Key Words: Soy protein concentrate, grass carp, fingerling feed, China

**Production of Grass Carp Fingerlings with**

**the ASA-IM Formulated 36/7 SPC Feed**

Results of ASA-IM/China 2010 Feeding Demo U-35-10-516

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**Introduction**

A pond Feeding demonstration was conducted in 2010 by the American Soybean Association International Marketing (ASA-IM) program in cooperation with the Shanxi Provincial Fishery Extension Center and the Datong Municipal Fishery Extension Center to show the effectiveness of replacing fishmeal with soy protein concentrate (SPC) in the ASA-IM 36/7[[1]](#footnote-1) fingerling feed for grass carp. The demonstration was conducted at the Demo Farm of the Datong Municipal Fishery Extension Center to demonstrate to fish farmers and feed millers in the north region of China that a protein fingerling feed could be used to culture grass carp fingerlings. The ability to use all-plant protein feeds at the fingerling stage provides feed millers with an option to reduce feed cost associated with the rising price of fishmeal, as well as a means to improve industry sustainability by providing a fingerling feed in which the majority of protein is supplied from renewable plant sources.

**PROTOCOLS**

A two-month feeding demonstration was conducted at the Datong Municipal Fishery Extension Center, Shanxi Province. Grass carp fry of size 0.75-g were stocked in three 2.0-mu (0.13 ha) fingerling ponds at a density of 5,000 fish per mu (75,000/ha), together with 1,000 silver carp fry per mu (15,000/ha). Grass carp in the three demonstration ponds were fed the locally available high protein feed till they reached an average size of 2-3 g, at which time the fish were weaned to the 36/7 SPC diet. The 36/7 diet was formulated by ASA-IM and replaced the standard 20% fishmeal inclusion with low antigen, feed grade SPC having a crude protein content of 65% (Tables 1 and 2). The feed grade SPC was produced by ADM in China under the trade name Soycomil.

The 36/7 SPC feed was fed in extruded, floating pellet form, with an initial feed pellet size of 1.5-mm. Grass carp in all ponds were fed to satiation three times daily for the first month, and to satiation twice daily using the ASA-IM 90% average satiation feeding technique. Fish in the three replicate demonstration ponds received an identical amount of feed each day and at each feeding. All feeds were produced by the Ningbo Techbank Feed Company, Zhejiang Province, China. Pond management was based on the ASA-IM 80:20 production model with soybased feed technology.

**RESULTS**

Grass carp fingerlings in the Datong pond demonstration were fed for 66 days between August and October 2010. Grass carp grew from 0.75 g to an average weight of 27 g, with an average FCR with the 36/7 SPC feed of 0.99:1 (Table 3, Figure 1). Fish biomass at harvest averaged 108 kg/mu (1,620 kg/ha) for grass carp. An additional 44 kg/mu (660 kg/ha) of silver carp were produced on average in the three demonstration ponds.

The demonstration yielded a net economic return of RMB 3,766 ($570.6) [[2]](#footnote-2) from the 6 mu of fingerling ponds, and represented an average net return of RMB 627.7 per mu ($1,425/ha). Harvested fish had average market prices of RMB 18/kg ($2.7/g) for grass carp fingerlings and RMB 7/kg ($1.06/kg) for silver carp fingerlings. The average return on investment (ROI) for the three ponds was 38.8%.

**SUMMARY AND CONCLUSIONS**

The harvest size of grass carp fingerlings was smaller than the average because of short production cycle and cold temperature delayed the breeding of Chinese carps in 2010. The average FCR of the 36/7 SPC from the three demonstration ponds was 0.99:1, that was much similar to the grass carp fingerling in Harbin in 2008. The demonstration results further demonstrated that grass carp fingerlings do not have a requirement for fishmeal in their diet and that an all-plant protein feed, in which fishmeal is replaced with SPC, can be used to efficiently and economically produce grass carp fingerlings in ponds in China and elsewhere in the world.

Feed mills are encouraged to incorporate low antigen, feed grade SPC 65% in their fingerling feed formulations especially when fishmeal price is so high. Use of SPC as a fishmeal replacement in the fingerling diet of freshwater fish species can reduce demand on the limited supply of fishmeal and help stabilize feed prices for fish producers in China.

**ACKNOWLEDGEMENTS**

ASA-IM gratefully acknowledges the participation and cooperation of the Shanxi Provincial Fishery Extension Center and the Datong Municipal Fishery Extension Center Demonstration Farm in conducting this feeding demonstration in cooperation with ASA-IM China. All of these organizations contributed time, personnel, facilities and funding for this water conservation demonstration for aquaculture sustainability. The ASA-IM also like to thank Ningbo Techbank Feed Company for producing all demonstration feeds; Chengdu Phoenix Aquafeed Company for producing the vitamin and mineral premix; ADM, Qinhuangdao Goldensea Foodstuff Co.,Ltd and Yihai (Fangchenggang) Soybeans Industries Co., Ltd, Yihai Group for the free contribution of SPC product and; the Novus for the free contribution of antioxidant - Solis Mos.

**Chinese Currency and Production Unit Conversions:**

RMB 6.6 = US$1.00
15 mu = 1.0 hectare (ha)
kg/mu x 15 = kg/ha
1.0 kg = 2.2 lb
6 mu = 1.0 acre (ac)
kg/mu x 13.2 = lb/ac

Table 1. Formula for the ASA-IM 36/7 SPC feed used in the 2010 grass carp fingerling 80:20 pond feeding demonstration at the Datong Municipal Fishery Extension Center Demo Far, Shanxi Province, China.

 Ingredient Percent of total

|  |  |
| --- | --- |
| Soybean Meal | 30.00 |
| Soy Protein Concentrate (SPC) | 12.00 |
| Soy Hulls | 0.00 |
| Wheat Flour8 | 12.50 |
| Wheat Midds8  | 23.50 |
| Corn Gluten Meal | 7.00 |
| Blood Meal, spray dried | 5.25 |
| Calcium phosphate mono - 21%P | 2.26 |
| Fish, Anchovy  | 0.00 |
| Fish Oil | 1.00 |
| Soy Oil | 3.90 |
| Soy Lecithin | 1.50 |
| Vitamin Premix-F2 | 0.50 |
| Mineral Premix F-1 | 0.25 |
| DL-Methionine 99% | 0.15 |
| Choline Chloride 50% | 0.12 |
| Stay C - 35% | 0.03 |
| Antioxidant4 | 0.02 |
| Mycotoxin Binder5 | 0.01 |
| Mold Inhibitor6 | 0.01 |
| Total | 100.00 |
|  |  |

Table 2. Calculated nutritional profiles of the ASA-IM 36/7 SPC fingerling diets tested in the 2010 grass carp pond feeding demonstration conducted the Datong Municipal Fishery Extension Center Demo Far, Shanxi Province, China.

 Nutrient As fed Unit

|  |  |  |
| --- | --- | --- |
| DE Fish | 2852.85 | kcal/kg |
| NFE | 35.56 | % |
| Starch | 18.53 | % |
| \*Protein | 36.00 | % |
| Protein, dig. | 34.06 | % |
| Fish Protein | 0.00 | % |
| Soy Protein | 21.60 | % |
| \*Fat | 7.64 | % |
| W 3 | 0.69 | % |
| W 6 | 3.33 | % |
| Fiber | 3.99 | % |
| \*Ash | 6.31 | % |
| Calcium | 0.53 | % |
| Phos Avail | 0.61 | % |
| Iron | 596.89 | % |
| Copper | 27.53 | % |
| Zinc | 122.95 | ppm |
| Selenium | 0.79 | ppm |
| Moisture | 8.34 | ppm |
| Vitamin C | 105.00 | ppm |
| Choline | 2491.08 | % |
| Ethoxyquin | 134.50 | mg/kg |
| Arginine | 2.20 | mg/kg |
| Lysine | 2.08 | mg/kg |
| Methionine | 0.68 | % |
| Meth+Cyst | 1.20 | % |
| Threonine | 1.42 | % |
| Tryptophan | 0.41 | % |

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Table 3. Vitamin and mineral premix formulations for the ASA-IM 36/7 SPC feed used in the 2010 grass carp fingerling pond demonstration at the Datong Municipal Fishery Extension Center Demo Far, Shanxi Province, China. Quantities of vitamins and minerals are per kilogram of premix. Both premixes were produced at the Phoenix Feed Mill premix plant in Chengdu, Sichuan Province.

 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

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**Figure 1.** Growth curve for grass carp fingerlings fed 36/7 SPC feeds at Datong Municipal Fishery Extension Center Demo Farm, Shanxi Province. The 36/7 FM feed contained 20% fishmeal, while the 36/7 SPC feed replaced all fishmeal with low antigen soy protein concentrate (SPC).

Table 3. Results of the 2010 aquaculture feeding demonstration in Datong, Shanxi Province that demonstrated grass carp fingerling production in ponds with theASA-IM 36/7 SPC fingerling feed in which fishmeal was replaced with soy protein concentrate.

 Feed GrC1 stocking Stocking rate No. days Harvest wt. (g) PG3 (kg/mu) Survival (%) FCR Net economic ROI

treatment size (g) (fish/mu) fed GrCSiC2 GrC SiC GrC SiC return (RMB/mu) (%)

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36/7 SPC 0.75 5,000 66 34 40 136 28 80 70 0.73 1,028 63.6

36/7 SPC 0.75 5,000 66 20 76 78 55 78 73 1.33 173.4 10.7

36/7 SPC 0.75 5,000 66 27 60 110 44 82 72 0.91 681.5 42.2

Mean 0.75 5,000 66 27 58.6 108 42 80 71.7 0.99 627.7 38.3

1GrC = Grass Carp

2SiC = Silver Carp

3PG  = Gross Production

1. 1The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 36/7 indicates 36% crude protein and 7% crude fat. [↑](#footnote-ref-1)
2. [↑](#footnote-ref-2)