



FEED THE FUTURE

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

AQUACULTURE AND RURAL COMMUNITIES: INTEGRATED AGRICULTURE-AQUACULTURE AS FARM DIVERSIFICATION STRATEGY

The Feed the Future Innovation Lab for Fish Farm Diversification team implemented a research-for-development activity with small-scale rice farmers and extension workers in two states of Nigeria. Integrating agriculture and aquaculture by introducing fish into rice farming aims to transform existing rice farming to become more productive, climate-friendly, and resilient. The team prioritized culturally acceptable and easy-to-implement practices to ensure sustained adoption with long-term benefits for the farming communities. The activity, jointly implemented by the Food and Agriculture Organization of the United Nations (FAO), the University of Ibadan in Nigeria, and the University of Georgia in the U.S., worked closely with rural smallholder rice farmers and extension staff to implement on-farm demonstration trials. It also undertook a series of analyses and participatory community appraisals to assess current farming systems and identify entry points for the farm diversification strategy:



Adaptive research plot. Photo by Oladeji Kazeem Kareem

- The team documented key features of agricultural production and mapped wetland areas in Kebbi and Ebonyi States, Nigeria, identifying suitable areas for rice and fish farming. The seasonal calendar of farming activities is conducive to rice cultivation two times a year depending on annual rainfall patterns, thus also presenting the opportunity for fish farming two times a year.
- The team conducted a baseline analysis of food security and nutrition, which indicated severe food insecurity in the communities. Integrated rice-fish farming could increase farm yields while enhancing food and nutrition security and increasing incomes.
- The activity created an innovation platform on integrating agriculture and aquaculture, which served as a forum for farmers, extension workers, researchers, and other stakeholders to jointly discuss progress and co-develop solutions to issues encountered during the farm diversification process.

WORKING WITH FARMERS TO DIVERSIFY PRODUCTION

The team used the experimental outcomes and lessons learned from the rice-fish trials to develop a technology guide enabling more than 100 rice farmers with little or no knowledge of aquaculture to successfully introduce fish into their rice fields and, as a result, rice-fish farming clusters are now emerging in rice-growing communities of Kebbi and Ebonyi States. To facilitate the adoption process, the team trained over 700 farmers and prepared technology guides with practical advice on management of rice fields and fish crops in integrated systems, water use and management, and business plan models, which can then be locally adapted. Opportunities for improvement include locally available feeds and post-harvest processing as a good strategy to increase the value of fish.



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IDENTIFYING LOCALLY AVAILABLE FEED INGREDIENTS

Feed costs typically are the major expense in aquaculture operations. The farming of fish in rice fields offers the advantage of “free food” but farmers can obtain higher fish yields with supplementary feeding. Therefore, the team identified and tested locally available feed ingredients for application in the rice-fish system: rice bran and fish offal meal as energy and protein in fish feed. The experimental study on nutrient digestibility of these feed ingredients revealed that both rice bran and fish offal meal were suitable for African catfish (*Clarias gariepinus*) and Nile tilapia (*Oreochromis niloticus*). The results also showed that catfish fed with the locally available feed formulations reached similar optimum growth performance compared to those fed with conventional feeds, and, in particular, the fish grew faster when fish offal meal was provided.

CONCLUSIONS AND RECOMMENDATIONS

The farm diversification trials demonstrated how including fish in rice farming can boost more efficient use of resources and higher production, the local supply of nutritious food for home consumption, and income generation through the sale of fish. More rice and fish are available to the communities, decreasing hunger. These results were well received by hundreds of rice farmers in Kebbi and Ebonyi States, demonstrating a prime opportunity to consolidate successes and lessons learned to replicate, expand, and scale the farm diversification (rice-fish) activities in these states and beyond using participatory approaches. The main conclusions and recommendations of the activity include the following:

- Diversification of rice-based systems with fish is a viable strategy providing higher returns than rice monocropping and should be promoted through participatory approaches such as Innovation Platforms or Farmer Field Schools together with local extension systems and agents.
- Fish becoming available locally from integrated rice-fish systems increases household dietary diversity and/or generates income used for the food budget, thus addressing the high prevalence of food insecurity. These results should be documented in local languages and disseminated widely for upscaling in Ebonyi, Kebbi, and other states of Nigeria.
- Post-harvest processing using smoking kilns increases the value of smaller fish available at rice harvest. This can compensate for the market preference for larger fresh fish, and this and other options for value addition should be further tried and promoted as part of the participatory field schools.
- The reduced use of chemicals in integrated rice-fish systems leads to better ecosystem health and increased biodiversity utilized by households. Further studies are recommended to quantify these effects in terms of cost savings and health of the farming environment and communities.
- The use of locally available feed ingredients reduces feed costs for the farmer, is more efficient and climate-friendly, and enhances resilience. Other feed ingredients, including novel alternatives such as insect larvae, may also be tested for inclusion in locally produced feeds that reduce dependency on costly imported feeds and increase the resilience of the farms and farmers.

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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