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Aquafeeds

Soy-based feeds evaluated for production of Amazonian paiche

17 December 2015

By Herbert E. Quintero, Ph.D. , Michael C. Cremer, Ph.D.; Jairo Amezquita; Francisco de la Torre and Luis Henostroza

Fast-growing species produced via aquaculture since 2009

Arapaima, pirarucu or pacha (*Arapaima gigas*) is the largest freshwater fish. Growing up to 3 meters in length and 200 kg in weight, they are endemic to tropical South America and are found primarily in the lowlands of the watersheds of the Araguaia-Tocantins, the Solimões-Amazon River, and Essequibo River basins in Brazil, Guyana and Peru.

Although the paiche has been included on the international trade-restricted list due to the fact that it is considered endangered by the Convention on International Trade in Endangered Species, the company Amazon Fish Products S.A. has a permit to commercialize the fish because they have been produced by aquaculture since 2009. The interest in growing paiche is related to the fact that the fish have the best growth rate among Amazonian cultivated fish species, growing 27-41 g/day and up to 15 kg/year.

The feeding demonstration at Amazon Fish Products S.A. evaluated the performance of paiche given three different feeds. Interest in growing paiche relates to the fact the fish can grow up to 15 kg/year in culture.

Paiche diets

Paiche feed on prey consisting primarily of detritivorous/algivorous and omnivorous fish that are not top predators, and probably play a key role in regulating the energy and nutrient flows of aquatic ecosystems. In aquaculture, the fish are fed high-protein (45 percent) feed, which can become a limiting factor for production due to the cost and availability of fishmeal ingredients.

The authors therefore performed a commercial feeding demonstration to evaluate the use of new soy ingredients that have high protein content and low levels of the oligosaccharides raffinose and stachyose as partial replacements for fishmeal in diets for paiche. The feeding demonstration was conducted at the Amazon Fish Products hatchery in Ucayali, Pucallpa, Peru.

Study setup

Three test diets formulated to contain 45 percent crude protein and 13 percent fat were assigned to two 0.85-cubic meter replicate tanks in sequential order, with a commercial diet (COM) in tanks C1 and C2, an experimental diet with low-oligosaccharide soybean meal (S.M.) in tanks C3 and C4, and an experimental diet with soy protein concentrate (SPC) in tanks C5 and C6. All tanks were operated with a constant water flow of 5 L/minute.

Fish for the demonstration had an average individual weight of 647.4 g. They were intended to be stocked at a density of 62 fish/tank, with an average fish biomass equivalent to 47.4 kg/cubic meter, but some of the fish jumped between tanks. The results of this demonstration should therefore be considered anecdotal.

The fish were fed ad libitum, and six fish were sampled weekly from each tank over a 62-day period. Individual fish weights and lengths were determined during each sampling. Fish were harvested after 62 days at an average weight of 2.0 kg.

Results

The weekly growth data is shown in Tables 1 and 2. Final average weights for fish fed the commercial diet were 2,198 and 2,132 g in each replicate tank, while average weights for fish fed the S.M. diet were 2,121 and 2,166 g. Average fish weights for the SPC treatment were 1,981 and 2,098 g.

Treatment	Replicate	No. of fish: Initial	No. of fish: Final	Survival (%)	Individual weight (g): Initial	Individual weight (g): Final
COM	C1	61	61	100	647.44	2,197.7
COM	C2	64	64	100	647.44	2,132.0
S.M.	C3	53	52	98.1	647.44	2,120.8
S.M.	C4	60	60	100	647.44	2,166.0
SPC	C5	62	55	88.7	647.44	1,980.8
SPC	C6	75	74	98.7	647.44	2,097.8

Relative weight, a measure of fish condition, indicates if animals are thin or fat. A fish with a relative weight value of 80 percent or less is considered severely thin, indicating a lack of food. Fish for this demonstration were in very poor condition at the time of stocking, with relative weights of 78.59 ± 4.09 percent. After the first sampling, fish condition improved to an average of 94.57 percent, and by the end of the demonstration, the average relative weight for all the fish was 99.07 percent.

Fish biomasses at harvest were 158.3 and 161.1 kg/cubic meter for the two tanks fed the commercial diet. Fish in tanks fed the soybean meal-based diet had harvest biomasses of 130.2 and 153.4 kg/cubic meter, while fish fed the SPC diet had biomasses of 128.6 and 180.8 kg/cubic meter (Table 2, Figure 1).

Treatment	Replicate	Weight gain	Specific growth rate	Biomass gained (kg)	Final density (kg/m3)	Feed Conversion Ratio
COM	C1	239.43	1.97	94.56	158.27	0.92
COM	C2	229.30	1.92	95.01	161.10	0.87
S.M.	C3	227.57	1.91	75.97	130.20	0.99
S.M.	C4	234.55	1.95	91.11	153.44	0.92
SPC	C5	205.94	1.80	68.80	128.62	1.18
SPC	C6	224.01	1.90	106.68	183.28	0.94

With a value of 234.4 percent, average weight gain was highest for paiche given the commercial diet. Fish that received the S.M. feed had weight gains of 231.1 percent, and paiche on the SPC diet gained 215.0 percent.

Feed-conversion ratios (FCRs) were lower for fish fed the COM diet, with an average ratio of 0.895 ± 0.035. Fish fed diet S.M. had an average FCR of 0.950 ± 0.057, and fish fed the SPC diet had an average FCR of 1.060 ± 0.170.

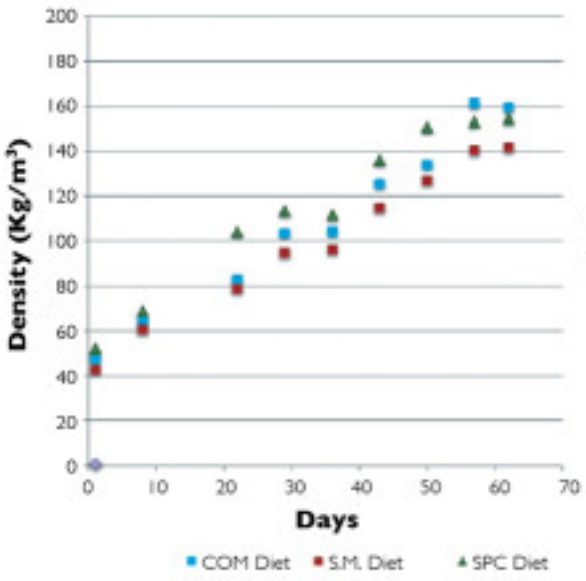

Figure 1. Average culture density for paiche given three test feeds.

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Perspectives

The results of this study confirmed that paiche can be raised at very high densities. Diets based on soybean meal and feed-grade soy protein concentrate yielded fish performance similar to that for paiche fed a fishmeal-based diet. Hence, soy-based feeds can be alternatives to traditional fishmeal-based feeds for the continued development of a commercial paiche-farming industry.

Authors

HERBERT E. QUINTERO, PH.D.

Aquaculture Research Station
University of Arkansas at Pine Bluff
1200 North University Drive
Mail Slot 4912
Pine Bluff, AR 71601 USA

qfherbert@gmail.com (mailto:qfherbert@gmail.com)

MICHAEL C. CREMER, PH.D.; JAIRO AMEZQUITA; FRANCISCO DE LA TORRE

U. S. Soybean Export Council
Guadalajara World Trade Center
Guadalajara, Jalisco, Mexico

LUIS HENOSTROZA

Amazon Fish Products,
S.A., Kilometro 10
de la Carretera Federico Basadre
Pucallpa, Ucayali, Peru