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## **Channel Catfish Production in 4-m<sup>3</sup> LVHD Cages with a Soy-Based Feed, Jiangxi Province, China**

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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 compare channel catfish production in Low Volume High Density (LVHD) cages with an ASA-IM soy-based feed versus production with a locally manufactured feed. The feeding trial was conducted at the Wanan County Fishery Bureau cage fish farm in Wanan Reservoir, Jiangxi Province, China.

### **FEEDING TRIAL PROTOCOLS**

Six, 4-m<sup>3</sup> LVHD cages were used in the feeding trial to demonstrate the productivity and economic return of channel catfish cage culture using the ASA-IM cage technology. Locally produced channel catfish fingerlings were stocked in the six LVHD cages at a density of 225 fish per m<sup>3</sup> of cage volume, or 900 fish per cage. Mean weight of the catfish in all cages at stocking was 55 g. Catfish were stocked in the trial cages on 30 April 2006 and fed for 176 days. The target harvest size for channel catfish was 750 g per fish, representing a fish biomass at harvest of 150 kg/m<sup>3</sup> of cage volume, or 600 kg per cage.

Catfish in three of the trial cages were fed the ASA-IM 32/6 growout feed (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<sup>1</sup>. Fish in the three cages were fed to satiation twice daily, with the fish in all cages receiving the same amount of feed at each feeding. All feed was fed in extruded, floating pellet form.

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<sup>1</sup>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.

Catfish in the other three LVHD cages were fed a locally produced feed having the same 32% crude protein level as the ASA-IM feed. Fish were fed the local feed twice daily, following the same protocols as the cages receiving the ASA-IM feed.

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 better than catfish fed the local 32% protein feed, in terms of fish growth, feed conversion efficiency and economic return. Channel catfish fed the ASA-IM 32/6 feed grew from 55 g to an average weight of 737 g in 176 days of feeding (Table 4). Catfish in each of the three ASA-IM cages were fed a total of 741.2 kg of feed, which yielded an average of 504 kg of net fish growth per cage with an average FCR of 1.47:1. In comparison, the channel catfish fed the local feed grew to 691 g with an FCR of 1.61:1. Fish growth on the local feed was 6.8% less than on the ASA-IM feed, and FCR with the local feed was 9.5% higher than FCR with the ASA-IM feed.

Catfish production in the ASA-IM cages averaged 553.2 kg per cage (138.3 kg/m<sup>3</sup> of cage volume), and was 9% higher than catfish production with the local feed. Catfish survival averaged 83.5% in the ASA-IM cages and 81.3% in the local feed cages (Table 4). Fish health and survival were compromised during a period of high water turbidity from March to June. Catfish became diseased during this high turbidity period and approximately 15% of the ASA-IM cage fish and 18% of the local feed cage fish died.

Net economic return for the ASA-IM cages averaged RMB 2,172 (\$275) per cage, and yielded a return on investment (ROI) of 58.8%. Net economic return was 34% higher, and ROI 15.8% higher, with the ASA-IM feed than with the local feed (Table 4).

## **SUMMARY AND CONCLUSIONS**

Channel catfish grew rapidly and efficiently on the ASA-IM 32/6 soy-based feed. Average channel catfish growth in the 4-m<sup>3</sup> LVHD cages was 3.88 g per day for the 176-day trial period, and the ASA-IM feed yielded an acceptable FCR of 1.5:1. Better fish growth, lower FCR and higher economic return indicated the soy-based ASA-IM feed was superior to the local feed with the same 32% crude protein level.

## **ACKNOWLEDGEMENTS**

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Table 1. Formula for the ASA-IM 32/6 soy-based feed used in the 2006 channel catfish LVHD cage feeding trial in Wanan Reservoir, Jiangxi Province, China. The feed was fed in extruded, floating pellet form. The feed was produced as a least-cost formulation by Techbank Feed Mill, Shanghai, under supervision of ASA-IM. Individual batches of feed produced over the trial duration may have varied in ingredient composition due to differences in specific ingredient nutrient profiles and ingredient availability.

Ingredient	Percent of total
Soybean Meal 46%	51.00
Wheat Middlings 14%	14.00
Wheat Flour 11%	12.00
DDGS, 27/10	11.50
Fish Meal, 65/8	3.00
Ca Phosphate Mono 21%	2.00
Soy Oil	1.50
Soy Lecithin	1.50
Corn Gluten Meal 60%	1.50
Fish Oil	1.20
Vit PMX F-2	0.50
Min PMX F-1	0.25
Stay C – 35%	0.03
Ethoxyquin, SQ mixture 6	0.02
TOTAL	100.00

Table 2. Calculated nutritional profile of the ASA-IM 32/6 soy-based feed used in the 2006 tilapia LVHD cage feeding trial in Wanan Reservoir, Jiangxi Province, China. The feed was produced in extruded, floating pellet form.

Nutrient	Value, As Fed
DE Fish (extruded)	2369.68
NFE	39.83
Starch	17.89
Protein, crude	32.74
Protein, digestible	29.82
Fish Protein	1.95
Soy Protein	23.46
Fat	6.07
W-3 (omega 3 fatty acid)	0.57
W-6 (omega 6 fatty acid)	2.08
Ash	6.06
Calcium	0.60
Phosphorus, available	0.61
Choline	2469.93
Vitamin C	105.00
Ethoxyquin	134.50
Arginine	2.06
Isoleucine	1.63
Lysine	1.85
Methionine	0.50
Methionine + Cystine	1.00

Table 3. Vitamin and mineral premix formulations included in the ASA-IM 32/6 soy-based feed used in the 2006 tilapia LVHD cage feeding trial in Wanan Reservoir, Jiangxi Province, China. Quantities of vitamins and minerals are per kilogram of premix.

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 2006 ASA-IM aquaculture trial in Wanan Reservoir, Jiangxi Province that compared fingerling to market growth performance of channel catfish in 4-m<sup>3</sup> LVHD cages when fed either the ASA-IM 32/6 soy-based feed or a local feed containing 32% crude protein.

Cage No.	Cage size	Stocking size (g)	Stocking rate (fish/m <sup>3</sup> )	No. days fed	Harvest wt (g/fish)	P <sub>G</sub> <sup>1</sup> (kg/m <sup>3</sup> )	Survival (%)	FCR feed only	Net income (RMB/m <sup>3</sup> ) <sup>2</sup>	ROI (%)
1	4-m <sup>3</sup>	55	225	176	722	137.7	84.8	1.48	537	58.2
2	4-m <sup>3</sup>	55	225	176	740	136.1	81.8	1.50	520	56.3
3	4-m <sup>3</sup>	<u>55</u>	<u>225</u>	<u>176</u>	<u>748</u>	<u>141.0</u>	<u>83.8</u>	<u>1.44</u>	<u>572</u>	<u>62.0</u>
Mean		55	225	176	737	138.3	83.5	1.47	543	58.8
4	4-m <sup>3</sup>	55	225	176	672	122.7	81.2	1.67	360	38.2
5	4-m <sup>3</sup>	55	225	176	700	127.7	81.0	1.60	412	43.8
6	4-m <sup>3</sup>	<u>55</u>	<u>225</u>	<u>176</u>	<u>702</u>	<u>130.5</u>	<u>81.6</u>	<u>1.57</u>	<u>441</u>	<u>46.9</u>
Mean		55	225	176	691	127.0	81.3	1.61	405	43.0

<sup>1</sup>P<sub>G</sub> = Gross Production

<sup>2</sup>RMB exchange rate: RMB 7.9 = \$1.00