



NO LONGER BUGGED BY FEED COSTS: INSECT FARMING IMPACTS ON SMALL SCALE FARMERS IN NIGERIA

Small-scale farmers make up 94% of the Nigerian fish farming sector, for whom the main hindrance in fish production is the scarcity of and high-production cost associated with fish feed. Additionally, a staggering 90% of fish catch used for fishmeal is considered food grade and could be an important source of nutrition to Nigerian communities. There is a critical need for alternatives to fish meal in aquaculture production since the environmental and economic issues surrounding current global protein production are growing. Luckily, the potential to develop a high financially valued industry via insects is a viable option for fish farmers. One Feed the Future Innovation Lab for Fish team established insect farms for an insect-to-fish (ITF) farming system to work in synchrony with local fish farmers, mass rearing insects, specifically the black soldier fly (BSF), as an alternative fish feed component.



Tanks at Ikwo Local Government Area in Ebonyi State. Photo by Bolarin Omonona.

STAKEHOLDER SURVEYS

The study relied on primary data collected from farmers in Cross River, Ebonyi, and Oyo States, Nigeria. The team used a structured questionnaire to gather information about the farmers and their production practices, analyze costs of production including feed costs, and estimate the profitability of catfish farming. The majority of the catfish farmers were male (86.6%), married (90.9%), and had tertiary education such as college or trade school (67%). They had engaged in farming as their primary occupation (76.8%) and had been catfish farming for 1 to 10 years (73.8%). Approximately 60% of the farmers had two production cycles in a year. Over half (59.2%) of the farmers used both imported and locally made feeds in rearing catfish, while 37.2% and 3.7% used exclusively imported and local feed, respectively. These survey results helped inform the team's assessment of whether and how insect farming could be integrated into the value chain.

CATFISH FARMING ENTERPRISE

Results from this study indicated that catfish farming is a lucrative livestock enterprise. Approximately one-third of farmers incurred total costs less than 3 million Nigerian Naira in Nigerian currency (\$3,900 USD) while another third of farmers had costs above 9 million Naira (\$11,600 USD) in a year. Over half of the catfish farmers generated less than 4 million Naira (\$5,200 USD) and one-quarter of the farmers had more than 9 million Naira (\$11,600 USD) in a year. Cost of feed was the most significant total cost for the farmers at over 80%, while labor, fingerlings, lime, medications, transportation, and fertilizer jointly contributed to the remainder of the production costs. Currently, about 10% of the farmers have adopted the ITF farming system to assist in lowering aquaculture production costs.

Farmers' main challenge was the inability to continue fish farming due to high costs. The Fish Innovation Lab recommended BSF propagation for the aquaculture industry and developed training for farmers. The team collaborated



ACTIVITY TEAM

Lead PI and U.S. PI

Jennifer L. Pechal, PhD
Michigan State University

Nigeria PI

Bolarin T. Omonona, PhD
University of Ibadan

U.S. Co-PI

Simone Valle de Souza, PhD
Michigan State University

Collaborators

Olufemi B. Adedeji, PhD, DVM
University of Ibadan

Yetunde Agbeja, PhD
University of Ibadan

Abigail Bennett, PhD
Michigan State University

M. Eric Benbow, PhD
Michigan State University

with local Agricultural Development Project members to disseminate the training across states. There is still great potential for local livelihood sustainability to improve as the propagation of BSF will generate income for individuals involved across the fish value chain.

SAFETY OF BLACK SOLDIER FLY LARVAE MEAL

To address potential concerns about the safety of BSF larvae meal, the team evaluated samples to assess microbial communities for potential pathogens. Farmers can directly benefit by selling BSF-derived value-added products such as nutrient-rich compost that is naturally produced during the BSF rearing process. Using whole genome sequencing to identify potential microbial pathogens, the team found low levels of opportunistic pathogens for humans (less than 10% of the DNA fragments analyzed), but major foodborne pathogens were not identified, and a high proportion of the DNA was unknown. This indicates that fish feed made from BSF larvae—which is rich in protein, fats, and oil—is safe for fish to eat and will not transmit diseases because the BSF is not a vector of disease. This makes BSF larvae a safe fish feed alternative for fish and humans alike. Additional analysis may yield important discoveries about the microbial community structure of BSF-derived products, which will benefit producers using the ITF farming system as well as consumers.

SOLUTIONS THROUGH ITF FARMING FOR NIGERIA

This study focused on building Nigerians' knowledge, skills, and resilience to food insecurity while promoting responsible aquaculture practices. The outputs have demonstrated a capability to support locally produced, nutritious food by developing more self-reliant, resilient ITF farming

systems. Local BSF larvae production acts as a local waste management tool while reducing the cost of fish feed for fish production. As adoption of BSF for feed expands, these activities will continue to increase food and job security for growing populations and serve as a noncompetitive resource with human food production to improve sustainability of the aquaculture industry. Investing in economic opportunities and sustainable food systems, such as ITF farming systems, will empower more Nigerian families, especially women and youth, to increase future income and nutritional needs.

RECOMMENDATIONS

Fish farmers, including youth and women, interested in rearing BSF larvae should be assisted in the acquisition of the basic BSF larvae production knowledge and kits, especially the mating nets/cages and the larvae growth crates. These materials will incentivize farmers to produce the BSF larvae for fish feeding. The team found that BSF larvae can be successfully fed directly to the fish without compounding it into a feed. So, the lack of feed mills in Ebonyi and Cross River States will not hinder the use of BSF larvae in feeding of catfish across Nigeria.

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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