Potential for Sustainable and Cost-Effective Biofertiliser from Yellowfin Tuna By-Products

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Background & Rationale

- Rice is the staple food in Sri Lanka, where cultivation predominantly depends on chemical fertilisers.
- In 2021, a government ban aimed to shift towards organic alternatives but was reversed due to limited availability.
- Meanwhile, fish by-products, particularly from yellowfin tuna (YFT), remain largely underutilised, with most being discarded or minimally used for animal feed
- This project explores the potential of converting YFT by-products into cost-effective, eco-friendly organic fertiliser for rice cultivation, offering a sustainable solution to reduce chemical fertiliser use and address fish waste management.

Methodology

The experiment was conducted using ground by-products of Redfish (*Sebastes marinus)* : head, bones, skin, viscera, and fins.
Three fertiliser methods were tested: acid fish silage, fermentation and enzymatic hydrolysis.

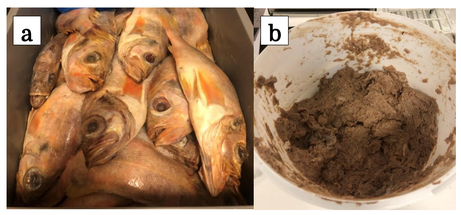
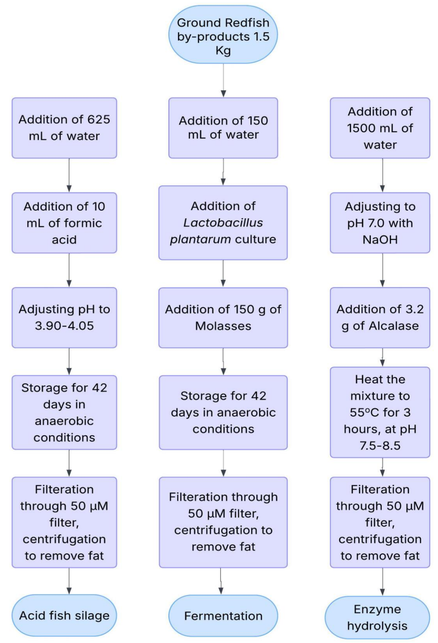


Figure 1: (a) Whole Redfish (b) Minced Redfish paste

Methodology cont.



Results

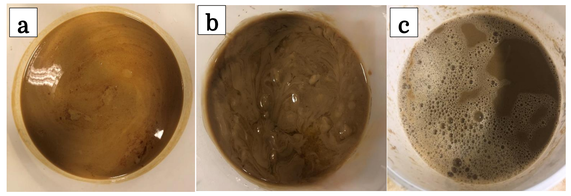


Figure 2: (a) silage (day 42) (b) fermentation (day 42) (c) enzyme hydrolysed fertiliser (day 1).

Table 1: Crude protein levels of fertilisers (based on initial weight of raw material).

Raw fish paste	acid fish silage	fermented fertiliser	enzyme fertiliser
15.94%	16.21%	16.50%	15.73%

Results cont.

- Three fertilisers exhibited distinct sensory characteristics:
  - Silage: Smooth, free-flowing liquid with clear oil separation and a fish oil odour.
  - Fermentation: Thick and clumpy, no oil separation, with a fruity odour and a hint of spirit.
  - Enzyme hydrolysate: Least thick, with clear oil separation, and a characteristic fishy odour.
- At the end of the trial, the highest undigested parts were in the acid fish silage method (21.00%), followed by the enzymatic method (14.53%) and fermentation (10.19%)

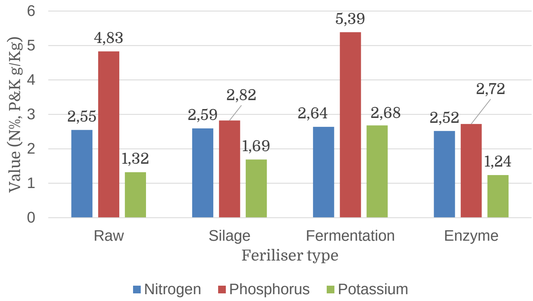


Figure 3: N, P, K yield in three fertilisers (based on initial weight of raw materials used).

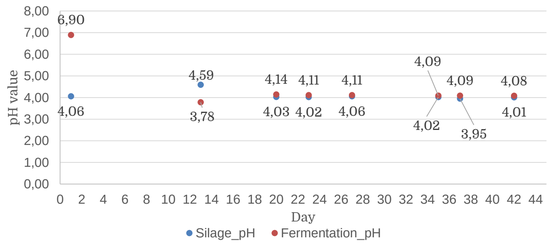


Figure 4: Daily pH changes in silage and fermentation.

Conclusions

- Fermentation produced higher N%, P, and K compared to silage and enzyme-hydrolysed fertilisers.
- It required less effort, and the pH stabilised on its own after day 19.
- Therefore, fermentation is the most feasible option for practical adoption.
- While the levels of N and P in fermented fertiliser are adequate for meeting Sri Lanka's rice cultivation requirements, the K levels are not sufficient for standalone use.

Recommendations

- Conducting a plant trial to assess the practical use of fermented fertilizer.
- Since fish waste alone provides insufficient K, organic compounds such as animal manure and wood ash can be added.
- Further research is needed to identify the best organic matter for K enrichment and determine the appropriate quantities.

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