



# Fish & Roots, Tubers and Bananas in Agri-Food Systems:

Opportunities for, and constraints to integrated production, value-addition and human consumption.

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# Objective

- Partnerships for sustainable development



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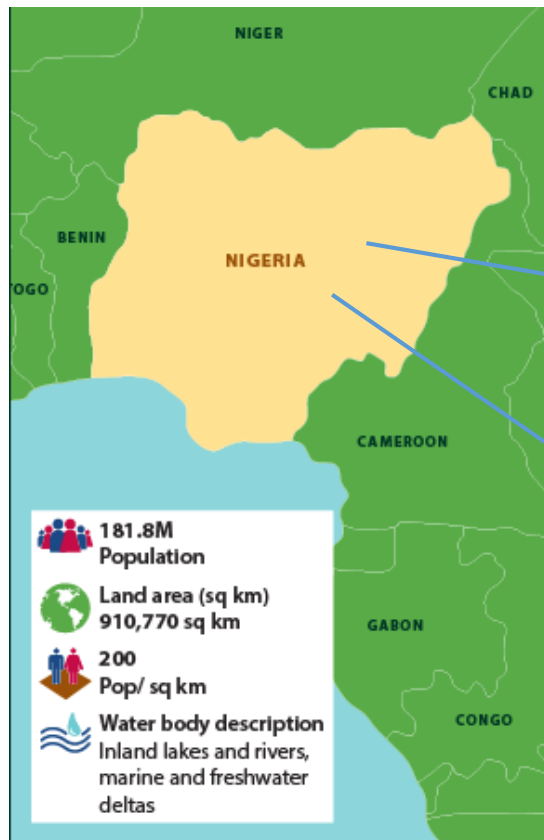
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- **Objective:** Identify areas for collaboration, innovation and exchange between largely separate agri-food systems.

# Multi-regional perspective

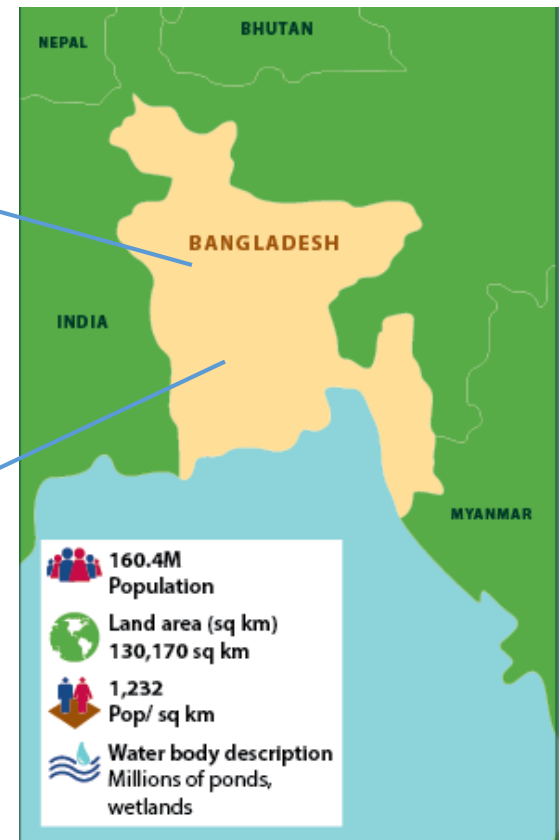
- A global literature review
- Country-level case studies



Integrated  
agriculture-  
aquaculture

Leveraging  
cassava peels for  
use in aquafeed

Co-consumption  
of nutrient-rich  
fish and RTBs



# Integrated Agriculture-Aquaculture (IAA): Roots, Tubers, Bananas and Fish in Bangladesh



Bananas and cocoyam grow on pond-dike in Rangpur, Bangladesh. Photo by Molly Atkins

# Opportunities

## ‘Multiple-goal agriculture’ Pearson & Ison (1992)

- Production diversity -> dietary diversity
- Promotes ecological approaches
- Optimized per unit production (Dey *et al.* 2010; Mamun, Nusrat and Debi, 2011; Mohri *et al.* 2013)



# Constraints

- Knowledge and time requirements
- Temporal and spatial mis-matches (Prein, 2002).

## Research and Development Priorities:

- Encourage households to diversify production – fish, especially small fish, micronutrient-rich vegetables.
- Training on re-use of agricultural by-products for fish production or vice versa? But further research is needed on fish feeding practices of smallholder farmers to identify best practices in using RTB agricultural by-products as fish feed in home ponds.



AIN Project beneficiaries taking care of vegetables on pond dike. Khanpur, Bagerhat, Bangladesh. Photo by Habibul Haque.

# Fish feed: A focal area for integration



A farmer feeding tilapia in his pond in Comilla, Bangladesh. Photo by Saikat Mandal Tanu

# Utilising agricultural by-products: cassava peels in Nigeria – an opportunity

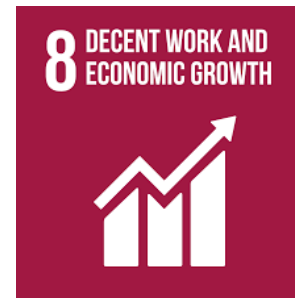
- > 6 million tonnes of cassava peel, leaves, and pomace is discarded by the domestic cassava processing sectors (FAO, 2007).
- These waste heaps emit carbon dioxide, produce a foul-smell, and may cause surface water pollution (Lukuyu *et al.*, 2014).



Image: Discarded cassava peels at a *garri* processing factory in Oyo state. Photo credit: Agboola, J.O.

## ‘Waste’ -> valued product

- Industry, innovation & infrastructure
- Additional job opportunities - for women? (Amole, 2016; Okike *et al.*, 2014).





# Constraints

- Scale and seasonality
- Logistical/spatial considerations
- Additional processing requirements and the associated workload

Further research should prioritise:

- The effects of replacement on fish growth performance and feed utilization
- Economic implications of replacing traditional carbohydrate sources with RTB crops
- Practical issues associated with the seasonality of RTB by-products



Image. Mixing feed ingredients before pelleting.  
WorldFish



Image. Packaged commercial compound fish feed,  
Bangladesh.

# Integration at the point of consumption

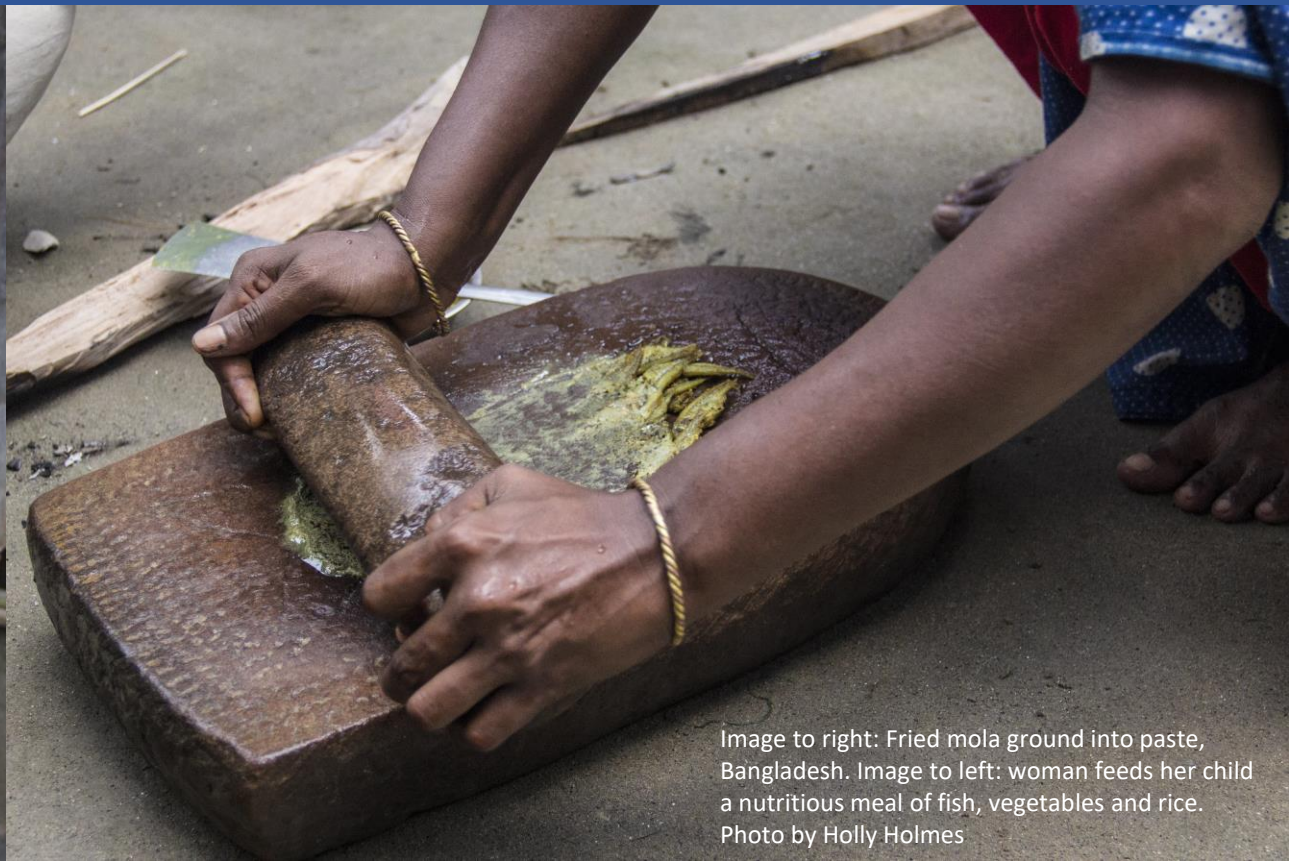


Image to right: Fried mola ground into paste, Bangladesh. Image to left: woman feeds her child a nutritious meal of fish, vegetables and rice. Photo by Holly Holmes

# Integration at the point of consumption

## SDG 2 Zero Hunger & 3 Good Health and Wellbeing

- On the same plate
- Improving the nutritional quality of traditional snack foods
- Complementary food products for infants and young children (Bogard *et al.* 2015)
- The 'enhancing factor' of fish (Tontisirin, Nantel and Bhattacharjee, 2002; Bæch *et al.* 2003)



Image. Processing of fish paste in Cambodia. Photo credit: Fani Llauradó



Image. Ingredients for nutritious porridge for young children, Cambodia. Photo by Finn Thilsted.

# Constraints

- Consumer preferences

Research and development priorities:

- Identify micronutrient-rich combinations of fish and RTB products—such as small indigenous fish and OSP—and develop social and behaviour change communication (SBCC) materials that educate care takers of the nutritional benefits of feeding children these ingredients as a combination.



Image. Women in Cambodia preparing a meal with products from community Rice-Field Fishery. Photo by Fani Llauradó

# Conclusion

## Data gaps – a common constraint

- Greater collaboration, innovation and exchange across agri-food systems can contribute towards multiple SDGs.
- Requires financial investment and new governance arrangements to facilitate improved institutional design that stimulates integrative management, technological innovation and deployment; and continued commitment to nutrition-sensitive agricultural approaches



Thank you

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