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Grass Carp Exhibit Excellent Growth and Feed Conversion on Cost Efficient, Soy-Based Diet

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INTRODUCTION

Pond feeding trials conducted cooperatively by the American Soybean Association International Marketing (ASA-IM) program and the Shenyang Municipal Fishery Research Institute demonstrated the economic value of a soy-based, low fat and high fiber diet for producing two and three-year old grass carp. Feeding trials were conducted in 2004 and 2005 to demonstrate fish performance on the soy-based feed and the resulting economic value to fish farmers in the northeastern region of China.

GRASS CARP FEED

The ASA-IM soy-based, 32/3¹ grass carp feed is formulated to provide a nutritionally balanced ration that resembles the low energy and high fiber levels in the natural diet of grass carp (Tables 1-3). The feed is formulated to contain approximately 20% less energy and 5% more fiber than the standard ASA-IM carp 32/6 growout feed. The grass carp feed is an all-plant protein ration that uses soybean meal and soy hulls as the primary suppliers of protein and fiber in the diet, respectively. The energy level of the feed is kept low by maintaining fat at 3% in the diet. This lower energy level helps to reduce the cost of the feed.

FEEDING TRIAL RESULTS

In 2004, the ASA-IM 32/3 feed was used to culture grass carp in ponds from fingerling to approximately 1 kg size. Fish were stocked in three, 2.4-mu (0.16-ha) ponds at the Shenyang Municipal Fishery Research Institute facility outside Shenyang, Liaoning Province, at a density of 500 grass carp and 100 silver carp per mu (7,500 grass carp and

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 3% crude fat.

1,500 silver carp per ha), using the ASA-IM 80:20 pond technology model. Grass carp were fed the ASA-IM 32/3 feed twice daily for 108 days between 7 May and 22 August 2004. Grass carp grew from 87 g to an average weight of 1,126 g per fish during this period (Table 4). Fish production averaged 535 kg/mu (8,025 kg/ha) for grass carp and 136 kg/mu (2,036 kg/ha) for silver carp. Average survival rates for grass carp and silver carp were 95% and 100%, respectively. The feed conversion ratio (FCR) for grass carp with the all-plant protein, soy-based feed averaged 1.13:1. The combination of efficient FCR and low cost of the feed allowed the producer to realize an average net economic return of RMB 1,674 per mu (\$3,040/ha) at market prices of RMB 8.4/kg (\$1.02/kg) for grass carp and RMB 3.2/kg (\$0.39/kg) for silver carp. Return on investment (ROI) for the three demonstration ponds averaged 51.4%. Grass carp exhibited rapid growth, aggressive feeding behavior and high feed conversion efficiency with the soy-based low fat and high fiber feed in this feeding trial. Grass carp remained healthy, without incidence of disease, and water quality remained good, with no water exchange required, throughout the trial.

In a follow-on trial in 2005, the ASA-IM 32/3 feed was used to culture grass carp in their third production season to a target market size of 1.5 kg. Sub-market size grass carp of approximately 600 g in size were fed the 32/3 feed twice a day for 87 days in ponds following the ASA-IM 80:20 model. Grass carp grew from 583 g to an average weight of 1,820 g during this period (Table 5). Grass carp exceeded the 1.5 kg target by 21% and exhibited an average weight gain of 14.2 g/day. Grass carp production averaged 455kg/mu (6,825 kg/ha), with an average additional 79 kg/mu (1,185 kg/ha) of silver carp harvested from each of the three demonstration ponds. Survival rate for the grass carp was 100% in all ponds. No drugs or chemicals were used in the trial, and the grass carp remained disease free throughout the production cycle. Grass carp FCR during this third growth year averaged 1.66:1. The low FCR and rapid fish growth netted the producer RMB 673/mu and a ROI of 22.2% in just 87 days. Harvested grass carp had good body conformation and were well accepted in the market.

SUMMARY AND CONCLUSIONS

Grass carp feeding trials with second and third production year fish fed the soymeal-based ASA-IM 32/3 feed yielded rapid fish growth, good feed conversion efficiency, and high economic return. The low fat and high fiber diet with 32% crude protein produced grass carp with good body conformation and marketability. Use of the ASA-IM 80:20 pond production model allowed for maintenance of excellent water quality and no diseases during both feeding trials. No drugs or chemicals were used or required during the feeding trials, allowing the producer to harvest and market high quality, uncontaminated fish that met the standard for a “green” product. Use of the soy-based grass carp feed netted good economic return for both second and third year fish, and demonstrated the feasibility of sustainable production of grass carp with an environmentally safe feed for the northeastern region of China.

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Table 1. Formula for the ASA-IM 32/3, all-plant protein, soy-based feed used in the 2004 and 2005 grass carp pond feeding trials in Shenyang, Liaoning Province, China. The feed is a reduced energy, high fiber feed fed in extruded, floating pellet form. Feed formulas varied slightly in 2004 and 2005 depending on specific ingredient nutrient profiles and ingredient availability.

Ingredient	Percent of total
Soybean Meal 44	50.00
Wheat, SWW	20.00
Soy Hulls	15.00
Corn Gluten Meal 60%	10.00
Ca Phosphate Mono	2.40
Fish Oil, Unspec.	1.80
Vit PMX F-2	0.50
Min PMX F-1	0.25
Stay C – 35%	0.03
Ethoxyquin	0.02
TOTAL	100.00

Table 2. Calculated nutritional profile of the ASA-IM 32/3, all-plant protein, soy-based feed used in the 2004 and 2005 grass carp pond feeding trials in Shenyang, Liaoning Province, China. The feed is a reduced energy, high fiber feed fed in extruded, floating pellet form.

Nutrient	Value, As Fed
DE Fish (extruded)	2280.50
Starch	17.58
Protein, crude	31.82
Protein, digestible	29.73
Fish Protein	0.00
Soy Protein	23.80
Fat	2.99
W-3 (omega 3 fatty acid)	0.51
W-6 (omega 6 fatty acid)	0.56
Ash	6.81
Calcium	0.66
Phosphorus, available	0.61
Choline	1911.02
Vitamin C	105.00
Ethoxyquin	192.50
Arginine	1.91
Isoleucine	1.41
Lysine	1.59
Methionine	0.48
Methionine + Cystine	1.03

Table 3. Vitamin and mineral premix formulations used in the ASA-IM 32/3, all-plant protein, soy-based grass carp feed. 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 2004 ASA-IM aquaculture trial in Shenyang that demonstrated fingerling to market growth performance of grass carp in ponds using the ASA 80:20 production model and a 32/3 soy-based feed fed in extruded, floating pellet form.

Pond No.	GrC 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)	ROI (%)
				GrC	SiC ²	GrC	SiC	GrC	SiC			
1	87	500	108	1,193	1,405	560.7	140.5	94.0	100	1.07	1,905	58.5
2	87	500	108	1,044	1,450	500.1	145.0	95.8	100	1.21	1,410	43.3
3	87	500	108	1,141	1,215	544.3	121.5	95.4	100	1.10	1,706	52.4
Mean	87	500	108	1,126	1,357	535.0	135.7	95.1	100	1.13	1,674	51.4

¹GrC = Grass Carp

²SiC = Silver Carp

³P_G = Gross Production

Table 5. Results of the 2005 ASA-IM aquaculture trial in Shenyang that demonstrated third-year growth performance of grass carp in ponds using the ASA 80:20 production model and a 32/3 soy-based feed fed in extruded, floating pellet form.

Pond No.	GrC ¹ stocking size (g)	Stocking rate (fish/mu)	No. days fed	Harvest wt. (g)		P _G ³ (kg/mu)		Survival (%) GrC	FCR	Net income (RMB/mu)	ROI (%)
				GrC	SiC ²	GrC	SiC				
1	583	250	87	1755	665	439	67	100	1.75	512	16.9
2	583	250	87	1838	743	460	74	100	1.64	693	22.9
3	583	250	87	1868	966	467	97	100	1.60	815	26.9
Mean	583	250	87	1820	791	455	79	100	1.66	673	22.2

¹GrC = Grass Carp

²SiC = Silver Carp

³P_G = Gross Production