

Aquafeed and Alternative Feed ingredients

By

Emmanuel K. Ajani and Bamidele Omitoyin

Department of Aquaculture and Fisheries Management

*(African Union Centre of Excellence in Aquaculture
and Inland Fisheries)*

University of Ibadan, Nigeria

Introduction

- ▶ Aquafeeds have been the main sustainable platform for the aquaculture industry in Africa,
 - ▶ as they provide essential nutrients needed for the growth, health and productivity of the farmed fishes.
 - ▶ Without high-quality aquafeeds, it would be challenging to meet the increasing global demand for farmed fish.

- ❖ Conventional feedstuffs like fish meal, soybean meal, groundnut meal, maize and cowpeas used for preparing aquafeeds are becoming scarcer and more expensive
- ❑ due to issues of sustainability, competitive use by humans and livestock, resource availability, cost-effectiveness
- ❑ the effect of climate change thus making the use of aquafeeds unsustainable





- ▶ The use of conventional fish feed ingredients has led to water pollution, habitat degradation, and
- ▶ The depletion of fishery resources especially the reliance on fishmeal obtained from wild-caught fish contributes to overfishing and disrupts the marine ecosystem
- ▶ Limited availability of traditional fish ingredients
- ▶ High cost of import poses significant challenges to the aquaculture industry in Africa
- ▶ Hence the search for Alternative fish feed ingredients

The Alternative Raw Ingredients

- ▶ A variety of alternative raw feed ingredients have shown promise in aquafeeds.
 - ▶ These alternatives offer a sustainable source of nutrients and can help reduce the pressure on traditional fish feed ingredients.
 - ▶ These potential alternative fish feed ingredients holds the future for sustainable aquaculture production in Africa
- ▶ These are
 - ▶ insect meal (black soldier fly larvae, housefly maggots, mealworms and crickets),
 - ▶ Animal by-products (leftover parts from the slaughter or processing of animals, such as poultry, cattle, pigs and fish),
 - ▶ plant by-products (plant residues from the processing of crops, such as oilseeds, cereals, fruits and vegetables) and
 - ▶ Algae (photosynthetic microorganisms that can produce various bioactive compounds)

Alternative Raw Ingredients: Insect Meal



- ▶ Insect-based ingredients from insects such as black soldier fly larvae, mealworms etc.
 - ▶ are both alternative feed ingredients with significant potential in the animal feed industry.
 - ▶ Benefits of high nutritional content, sustainability, and low environmental impact
 - ▶ Thus making them a promising alternative to traditional animal feeds

Alternative Raw Ingredients: Insect Meal

- ▶ Insect meals have significant potential in the fish feed industry due to their
 - ▶ high nutritional content
 - ▶ sustainability
 - ▶ low environmental impact compared to traditional fish feeds.
- ▶ These alternative feed ingredients are particularly useful for farmed fish production, where traditional feeds can be expensive and harm the environment.
- ▶ The use of insect-based feeds can lead to improved animal health and welfare, as well as increased productivity.
- ▶ As the demand for sustainable and environmentally friendly products continues to grow, black soldier fly larvae and mealworms may become more widely accepted in the animal feed industry.

Alternative Raw Ingredients: Animal by- products

- ▶ Animal by-products that have been explored as potential fish feed ingredients include
 - ▶ poultry meal,
 - ▶ bone meal,
 - ▶ meat meal
 - ▶ blood plasma,
 - ▶ poultry offal meal, and
 - ▶ hydrolysed feather meal
- ▶ These products can also provide a source of protein and nutrients for fish growth



Alternative Raw Ingredients: Animal by- products

- ▶ These alternatives have shown promise in providing essential nutrients for fish growth and development.
- ▶ Incorporating animal by-products into fish feed has the potential to provide
 - ▶ a cost-effective and
 - ▶ sustainable solution for feeding farmed fish
- ▶ Thus reducing reliance on traditional fishmeal sources

Alternative Raw Ingredients: Plant by-products

- ▶ One promising option is the use of plant by-products as a feed ingredient.
 - **Corn gluten meal:** Another high-protein by-product, corn gluten meal has been used as a partial replacement for fishmeal in some feed formulations.
 - **Rice bran:** This by-product of rice processing is high in energy and has been shown to support growth in some fish species.
 - **Brewer's yeast:** This by-product of the brewing industry is high in protein and has been used in fish feed formulations
 - **Cassava meal:** This by-
- ▶ **Peanut meal:** This by-product of peanut oil production is high in protein and can be used as a partial replacement for fishmeal in some feed formulations.
- ▶ **Sugar beet pulp:** This by-product of sugar production is high in fibre and energy, making it a potential ingredient in fish feed formulations.
- ▶ **Sunflower meal:** Another high-protein by-product, sunflower meal has been used as a partial replacement for fishmeal in some feed formulations.
- ▶ **Soybean hulls:** These are the outer shells of soybeans and are high in fibre, making them a potential ingredient in fish feed formulations.
- ▶ **Sweet potato pomace:** This by-product of sweet potato processing is rich in carbohydrates and fibre, making it a potential ingredient in fish feed formulations
- ▶ And many more

Alternative Raw Ingredients: Plant by- products

- ▶ The use of plant by-products as alternative fish feed ingredients offers a sustainable solution to the growing demand for environmentally responsible aquaculture practices
 - Cost-effective: Using plant by-products can significantly reduce the cost of fish feed production.
 - Sustainable: It reduces the pressure on wild fish stocks and supports a more sustainable aquaculture industry.
 - Nutritious: Plant by-products can provide essential nutrients such as protein, fat, and carbohydrates needed for fish growth and health.
 - Versatile: A wide range of plant by-products such as soybean meal, rice bran, and wheat bran can be used in fish feed formulations.
 - Environmental Benefits: Using plant by-products reduces the amount of waste generated by the food industry, which can have positive environmental impacts.

Alternative Raw Ingredients: Plant by- products

- ▶ Increased shelf life: Some plant by-products such as grape pomace and tomato waste contain natural antioxidants that can increase the shelf life of fish feed.
- ▶ Reduced water pollution: Traditional fish feed ingredients such as fishmeal and soybean meal can contribute to water pollution when they are not properly processed. Plant by-products, on the other hand, are less likely to cause pollution.
- ▶ Improved gut health: Certain plant by-products such as garlic powder and onion waste have been shown to improve gut health in fish, which can lead to better growth and disease resistance.
- ▶ Enhanced flavour: Some plant by-products such as citrus pulp and apple pomace can enhance the flavour of fish feed, making it more palatable for fish.

- ▶ Algae is a promising source of protein, carbohydrates, and lipids, with potential benefits as a fish feed ingredient.

- ▶ Algae also has a low carbon footprint and can be grown in various aquatic environments.

- ▶ Algae and single-celled protein offer promising solutions to the challenges of traditional fish feed while promoting environmental sustainability.

- ▶ Single-celled protein, also known as microbial protein, is produced from microorganisms such as bacteria, yeast, and fungi.

- ▶ These microorganisms can be grown on various organic substrates, such as waste streams from food production.

- ▶ Single-celled protein has high protein content, and

- ▶ the production process has a low environmental impact compared to traditional fish feed

Alternative Raw Ingredients for Aquafeeds

Benefits and and Potential Potential Drawbacks

- ▶ Using alternative raw ingredients in aquafeeds brings several benefits, including improved feed sustainability and reduced environmental impact.
- ▶ However, challenges such as **ingredient quality, digestibility, and acceptance by farmed species need to be addressed** to ensure optimal feed performance and fish health.

Research and Development Efforts

- ▶ Ongoing research and development initiatives aim to explore the potential of alternative raw ingredients in aquafeeds.
 - ▶ Scientists and feed manufacturers work together to evaluate ingredient functionality, develop new processing techniques
 - ▶ improve the overall nutritional profiles of aquafeeds.
 - ▶ Alternative feed ingredients have been tested in Aquaculture feeds for several farmed fish species.
 - ▶ Research efforts have shown that these by-products hold enormous potential in future fish feed formulations see Table 1
- ▶ [Emmanuel Table 1.doc](#)

The Emerging Trends in aquafeeds and alternative alternative raw ingredients:

Functional Feed Additives

- The integration of functional feed additives, such as probiotics and prebiotics, in aquafeeds is gaining traction.
- These additives offer potential health benefits and can enhance the performance and resilience of farmed species.

Circular Economy Approaches

- The adoption of circular economy principles in aquafeed production aims to minimize waste and maximize resource efficiency.
- This includes utilizing by-by-products from other industries, implementing bioconversion processes, processes, and optimizing feed formulations.

Genetic Improvements

- Continued genetic advancements in aquaculture species, combined with customized feed formulations, can lead to enhanced growth rates, feed conversion efficiency, and disease resistance.
- This integration of genetics and nutrition holds great promise for the future of aquaculture.

Opportunity

▶ Diversification of Raw

- ▶ Exploring a wider range of of alternative raw ingredients can improve improve the resilience and and sustainability of aquafeed production, decreasing reliance on scarce resources.

▶ Market Demand for Sustainable Products

- ▶ Increasing consumer awareness and for sustainably produced seafood create opportunities
 - ▶ the aquaculture industry to emphasize their commitment to environmentally-friendly practices
 - ▶ through the utilization of alternative raw ingredients environmental friendly

Challenges

- ▶ **Cost-effectiveness and Scalability**
 - ▶ Ensuring the cost-effectiveness and scalability of alternative raw ingredients poses a challenge.
 - ▶ Research and innovation in ingredient production and processing can address these concerns and facilitate market adoption.
- ▶ **Regulatory Frameworks and Standards**
 - ▶ The development of clear regulations and standardized criteria for alternative raw ingredients in aquafeeds is essential to ensure quality control, safety, and integrity in the production and marketing of aquaculture products.

Conclusion

- ▶ More research and innovation are, however, needed to overcome these challenges and unlock the full potential of alternative feed ingredients as a sustainable and circular solution for aquaculture production.
- ▶ Further research is needed to optimize the processing methods, formulation strategies and feeding practices of these alternative feed ingredients for different fish species and culture systems.
- ▶ Generally, these alternative fish feed ingredients can reduce the dependence on imported feed ingredients, lower the cost of production, improve the nutritional quality of fish and enhance the environmental and social sustainability of aquaculture in Africa.

▶ Thank you