Crucian Carp Growth Performance from Fingerling to Market Size with a Soy-Based Diet

Results of ASA/China 1999 Feeding Trial 35-99-56

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ABSTRACT

Three fingerling sizes of crucian carp were grown to market size in ponds using the ASA 80:20 production model and a soy-based diet. Fish were Fengzhen crucian x Xingguo red common carp bred in 1998 at the Tai Xing Fish Stock Farm in Jiangsu Province. Fish were stocked at 1000 crucian carp per mu together with 60 silver carp per mu. Fingerlings of sizes 63 g and 44 g grew respectively to 411 g and 383 g in 212 days of feeding. Fingerlings of size 32 g grew to 363 g in 214 days of feeding. The 63-g fingerlings reached a market size of 250 g in 150 days, while the 44-g and 32-g fish reached 250 g in 158 and 165 days, respectively. Stocking fingerlings of different sizes may be a good management strategy for fish farmers interested in extending the marketing season for crucian carp. Feeding for 212 to and 214 days yielded 363-g to 411-g fish having high market value because of their large size. FCR with the ASA all-plant protein, soy-based diet averaged 1.50 to 1.61. Use of this diet in the extruded, floating form allowed the Tai Xing farm manager to closely monitor fish feeding performance and fish health and prevented over-feeding of fish and wasting of feed.

INTRODUCTION

The American Soybean Association (ASA), in cooperation with the China National Fisheries Extension Center (NEC) and affiliate organizations, initiated a series of sequential, on-farm feeding trials in 1998 to quantify crucian carp growth performance from the advanced fry (summer flower) stage to market size. The objective of the trials was to establish feed-based growth parameters for the different production phases so that fish farmers could better plan production and marketing strategies for this species. The 1999 feeding trial reported in this paper evaluated fingerling to market growth performance of three fingerling sizes of crucian carp.

MATERIALS AND METHODS

Fish for this trial were Tai Xing strain crucian carp produced in 1998 by breeding female Fengzhen crucian carp with male Xingguo red common carp at the Tai Xing Fish Stock Farm in Tai Xing, Jiangsu Province. These fish were grown to fingerlings in 1998 at stocking densities of 3,000, 6,000 and 10,000 fish per mu using the ASA feed-based, 80:20 pond production model. Fingerlings from these three stocking densities averaged 77 g, 54 g and 37 g at harvest in October 1998. The three fingerling size groups were segregated and over-wintered at Tai Xing for use in the 1999 fingerling to market growout study.

In March 1999, approximately 6,000 fingerlings of each size group were randomly selected for use in the fingerling to market growout study. Fingerlings of the three size groups averaged 63 g, 44 g and 32 g, respectively, on March 12 when they were restocked in six, 1.6-mu and three 2.0-mu ponds (Table 1). Each fingerling size group was stocked in three ponds. Crucian carp fingerlings were stocked at a density of 1,000 fish per mu together with 60 silver carp fingerlings per mu. Pond water depth averaged approximately 1.5 m. All ponds were equipped with water exchange and stand-by aeration.

Crucian carp were fed an extruded (floating) feed formulated by ASA and produced by Shanghai Fwuso aquafeed mill. The feed was formulated to be an all-plant protein diet with 32% protein and 6% fat. Dehulled soybean meal (47.5% crude protein) was the primary protein source (Table 2). Initial feed pellet size was 2.5 mm. Feed pellet size was increased as the fish grew. Feeding rate and frequency varied with fish size and water temperature following guidelines contained in the ASA handout *Feeding Guide for Crucian Carp*. Target market size for the crucian carp was $\geq$250 g.

Fish in all ponds were sampled once per month on the same date each month. At the conclusion of the trial, all ponds were drained and the crucian carp and silver carp in each pond counted and weighed to determine survival, gross production, average fish weight and feed conversion ratio (FCR).

RESULTS

Feeding commenced on 14 April for all three fingerling size groups and ended on November 12 for the 63-g and 44-g fingerling treatments, and on November 14 for the 32-g fingerling treatment. The 63-g and 44-g crucian carp fingerlings grew to 411 g and 383 g, respectively, in 212 days of feeding (Table 1; Figure 1). The 32-g crucian carp fingerlings grew to 363 g in 214 days of feeding (Table 1; Figure 1).

Net production from the 63-g fingerling ponds averaged 323 kg/mu of crucian carp and 69 kg/mu of silver carp (Table 1). The 44-g fingerling ponds had an average net production of 318 kg/mu of crucian carp and 69 kg/mu of silver carp. Net production for the 32-g fingerling ponds averaged 301 kg/mu of crucian carp and 68 kg/mu of silver carp.

Feed conversion ratios for the 63-g, 44-g and 32-g fingerling treatments were 1.61, 1.50 and 1.57, respectively (Table 1). Average survival was 94% for the 63-g and 44-g fingerlings and 92% for the 32-g fingerlings (Table 1).

SUMMARY AND CONCLUSIONS

Feed-based production of crucian carp using the ASA 80:20 pond production model and an extruded, soy-based diet was feasible with all three fingerling sizes tested. Crucian carp of all three fingerling sizes exceeded the target market size of $\geq$250 g. The 63-g fingerlings grew to the 250 g target size in 150 days (early September), while the 44-g and 32-g fingerlings grew to 250 g in approximately 158 and 165 days, respectively (Figure 1).

Beginning feeding in mid-April when average afternoon water temperature was 16^{o} C and continuing feeding into November when average afternoon water temperature was 18^{o} C proved to be a good management strategy. Excellent fish growth was obtained in the first and last 60 days of the trial when average afternoon water temperatures were below 25^{o} C (reference growth curve slope, Figure 1). The growth rate of crucian carp was lower when average afternoon water temperatures exceeded 25^{o} C.

Stocking fingerlings of different sizes may be a good management strategy for farm producers interested in extending the marketing season for crucian carp. Feed-based fry to fingerling production trials conducted in 1998 indicated 100 g, 75 g, 54 g and 37 g crucian carp fingerlings could be produced at fry stocking densities of 1,000, 3,000, 6,000 and 10,000 fish per mu, respectively, using the ASA feed-based production model (Cremer and Zhang 1999). Results of the 1999 fingerling to market size growout study show that crucian carp fingerlings $\geq$63 g can reach a marketable 250 g within 150 days, and that fingerlings as small as 32 g can reach 250 g within 165 days using the ASA feed-based production model. Production for 212 days and 214 days with 63-g, 44-g and 32-g crucian carp fingerlings yielded 411 g, 383 g and 363 g fish having high market value because of their large size.

The all-plant protein, soy-based ASA growout diet resulted in excellent feed conversion efficiency with all three fingerling size groups tested in the 1999 trial. FCR ranged from 1.50:1 to 1.61:1. Use of this diet in the extruded, floating form allowed the Tai Xing farm manager to closely monitor fish feeding performance and fish health and prevented over-feeding of fish and wasting of feed.

ACKNOWLEGEMENTS

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CITATIONS

Cremer, M.C. and Zhang Jian. 1999. Feed-based Fry to Fingerling Growth Performance of Crucian Carp at Seven Stocking Densities. American Soybean Association Publication AQ10-99, Beijing, P.R. China.

Chinese Currency and Production Unit Conversions:

RMB 8.26 = 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. Results of the 1999 ASA aquaculture trial at Tai Xing Fish Stock Farm that evaluated pond production performance of three fingerling sizes of crucian carp using the ASA 80:20 production model and an all-plant protein, soy-based diet.

Fingerling stocking size (g)	Stocking rate (fish/mu)		No. days fed	CrC harvest weight (g)	Net production (kg/mu)		Survival (%)	FCR
	CrC[1]	SiC[2]			CrC	SiC		
63	1000	60	212	411	323	69	94	1.61
44	1000	60	212	383	318	69	94	1.50
32	1000	60	214	363	301	68	92	1.57

[1]CrC = crucian carp
[2]SiC = silver carp

Table 2. Feed formula for the ASA all-plant protein, soy-based growout diet used in the 1999 crucian carp growout trial at Tai Xing Fish Stock Farm, Jiangsu Province.

Ingredient	Percentage of ration
Soybean meal 47.5	52.8
Wheat, SWW	23.6
Wheat midds	10.0
Corn gluten meal 60%	6.0
Fish oil	3.53
Soy lecithin	1.0
Ca phosphate mono	2.7
Vit PMX Roche 2118	0.1
Min PMX F-1	0.25
Ethoxyquin	0.02

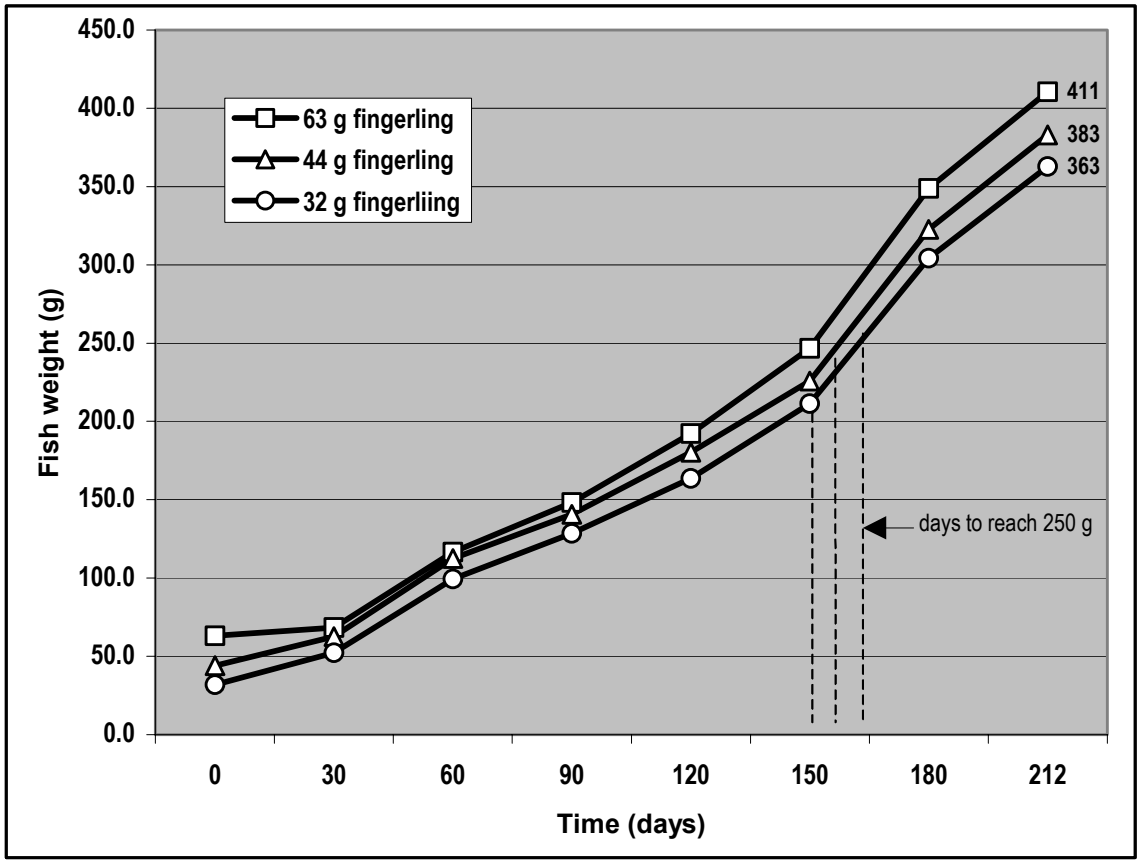

Figure 1. Growth curves for 63 g, 44 g and 32 g crucian carp fingerlings grown to market size in the 1999 ASA trial at Tai Xing Fish Stock Farm in Jiangsu Province, China. Data points represent fish size at monthly sampling intervals. The three fingerling size groups reached the minimum target market size of 250 g in approximately 150, 158 and 165 days. Feeding with a soy-based, 32% protein diet for 212 to 214 days produced fish averaging 411 g, 383 g and 363 g in weight from the 63 g, 44 g and 32 g fingerling sizes, respectively. Growth was best between days 30 and 60 and after day 150 when water temperatures were below 25^{o}C.