

Second Generation Growth Performance of 'Texas Select' Strain Channel Catfish Fry with Soy-Based Feeds

Results of ASA/China 2000 Feeding Trial 35-00-093

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ABSTRACT

Texas Select strain channel catfish imported as sac-fry from the United States in 1997 were bred for the first time in China in 2000 at the Tai Xing Fish Stock Farm in Tai Xing, Jiangsu Province. First time breeding of 3-year old Texas Select catfish produced a limited number of spawns, and egg masses were small in size. Evaluation of the Tai Xing breeding program indicated insufficient spawning containers were used and spawning containers were set too deep in the ponds. Spawning container numbers should be increased from a ratio of one container per 10 females to a ratio of containers to female brood fish of 1:2 or 2:3. Spawning containers should be placed no deeper than 60 cm beneath the pond water surface, and only moved to deeper water if the pond water warms significantly at the ≥ 1.0 -m depth. Catfish fry hatched from 3-year old Texas Select catfish spawns exhibited excellent growth performance, feed conversion and survival characteristics. Fish in five replicate ponds grew from 0.08 g to 45.9 g in 81 days of feeding, with an FCR of 1.31:1 and survival of 85.1%. This compares favorably to the growth of the parent stock in 1997, which grew to 72 g in 149 days with an FCR of 1.47:1.

INTRODUCTION

The American Soybean Association (ASA), in cooperation with the China National Fisheries Extension Center (NEC), the Tai Xing Fish Stock Farm and the Jiangsu Provincial Fisheries Extension Center, continued in 2000 the 5-year evaluation of Texas Select strain channel catfish that was begun in 1997. This 5-year evaluation was initiated in 1997 when ASA assisted the NEC in importing 2-day old sac-fry of Texas Select strain channel catfish from the United States. ASA provided channel catfish hatchery, nutrition and production technology support to Tai Xing in 1997, and conducted a fry to fingerling feeding trial at Tai Xing with the imported catfish. In 1998, catfish fingerlings produced in the 1997 ASA trial were grown to market size in a second-year ASA feeding trial. The same fish were then grown to brood stock in 1999 in the third year of ASA feeding trials. These 3-year old brood fish were then bred for the first time in the spring of 2000 at the Tai Xing farm. This paper reports on the breeding performance of the 3-year old fish and the results of the ASA feeding trial to assess performance of second generation catfish produced in the Tai Xing breeding program.

MATERIALS AND METHODS

Channel Catfish Breeding

A total of 3,024 brood pairs of 3-year old Texas Select strain channel catfish were stocked in six ponds with a collective water surface area of 42 mu. White plastic spawning buckets were set in the

ponds at a depth of ≥ 1.0 meter and at a ratio of 1 container per 10 female brood fish. Spawning containers were checked daily for egg masses, beginning in early June. Egg masses were transferred to the Tai Xing catfish hatchery and incubated in concrete tanks with aeration and continuous water exchange. Individual egg masses were weighed and egg samples taken to determine average number of eggs per kilogram of egg mass and average number of eggs per spawn.

Fry-Fingerling Growout Trial

Fry to fingerling growth performance was assessed for second generation, Texas Select strain channel catfish produced from 3-year old, first-time spawning adults. Swim-up stage catfish were selected for the trial from spawns taken in June 2000. Pond management was based on the ASA 80:20 production technology model.

Five ponds of size 2.0-mu at the Tai Xing Fish Stock Farm were used for the fry to fingerling performance assessment. Ten-day post swim-up stage catfish fry were stocked in ponds at 6,000 fish per mu, together with 800 silver carp fry per mu. Pond water depth averaged approximately 1.5 m in all ponds. All ponds were equipped with water exchange and stand-by aeration.

Feeding commenced at the swim-up stage, in the hatchery with fish stocked in 1-m² floating hatchery trays. The fry to fingerling feeding regime was as follows:

1. ASA 52/16 Starter Feed (Table 1) - Fed from swim-up stage to 10 days post swim-up in No. 1 crumble form (0.5-mm) in floating hatchery trays.
2. ASA 41/11 Fry Feed (Table 2) - After 10-day hatchery feeding, stock advanced fry in trial ponds and feed the ASA formulated 41/11 fry diet in No. 2 (0.6-1.0 mm) and No. 3 (1.1-1.5 mm) crumble form until catfish attain an average fish size of 1.5-2.0 g.
3. ASA 36/7 Fingerling Feed (Table 2) – When catfish reach an average size of 1.5-2.0 g, wean fish to the ASA 36/7 fingerling diet in extruded (floating) form, with initial pellet size of 1.5 mm. Increase pellet size as fish grow. Feed twice daily according to ASA feed table guidelines.

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 channel catfish and silver carp in each pond counted and weighed to determine average fish weight, gross and net production, feed conversion ratio (FCR) and fish survival.

RESULTS

Channel Catfish Breeding

A total of 133 spawns were obtained from 3,024 brood fish pairs during June and July 2000. Spawning commenced on June 10. Over 90% of the spawns (122) were obtained within 30 days of the first spawn. Average egg mass weight was approximately 260 g, with the weight of individual egg masses ranging from 0.1 kg to 0.5 kg. Average number of eggs per spawn was approximately 4,000, and average number of eggs per kilogram of egg mass was approximately 16,000. Catfish egg hatching success rate was 88%.

Fry-Fingerling Growout

Channel catfish were fed a total of 81 days during the 110-day pond culture period from 28 June to 16 October 2000. Channel catfish grew from 0.08 g to 45.9 g in the 110-day culture period (Figure 1; Table 3). Catfish fingerlings were uniform in size, with mean fish weight variability among the five replicate ponds of less than 6%. Mean fish weight ranged from 44.7 g to 47.2 g among the five replicate ponds (Table 3). FCR for the channel catfish averaged 1.31:1 for all fish. Catfish survival averaged 85.1% (Table 3). Silver carp fry grew from 0.5 g to an average weight of 74 g, with 94.1% survival. The production ratio of fed catfish to filtering silver carp at harvest was 81:19.

Net income averaged RMB 1667.31/mu for the ten mu of trial ponds (Table 3). Return on investment (ROI) averaged 51% for the 51,048 catfish fingerlings harvested from the five trial ponds.

SUMMARY AND CONCLUSIONS

Channel Catfish Breeding

First time breeding of 3-year old Texas Select strain channel catfish produced a lower number of spawns than anticipated by the Tai Xing Fish Stock Farm, and egg masses were small in size. Evaluation of the Tai Xing breeding program indicated insufficient spawning containers were used and spawning containers were set too deep in the spawning ponds. Spawning containers should be placed in ponds in early May to permit selection and cleaning by brood fish. Spawning container numbers should be increased from the ratio of one container per 10 females used by Tai Xing in 2000 to a ratio of containers to female brood fish of 1:2 or 2:3. This will reduce competition and fighting among brood fish for spawning space. Spawning containers should be placed no deeper than 60 cm beneath the pond water surface, and only moved to deeper water as the pond water warms at the ≥ 1.0 -m depth. Tai Xing spawning containers are white in color. Improved spawning performance may be obtained with darker colored spawning containers. Spawning performance may additionally be improved by feeding brood fish the ASA 36/7 fingerling feed throughout the year. This diet contains higher levels of critical vitamins, minerals and essential amino and fatty acids.

Second Generation Catfish Performance

Second generation Texas Select channel catfish produced by 3-year old, first-time spawners exhibited excellent performance characteristics. Catfish exhibited rapid growth, good feed conversion, and high survival from the advanced fry to fingerling stages, with little variation among the five treatment replicates. FCR with the ASA soymeal-based feeds averaged 1.31:1 for the 51,000 fingerlings produced in this trial. This compared favorably to the growth of the parent stock in 1997, which grew from advanced fry to 72 g in 149 days of feeding, with an FCR of 1.47:1. Growth performance could have been improved if the Tai Xing farm had followed the prescribed feeding protocols. Fish were not fed for the first 30 days after stocking in the trial ponds, which slowed their growth. ASA recommends that the Tai Xing farm follow the recommended feeding regime for channel catfish to optimize fish health, growth performance and economic return. A good economic return and high ROI were obtained using the ASA 80:20 pond production model and soymeal-based aquafeeds.

ACKNOWLEDGEMENTS

ASA gratefully acknowledges the Tai Xing Fish Stock Farm, the Jiangsu Fisheries Extension Center, and the Director and staff of the National Fisheries Extension Center for their assistance and support for this aquaculture trial.

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

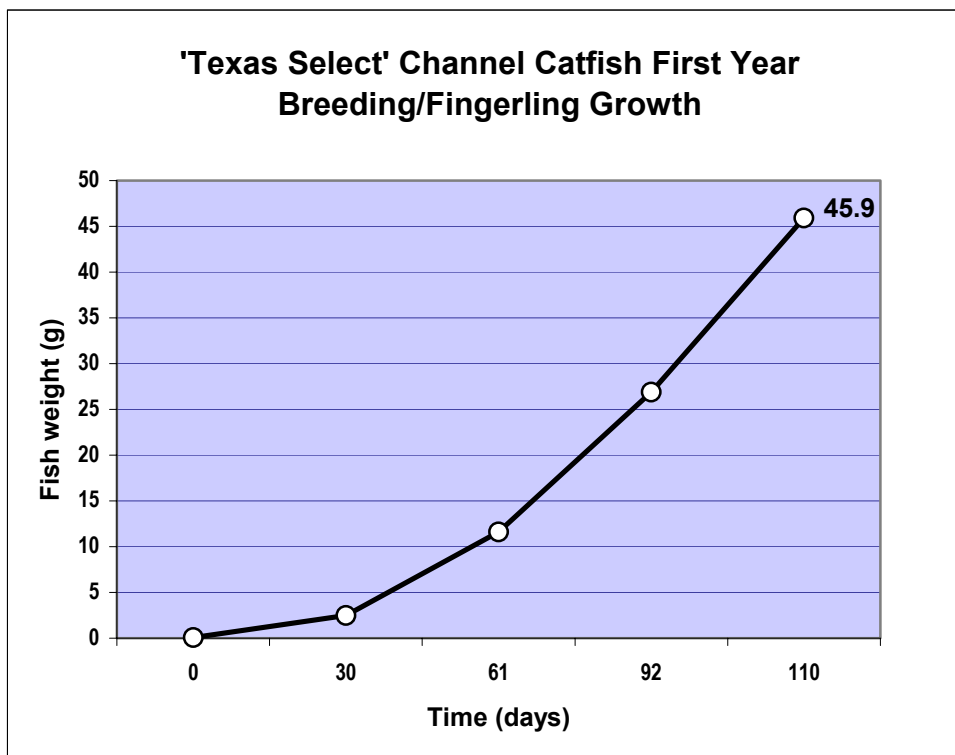


FIGURE 1. Growth curve for channel catfish from fry to fingerling stages in the feeding trial conducted at Tai Xing Fish Stock Farm with second generation Texas Select strain channel catfish. Catfish grew from 0.08 g to 45.9 g in 110 days, with an FCR of 1.31:1, on a combination of soymeal-based ASA 41/11 fry and 36/7 fingerling feeds.

Table 1. Formulation for the ASA 52/16 starter feed used in the 2000 Texas Select channel catfish fry to fingerling production trial at the Tai Xing Fish Stock Farm in Tai Xing, Jiangsu Province, China.¹

Ingredient	ASA 52/16 Starter Feed
Fishmeal, white 68/8	51.0
Wheat, SWW	12.5
Fish Oil, Unspec.	10.5
Blood ML mg. 93/.1	7.5
Soybean Meal 47.5	6.0
Yeast, Brewer's Dehydrated	5.0
Wheat Gluten	5.0
Soy lecithin	1.5
Vit PMX-F1	0.5
Min PMX T&S1	0.28
Stable Vitamin C 35%	0.20
Ethoxyquin	0.02
TOTAL	100.00

¹The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 52/16 indicates 52% crude protein and 16% crude fat.

Table 2. Formulations for the ASA 41/11 fry and 36/7 fingerling feed rations used in the 2000 Texas Select channel catfish fry to fingerling production trial at the Tai Xing Fish Stock Farm in Tai Xing, Jiangsu Province, China.¹

Ingredient	41/11 Fry Feed	36/7 Fingerling Feed
Soybean meal 47.5	46.30	46.30
Wheat, SWW	13.00	19.00
Wheat middlings	-----	8.00
Corn gluten meal 60%	15.00	10.00
Fishmeal, Anchovy 65/10	14.00	8.00
Fish oil	4.03	4.58
Soy oil	4.00	-----
Soy lecithin	1.50	1.50
Ca phosphate mono	1.70	2.20
Vit PMX Roche 2118	0.20	0.15
Min PMX F-1	0.25	0.25
Ethoxyquin	0.02	0.02
Total	100.00	100.00

¹The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, e.g. 41/11 indicates 41% crude protein and 11% crude fat.

TABLE 3. Results of the 2000 ASA aquaculture trial at the Tai Xing Fish Stock Farm that evaluated second generation Texas Select channel catfish growth performance from fry to fingerling stages using the ASA 80:20 production model and ASA soymeal-based aquafeeds.

Rep. No.	ChC ¹ stocking size (g)	Stocking rate (fish/mu)	No. days fed	Harvest wt. (g)		P _G ³ (kg/mu)		P _N ⁴ (kg/mu)		Survival ChC (%)	FCR	Net (RMB/mu)	ROI (%)
				ChC	SiC ²	ChC	SiC	ChC	SiC				
1	0.08	6000	81	47.2	74.2	236.4	55.9	236.0	55.4	83.5	1.30	1718	52.2
2	0.08	6000	81	45.8	73.8	235.2	56.2	234.7	55.8	85.6	1.31	1695	51.5
3	0.08	6000	81	44.7	74.3	230.9	57.0	230.4	56.6	86.1	1.33	1613	49.0
4	0.08	6000	81	45.6	77.1	233.1	58.4	232.6	58.0	85.2	1.32	1664	50.6
5	0.08	6000	81	46.4	70.2	236.7	51.0	236.2	50.6	85.0	1.30	1698	51.6
Mean	0.08	6000	81	45.9	73.9	234.5	55.7	234.0	55.3	85.1	1.31	1677	51.0

¹ChC = Channel catfish

²SiC = Silver carp

³P_G = Gross Production

⁴P_N = Net Production