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Aquafeeds

Trials test cottonseed meal as soybean replacement in shrimp feed

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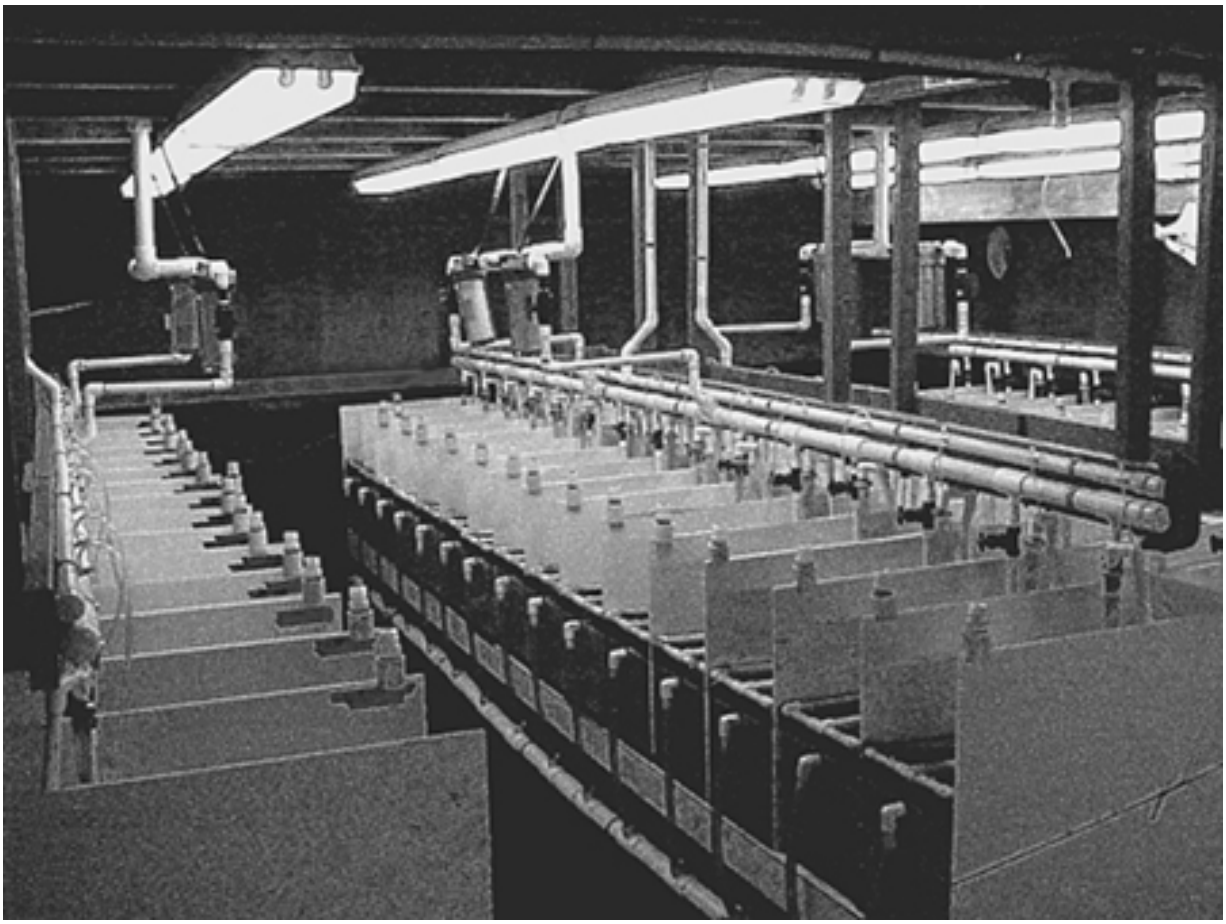
Satisfactory fish growth with diets with up to 40 percent inclusion

Aquaculture feed manufacturers have a genuine interest in the use of plant proteins. Reflecting this interest, soybean meal has become a major aquatic feed ingredient. Cottonseed meal is a lower-cost protein alternative to soybean meal, but its use in commercial shrimp feeds may be limited because it contains gossypol and has low available lysine content.

Through a grant from the United States Department of Agriculture's Agricultural Research Service, the authors studied replacement of soybean meal with mechanically extracted and solvent-extracted cottonseed meal.



The trials with feed containing cottonseed meal were conducted in aerated glass aquariums.

Experimental feeds

Tested feeds contained 10, 20 and 30 percent cottonseed meal by weight in the two extracted forms (Table 1). Inclusion levels of 26 percent fishmeal and 5 percent shrimp meal were held constant for all feeds.

Soybean meal and wheat flour content was manipulated to maintain isonitrogenous feeds. A feed without cottonseed meal served as a control. Average proximate analysis, and total and free gossypol content of feeds is presented in Table 2.

Divakaran, Ingredient composition (percentage as fed) for feeds, Table 1

Ingredient	Control	ME-10	ME-20	ME-30	SE-10	SE-20	SE-30
Cottonseed meal	0.0	10.0	20.0	30.0	10.0	20.0	30.0
Soybean meal	22.7	13.9	5.0	0.0	15.1	7.5	0.0
Wheat flour	20.2	19.7	19.2	2.7	18.9	17.6	16.1
Corn starch	0.0	0.0	0.0	11.2	0.0	0.0	0.2

Ingredient	Control	ME-10	ME-20	ME-30	SE-10	SE-20	SE-30
Fish oil	4.0	5.6	5.8	6.4	5.1	5.2	5.7
Cellufil	7.0	5.2	4.5	4.6	5.1	4.1	3.1
Diatomaceous earth	5.2	4.7	4.7	4.3	4.9	4.9	4.1

Table 1. Ingredient composition (percentage as fed) for feeds with mechanically extracted (ME) or solvent-extracted (SE) cottonseed meal.

Divakaran, Proximate feed composition (percent dry matter), Table 2

	Control	ME-10	ME-20	ME-30	SE-10	SE-20	SE-30
Crude protein	37.7	38.1	40.1	38.3	40.4	39.0	40.9
Ether extract	9.0	10.2	10.1	12.2	11.7	11.3	12.0
Intake energy	3,974	4,245	4,321	4,352	4,303	4,333	4,427
Total gossypol	0	1,500	2,000	2,900	670	1,500	2,000
Free gossypol	0	250	120	110	90	100	100

Table 2. Proximate feed composition (percent dry matter), intake energy (kcal/kg-1), and gossypol content (ppm).

Setup

The feeding trial was conducted in aerated glass aquariums with flow-through seawater. *Litopenaeus vannamei* shrimp of about 1.8 kg individual weight were stocked at 50 juveniles per square meter. Water temperature was maintained at 26.5±0.5 degrees-C, with salinity at 33±0.4 psu (practical salinity units; ocean water has a salinity of approximately 35 psu). Feed was provided to shrimp three times daily during 10 weeks. Five replicates per treatment were used.

Results

The cottonseed meal feeds yielded shrimp biological performance similar to that obtained with the soy-based control feed. Statistical analysis of the results did not detect significant differences among the feeds in terms of survival and weight gain. Specific growth rate was significantly higher only for the 30 percent solvent-extracted cottonseed meal feed compared to the control feed. Specifigrowth rate was 2.08 percent per day for the test feed and 1.88 percent per day for the control.

Conclusion

It appears cottonseed meal can be included in shrimp feeds as a replacement for soybean meal. This is in accordance with other studies that reported satisfactory fish growth when diets containing as high as 40 percent cottonseed meal were fed to fish. However, we found cottonseed meal difficult to blend into the feed mix to achieve uniform distribution.

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