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Feeding Trials Evaluate Feed-based Production of Bighead Carp

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INTRODUCTION

Two feeding trials were conducted cooperatively by the American Soybean Association International Marketing (ASA-IM) program and the Anhui Provincial Fishery Extension Center to evaluate feed-based production of bighead carp in ponds. The trials were conducted at the Changling Fish Farm in Feidong District, near Hefei, Anhui Province.

FEEDING TRIAL PROTOCOLS

Two feeding trials were conducted with bighead carp serving as the fed species in the ASA-IM 80:20 pond model. In the first trial, three, 5-mu (0.33-ha) ponds were used to evaluate feed-based production of bighead carp from sub-market to market stages. Bighead carp were stocked in the three trial ponds at a density of 220 fish per mu (3,300/ha), together with 80 silver carp per mu (1,200/ha). Mean weights of the bighead and silver carps at stocking were 385 g and 100 g, respectively (Table 6). Bighead carp were stocked in the ponds on 3 March 2006. Feeding was begun on 1 May 2006 using the ASA-IM 32/6[1] feed. The ASA-IM 32/6 feed is a least-cost formulated, all or primarily plant protein ration that has soybean meal as the primary source of protein (Tables 1-2, 5). Bighead carp 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 bighead carp was 1,500 g per 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.

The second trial evaluated feed-based production of bighead carp fingerlings. Bighead carp were stocked in three, 5-mu (0.33-ha) trial ponds at a density of 1,000 fish per mu (15,000/ha), together with 100 silver carp per mu (1,500/ha). Mean weight of the bighead and silver carp at stocking was 17 g for each species (Table 6). Bighead carp were stocked in the ponds on 6 August 2006. Feeding was begun on 16 August 2006 using the ASA-IM 36/7 feed. The ASA-IM 36/7 feed is a least-cost formulated, primarily plant protein ration that has soybean meal as the primary source of protein (Tables 3-5). Bighead carp were fed the 36/7 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.

FEEDING TRIAL RESULTS

Bighead carp in the market growout trial grew from 385 g to an average weight of 918 g per fish during 150 days of feeding (Table 6). There was significant variation in bighead carp size at harvest, from fish that had hardly grown to very large fish. Silver carp grew from 80 g to an average weight of 893 g. Fish production averaged 201.2 kg/mu (3,018 kg/ha) for bighead carp and 70.7 kg/mu (1,060 kg/ha) for silver carp. The average survival rates for bighead and silver carp were 99.5% and 98.8%, respectively. The feed conversion ratio (FCR) for bighead carp with the 32/6 feed averaged 3.6:1 for the three trial ponds.

Bighead carp in the fingerling trial grew from 17 g to an average weight of 109 g in 85 days of feeding. There was also significant variation in bighead carp size at harvest in this trial. Silver carp grew from 17 g to 160 g. Fish production averaged 108.4 kg/mu (1,626 kg/ha) for bighead carp and 15.8 kg/mu (237 kg/ha) for silver carp. Survival rate for both species was 99%. Average FCR with the 36/7 feed was 1.65:1.

SUMMARY AND CONCLUSIONS

Bighead carp exhibited cautious feeding behavior and were not aggressive in consuming extruded, floating feed in the market growout trial. Bighead carp consumed all of the feed given, but it typically took 2-3 hours for all feed to be consumed. Bighead carp growth was slow and highly variable despite all of the feed being eaten. The average FCR of 3.6:1 indicated poor feed utilization, but was confounded by the large size variation in bighead carp at harvest. It is believed that the low stocking density of 220 bighead carp per mu may have contributed to the establishment of a feeding hierarchy that resulted in significant size variation among the fed fish. The trial cooperator also reported abnormal eutrophication and fish surfacing in the market growout ponds, despite the low fish stocking density and low feeding levels.

Bighead carp growth and feed conversion efficiency were better, but still poorer than expected, in the fingerling trial. FCR improved to 1.65:1, and was less than half that yielded in the market growout trial. Low stocking density may have also contributed to the establishment of a feeding hierarchy in this trial that could have impacted fish production performance and increased the variation in fish size and feed utilization.

These initial trials to evaluate bighead carp as a fed species in an 80:20 system yielded poor results. However, it is recommended that a follow-on study be conducted in which bighead carp are started on extruded feed at size 2-3 g and stocked in ponds at a typical stocking density of 5,000 fish per mu (75,000/ha). Conducting a feeding trial in which bighead carp are trained on extruded feed at a young age and stocked at a density that will eliminate establishment of a feeding hierarchy is needed to determine whether bighead carp can or cannot be successful produced in feed-based pond systems.

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Table 1. Formula for the ASA-IM 32/6 soy-based feed used in the 2006 bighead carp pond market growout trial in Hefei, Anhui 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 may have 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 bighead carp pond growout trial in Hefei, Anhui 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. Formula for the ASA-IM 36/7, soy-based feed used in the 2006 bighead fingerling trial in Hefei, Anhui 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 may have varied slightly during the trial period depending on specific ingredient nutrient profiles and ingredient availability.

Ingredient	Percent of total
Soybean Meal 46%	43.50
Wheat Middlings 14%	14.00
Fish Meal 65/8	13.00
Wheat Flour 11%	12.00
Corn Gluten Meal 60%	5.00
DDGS 27/10	5.00
Fish Oil, Unspec.	2.50
Ca Phosphate Mono 21%	1.69
Soy Lecithin	1.50
Soy Oil	1.00
Vit PMX F-2	0.50
Min PMX F-1	0.25
Stay C 35%	0.03
Ethoxyquin, SQ mixture 6	0.02
Choline Chloride 60%	0.01
TOTAL	100.00

Table 4. Calculated nutritional profile of the ASA-IM 36/7, soy-based feed used in the 2006 bighead carp fingerling feeding trial in Hefie, Anhui Province, China. The feed was produced in extruded, floating pellet form.

Nutrient	Value, As Fed
DE Fish (extruded)	2871.61
Starch	17.98
Protein, crude	36.14
Protein, digestible	33.55
Fish Protein	8.45
Soy Protein	20.01
Fat	6.96
W-3 (omega 3 fatty acid)	1.02
W-6 (omega 6 fatty acid)	1.62
Fiber	3.22
Ash	6.86
Calcium	0.92
Phosphorus, available	0.70
Choline	2497.61
Vitamin C	105.00
Ethoxyquin	134.50
Arginine	2.19
Isoleucine	1.77
Lysine	2.12
Methionine	0.68
Methionine + Cystine	1.20

Table 5. Vitamin and mineral premix formulations used in the ASA-IM 32/6 and 36/7 soy-based carp feeds. 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 6. Results of the 2006 ASA-IM aquaculture trial in Anhui that evaluated feed-based production of bighead carp in ponds using the ASA 80:20 production model and soy-based feeds fed in extruded, floating pellet form.

Pond No.	BhC[1] stocking size (g)	Stocking rate (fish/mu)	No. days fed	Harvest wt. (g) BhC	Harvest wt. (g) SiC[2]	P_G[3] (kg/mu) BhC	P_G[3] (kg/mu) SiC	Survival (%) BhC	Survival (%) SiC	FCR	Net income (RMB/mu)[4]
Market Growout Trial											
1	385	220	150	965	915	211.4	72	99.5	98.7	3.3	-2,129
2	385	220	150	860	865	188.4	68	99.5	98.8	4.1	-2,248
3	385	220	150	930	900	203.8	72	99.6	99.8	3.5	-2,149
Mean	385	220	150	918	893	201.2	71	99.5	98.8	3.6	-2,176
Fingerling Trial											
1,2,3 (mean)	17	1,000	85	109	160	108.4	15.8	99.6	99.0	1.65	- 567

[1]BhC = Bighead carp

[2]SiC = Silver Carp

[3]P_G = Gross Production

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