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Aquafeeds

Feed study tests vegetable replacements for marine ingredients

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By David Z. McMahon , Bart Baca, Ph.D. , Andrew Rogerson, Ph.D. , Tzachi M. Samocha, Ph.D. and John Reguzzoni

Experimental shrimp diet with low levels of vegetable protein and lipids produced acceptable results

Feed was manually broadcast to ponds during the study.

Most aquafeed manufacturers use expensive squid meal, fishmeal, and marine fish oils to meet protein requirements in their products. However, recent research has shown that vegetable and terrestrial animal proteins and oils could be used to successfully replace marine proteins and oils in feeds for many aquatic species, including penaeid shrimp.

Feed study

In late 2001, the authors conducted a 69-day grow-out trial in outdoor ponds at the OceanBoy Farms facility in Labelle, Florida, USA to compare the performance of various aquafeeds. OceanBoy is engaged in applied research to increase protein levels from vegetable sources in its shrimp feeds.

The diets were tested at varying stocking densities, ranging 33 to 138 shrimp per square meter. Animals used in the study were first reared for 21 days in a greenhouse nursery system and then moved to 12 outdoor, 1-ha, plastic-lined ponds with strong aeration and zero water exchange.

Water quality

Dissolved oxygen, pH, salinity, and temperature were monitored twice daily. Ammonia, nitrite, and nitrate levels were monitored weekly. All water-quality parameters measured remained within acceptable levels.

Feeds tested

Four diets were used in the study. Table 1 shows proximate analyses of the feeds described below.

- Diet 1: Experimental OceanBoy formulation with low levels of vegetable protein and lipids, and standard vitamin and enzyme input.
- Diet 2: Feed with lipids of vegetable origin and protein from vegetable and marine sources (OceanBoy formulation).
- Diet 3: Formulation provided by Dr. Allen Davis of Auburn University in Auburn, Alabama, USA with poultry meal instead of fishmeal and fish oil for palatability.
- Diet 4: Formulated by Robins McIntosh (formerly with Belize Aquaculture Ltd.), this diet contained medium levels of marine proteins and oils.

McMahon, Proximate analysis of selected feeds, Table 1

Crude Feed	Moisture	Protein	Crude Fiber	Ash	Crude Fat	Metabolize Energy
Diet 1	9.35	22.32	2.9	6.1	6.1	1,484
Diet 2	8.72	27.6	1.8	6.05	8.2	1,539
Diet 3	8.44	33.45	2.6	7.94	10.9	1,535
Diet 4	9.15	33.84	1.8	8.04	10.1	1,517

Table 1. Proximate analysis of selected feeds.

Results

Table 2 summarizes survival, growth, feed conversion and stocking density after 69 days of culture. As shown in the table, diet 4 produced the highest mean final weight (10.40 grams), followed by 6.97 grams for diet 3, 6.23 grams for diet 2, and 5.40 grams for diet 1. Diets 3 and 4 produced survival results of about 87 percent, closely followed by diet 2 and then diet 1 at 73 percent. The lowest feed conversion ratio (1.17) was obtained with diet 2.

McMahon, Summary of survival, growth, feed conversion, Table 2

Feed	Survival (%)	Average Weight (g)	Feed-Conversion Ratio	Stocking Density (animals/m^2)
Diet 1	60.0	5.8	5.5	33.2
	71.0	6.0	2.1	70.6
	89.0	4.4	2.4	67.5
Diet 2	85.0	5.9	1.2	106
	83.0	6.3	1.5	84
	88.0	6.5	0.8	116.5
Diet 3	7.0	7.0	1.9	111.7
	7.6	7.6	1.9	137.8
	6.3	6.3	2.1	84
Diet 4	12.5	12.5	3.8	99.9
	8.7	8.7	4.2	45.8
	10.0	10.0	8.3	131.6

Table 2. Summary of survival, growth, feed conversion, and stocking density after 69 days of culture.

Conclusion

The study of feed performance showed that an experimental diet with low levels of vegetable protein and lipids, although ranking last in growth and survival among the diets tested, still produced acceptable results. Feed protein requirements can effectively be reduced and vegetable protein sources increased in shrimp feeds.

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Authors

DAVID Z. MCMAHON

Nova Southeastern University
Oceanographic Center
8000 North Ocean Drive
Dania, Florida 33004 USA

BART BACA, PH.D.

Nova Southeastern University
Oceanographic Center
8000 North Ocean Drive
Dania, Florida 33004 USA

ANDREW ROGERSON, PH.D.

Nova Southeastern University
Oceanographic Center
8000 North Ocean Drive
Dania, Florida 33004 USA

TZACHI M. SAMOCHA, PH.D.

Texas Agricultural Experiment Station
Shrimp Mariculture Research Facility
Corpus Christi, Texas, USA

JOHN REGUZZONI

OceanBoy Farms, Inc.
Clewiston, Florida, USA