

Soy, Barley & Beer

Show Promise in Fish Feed

By Rebecca Nelson

One of the primary concerns and expenses in the aquaculture and aquaponics industries is the use of fish meal as the protein source in commercially manufactured fish food. Millions of tons of fish are removed from the oceans each year to feed fish and other farmed animals. New developments are allowing fish food manufacturers to look to and utilize other sources for protein.

Research into soy, barley and beer (actually, the sludge that results from the beer brewing process) is demonstrating that viable alternatives to fish meal are becoming available.

Soy

Ohio State University aquaculturists with OSU South Centers at Piketon, Ohio are exploring the feasibility of using soybeans as an alternative to fishmeal, and plan to test the new fish food product on yellow perch. The project is supported by a one-year \$50,000 Ohio Soybean Council grant, with the Ohio Agricultural Research and Development Center providing a \$50,000 match.

If successful, soy-based fishmeal and soybean oil would be an answer to declining fishmeal production, said Han-Ping Wang, director of the Ohio Aquaculture Research and Development Integration Program, and the university's principal investigator.

"The aquaculture industry demands 25 percent of the global fishmeal supply and 36 percent of the global fish oil supply, but fishmeal production is decreasing because of the decline of ocean fish used to make the product," said Wang. "As a result, we see a great potential for us to use soybeans as a replacement due to its high protein content."

The OSU team working on this project has three main objectives: to determine if genetically improved yellow perch reared on soybean meal-based diets perform just as well as those on fish meal diets and assess whether sufficient genetic variation exists for selective breeding; determine if soybean meal-based diets are suitable for spot fin shiners, a popular bait-fish; and develop and implement educational programs and promotional materials designed to promote the growth of the aquaculture industry in Ohio.

Wang is confident that the chosen aquaculture species will perform well with soybean meal-based diets through genetic improvement. The final step is disseminating the information to Ohio fish farmers. Researchers plan to educate soybean and fish farmers and other stakeholders on incorporating an agricultural product into the aquaculture industry. Ohio's aquaculture industry has exploded over the past decade, increasing from \$1.8 million in 1997 to \$6.6 million in 2007, according to the U.S. Department of Agriculture.

Barley

Agricultural Research Service (ARS) scientists and Montana Microbial Products (MMP) of Butte, Mont., have developed a barley protein concentrate that could be fed to trout and other commercially produced fish.



Physiologist Rick Barrows at the ARS Small Grains and Potato Germplasm Research Unit in Aberdeen, Idaho, teamed with MMP to apply for a patent on a

new enzymatic method that concentrates barley protein and produces raw material for another valuable commodity—ethanol. This process provides a high-protein ingredient that may replace other, more expensive protein sources like fishmeal and soy protein concentrate in commercial fish feed.

Currently there is no commercial production of barley protein concentrate, but MMP is producing small quantities for fish-feeding studies with trout, salmon and other species. MMP projects that the concentrate will sell for \$700 to \$1,200 per ton. Since fishmeal costs about \$1,200 per ton, the projected costs of barley protein concentrate compare favorably.

Feeding trials conducted by the Aberdeen researchers and MMP show that barley protein concentrate successfully replaced both fishmeal and soy protein concentrates in fish feed, meeting the fishes' protein requirements. Barrows and other researchers in the ARS unit also are examining the genetics of barley to modify the grain for improved protein yield and nutritional composition.

According to Barrows, feed is part of a complex interplay of genetics, nutrition and economics in fish production. Barley protein concentrate could completely replace fishmeal in fish feed if other essential nutrients are provided as supplements.

Using barley protein instead of fishmeal in commercial fish feed could help reduce the demand for millions of tons of fish taken from the ocean each year to produce fishmeal.

ARS is the principal intramural scientific research agency of the U.S. Department of Agriculture (USDA). This research supports the USDA priorities of promoting international food security and developing new sources of bioenergy.



Beer Sludge

Biologist Andrew Logan, Idaho Springs, Colorado, is turning waste from breweries into food for farmed fish. His company, Oberon FMR, spent a decade refining a proprietary mixture of microbes trained to eat food-based wastewater. When

dried, the bacteria become high-protein flakes for the booming \$100 billion aquaculture industry.

By law, breweries and foodmakers must find safe removal solutions for wastewater; hauling it away and composting it (or, in winter, storing it) can cost up to \$3 million a year. Now Oberon takes it off companies' hands for free. With 65 million tons of seafood farmed for human consumption annually, fish farms are growing by an average of 9% a year and need a new kind of premium feed.

Logan and classmate Seth Terry read a book that suggested creating protein from modified bacteria, and Oberon was born. The pair tried feeding their product to tilapia, then took it to the salmon in Norway. A 16-month pilot project at Colorado's New Belgium brewery (makers of Fat Tire ale) followed. Oberon has since inked a deal with Miller-Coors to turn 5,000 tons of sludge into 6,000 tons of food flakes.

Conclusion

The demand for protein sources used in animal feeds will only continue to grow. At the same time, the natural fish populations caught to make fish meal are shrinking. Soy, barley and beer sludge are three potential sources that can reduce the need for fish meal and the continued harvest of fish from the oceans for this purpose. In addition, research is being done on other sources of protein for animal feed, including corn, wheat and even feathers from chicken processing.

As aquaculture and aquaponics continue to grow, this research and the companies pioneering this effort, will help to ensure our industries sustainability and profitability.

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