

**Key Words:** Grass carp, Soy-based feed, 80:20 pond technology, China

# **Comparison on Production Performance of Grass Carp at Two Different Stocking Densities with the USSEC 32/3 Soybased Feed in Shanxi Province**

**Results of USSEC 2013 Aquaculture Freshwater Feeding  
Demonstration  
Project U13CXNA006**

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## **INTRODUCTION**

A comparison feeding demonstration on grass carp density was jointly conducted in 2013 by the U.S. Soybean Export Council (USSEC), in cooperation with the Shanxi Provincial Fishery Extension Center, Taiyuan City, Shanxi Province. The feeding demonstration was conducted at the Yongji Municipal Fish Stock Farm, Yuncheng City, Shanxi Province. The primary objective of the demonstration was to evaluate the production performance of grass carp at two different stocking densities using the USSEC 80:20 pond production technology, 32/3<sup>1</sup>extruded soybased feed and improved aeration system.

## **DEMONSTRATION PROTOCOLS**

Six ponds with a total area of 34 mu (2.3 ha) at the Yongji Municipal Fish Stock Farm, Shanxi Province were used for the grass carp density comparison demonstration. The

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<sup>1</sup> The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 32/3 indicates 32% crude protein and 3% crude fat.

average water depth of the trial ponds was 1.5 m. All the trial ponds were newly renovated and prepared identically before stocking. Ponds were equipped with the low-energy bottom diffused aeration systems in case of LODOS emergency.

The six demonstration ponds were stocked on 4 April 2013 with grass carp fingerlings produced locally. Grass carp averaged 90 g in weight at the time of stocking. The grass carp fingerlings were randomly stocked at a density of 1,200 fish/mu (18,000/ha) and 1,500 fish/mu (22,500/ha) in six trial ponds. Each density treatment had three replicates. All fish were healthy, disease free and of uniform size, age and genotype at stocking.

Grass carp fingerlings in the six trial ponds were fed the USSEC 32/3 soybased feed with no fishmeal. The trial feed was fed in extruded, floating pellet form. Fish in all trial ponds were fed three times daily using the USSEC 90% satiation feeding technique. Fish in the three replicate ponds of each density treatment received an identical amount of feed each day and at each feeding, but the 90% satiation feed amount was adjusted separately for each density treatment. Daily feed records for each pond were kept by the cooperator. Daily feed amounts were added together and recorded in the USSEC Demonstration Data Book for each respective sampling period and for each feed treatment. The 32/3 grass carp growout feed was produced by Ningbo Techbank Feed Company, Zhejiang Province using USSEC formulations and under USSEC technical support and guidance. The test feed was least-cost formulated from available ingredients in the region.

Fish were sampled at approximately 30-day intervals during the course of the trial to monitor growth and fish health. Data on fish survival, gross and net production, average fish weight, and feed conversion efficiency were obtained at harvest for fish in each pond. All fish from each pond were weighed at harvest and sub-samples from each pond counted to get the average fish weight for each species in each pond population. Data on production input costs was recorded throughout the trial to determine the economic return with the USSEC feed and technology.

## **DEMONSTRATION RESULTS**

Grass carp were cultured in this feeding demonstration for a total of 180 days from 11 April to 16 October, 2013. Grass carp grew from 90 g to 1,038 g and 1,029 g at the stocking densities of 1,200 and 1,500 fish/mu, respectively. Grass carp biomass at harvest was 1,217 kg/mu (18,255 kg/ha) and 1,487 kg/mu (22,305 kg/ha) and; the survival rate averaged 97.7% and 96.3% at the two different stocking densities of 1,200 and 1,500 fish/mu (Table 4).

Grass carp feeding trial averaged the FCR of 1.37:1 and 1.42:1 at the stocking density of 1,200 fish/mu and 1,500 fish/mu, respectively. (Table 4).

The harvested grass carp and silver carp were sold to local markets. Market values for harvested fish were RMB 11.4/kg (\$1.84/kg) for grass carp and RMB 3.4 (\$0.55) per kg for silver carp (Table 4). The three replicated ponds yielded an average net economic return of RMB 4,507/mu (\$11,082/ha) and 5,282/mu and \$12,988/ha for the densities of

1,200 fish/mu and 1,500 fish/mu, respectively. The average return on investment was 43.0% and 39.7% for the three replicate ponds of each density treatment, respectively for the 1,200 and 1,500 fish/mu densities.

## **SUMMARY AND CONCLUSIONS**

The 2012 trial results of the grass carp density comparison demonstration indicate that the USSEC 32/3 extruded soybased feed and upgraded bottom diffused aeration system yielded significant production performance, economic and risk advantages as stocking density of grass carp increased. Grass carp biomass at harvest was increased 68.8% when stocking density was doubled from 600 to 1,200 fish per mu, with a corresponding ROI increase of 20%. But the 2013 trial results show that the ROI declined with the increase of stocking density though there was no significant difference in growth and FCR. The cooperators reported that the production risk was higher at the stocking density of 1,500 fish/mu, especially at the abnormal hot summer in 2013. It's highly recommended that 1,200 fish per should be an appropriate density for fish farmers to manage in the region.

Grass carp survival was reported to have been much improved in this demonstration, which used an injection vaccine, in comparison to traditional ponds without use of the vaccine. The grass carp in this demonstration were also reported to grow faster with the USSEC 32/3 floating, soy-based feed than the fish fed a local sinking feed in other ponds on the farm.

No drugs and chemicals were used throughout the entire demonstration period with the USSEC 80:20 pond production and extruded soy-based feed technology. It is the second year for the USSEC to promote the 80:20 pond production model and eco-friendly aquaculture technology. The two-year trial results have proved that it is more advantageous to use extruded soy-based over locally manufactured sinking pellet in terms of water quality, fish health, production performance and pond management. It has been reported that the total tonnage of extruded feed has been increased by 10 times in the region in 2013 through the joint efforts from the USSEC and the Shanxi Provincial Fishery Extension Center.

## **ACKNOWLEDGEMENTS**

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**Chinese Currency and Production Unit Conversions:**

RMB 6.10 = 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 USSEC 32/3 soy-based feed used in the 2013 grass carp growout feeding demonstration with the two stocking densities at the Yongji Municipal Fish Stock Farm, Yuncheng City, Shanxi Province, China. The demonstration feed was produced by Ningbo Techbank Feed Company, Zhejiang Province.

Ingredient	Percent of total
Soybean Meal	43.00
Soy Hulls	5.00
Wheat Midds	40.75
Corn Gluten Meal	2.00
Blood Meal, spray dried	5.00
Calcium phosphate mono - 21%P	1.48
Fish, Anchovy	0.00
Fish Oil	1.00
Vitamin Premix-F2	0.50
Mineral Premix F-1	0.25
DL-Methionine( 99%)	0.18
Choline Chloride 50%	0.19
Stay C - 35%	0.03
Ethoxyquin - Antioxidant	0.02
Solis MOS - Mycotoxin Binder	0.50
Mold Inhibitor6	0.10
<b>Total</b>	<b>100.00</b>

Table 2. Calculated nutritional profile of the USSEC 32/3 soy-based growout diet tested in the 2013 grass carp growout feeding demonstration with the two stocking densities at the Yongji Municipal Fish Stock Farm, Yuncheng City, Shanxi Province, China. The demonstration feed was produced by Ningbo Techbank Feed Company, Zhejiang Province.

Nutrient	Amount	Unit
DE Fish (extr)	2217.59	kcal/kg
NFE	39.83	%
Starch	16.56	%
*Protein	32.01	%
Protein, dig.	28.86	%
Fish Protein	0.00	%
Soy Protein	20.27	%
Soy NFE	15.44	%
*Fat	3.04	%
W 3	0.31	%
W 6	0.58	%
Fiber	7.29	%
*Ash	6.06	%
Calcium	0.49	%
Phos Avail	0.51	%
Iron	486.55	ppm
Copper	30.63	ppm
Zinc	147.28	ppm
Selenium	1.09	ppm
Moisture	9.68	%
Vitamin C	105.00	mg/kg
Choline	2519.43	mg/kg
Ethoxyquin	134.50	mg/kg
Arginine	1.89	%
Lysine	1.83	%
Methionine	0.61	%
Meth+Cyst	1.15	%
Threonine	1.24	%
Tryptophan	0.38	%

Table 3. Vitamin and mineral premix formulations for the 2013 USSEC grass carp density comparison demonstration at the Yongji Municipal Fish Stock Farm in Shanxi Province, China. Quantities of vitamins and minerals are per kilogram of premix. Both premixes were produced by Chengdu Phoenix Feed Company, Sichuan Province.

<b>Ingredient</b>	<b>Unit</b>	<b>Amount</b>
<u><i>Vitamin Premix F-2</i></u>		
<i>Vitamin A</i>	<i>IU/kg</i>	<i>1,200,000</i>
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
<u>Mineral Premix F-1</u>		
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



Table 4. Results of the 2013 USSEC grass carp density comparison demonstration with the 32/3 soybased feed at the Yongji Municipal Fish Stock Farm in Shanxi Province, China.

Pond No. <sup>1</sup>	GrC <sup>1</sup> stocking size (g)	Stocking rate (GrC/mu)	No. days fed	Harvest wt. (g)		P <sub>G</sub> <sup>4</sup> (kg/mu)		Survival (%)		FCR	Net income (RMB/mu)	ROI (%)
				GrC <sup>2</sup>	SiC <sup>3</sup>	GrC	SiC	GrC	SiC			
1	90	1,200	180	1,020	905	1,212	174	99	96	1.37	4,476	41.0
2	90	1,200	180	1,030	880	1,211	171	98	97	1.38	4,444	41.0
3	90	1,200	180	1,065	845	1,227	161	96	95	1.37	4,602	43.0
<b>Mean</b>	<b>90</b>	<b>1,200</b>	<b>180</b>	<b>1,038</b>	<b>877</b>	<b>1,217</b>	<b>169</b>	<b>97.7</b>	<b>96</b>	<b>1.37</b>	<b>4,507</b>	<b>41.7</b>
4	90	1,500	180	1,050	805	1,512	153	96	95	1.40	5,568	42.0
5	90	1,500	180	997	810	1,466	156	98	96	1.44	5,052	38.0
6	90	1,500	180	1,040	808	1,482	158	95	98	1.43	5,225	39.0
<b>Mean</b>	<b>90</b>	<b>1,500</b>	<b>180</b>	<b>1,029</b>	<b>808</b>	<b>1,487</b>	<b>156</b>	<b>96.3</b>	<b>96.3</b>	<b>1.42</b>	<b>5,282</b>	<b>39.7</b>

<sup>1</sup>Grass carp stocking density in ponds 1-3 was 1,200 fish/mu; grass carp stocking density in ponds 4-6, was 1,500 fish/mu. All grass carp growout were fed the USSEC formulated 32/3 extruded and soy-based feed.

<sup>2</sup>GrC = Grass Carp; <sup>3</sup>SiC = Silver Carp

<sup>4</sup>P<sub>G</sub> = Gross Production