Key Words: Channel catfish, soybean meal, 80:20 pond technology, China

Channel Catfish Exhibit Rapid Growth on Soy-Based Feed in Nanjing Pond Feeding Trial

Michael C. Cremer, Zhou Enhua and Zhang Jian
ASA-IM/China Aquaculture Program

INTRODUCTION

A feeding trial was conducted cooperatively by the American Soybean Association International Marketing (ASA-IM) program and the Nanjing Municipal Fishery Extension Center to demonstrate feed-based production of channel catfish using the ASA-IM 80:20 pond technology and soy-based feed. The demonstration trial was conducted at the Extension Center fish farm near Nanjing, Jiangsu Province.

FEEDING TRIAL PROTOCOLS

Three, 2.5-mu (0.17-ha) ponds were used in the feeding trial to demonstrate feed-based production of channel catfish. Channel catfish were stocked in the trial ponds at a density of 700 fish per mu (10,500/ha), together with 100 silver carp per mu (1,500/ha). Mean weights of the channel catfish and silver carp at stocking were 175 g and 150 g, respectively. Fish were stocked in the ponds on 23 May 2006, and fed for 95 days with the ASA-IM 32/6[1] feed. The ASA-IM feed is a least-cost formulated, all or primarily plant protein ration that has soybean meal as the primary source of protein. Channel catfish were fed the 32/6 feed to satiation twice daily, with fish in the three trial ponds receiving the same amount of feed at each feeding. All feed was fed in extruded, floating pellet form. Target market size for the channel catfish was 600 g per fish.

Data on fish survival, gross and net production, average fish weight, and feed conversion efficiency were obtained at harvest for fish in each pond. All fish from each pond were weighed at harvest and sub-samples from each pond counted to get the average fish

[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.

weight for each species in each pond population. Data on production input costs was recorded throughout the trial to determine the economic return with the ASA-IM feed and technology.

FEEDING TRIAL RESULTS

Channel grew from 175 g to an average weight of 757 g per fish in 95 days of feeding (Table 4). Fish production at harvest averaged 530 kg/mu (7,950 kg/ha) for channel catfish and 78 kg/mu (1,170 kg/ha) for silver carp. Channel catfish and silver carp represented 87% and 13%, respectively, of the total harvested fish biomass of 608 kg/mu (9,120 kg/ha). Average weight of silver carp from the three trial ponds at harvest was 780 g. The average survival rate for both channel catfish and silver carp was 100%.

Channel catfish were fed a total of 399 kg of feed per mu (5,988 kg/ha) over the 95-day trial. The feed yielded net catfish growth of 407 kg per mu (6,100 kg/ha) at an average feed conversion ratio (FCR) with the soy-based 32/6 feed of 0.99:1 for the three trial ponds.

The trial yielded an average net economic return of RMB 1,538 per mu ($2,920/ha) at market prices of RMB 12/kg ($1.52/kg) for channel catfish and RMB 4.4/kg ($0.557/kg) for silver carp (Table 4). Return on investment (ROI) for the three demonstration ponds averaged 29.5%**.**

SUMMARY AND CONCLUSIONS

Channel catfish grew rapidly on the soy-based feed and exceeded the target market size of 600 g by 26% in just 95 days of feeding. The low FCR of 0.99:1 was better than normal and indicated excellent feed utilization efficiency. However, average channel catfish production of 530 kg/mu (7,950 kg/ha) exceeded the target harvest biomass of 420 kg/mu (6,300 kg/ha) by 26% and was deemed to be potentially excessive for sustainable production. ASA-IM recommends earlier harvesting of fish in the future, particularly if the FCR is >1.0:1, to prevent environmental degradation of the ponds and surrounding area that receive the pond water discharge.

No drugs or chemicals were used in the trial. As a result, the ASA-IM soy-based feed produced a quality “green” product of good body conformation and taste. The cooperator reported the results from this trial were the best results ever obtained at their facility. The cooperator also reported that the quality of trial feed was very good and generated high economic return.

ACKNOWLEDGEMENTS

ASA-IM gratefully acknowledges the participation and cooperation of the Nanjing Municipal Fishery Extension Center and the Jiangsu Provincial Fishery Extension Center. Both organizations contributed staff, pond facilities and/or financial support to conduct the channel catfish feeding trial detailed in this report.

Table 1. Formula for the ASA-IM 32/6 soy-based feed used in the 2006 channel catfish pond feeding trial in Nanjing, Jiangsu Province, China. The feed was produced as a least-cost formulation by Techbank Feed Mill, Shanghai, under supervision of ASA-IM. The feed was fed in extruded, floating pellet form. Feed batch formulations varied slightly during the trial period depending on 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 channel catfish pond feeding trial in Nanjing, Jiangsu 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 used in the ASA-IM 32/6 soy-based feed. Quantities of vitamins and minerals are per kilogram of premix.

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

Table 4. Results of the 2006 ASA-IM aquaculture trial in Nanjing that demonstrated growth performance of channel catfish in ponds using the ASA 80:20 production model and a 32/6 soy-based feed fed in extruded, floating pellet form.

Pond No.	ChC[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)[4]	ROI (%)
				ChC	SiC[2]	ChC	SiC	ChC	SiC			
1	175	700	95	723	780	506.1	78	100	100	1.05	1,253	24.0
2	175	700	95	814	820	570.1	82	100	100	0.89	2,038	39.0
3	175	700	95	733	740	513.4	74	100	100	1.02	1,323	25.6
Mean	175	700	95	757	780	529.9	78	100	100	0.99	1,538	29.5

[1]CoC = Channel catfish

[2]SiC = Silver Carp

[3]P_G = Gross Production

[4]RMB exchange rate: RMB 7.9 = $1.00