IMPACT

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Low-phosphorus feeds development

The Situation

Nutrients in aquaculture effluent waters have come under increasing regulatory scrutiny because of their role in stimulating unwanted aquatic plant growth in public waterways. As a result, a number of states, including Idaho, developed regulations that restrict the amount of phosphorus, nitrogen, and solids that are allowed in the discharge water of freshwater fish culture facilities. These new regulations threaten to dramatically reduce industry trout production by reducing the amount of phosphorus in the Environmental Protection Agency discharge permit. Phosphorus is the nutrient with the greatest impact on algae and plant growth in freshwater; therefore, Idaho's Department of Environmental Quality developed and implemented a Total Maximum Daily Load on the Mid-Snake River that reduced the amount of phosphorus discharged from aquaculture facilities by 40 percent.

Our Response

In response to the challenge of decreasing the amount of phosphorus discharged while maintaining the economic viability of the trout industry, University of Idaho Extension collaborated with fish nutritionists, fish feed manufacturers and the Western Regional Aquaculture Center. The collaboration resulted in two major research and outreach efforts that focused on determining ways to reduce phosphorus levels in hatchery discharge water.

Feeds are the source of phosphorus in fish production systems, thus emphasis was placed on reducing total phosphorus levels in feeds, determining dietary phosphorus requirements of trout at various life stages, and ensuring that levels of available phosphorus in feeds were sufficient to meet the nutritional needs of the fish. The second research and outreach project focused on further development of economical, high-performance, low-polluting feeds and feeding strategies. The study included additional efforts to reduce phosphorus discharge levels in aquaculture facility effluents.

Improved water quality. Photo by Gary Fornshell.

Results from the first project showed that a low-phosphorus feed provided a 33% reduction in the amount of phosphorus discharged compared to a regular trout feed, with no effects on fish quality or growth. In the second study, nutrient-dense feeds were tested. For growers, the higher the feed digestibility, the better the feed utilization efficiency and the lower the cost of production. From an environmental perspective, higher feed utilization efficiency results in less waste excretion and lower pollution potential.

Program Outcomes

Farm-scale testing validated the effects of feed changes on production efficiency and the economics of pro-

University of Idaho, U.S. Department of Agriculture, and Idaho counties cooperating.
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duction. It was found that phosphorus levels in feeds can be reduced for rainbow trout without affecting weight gain or product quality. In addition, determining the availability of phosphorus in key feed ingredients allows feed manufacturers to modify standard diets to achieve lower phosphorus discharge rates and lower feed costs. Higher feed utilization efficiency results in lower costs for producers, and decreased waste excretion and improved water quality.

Trout Industry

These two Western Regional Aquaculture Center research and outreach projects have had a major impact on the trout industry. The following are quotes from fish feed manufacturers and producers:

- "This research also led to further research with extruded nutrient dense diets that dramatically improved feed conversion rates and thereby reduced phosphorus effluent even further."
- "These projects provided fundamental insight into how we might reduce our total phosphorus environmental footprint. The economic impact of high-energy nutrient dense feeds is significant both in terms of improved feed conversion and reduced phosphorous discharge."
- "…this project provided a springboard for research into nutrient dense feeds. Had we not had the good phosphorous data resulting from this project, nutrient dense feeds had the potential to ruin a lot of fish."

Improvements

This cooperative research and outreach effort between University of Idaho Extension, fish nutritionists, feed manufacturers and producers:

- Prevented an estimated 20% loss in trout production.
- Allowed higher production levels worth more than $6 million per year.
- Permitted efficient low environmental-impact trout production by reducing phosphorus levels in discharge waters by over 40% without affecting growth of fish or product quality.

Low-phosphorus fish feed. Photo by Rick Barrows, USDA-ARS.

FOR MORE INFORMATION

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