

Channel Catfish Production in 1-m³ Cages with Soybean Meal and Fishmeal Based Feed Rations

Results of ASA/China 1999 Feeding Trial 35-99-66

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ABSTRACT

Channel catfish (*Ictalurus punctatus*) growth in 1-m³ cages was evaluated with three extruded feed rations with varying soybean meal and fishmeal inclusion rates. One ration was formulated as an all-plant protein diet with dehulled soybean meal as the primary protein source. The second ration was formulated with dehulled soybean meal as the primary protein source, but with 5% fishmeal. The third ration was formulated with fishmeal as the primary protein source. All three rations were designed to be nutritionally the same, with 32% protein and 6% fat. Channel catfish stocked at 400 fish per m³ grew from 69g to 467 g, 500 g and 532 g, respectively, on the all-plant protein soy-based, soy-based with 5% fishmeal, and fishmeal-based rations. Growth was significantly different ($P < 0.05$) among the three rations. FCR for the soy-based, soy-based with 5% fishmeal, and fishmeal-based rations was 1.45:1, 1.34:1 and 1.25:1, respectively. Net production for the soy-based, soy-based with 5% fishmeal, and fishmeal-based rations averaged 157 kg/m³, 171 kg/m³ and 183kg/m³, respectively. Survival averaged 99% for all feed treatments. Net economic return at the prevailing market price of RMB 21/kg was RMB 2147/m³, RMB 2373/m³ and RMB 2570/m³, respectively, for the all-plant protein soy-based, soy-based with 5% fishmeal, and fishmeal-based feed rations. Return to investment averaged 124%, 134% and 139% for the soy-based, soy-based with 5% fishmeal, and fishmeal-based ration treatments, respectively. Net economic return and return to investment were significantly different ($P < 0.05$) among the three feed treatments.

INTRODUCTION

The American Soybean Association (ASA), in cooperation with the Fujian Provincial Fisheries Extension Center, conducted a feeding trial in 1999 to evaluate channel catfish (*Ictalurus punctatus*) growth in cages using ASA LVHD technology and manufactured feeds varying in their protein source. The objective of the trial was to demonstrate that channel catfish do not require fishmeal in their diet and that growth with soybean meal based feeds is equal to that of feeds formulated with fishmeal.

MATERIALS AND METHODS

Channel catfish with an average weight of 69 g per fish were stocked at 400 fish per m³ in 15, 1-m³ cages in Shan Zai Reservoir in Fujian Province. Fish in five of the cages were fed a feed ration formulated with dehulled soybean meal as the primary protein source (Table 1). Fish in another five cages were fed a similar ration with dehulled soybean meal as the primary protein

source, but formulated to contain 5% fishmeal (Table 1). Fish in the final five cages were fed a ration formulated with fishmeal as the primary protein source (Table 1). The three feed rations were designed to be nutritionally the same, with 32% protein and 6% fat. All feeds were manufactured by Shanghai Fwuso aquafeed mill using ASA formulation specifications. Fish were fed *ad libitum*, with fish in all cages receiving the same amount of feed. The three feed rations were randomly assigned to the fifteen cages, with five replicates of each feed ration.

The fish were stocked in cages on 3 June 1999. All cages were outfitted with opaque covers and enclosures for floating feed. Cages were arranged according to ASA guidelines, with a minimum of one cage width of open space between cages in all directions. Fish in all cages were sampled once per month on approximately the same date each month. At the conclusion of the trial, all cages were emptied and the fish in each cage counted and weighed to determine average fish weight, gross and net production, feed conversion and survival.

RESULTS

Fish were fed a total of 135 days between 3 June and 15 October 1999. Catfish receiving the all-plant protein, soy-based ration grew from 69 g to 467 g (Table 2). Catfish receiving the soy-based ration with 5% fishmeal grew from 69 g to 500 g, and catfish receiving the fishmeal-based ration grew from 69 g to 532 g (Table 2). Fish growth was significantly different ($P<0.05$) with all three feed rations.

Net production averaged 157 kg/m³, 171 kg/m³ and 183 kg/m³ for fish fed the soy-based, soy-based + 5% fishmeal, and fishmeal-based rations, respectively (Table 2). FCR was 1.45:1 with the soy-based ration, 1.34:1 with the soy-based + 5% fishmeal ration, and 1.25:1 with the fishmeal-based ration (Table 2). FCR values were significantly different ($P<0.05$) for the three feed treatments. Survival averaged 99% for all three feed treatments.

Net economic return at the prevailing market price of RMB 21/kg averaged RMB 2147/m³ for fish fed the soy-based ration, RMB 2373/m³ for fish fed the soy-based + 5% fishmeal ration, and RMB 2570/m³ for fish fed the fishmeal-based ration (Table 2). Net economic return was significantly different ($P<0.05$) for the three feed treatments. Return to investment averaged 124%, 134% and 139% for the soy-based, soy-based + 5% fishmeal, and fishmeal-based rations, respectively.

SUMMARY AND CONCLUSIONS

Channel catfish growth, feed conversion efficiency and economic return were excellent for all three feeds tested. Catfish fed the all-plant protein ration formulated with 52.8% dehulled soybean meal grew from 69 g to 467 g in 135 days, with a feed conversion efficiency of 1.45 and a net economic return of RMB 2147/m³. However, catfish growth performance and economic return was best with the fishmeal-based feed ration. While the trial demonstrated that channel catfish grow well on an all-plant protein ration, it did not demonstrate equal fish growth with soy-based and fishmeal-based rations. Results of the trial indicate that while the three feed rations were designed to be nutritionally identical, they were not manufactured as such. Results indicate that there were significantly more protein and essential amino acids in the rations

containing fishmeal. It is hypothesized that a higher quality fishmeal was utilized by the feed manufacturer than was specified, which stimulated better growth and feed conversion efficiency with the rations containing the fishmeal. At the 1999 prices of RMB 3.20/kg, RMB 3.40/kg, and RMB 3.90/kg for the soy-based, soy-based + 5% fishmeal, and fishmeal-based rations, respectively, it was cost advantageous for the producer to use feeds containing high quality fishmeal. Cost advantages would diminish, however, with greater feed price differentials and lower quality fishmeal.

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Chinese Currency and Production Unit Conversions:

RMB 8.26 = US\$1.00

1.0 kg = 2.2 lb

TABLE 1. Feed formulations tested in the 1999 channel catfish cage trial conducted at Shan Zai Reservoir, Fujian Province, China. The feeds were formulated as 32% protein and 6% fat rations.

Ingredient	Soybean Meal Ration	Soy + 5% Fishmeal Ration	Fishmeal Ration
Dehulled soybean meal (47.5%)	52.8	45.4	4.6
Fishmeal, anchovy 65/10	-----	5.0	25.0
Wheat, SWW	23.6	24.0	20.8
Wheat middlings	10.0	13.5	31.0
Corn gluten meal (60%)	6.0	5.0	5.0
Cottonseed meal mech (41%)	-----	-----	10.0
Fish oil	3.53	3.53	1.53
Soy lecithin	1.00	1.00	1.00
Ca phosphate mono	2.70	2.20	0.70
Mineral premix	0.25	0.25	0.25
Vitamin premix Roche 2118	0.10	0.10	0.10
Ethoxyquin	0.02	0.02	0.02
TOTAL	100.00	100.00	100.00

TABLE 2. Results of the 1999 ASA aquaculture trial to evaluate channel catfish growth performance in 1.0-m³ cages with soybean meal based, soybean meal + fishmeal, and fishmeal based aquafeed rations.

Feed ration	Stocking rate (fish/m ³)	No. days fed	Fish harvest weight (g)	Net production (kg/m ³)	Survival (%)	FCR	Net economic return (RMB)	ROI (%)
Soy-based	400	135	467 ^a	157 ^a	99.0	1.45 ^a	2147/m ³ ^a	124
Soy + 5% fishmeal	400	135	500 ^b	171 ^b	99.0	1.34 ^b	2373/m ³ ^b	134
Fishmeal-based	400	135	532 ^c	183 ^c	98.9	1.25 ^c	2570/m ³ ^c	139

Data with the different superscripted letters are significantly different (P<0.05)