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Feed Based Production of Snakehead Fingerlings

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INTRODUCTION

A demonstration feeding trial was conducted cooperatively by the American Soybean Association International Marketing (ASA-IM) program and the Nanjing Municipal Fishery Extension Center at Nanjing, Jiangsu Province, China, with a native snakehead species *Ophiocephalus argus*. The trial was conducted to demonstrate to fish farmers in the region that high quality extruded feed could replace fresh fish for the production of snakehead fingerlings in ponds.

FEEDING TRIAL PROTOCOLS

The snakehead fingerling feeding trial was conducted in three, 2.0-mu (0.13-ha) at the demonstration fish farm of the Nanjing Municipal fishery Extension Center. The ponds were concrete sided with earthen bottoms, and had an average depth of 1.5 m. Fish were approximately 7-g snakehead purchased from Shandong Province. Snakehead were stocked in the three trial ponds at an average density of 20,053 fish per mu (300,800 fish/ha) on 29 July 2008. Target harvest size for the snakehead fingerlings was 50 g.

The snakehead were fed the ASA-IM 47/15¹ marine fish fingerling feed in extruded, floating pellet form from the time of stocking until harvest (Tables 1, 2 and 3). Feed pellet size was increased appropriately as the fish grew, with pellet size maintained at approximately one-half the full open mouth size of the fish. Snakehead were fed to satiation twice daily using the ASA-IM 90% satiation technique, with fish in the three trial ponds receiving the same amount of feed at each feeding. The feed was least-cost formulated by ASA-IM, and produced for ASA-IM by the Nanning Baiyang Aquafeed Company, Guangxi Province.

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

¹The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 47/15 indicates 47% crude protein and 15% crude fat.

weighed at harvest and sub-samples from each pond counted to get the average fish 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

Snakehead grew from 7 g to an average weight of 190 g per fish during 105 days of feeding between 4 August and 10 November 2008 (Table 4). Snakehead production at harvest averaged 2,847 kg/mu (42,705 kg/ha). The average survival rate for snakehead in the three trial ponds was 74.7%. The average feed conversion ratio (FCR) for snakehead with the ASA-IM 47/15 feed was 0.77:1.

The trial yielded an average net economic return of RMB 5,270 per mu (\$11,800/ha) at a market value of RMB 15/kg (\$2.24/kg) for snakehead (Table 4). Return on investment (ROI) for the three trial ponds averaged 13.9%. Feed cost for the 47/15 feed was RMB 10.7/kg (\$1.59/kg) and represented 60% of the total production cost for the trial.

SUMMARY AND CONCLUSIONS

The ASA-IM 47/15 marine fingerling feed yielded rapid growth and low FCR with snakehead *Ophiocephalus argus* in this trial. Snakehead growth to 190 g was nearly four times the target size of 50 g in 105 days. However, because the fish grew larger and faster than anticipated, the fish biomass in the ponds at harvest significantly exceeded the sustainable carrying capacity of the ponds. The sustainable carrying capacity of the ponds was estimated to be 780 kg per mu (11,700 kg/ha) based on the 0.77:1 FCR obtained in the trial. The harvest biomass of 2,847 kg/mu (42,705 kg/ha) was nearly four times the calculated sustainable carrying capacity. It is estimated that the production of 2,847 kg/mu of fish biomass yielded 1,320 kg/mu of feed waste, of which at least 800 kg/mu could not be assimilated and will require removal and disposal.

In addition to the environmental pollution and waste disposal problems related to the high snakehead biomass, production at this level incurred a high risk. Production cost averaged RMB 38,100 per mu (\$85,300/ha). Any significant fish loss would have resulted in a corresponding high economic loss.

It is recommended that snakehead fingerling producers stocking ponds at 20,000 fish/mu (300,000/ha) harvest the snakehead at ≤ 50 g, then redistribute the fish to other ponds at a lower and more sustainable stocking density. If snakehead in this trial had been harvested at 50 g and redistributed to other ponds, fish biomass at the initial stocking density would not have exceeded a sustainable 750 kg/mu (11,250 kg/ha), and the adverse impact on the pond environment would have been eliminated. In addition, the economic risk would have been greatly reduced. This strategy is recommended to fish farmers for long-term, sustainable production of snakehead.

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Table 1. Formula for the ASA-IM 47/15 marine fish fingerling feed fed to snakehead in the 2008 feeding trial conducted in Nanjing, Jiangsu Province, China. The feed was produced as a least-cost formulation by Nanning Baiyang Aquafeed Company, Guangxi Province, under supervision of ASA-IM. The feed was produced in extruded, floating pellet form.

Ingredient	Percent of total
Fish Meal, Anchovy 65%	50.00
Wheat	11.00
Fish Oil	10.10
Soybean Meal 46%	7.50
Corn Gluten Meal 60%	7.00
Blood Meal spr 85%	6.50
Cassava Meal 2.3%	5.00
Soy Lecithin/Corn Blend	2.00
Vit PMX F-2	0.50
Min PMX F-1	0.25
Choline Chloride 50%	0.05
Mold Inhibitor	0.05
Stay C – 35%	0.03
Ethoxyquin	0.02
TOTAL	100.00

Table 2. Calculated nutritional profile of the ASA-IM 47/15 marine fish fingerling feed used in the 2008 snakehead pond feeding trial in Nanjing, Guangxi Province, China. The feed was produced in extruded, floating pellet form.

Nutrient	Value, As Fed
DE Fish (extruded)	3,814
NFE	16.85
Starch	11.85
Protein, crude	47.04
Protein, digestible	44.61
DE:DP Ratio	8.55:1
Fish Protein	32.50
Soy Protein	3.45
Fat	15.06
W-3 (omega 3 fatty acid)	3.40
W-6 (omega 6 fatty acid)	0.82
Fiber	1.55
Ash	9.66
Calcium	2.08
Phosphorus, available	0.96
Choline	2,673
Vitamin C	105
Ethoxyquin	192.50
Arginine	2.58
Lysine	3.34
Methionine	1.24
Methionine + Cystine	1.74
Threonine	1.95
Tryptophan	0.52

Table 3. Vitamin and mineral premix formulations used in the ASA-IM 47/15 marine fish feed used in the 2008 snakehead fingerling feeding trial in Nanjing, Jiangsu Province. 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 2008 ASA-IM aquaculture trial in Nanjing, Jiangsu Province that evaluated growth performance of snakehead *Ophiocephalus argus* in ponds using the ASA-IM 47/15 marine fish feed fed in extruded, floating pellet form.

Pond No.	SkH ¹ stocking size (g)	Stocking rate (fish/mu)	Stocking rate (fish/ha)	No. days fed	Harvest wt. (g)	P _G ² (kg/mu) (kg/ha)		Survival (%)	FCR	Net income (RMB/mu) ³	ROI (%)
1	6.85	20,075	301,125	105	190.6	2,844	42,660	74.3	0.76	5,024	13.2
2	6.85	20,075	301,125	105	179.7	2,702	40,530	74.9	0.81	3,791	10.2
3	8.65	20,010	300,150	105	200.0	2,994	44,910	74.8	0.73	6,996	18.2
Mean	7.45	20,053	300,800	105	190.1	2,847	42,705	74.7	0.77	5,270	13.9

¹SkH = Snakehead

²P_G = Gross Production

³RMB exchange rate: RMB 607 = \$1.00