



RESEARCH
PROGRAM ON
Fish

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Good practices in fish nutrition and feeding

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Good practices in fish nutrition and feeding

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Reference

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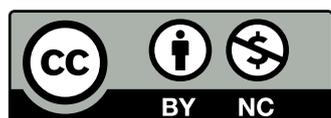
FISH is developing guidelines for better management practices (BMPs) at the global level and contextualized BMP resources at the country level to support sustainable and responsible tilapia farming in WorldFish focal and scaling countries.

This manual of good practices in fish nutrition and feeding in the specific context of the Democratic Republic of the Congo was produced in the hope of building the capacities of fish farmers and extension services, and to promote other aquaculture technologies (the GIFT strain of tilapia, for instance) and manuals of good aquaculture practices developed by WorldFish.

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Introduction

Proper nutrition for fish is dependent on the quality of the ingredients used to make their feed, how it is formulated (recipe), the techniques and equipment used in producing it, care taken during storage and the feeding technique applied.



Photo credit: WorldFish

Plant-based food for juvenile tilapia.

1. Ingredients

1.1. Choosing the ingredients

The following criteria need to be taken into account in selecting ingredients for fish feed:

1. Nutritional value (protein, fat, carbohydrates and fibre);
2. Availability (seasonal or annual);
3. Price and cost to transport; and

4. Any pre-treatment needed to make the ingredient more digestible.

The ingredients must be kept in a dry place that is protected from sunlight and rodents, in order to maintain them fresh. Ideally, ingredients should be purchased within a week prior to producing the feed.



Ingredients for fish feed in labelled bins in Kalambo.

1.2. Preparation and processing of ingredients

All ingredients selected must be dry. Any ingredients purchased fresh – such as brewer's spent grain – must first be dried (pre-treated). Each ingredient is then ground to obtain a fine meal ($\leq 800 \mu\text{m}$ is optimal) to facilitate mixing with other ingredients. Each ingredient must be ground separately to avoid any contamination or undesirable mixing.

The milling machine must be cleaned carefully between ingredients. Once each ingredient has been ground, sifting is recommended (ensuring that the sieving mesh size is $\leq 800 \mu\text{m}$) to eliminate any coarse particles and obtain a homogeneous powder.



Photo credit: Janvier Mushagalusa/IFRA-Obusegum Obasamjo Campus/Kalambo Democratic Republic of the Congo

Left: Drying ingredients for fish feed.
Right: A woman mills ingredients in Kalambo-Sud Kivu.

2. 2. Formulation of fish feed

Once the ingredients are ready, a recipe is prepared based on the nutritional requirements of each species of fish targeted (tilapia, African catfish, common carp, etc.) and their respective stage of development (larvae, starter, grower and finisher). A specific recipe must be produced for each species of fish and each stage of development.

A good recipe combines several ingredients to provide the necessary nutrients to provide balanced nutrition for proper growth and development of the fish.



Photo credit: Janvier Mushagajusa/ITA-Olusegun Obasanjo Campus/Kalumbo/Democratic Republic of the Congo

3. Production of fish feed

3.1. Mixing the ingredients

To comply with the quantities specified in the recipe, the different ingredients must be carefully weighed individually, one after the other. They are then mixed together in strict accordance with the proportions indicated in the recipe. It is recommended that ingredients in smaller quantities (vitamins, minerals, salts, etc.) be added first, then ingredients in progressively larger proportions to produce a homogeneous mixture.

The capacity of the mixer needs to be taken into account; in other words, if the aim is to produce a total of 100 kg of feed and the mixer only has a 25 kg capacity, the recipe should be modified to produce 20 kg five times in order to obtain the desired 100 kg. The ingredients should be mixed for at least 20 minutes to obtain a homogeneous product. Each ingredient in the formula should be present in the suggested proportion in each gram of final product.



Photo credit: Janvier Mushagalusa/IITA-Olusgun Obasanjo Campus/Kalambo Democratic Republic of the Congo

A technician mixes ingredients for fish feed at IITA-Kalambo.

3.2. Producing pellets

Between 6 and 9 litres of clean water (30 per cent – 45 per cent by volume/mass) are added to about 20 kg of the mix, combining to form a dough. The resulting dough is then pressed into the pelletizer to produce noodles or “spaghetti” that are then cut to form sinking pellets, or through the extruder to produce floating pellets.

3.3. Drying the pellets

The pellets are dried on a dryer at a temperature of between 50° C and 65° C for 6 to 18 hours. It is recommended that the pellets be turned regularly, ideally once every hour, to achieve a standard level of dryness. It is important to dry the pellets well. The shelf life of the resulting product depends on its moisture content, which must be < 15 per cent at the end of the drying period. In extreme cases, such as when no dryer is available, pellets may be dried in the open air, but they must be kept away from sunlight to avoid degrading the fats. Sundried feed should not be kept longer than three days.



Photo credit: Janvier Mushagalusa/IITA-Olusgun Obasanjo Campus/Kalamba Democratic Republic of Congo

Drying pellets using a locally designed dryer at IITA-Kalambo.

3.4. Storage of fish feed

Some animals (such as rodents and birds) are fond of fish feed. Physical barriers should be used to keep them away. The shop door should be kept closed at all times and the shop window should be equipped with a screen. Humidity is a crucial element that must be controlled or managed to store fish feed properly. High levels of humidity could lead to contamination of the feed (by fungal substances) and reduce its nutritional value.

Therefore, it is important to keep the storage area clean, dry and well ventilated. If necessary, times for storage and use of the feed should be shortened. The feed should be stored a few centimetres off the ground, preferably on pallets. Sacks should not be placed against walls.



Photo credit: Janvier Mushaga/USAID/Olusgun Obasajo Campus/Kalumbo Democratic Republic of the Congo

Fish feed storage at a warehouse in Bukavu.

3.5. Maintenance and quality control of fish seed

All scales and weights used in the feed manufacturing process should be adapted to the range of weights and volumes to be measured and tested regularly for calibration. All mixers used in manufacturing the feed and processing the ingredients should be adapted to the range of weights or volumes to be mixed and be capable of producing homogeneous mixtures.

All containers and equipment used in manufacturing, processing, transportation, storage, maintenance and weighing must be kept clean at all times.

Ingredients and feed should be sent to a testing laboratory regularly for analysis (at least once a month during regular production) to ensure quality. The laboratory analysis may measure content of proteins, fats and fibres, and any contaminants that may be present.



Photo credit: Javier Muthaigalusa/IITA, Calicut, Kerala, India

Feed produced in different sized formats for the project at IITA-Kalambo.

4. Feeding fish

Fish should be fed at least twice a day (at 9.00 and 15.00) or three times a day (at 9.00, 12.00 and 16.00). Fry or fingerlings, however, need to be fed at least five times a day (at 8.00, 10.00, 12.00, 14.00 and 16.00) as their stomachs are still very small.

Feeding rates diminish as the fish grow. Fish may be fed 8 per cent of their weight per day at the starter stage, declining gradually to 3 per cent at the grower stage and 2 per cent at the finisher stage.

Pellet size, however, increases as the fish grow larger.

It is recommended that fish be fed when the weather is fine and not when it is raining. During the feeding process, fish should be visually checked to see whether they are eating and active. If they are not eating, feeding should be stopped and the water quality verified.



Photo credit: Janvier Mushyigusa/IRAC/Olusgun Obasanyo Campus/Kahamba Democratic Republic of the Congo

A technician feeding fish at the fish farming station in Nyakabera.



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About FISH

The CGIAR Research Program on Fish Agri-Food Systems (FISH) is a multidisciplinary research program. Designed in collaboration with research partners, beneficiaries and stakeholders, FISH develops and implements research innovations that optimize the individual and joint contributions of aquaculture and small-scale fisheries to reducing poverty, improving food and nutrition security and sustaining the underlying natural resources and ecosystems services upon which both depend. The program is led by WorldFish, a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

For more information, please visit fish.cgiar.org