FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

REPLACING FISHMEAL WITH SINGLE-CELL PROTEINS IN TILAPIA DIETS IN ZAMBIA

This project of the Feed the Future Innovation Lab for Fish (Fish Innovation Lab) investigated whether the DY-Pro, a single cell protein produced by Meridian Biotech in the United States, could be used as an alternative protein ingredient to substitute fishmeal, thus supporting the sustainable growth of tilapia farming globally. In this partnership between public and private entities in the US and Zambia, the research team conducted a feed trial to study the effects of graduated amounts of DY-Pro ingredient in feeds used for tilapia aquaculture in Zambia.

Researchers measure tilapia growth during feed trials at NRDC.
Tabitha Mulilo/WorldFish

FEED PROCESSING, ANIMAL SOURCING, ACCLIMATING THE FISH

Aller Aqua Zambia supplied the feed ingredients, and Texas A&M University produced seven experimental feeds, in which graded levels of DY-Pro were substituted for fishmeal. The diets were based on practical ingredients, and the control diet contained 14.85% fishmeal. Once made, the diets were shipped to Zambia where WorldFish Zambia received them and kept them frozen at the Natural Resource Development College (NRDC) (in the freezer purchased by the project) until the start of the experiment. Yalelo Zambia supplied the experimental tilapia, which were then acclimated at the newly constructed facility at NRDC. This acclimation period also served the purpose of testing the functioning of the new facility.

UPGRADE OF THE FISH FACILITY

The fish facility at NRDC in Lusaka, Zambia was upgraded through the design and building of a flow-through aquaculture system composed of 30 aquaria, a steel structure with three layers (levels), one 2000-L tank, one 1000-L tank, one air blower, one water pump, piping, and other materials.

COMPLETION OF THE EXPERIMENT

The experiment effectively started in the newly constructed fish facility at NRDC. Eleven fish were stocked in each aquarium, with an average body weight of 11 g per fish, for a total of 330 fish stocked in the 30 aquaria. When the experiment was completed, data on fish growth, feed intake, and water quality were collected.

The proximate composition of the fish and feed samples was analyzed in a local lab in Zambia, and gut samples were shipped to Mississippi State University for gut immunohistochemistry analysis. Following receipt

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PROJECT TEAM

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U.S. co-PIs	**Don Corace** Meridian Biotech
	Wes Baumgartner, PhD Mississippi State University
Zambia PI	**Rodrigue Yossa, PhD** WorldFish
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of the results of the lab analyses, the data were analyzed and the results of the experiment discussed with the research team. The writing of a manuscript, based on the results of the experiment, is in progress.

Results of the research activities associated with this project demonstrated that the use of DY-Pro in the diet of tilapia could replace all of the fishmeal provided in the control diet (14.85%) without any significant negative effects on fish growth or body condition factor. It is worth noting that there was a significant ($p < 0.05$) negative linear regression between the replacement level of fishmeal by DY-Pro and feed intake and feed conversion ratio (amount of feed required per unit body weight gain). The increase in the replacement level of the fishmeal by the DY-Pro led to a decrease in the feed intake and feed conversion ratio but showed similar growth performance as fish fed the control diet. As such, DY-Pro could effectively help reduce pressure on the fisheries stocks by replacing all of the fishmeal provided in the control diet without negatively impacting fish weight gain, feed conversion, or health of the fish.

These feed-trial results show that tilapia given DY-Pro consumed less feed to achieve the same growth than tilapia given fishmeal feed, indicating that DY-Pro is a more efficient feed ingredient, which can save producers on costs. These potential cost savings, as well as potential environmental benefits of a more sustainable feed ingredient, indicate that single-cell-protein technology provides a promising alternative feed ingredient for tilapia aquaculture in Zambia and other locations.

All research partners have worked actively to achieve the project milestones, and the experiment was effectively completed with the active participation of all project partners and two young NRDC interns, Chewe Mukuka (female) and Yobe Mtonga (male), hired to support the project while developing their aquaculture and research capacities. These interns have gained extensive technical and scientific aquaculture and research experiences throughout the project.

In order to disseminate the findings of this project, the team is preparing a manuscript, which will be submitted for publication. A success story has been published, and an outreach presentation will be made before the government and the civil society in Zambia in 2021.

ABOUT THE FISH INNOVATION LAB

The Fish Innovation Lab supports the United States Agency for International Development's agricultural research and capacity building work under Feed the Future, the U.S. Government's global hunger and food security initiative. Mississippi State University is the program's management entity. The University of Rhode Island, Texas State University, Washington University in St. Louis, and RTI International serve as management partners.

www.fishinnovationlab.msstate.edu

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