

# **Growth Performance of Common Carp Fed Soy-Based Feed in Raceways in Subang, Indonesia**

## **Results of ASA-IM/Soy-in-Aquaculture 2006 Feeding Demonstration Project**

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### **ABSTRACT**

A feeding demonstration was conducted at Subang, West Java, Indonesia to demonstrate the growth potential of common carp (*Cyprinus carpio*) cultured using soy-based feeds in 25.2 m<sup>3</sup> raceways. Common carp fingerlings of 47 g were stocked into three 25.2 m<sup>3</sup> raceways at 1260 fish per raceway. Fish in all three raceways were fed a soybean meal based, extruded feed that was produced domestically in Indonesia. After 147 days of culture the common carp reached an average size of 532 g with an average FCR of 1.90:1. Gross production averaged 448 kg/raceway or 18 kg/m<sup>3</sup> of raceway volume.

## **INTRODUCTION**

The American Soybean Association International Marketing (ASA-IM), under the Soy-in-Aquaculture (SIA) Project and in cooperation with a local farmer, Mr. Giri, in Cijambe, Subang, West Java, Indonesia, conducted a 147 day feeding demonstration with common carp in raceways. The objective of the project was to demonstrate the feasibility of culturing common carp in raceways using a soy-based feed.

## **MATERIALS AND METHODS**

Three, 25.2 m<sup>3</sup> (7 m x 3 m x 1.2 m) raceways at the Giri raceway farm site in Subang, were used for the demonstration. The raceways were constructed of cement and water entered from a nearby river through a series of sluices. The three demonstration raceways were adjacent to one another on the farm site.

Common carp fingerlings of size 10 g were obtained from a local hatchery and grown on site to about 47 g for the demonstration. Common carp were stocked in the demonstration raceways at a density of 1,260 fish per raceway. Fish in all three raceways were of uniform size and age at stocking. Common carp production targets were 500 g per fish and 630 kg per raceway, or 25 kg/m<sup>3</sup> of raceway volume.

Common carp were fed twice daily with an extruded, floating, pelleted feed formulated to contain 32% crude protein and 6% crude lipid (32/6). The 32/6 feed was least-cost formulated by ASA-IM and contained 40% dehulled soybean meal. The 32/6 feed was produced domestically in Indonesia by Feedmill A. The three raceways were treated as replicates of a single feed treatment, with fish in all raceways fed identically at each feeding using the ASA-IM satiation feeding technique.

Raceway management was based on the ASA-IM production model. At the conclusion of the project, all raceways were completely harvested and all fish weighed. Ten percent of the harvested fish (about 200 fish) were enumerated when weighed to obtain an average fish size and to estimate fish survival. This was done to limit stress as the fish were to be later sold in a live market. Results were used to determine fish survival, average fish weight, gross fish production, feed conversion ratio (FCR), profitability and Return On Investment (ROI).

## **RESULTS**

Common carp were cultured a total of 147 days between June 3 and October 28, 2006. Common carp fed the soy-based feed grew from an average of 47 g to 532 g in this period. Gross production in the raceways averaged 448 kg, or 18 kg/m<sup>3</sup> of raceway volume, with an average survival of 67% and average FCR of 1.90:1 (Table 3). Financial returns averaged 1,324,760 IDR/raceway or 37% average ROI (Table 4).

## **SUMMARY AND CONCLUSIONS**

Common carp may be grown successfully using the ASA-IM raceway technique with a soy-based, extruded feed. However, common carp performance on formulated feed in this demonstration was compromised by an outbreak of Koi Herpes Virus (KHV) near the start of the project. Additionally, there were problems with non-target species entering the culture system (tilapia and pacu, both feed taking species) and consuming feed. As a result, common carp FCR was higher than the expected level of  $\leq 1.3:1$ . Fish growth and FCR were impacted by both the chronic KHV infection and non-target fish consuming feed meant for the target fish. This can be seen in Figure 2, which shows average FCRs rising quickly and then dropping, only to rise again. This can be explained by the initial mortality event artificially raising the average FCR as fish that consumed feed died, then as the population stabilized the FCR dropped. Soon however, non-target fish started appearing in the raceways, and while they were removed when possible, they consumed feed yet did not contribute to the final biomass, thereby raising the FCR again.

The financial aspect of this demonstration was important. Farm staff informed ASA-IM that typical raceways produce ~500g fish in five months with 54% survival and 700,000 IDR/raceway profit. This project yielded 532-g carp in less than five months with a survival rate of 67% and an average profit of 1,324,760 IDR/raceway (37% average ROI). Financially this represents a net return that is 89% higher than the 700,000 IDR norm. Even with the KHV mortality and non-target fish issue, the trial demonstrated better performance and financial return.

The large number of “non-target” fish removed (187 kg total) was a significant factor in the increase of FCR and possible increase in the time of culture and reduction in profitability. A rough calculation shows that factoring in the non-target growth as 90% of the removed weight (169.3kg), and treating these fish as if their weight contributed to the final sales, the average FCR would improve to 1.67 and the average financial return to 1,432,138 IDR/raceway (or 39% ROI).

The cooperating farmer had several comments on the project that are listed below:

- Using ASA-IM feed and feeding technology significantly reduced the labor cost
- ASA-IM technology was very simple and practical
- The survival rate of fish was enhanced (around 67% compared to usual farmer e.g. 54%)
- Fish had a good growth rate; 500 g per fish was reached in less than 5 months
- Fish were uniform in size
- Better profits compared to the traditional system using sinking feeds
- Because floating feeds were used, the feed requirement for the fish could be observed directly so feed was not wasted
- The quality of ASA-IM floating feed was very good (small amount dust/fines were found with extruded, floating feed compared to sinking feed)
- The feed packaging (@30kg) was convenient as it was not so heavy and easier to handle

Results of the demonstration indicate the current raceway culture system can be improved by using better feeding technologies and extruded, floating feeds (such as those demonstrated by the

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ASA-IM in this demonstration) to lead to better profitability. However, maximizing profitability of this system will require that the farmer attempt to obtain non-KHV infected fingerlings, exclude non-target fish from the culture system and strictly control what feed is used and how it is fed.

### **ACKNOWLEDGEMENTS**

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**Growth Curve of Common Carp Fed an Extruded, Soy-Based Feed in Subang West Java, Indonesia, 2006**

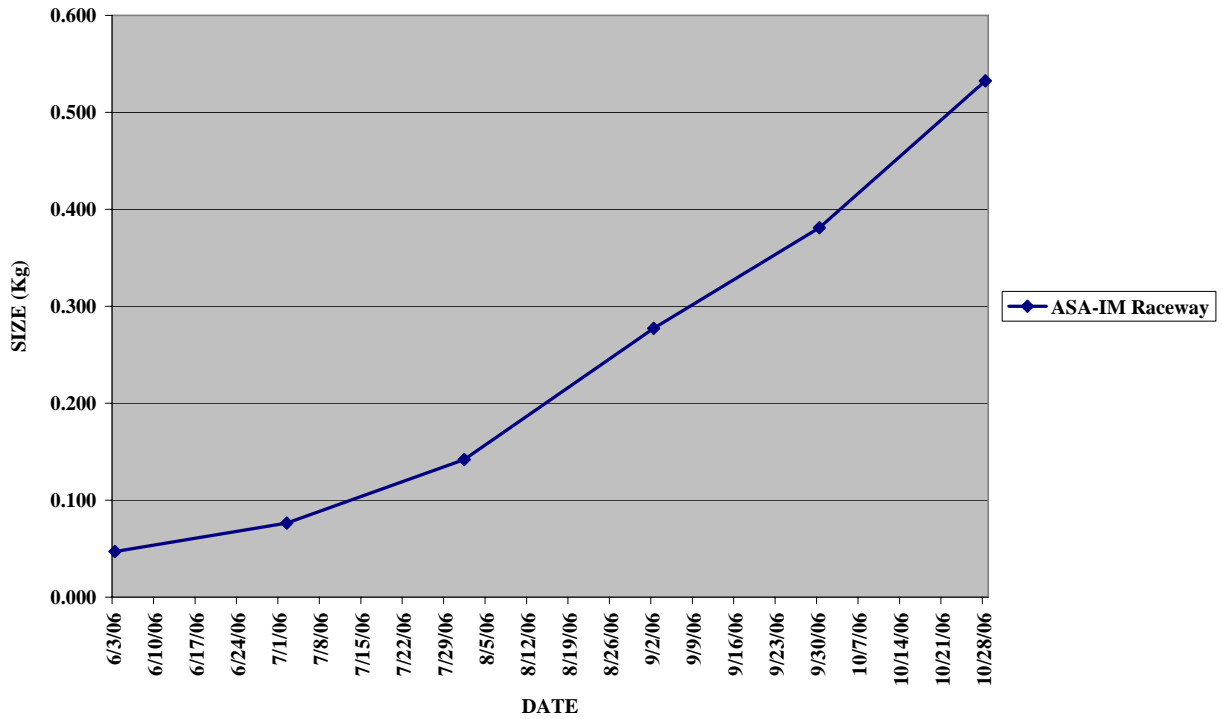


FIGURE 1. Growth curve for common carp over a 147-day culture period in the 2006 ASA-IM SIA Common Carp Demonstration Project in Subang, Indonesia. Common carp grew from an average of 47 g to 532 g using a 32/6 formulated feed.

**FCR Curve of Common Carp Fed an Extruded, Soy-Based Feed  
in Subang West Java, Indonesia, 2006**

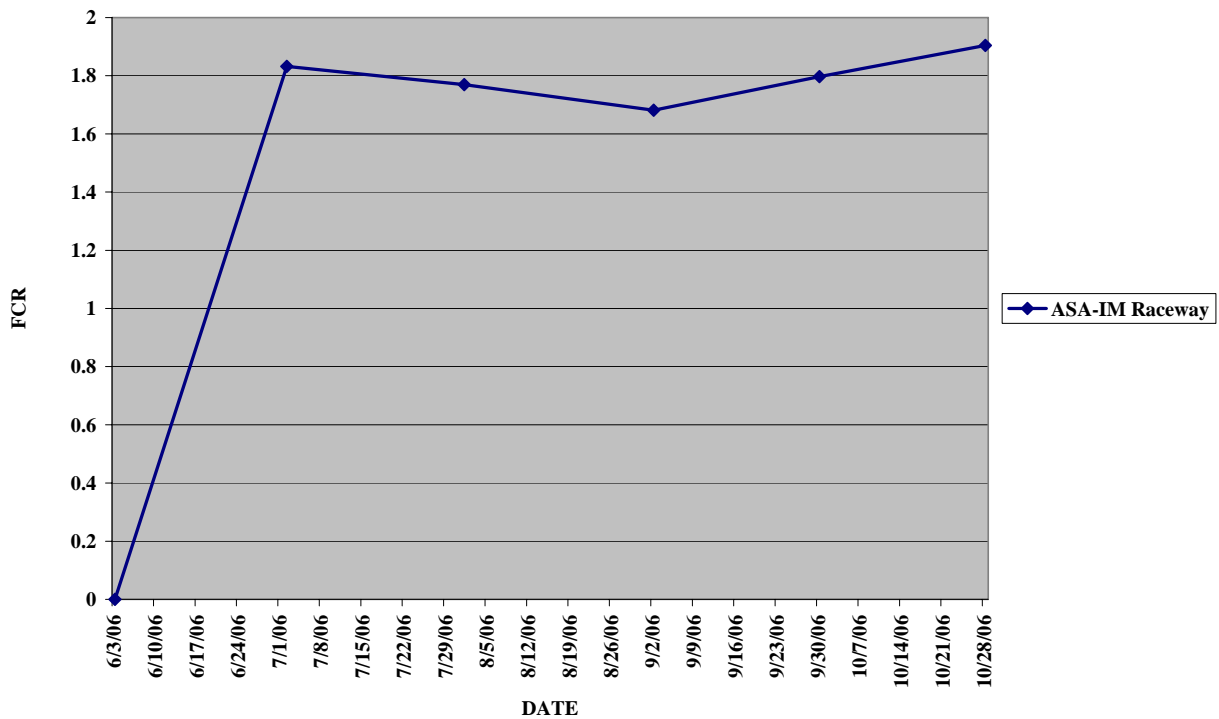


FIGURE 2. FCR curve for common carp on over a 147-day culture period in the 2006 ASA-IM SIA Common Carp Demonstration Project in Subang, Indonesia. Common carp fed with formulated feed in this period had an overall average FCR of 1.90:1.

TABLE 1. Formula provided to Feedmill A for the ASA-IM 32/6, soymeal-based feed used in the 2006 ASA-IM SIA Common Carp Demonstration Project at Subang, West Java, Indonesia that demonstrated growth performance of common carp using the ASA-IM production model and floating formulated aquafeeds. The feed was fed in 2-mm and 3-mm pellet sizes.

**32/6<sup>1</sup> Freshwater Fish Growout Feed  
2006 Indonesia Common carp**

Ingredient	% Inclusion Rate*
Soybean Meal - 48%	40.00
Wheat, Feed Flour - 14.8%	30.00
Poultry BP-57%	10.00
Wheat Bran - 14.8%	7.50
Corn, whole grain 8.8%	5.00
Fish, Anchovy 65/7.5	3.00
Fish Oil, local	2.20
Calcium phos. mono - 21%	1.47
Vitamin Premix F2	0.50
Mineral Premix F1	0.25
Choline Chloride - 60%	0.05
Stay C - 35%	0.03
<b>TOTAL</b>	<b>100.00</b>

\*Note, this list does not include the Feedmill A mold inhibitor and antioxidant.

<sup>1</sup>The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 32/6 indicates 32% crude protein and 6% crude fat.

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TABLE 2. Vitamin and mineral premix formulas produced by BASF Indonesia and provided to Feedmill A for the ASA-IM 32/6 soymeal-based feed used in the 2006 ASA-IM SIA Common Carp Demonstration Project at Subang, West Java, Indonesia

Vitamin Premix PMX-F2<sup>1</sup>

Nutrient	Unit	As fed
Vitamin A	IU/kg	1200000
Vitamin D3	IU/kg	200000
Vitamin E	IU/kg	20000
Biotin	mg/kg	40
Folic acid	mg/kg	1800
Niacin	mg/kg	40000
Pantothenate	mg/kg	20000
Pyridoxine (B6)	mg/kg	5000
Riboflavin (B2)	mg/kg	8000
Thiamin (B1)	mg/kg	8000
Vitamin B12	mcg/kg	2000
Ethoxyquin	mg/kg	500

Mineral Premix PMX-F1<sup>1</sup>

Nutrient	Unit	As fed
Iron	ppm	40000
Manganese	ppm	10000
Copper	ppm	4000
Zinc	ppm	40000
Iodine	ppm	1800
Cobalt	ppm	20
Selenium	ppm	200

<sup>1</sup>Premix ingredient quantities are per kg of premix.

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TABLE 3. Results of the 2006 ASA-IM SIA Common Carp Demonstration Project at Subang, West Java, Indonesia that demonstrated growth performance of common carp using the ASA-IM production model with raceways and floating formulated aquafeeds.

Raceway No.	Raceway size (m <sup>3</sup> )	Stocking size (g)	Stocking rate (fish/raceway)	No. days cultured	Harvest weight (g)	Gross Production		Survival (%)	FCR
						(kg/raceway)	(kg/m <sup>3</sup> )		
14	25.2	46	1260	147	147 2	451	18	64	1.87
15	25.2	46	1260	147	533	468	19	70	1.82
16	25.2	49	1260	147	502	425	17	67	2.02
<b>Mean</b>	<b>25.2</b>	<b>47</b>	<b>1260</b>	<b>147</b>	<b>532</b>	<b>448</b>	<b>18</b>	<b>67</b>	<b>1.90</b>

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TABLE 4. Financial results of the 2006 ASA-IM SIA Common Carp Demonstration Project at Subang, West Java, Indonesia that demonstrated growth performance of common carp using the ASA-IM production model with raceways and floating formulated aquafeeds.

<u>Parameter</u>	<u>Race 14</u>	<u>Race 15</u>	<u>Race 16</u>	<u>Ave</u>
Total initial fish stocked (pcs)	1,260	1,260	1,260	1260
Mortality replacement	169	189	58	139
Fingerling price (IDR/pc) <sup>1</sup>	661	661	661	661
Initial size of fingerlings (kg)	0.046	0.046	0.049	0.047
Total harvest (kg)	451	468	425	448
Average size at harvest (kg)	0.562	0.533	0.502	0.532
Fish at harvest	803	878	846	842
Survival (%)	64%	70%	67%	67%
Initial weight of fish (kg)	36.92	40.37	41.47	39.59
Weight gain of fish (kg)	414	428	384	408
Feed 32/6 (kg)	776	778	775	776
Total feed used	776	778	775	776
Feed Price 32/6 IDR/kg	3400	3400	3400	3400
Cost of labor (IDR/month) <sup>2</sup>	4783	4783	4783	4783
Time of culture	4.9	4.9	4.9	4.9
FCR	1.87	1.82	2.02	1.90
Selling price (IDR/kg)	11000	11000	11000	11000
<b>Gross Profit (IDR)</b>	<b>4961000</b>	<b>5148000</b>	<b>4675000</b>	<b>4928000</b>
Total feed cost	2637142	2645846	2634150	2639046
Total fingerling cost (including replacements)	944569	957789	871198	924519
Total labor cost	23275	23275	23275	23275
Total misc cost <sup>3</sup>	16400	16400	16400	16400
Total Costs (IDR)*	3621386	3643310	3545023	3603240
<b>Net Profit (IDR)</b>	<b>1339614</b>	<b>1504690</b>	<b>1129977</b>	<b>1324760</b>
ROI	37%	41%	32%	37%
IDR/kg (profit)	2970	3215	2659	2948
IDR/kg (costs)	8030	7785	8341	8052

<sup>1</sup> 14,000 IDR/kg 178.5g fish 3,780 fish total

<sup>2</sup> 550,000 IDR/month 23 raceways with estimated ASA-IM 20% of this cost

<sup>3</sup> Salt 19,200 IDR + Screening material 30,000 IDR