

# **Three Year, Fry to Brooder Growth Performance of Texas Select Strain Channel Catfish on Soy-Based Diets**

## **Results of ASA/China Feeding Trials 35-97-70, 35-98-71 & 35-99-57**

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### **ABSTRACT**

Two-day old sac-fry of Texas Select strain channel catfish were imported from the United States to China in 1997 to establish a catfish breeding program at the Tai Xing Fish Stock Farm in Tai Xing, Jiangsu Province. The American Soybean Association cooperated with the Tai Xing farm to conduct a 3-year evaluation of the production performance of these fish through the fry to fingerling, fingerling to market, and market to brooder production phases. Sac-Fry grew to 72 g in 149 days in year one on a 36% protein, soy-based diet. Fingerlings grew to 926 g in year two on two 32% protein soy-based diets. Year three production yielded 2.15 kg brood stock on a 32% protein soy-based diet. Feed efficiency with the soy-based rations was high, with FCR values of 1.47, 1.50 and 1.65 for the fry to fingerling, fingerling to market, and market to brooder production phases, respectively. The Texas Select catfish strain demonstrated excellent growth performance and good feed efficiency in all three production phases evaluated. Work will continue in 2000 to evaluate the breeding performance of this strain of channel catfish.

### **INTRODUCTION**

The American Soybean Association (ASA), in cooperation with the Tai Xing Fish Stock Farm and the China National Fisheries Extension Center (NEC) and its Jiangsu Provincial affiliate, conducted a three-year series of sequential, on-farm feeding trials to quantify the growth performance of imported Texas Select strain channel catfish. Two-day sac fry of Texas Select strain channel catfish were imported to the Tai Xing Fish Stock Farm from the United States in the spring of 1997. A fry to fingerling production study was conducted in 1997. Fingerlings produced in the 1997 study were used to conduct a fingerling to market growout study in 1998. In 1999, two-year old catfish from the 1998 study were grown to brooder size to establish a channel catfish breeding program at the Tai Xing Fish Stock Farm in Jiangsu Province. A summary of fish growth performance from fry to brooder stages is presented in this paper. The 1997, 1998 and 1999 studies were all conducted in ponds using the ASA 80:20 production model and soy-based aquafeeds.

## **MATERIALS AND METHODS**

Two-day sac-fry of Texas Select strain channel catfish were imported from Southland Fisheries Corporation in the United States to China by the NEC in May 1997. The fish were air freighted from the United States to Shanghai and delivered by truck from Shanghai to the Tai Xing Fish Stock Farm in Tai Xing, Jiangsu Province.

At the Tai Xing farm, the catfish fry were intensively fed in floating, 1-m<sup>2</sup> trays in flowing water tanks from the swim-up stage to 10 days post swim-up. At 10 days post swim-up, catfish fry were stocked into ponds at a density of 10,000 fish per mu, together with silver carp fry at 1,000 fish per mu. A 40% protein fry diet was fed to the catfish in ponds until they attained an average weight of approximately 2 g. At size 2 g, the catfish were weaned to a 36% protein, soy-based fingerling feed formulated with 45% standard soybean meal (Table 1). The fingerling feed was formulated by ASA and produced by a Shanghai aquafeed mill as extruded, floating pellets. Initial feed pellet size was 1.5 mm. The catfish fry were fed in ponds for 149 days. The trial was terminated in November 1997 and the catfish fingerlings were over-wintered in ponds at the Tai Xing Fish Stock Farm.

Six thousand of the catfish fingerlings produced in the 1997 study were randomly selected in the spring of 1998 and restocked in six, 2-mu ponds for growout to market size. Catfish fingerlings were stocked at 500 fish per mu, together with 40 silver carp fingerlings per mu. Catfish in each of three ponds were fed one of two, 32% protein soy-based aquafeeds formulated by ASA and produced by Shanghai Fwuso aquafeed mill. One diet was an all-plant protein diet formulated with 50% standard soybean meal, while the other was formulated with 40% standard soybean meal and 5% fishmeal (Table 2). All feeds were produced as extruded, floating pellets. Channel catfish were fed for 167 to 170 days with these feeds. The trial was terminated in October 1998 and the fish were over-wintered in ponds at the Tai Xing Fish Stock Farm.

In the spring of 1999, two-year old catfish from the 1998 market growout study were restocked in six, 2-mu ponds for growout to brooder stock. Catfish were stocked at 200 fish per mu, together with 60 silver carp fingerlings per mu. Fish were fed the extruded, floating form of the ASA 32/6 growout diet (Table 3). This is an all-plant protein diet formulated with 52.8% dehulled soybean meal. Catfish were fed for 212 days. The trial was terminated in November 1999 and the fish over-wintered for use as breeding stock in 2000.

Catfish in all ponds in the 1997, 1998 and 1999 trials were sampled monthly to monitor growth performance. Sample data were plotted for each trial to obtain representative growth curves for each of the production phases.

## **RESULTS**

### **Fry to Fingerling Production**

Channel catfish fry stocked at 10,000 per mu in the 1997 trial grew from swim-up stage to 72 g in 149 days of feeding (Table 4). Average FCR with the soy-based fingerling diet was 1.47:1.

## Fingerling to Market Production

In 1998, 58-g catfish fingerlings grew to 921 g and 930 g in 167 and 170 days, respectively, on the 32% protein, soy-based growout diets with 0% and 5% fishmeal (Table 4; Figure 1). Net production of catfish averaged 392.5 kg/mu in the six test ponds. Net production of silver carp averaged 38 kg/mu. Catfish survival averaged 91%. FCR was 1.50:1 with the all-plant protein feed, and 1.49:1 with the feed containing 5% fishmeal. There was no significant difference ( $P>0.05$ ) in growth, net production, survival, or FCR for fish fed the soy-based feeds with and without fishmeal.

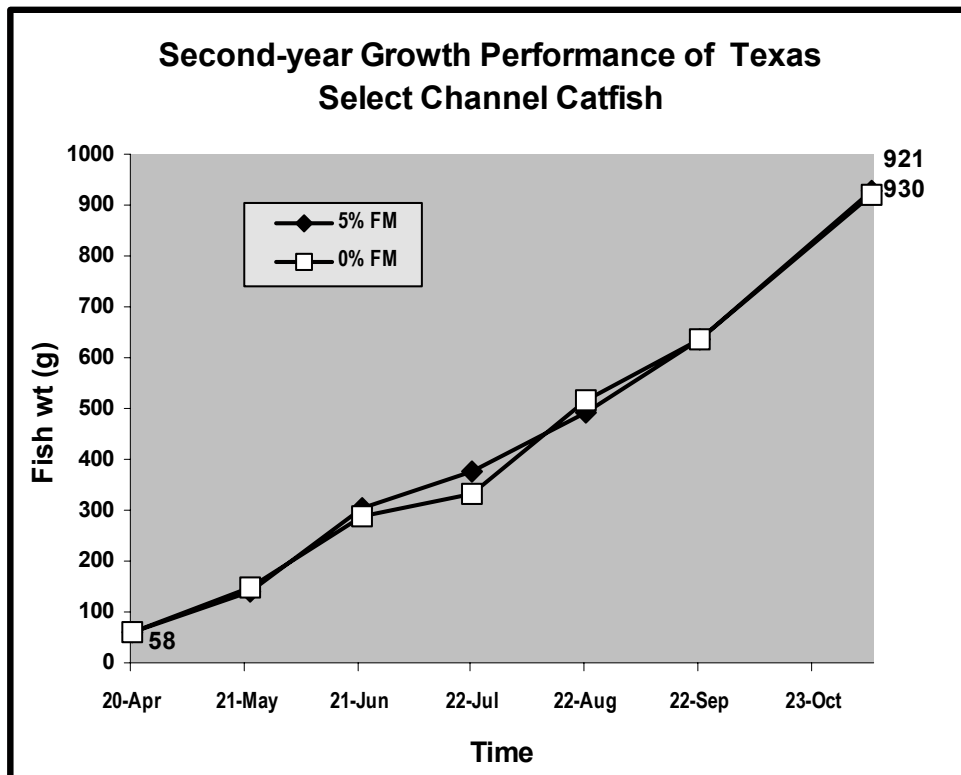


Figure 1. Second-year growth performance of Texas Select strain channel catfish at the Tai Xing Fish Stock Farm, Jiangsu Province, China. Average fish weight increased from 58 g to 926 g in 167 days on an all-plant protein aquafeed formulated with soybean meal as the primary protein source.

## Market to Brood Stock

The 2,400 Texas Select strain channel catfish stocked in the six 1999 trial ponds grew from an average weight of 710 g at stocking to 2,150 g in 212 days of feeding (Table 4; Figure 2). Average FCR with the 32/6 soy-based diet was 1.65:1. Catfish survival was 97.8%.

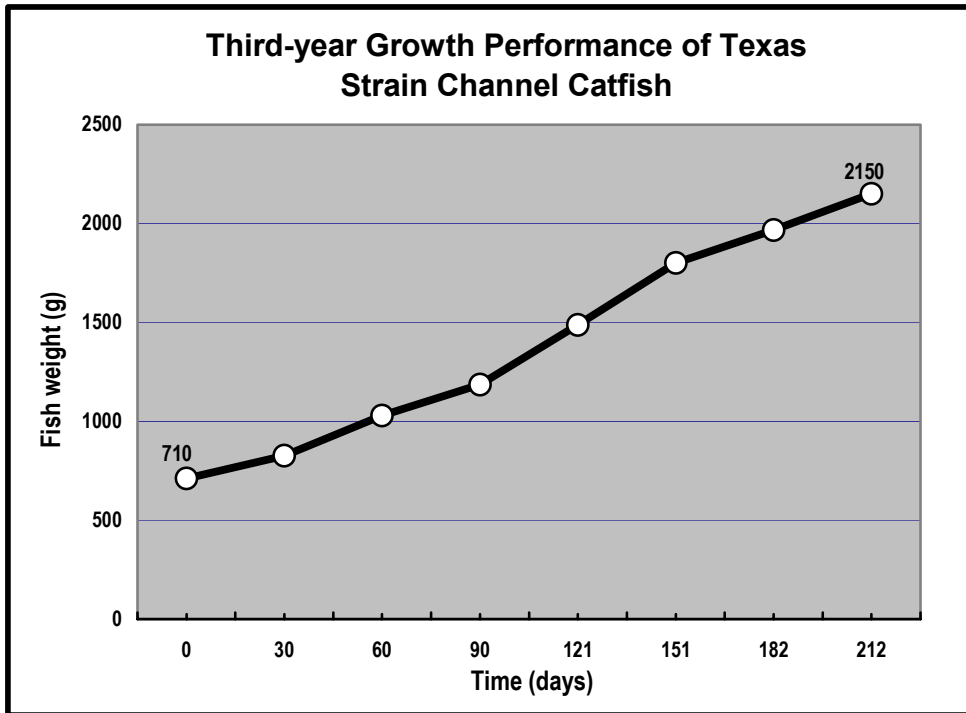


Figure 2. Third-year growth performance of Texas Select strain channel catfish at the Tai Xing Fish Stock Farm, Jiangsu Province, China. Average fish weight increased from 710 g to 2,150 g in 212 days on an all-plant protein aquafeed formulated with dehulled soybean meal as the primary protein source.

## SUMMARY AND CONCLUSIONS

The Texas Select catfish strain demonstrated excellent growth performance in three years of feeding trials with soy-based aquafeeds. Fry of this strain stocked at a density of 10,000/mu in 1997 grew to 72 g in 149 days on a 36% protein feed formulated with 45% soybean meal. Subsequent growout of these fingerlings in 1998 with 32% protein soy-based aquafeeds yielded fish weighing nearly 1 kg (926 g average). Third-year growout on a 32% protein feed formulated with high protein dehulled soybean meal produced brood stock with an average weight of 2.15 kg.

Feed efficiency with the soy-based fingerling and growout rations was good, with FCR values of 1.47, 1.50 and 1.65 for the fry to fingerling, fingerling to market, and market to brooder production phases, respectively. The soy-based diets produced both excellent growth and economic value for the Tai Xing Fish Stock Farm. Dehulled soybean meal in particular offered increased value in 1999 due to the lower cost per unit of protein that was obtained during the 1999 production season.

ASA will continue to work with the Tai Xing Fish Stock Farm in years 2000 to 2002 to evaluate breeding performance and F<sub>1</sub> generation growth performance of the Texas Select strain catfish.

## **ACKNOWLEDGEMENTS**

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### **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. Diet formulation for the ASA 36% protein fingerling ration fed in the 1997 fry to fingerling pond production study with *Texas select* strain channel catfish at the Tai Xing Fish Stock Farm in Jiangsu Province, China.

| Ingredient                | Ingredient percentage by weight |
|---------------------------|---------------------------------|
| Soybean meal (44%)        | 45.00                           |
| Wheat middlings (12%)     | 18.00                           |
| Rice bran                 | 11.00                           |
| Fish meal                 | 10.00                           |
| Corn gluten (60%)         | 7.00                            |
| Rapeseed meal             | 5.00                            |
| Soy oil                   | 2.20                            |
| Dicalcium phosphate (18%) | 1.05                            |
| Lysine HCl                | 0.50                            |
| Mineral premix            | 0.10                            |
| Vitamin C (coated)        | 0.10                            |
| Vitamin premix            | 0.05                            |
| Total                     | 100.00                          |

TABLE 2. Diet formulations for the two ASA 32% protein growout rations fed in the 1998 fingerling to market growout study with *Texas select* strain channel catfish at the Tai Xing Fish Stock Farm in Jiangsu Province, China.

| Ingredient                    | 0% fishmeal diet | 5% fishmeal diet |
|-------------------------------|------------------|------------------|
| Fish meal (65/10)             | 0.0              | 5.0              |
| Soybean meal (44%)            | 50.0             | 40.0             |
| Corn (extrusion cooked, 8.5%) | 20.0             | -----            |
| Wheat middlings (12%)         | 12.1             | -----            |
| Corn gluten (60%)             | 10.0             | 10.7             |
| Cottonseed meal (41%)         | 5.0              | 5.0              |
| Rice bran                     | -----            | 20.0             |
| Wheat flour                   | -----            | 11.0             |
| Rapeseed meal                 | -----            | 5.0              |
| Soy oil                       | 1.6              | 2.0              |
| Dicalcium phosphate (18%)     | 1.05             | 1.05             |
| Mineral premix                | 0.1              | 0.1              |
| Vitamin C (coated)            | 0.1              | 0.1              |
| Vitamin premix                | 0.05             | 0.05             |
| Total                         | 100.0            | 100.0            |

TABLE 3. Diet formulation for the ASA 32% protein, soy-based growout ration fed in the 1999 market to brood stock growout study with *Texas select* strain channel catfish at the Tai Xing Fish Stock Farm in Jiangsu Province, China.

| Ingredient                    | Ingredient percentage by weight |
|-------------------------------|---------------------------------|
| Dehulled soybean meal (47.5%) | 52.8                            |
| Wheat, SWW                    | 23.6                            |
| Wheat midds                   | 10.0                            |
| Corn gluten meal (60%)        | 6.0                             |
| Fish oil                      | 3.53                            |
| Ca phosphate mono             | 2.7                             |
| Soy lecithin                  | 1.0                             |
| Mineral premix                | 0.25                            |
| Vitamin premix Roche 2118     | 0.10                            |
| Ethoxyquin                    | 0.02                            |
| Total                         | 100.00                          |

TABLE 4. Production data for the 1997, 1998 and 1999 ASA pond trials that evaluated fry to brood stock growth performance of *Texas select* strain channel catfish with soy-based aquafeeds.

| Diet<br>(% CP/% SBM)              | Stocking density<br>(catfish/mu) | Mean weight<br>at stocking (g) | No. days<br>fed | Mean weight<br>at harvest (g) | Net production<br>(kg/mu) | Survival<br>(%) | FCR  |
|-----------------------------------|----------------------------------|--------------------------------|-----------------|-------------------------------|---------------------------|-----------------|------|
| <u>1997 Fry-Fingerling</u>        |                                  |                                |                 |                               |                           |                 |      |
| 36/45 <sup>1</sup>                | 10,000                           | 0.1                            | 149             | 72                            | 310                       | 43.0            | 1.47 |
| <u>1998 Fingerling-Market</u>     |                                  |                                |                 |                               |                           |                 |      |
| 0% fishmeal<br>32/50 <sup>1</sup> | 500                              | 58                             | 167             | 921                           | 389                       | 90.8            | 1.50 |
| 5% fishmeal<br>32/40 <sup>1</sup> | 500                              | 58                             | 170             | 930                           | 396                       | 91.5            | 1.49 |
| <u>1999 Market-Brooder</u>        |                                  |                                |                 |                               |                           |                 |      |
| 32/52.8 <sup>2</sup>              | 200                              | 710                            | 212             | 2150                          | 280                       | 97.8            | 1.65 |

<sup>1</sup> Standard soybean meal, 44% crude protein

<sup>2</sup> Dehulled soybean meal, 47.5% crude protein