per cage and yielded a ROI of 20.8%.

SUMMARY AND CONCLUSIONS

Channel catfish grew significantly larger and more efficiently on the ASA-IM 32/6 soy-based feed than the local feed in this comparison trial. Channel catfish fed the ASA-IM 32/6 soy-based feed exhibited 12% better growth, 32% higher production per cage, 18% better survival, and 40% lower FCR than catfish fed the local feed. Economic return with the ASA-IM 32/6 feed was more than twice the economic return as catfish fed the local feed, even though the cost of the ASA-IM feed (RMB 4.45/kg) was 17% higher than the local feed (RMB 3.80/kg).

Catfish survival in both feed treatments was substantially lower than is typically expected with catfish in LVHD cages. The low fish survival was attributed by the cooperator to a

period of high water turbidity that lasted for approximately 45 days and which impacted fish in the local feed cages more than fish in the ASA-IM cages.

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Table 1. Formula for the ASA-IM 32/6, soy-based feed used in the 2007 channel catfish LVHD cage trial in Wanan Reservoir, Jiangxi Province, China. The feed was produced by Ningbo Techbank Feed Mill using a least-cost formula provided by ASA-IM. The feed was produced in extruded, floating pellet form. Feed batch formulations may have varied slightly during the trial period depending on specific ingredient nutrient profiles and ingredient availability.

Ingredient	Percent of total
Soybean Meal 46%	50.00
Wheat Flour 11.7%	20.40
DDGS 24/12	16.00
Fish Meal, local 61/7	3.30
Soy Lecithin/Corn Blend	3.00
Corn Gluten Meal 60%	2.50
Ca Phosphate Mono 21%	1.79
Fish Oil (local)	1.10
Soy Oil	1.00
Vit PMX F-2	0.50
Min PMX F-1	0.25
Mold Inhibitor	0.10
Stay C 35%	0.03
Ethoxyquin, liquid 60	0.02
Choline Chloride 50%	0.01
TOTAL	100.00

Table 2. Calculated nutritional profile of the ASA-IM 32/6, soy-based feed used in the 2007 channel catfish LVHD cage trial in Wanan Reservoir, Jiangxi Province, China. The feed was produced in extruded, floating pellet form.

Nutrient	Value, As Fed
DE Fish (extruded)	2590
NFE	38.68
Starch	17.75
Protein, crude	32.88
Protein, digestible	29.82
DE:DP Ratio	8.7:1
Fish Protein	2.01
Soy Protein	23.00
Fat	6.08
W-3 (omega 3 fatty acid)	0.52
W-6 (omega 6 fatty acid)	2.12
Fiber	4.26
Ash	6.33
Calcium	0.64
Phosphorus, available	0.60
Choline	2511
Vitamin C	105
Ethoxyquin	134.5
Arginine	2.05
Lysine	1.84
Methionine	0.51
Methionine + Cystine	1.01
Threonine	1.28
Tryptophan	0.37

Table 3. Vitamin and mineral premix formulations used in the ASA-IM 32/6 soy-based feed. Quantities of vitamins and minerals are per kilogram of premix. Premixes were produced by the Phoenix Feed Mill premix plant in Chengdu, Sichuan Province, under supervision of ASA-IM.

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 Wanan Reservoir, Jiangxi Province, that compared fingerling to market growth performance of channel catfish in 4-m³ LVHD cages when fed either the ASA-IM 32/6 soy-based feed (cages 1, 2 and 3) or a local feed (cages 4, 5 and 6).

Cage No.	Cage size	Stocking size (g)	Stocking rate (fish/m ³)	No. days fed	Harvest wt (g/fish)	P _G ¹ (kg/cage)	Survival (%)	FCR	Net income (RMB/cage) ²	ROI (%)
1	4-m ³	94	200	179	916	670.7	91.5	1.30	2,104	45.7
2	4-m ³	94	200	179	938	621.0	82.8	1.42	1,607	34.9
3	4-m ³	<u>94</u>	<u>200</u>	<u>179</u>	<u>904</u>	<u>662.6</u>	<u>91.6</u>	<u>1.32</u>	<u>2,023</u>	<u>44.0</u>
Mean (ASA-IM 32/6)		94	200	179	919	651.4	88.6	1.35	1,912	41.5
4	4-m ³	96	200	179	815	472.2	73.4	1.97	626	15.3
5	4-m ³	96	200	179	843	446.8	66.3	2.11	372	9.1
6	4-m ³	<u>103</u>	<u>200</u>	<u>179</u>	<u>812</u>	<u>565.0</u>	<u>87.0</u>	<u>1.61</u>	<u>1,554</u>	<u>37.9</u>
Mean (local feed)		98	200	179	823	494.7	75.2	1.90	851	20.8

¹P_G = Gross Production

²RMB exchange rate: RMB 7.5 = \$1.00