



TILAPIA SEED REARING MANUAL

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Preface

The purpose of the manual is to assist extension workers and fish farmers in applying Tilapia seed rearing technologies. These technologies apply to seed rearing in pond, tank and hapas. This manual has been developed based on results from on station at National Aquaculture Centre in Domasi and on farm trials from various fish farms across the country. It has been noted that availability of high quality Tilapia seed depends on good rearing practices in commercial aquaculture operations. This manual therefore has been arranged in a step-by-step manner in the following sequence; production of fry; fry rearing; management; harvesting of fingerlings; transportation; and record keeping.

1. Introduction

Aquaculture in Malawi began in 1906, with the introduction of rainbow trout (*Onchorhynchus mykiss*) in the Mulunguzi Stream on the Zomba Plateau for angling. The use of indigenous species in fish farming began in 1956/57 with the culture of *Oreochromis shiranus*, Makumba and Chilinguni (*Tilapia rendalli*). Pond culture of these species increased with the establishment in 1957 of the Domasi Experimental Fish Farm for breeding and distribution to farmers. From the 1970s to date, the sector received support from several development agencies and project including, the Food and Agriculture Organization of the United Nations (FAO), GTZ, WorldFish (then the International Center for Living Aquatic Organisms (ICLARM)), United States Aid for International Development (USAID), European Union (EU), Department for International Development (DFID), Japanese International Cooperation Agency (JICA), UK Department of International Development (DFID). The support from Non-Governmental Organization (NGOs) encouraged wide adoption of fish farming in Malawi in the 1990s. These NGOs include: Action Aid, World Vision International, CARD, COMPASS, OXFAM, Concern Universal, Christian Service Commission and US Peace Corps.

Despite the support from various NGOs and development partners, fish production volumes from aquaculture have been very low largely because of lack of availability of quality fingerlings and lack of application of best management practices in rearing fish. Tilapia fry in Malawi are predominantly produced in ponds. Although intensive fry production using indoor hatchery and nursery operations using hapas and concrete tanks are now practiced, fingerling production has been low due to low survival rates from eggs to fry and from fry to fingerling. In addition, there has been limited success in use of all male tilapias. This manual outlines fingerling rearing technology that includes the production of all male tilapias using sex reversal technology.

2. Production of sex reversed fry

2.1. Preparation of feed for sex-reversal

- 1 Grind separately the dried fish meal and starter formulated feed and sieve them with a 250 μ m or 380 μ m mesh.
- 2 Mix the starter formulated feed and the dried fish thoroughly at the ratio of 6:4.
- 3 Prepare 20mg/ml Methyl Testosterone (MT) alcohol solution (solution A) and dilute it 25 times with water (solution B).
- 4 Spray solution B evenly on the feed mixture (Steps 1 and 2) at 100ml of solution B to 1 kg of feed.
- 5 Regrind the feed mixture which has been sprayed with solution B.

2.2. Sex-reversal in concrete tanks

The sex reversing treatment takes a duration of 28 days.

- 1 Clean the concrete tanks (12.5m \times 2m x1m or 25m \times 2 \times 1m).
- 2 Disinfect it with 15ppm trichloroisocyanuric acid (TCCA) or potassium permanganate,
- 3 Flush the tank with clean water after 30 minutes
- 4 Fill water to 50cm depth, and use 180 μ m sieve net at the water inlet for filtering.
- 5 Stock fry that have just absorbed their egg yolk sac at the density of 1000 - 1200 fry/m².
- 6 Feed 4 times a day, at 8:00, 11:00, 13:00, and 16:00 hours respectively. During the first week 1,000 fry are fed with 3g where as second, third, and fourth week the fry are fed with 4, 5 and 6g of MT treated feed respectively.
- 7 When feeding adjust feed based on how much the fingerling are actually consuming; don't feed if feed from the previous feeding has not been fully

consumed. Do not add all the feed in one go to the pond, or add feed in only one part of the pond.

- 8 Replace 30 per cent of concrete tank water with fresh water every week.
- 9 Remove any dead fry in timely fashion. Determine the reason for any mortalities.
- 10 Set up predator control facilities around the tank.
- 11 Keep accurate daily records.

2.3. Sex reversing treatment in hapas

- 1 Five days before stocking the fry, fix the hapas in a pond with clean water and a depth of 1.2 - 1.5m; check the hapas are in good condition. Aggressive fish species can be added in the pond outside hapas to control tadpoles and frogs.
- 2 Stock the collected fry into the hapas (5m×2m×1m) for sex reversal treatment.
- 3 Stock 2500 - 3000 fry/m².
- 4 Feed 4 times a day, at 8:00, 11:00, 13:00, and 16:00 hours respectively. During the first week 1,000 fry are fed with 3g where as second, third, and fourth week the fry are fed with 4, 5 and 6g of MT treated feed respectively
- 5 Replace 30 per cent of hapa water with fresh water every week.
- 6 Remove any dead fry in timely fashion.
- 7 If the water quality deteriorates in the hapa, use quick lime or change water to solve the problem.
- 8 Set up predator control facilities around the hapa.
- 9 Check how much feed is being consumed by the fry, and monitor the quality of the hapas, making repairs as needed.

3. Seed rearing

Seed rearing should be done for mixed sex fry that have been collected from breeding facilities (i.e. hapas, tanks and ponds) and sex reversed fry after completion of MT treatment (after 28 days).

3.1. Fry nursing in tanks

- 1 Use clean filtered water from the hatchery filter tanks.
- 2 Stock fry at the density of 10-20 fry/L or 10,000 -20,000 fry per tank of 1000L.
- 3 Sample the fry every 7 days and use a microscope to check for presence of diseases or parasites e.g. *Trichodina dactylogyrus*. Any presence of diseases or parasites should be treated immediately.
- 4 Clean the tanks by siphoning twice daily at 9:00 and 15:00 hours. Except during the feeding time, keep the water aerated day and night. When signs of lack of oxygen are observed e.g. fry breathing on the water surface, increase the aeration. Always maintain the right water level.
- 5 Crush the feed and broadcast all around the tank. Stay away and keep quite so that the larvae can feed on the surface. The water inlet should be turned off during the feeding time and re-opened after feeding so that the water is kept fresh with more oxygen.
- 6 Feed the fry 4 times per day (at 7:30; 11:00; 14:00 and 16:00 hours. At every feeding time give the feed 3-4 times at 10 minute intervals, check the belly side of the fry during the second or third feeding interval and make sure that 95% of the larvae have food inside their stomachs.

3.2. Fry nursing in ponds

3.2.1. Pond preparation

- 1 Ponds should have separate water inlets and outlets. Water inlets and outlets should be covered with a 180µm mesh size for screening out wild fish and predators.

- 2 The pond should have a reliable water source, good water quality, water depth of 1.2m, and an area of 400-1000m².
- 3 Pond dikes should be solid, without leakage, and if possible, be reinforced with cement. The dike should be at least 30cm above the ground, with draining ditches all around to prevent rainwater pouring into the pond which may ruin the dike and cause changes in water quality.

3.2.2. Pond reconditioning

- 1 A month before seed stocking, pond should be drained and exposed to sunlight to enhance pond bottom cracking, aeration and decomposition. This will also kill eggs and unwanted parasites.
- 2 The pond bottom and around the dike should be cleaned up to remove any weeds
- 3 The pond bottom should be levelled for easy collection of seed and easy drainage.
- 4 Maintain the water inlet and outlet as well as the ditches, and change the screen
- 5 The whole pond area should be inspected and damages repaired, as needed.

3.2.3. Protection facilities

- 1 Prepare reed mats with a height of 100cm;
- 2 Bury 20cm of mat into the pond dike tightly;
- 3 Use wooden stakes as poles for holding the fence;
- 4 Set up a polyethylene net over the pond to prevent bird predators.



Figure 1: Fencing around ponds prevents entry by predators

3.2.4. Pond disinfection

- 1 The pond should be disinfected with either quicklime or chlorine
- 2 Before disinfecting, the pond should be filled with water to 6~10cm deep
- 3 Quicklime lumps should be put into pond water at 120g/m^2 in order to dissolve and spread over the pond bottom, before the lime cools down.
- 4 15 – 20 mg of chlorine should be applied per litre of water.
- 5 These dose ranges depend on the agro-ecological zone

3.2.5. Pond filling

A day after disinfection, ponds should be filled with water to a depth of 1.2m.

3.2.6. Pond fertilization

- 1 Five days before stocking seed, fertilize the pond with chicken manure at 200g/m^2 or green folder (tender banana leaves, tender maize leaves, sweet potatoes leaves, plants that can easily rot in water) at 500g/m^2 .
- 2 Ferment chicken manure before being used:
 - a) dig a hole near the pond,
 - b) put in the chicken manure mixed with 2% quicklime,
 - c) cover the hole tightly with plastic film for about 7 days.

- 3 Green manure:
 - a) tie the green manure with ropes into 50kg bundles,
 - b) fasten the bundles with sticks to the four pond corners,
 - c) submerge in the water, and
 - d) turn them around every two days.

3.2.7. Water testing

Seven days after filling the pond, check if the water is conducive for fish survival.

Water testing method: Put a small hapa into the pond and stock about 10 fish in the hapa; after 24 hours, if the fish survive, then seed should be stocked. Before adding fry, screen the pond two to three times with a 380 micrometer net for tadpoles and frogs.

3.2.8. Fry stocking

Stock 80-100 fry/m²

3.2.9. Precautions

Difference between water temperatures (between fry source location and fry stocking location) should be less than 3°C. Stock fry in the morning, at the windward site of the pond. Operate cautiously.

3.2.10. Feeding

Feeding of artificial compound feed

- 1 Feeding should start from the second day of stocking.
- 2 Use special compound feed with a crude protein level of 35 per cent or higher, or use grow-out fish feed after grinding or soaking.
- 3 Apply four “fixed” principles, namely:

- i. Fixed quality: the compound feed used should be nutritionally comprehensive, with suitable pellet size, good palatability and should be stable in water; decayed feed should be avoided.
- ii. Fixed quantity: daily feeding rate is usually around 5-8 per cent of total fish weight, and should be eaten up within 30 minutes.
- iii. Fixed time: feed twice every day, between 8:00-9:00 and 15:00-16:00 hours respectively.
- iv. Fixed site: select a relatively central site near the pond edge where passage is convenient, as the fixed feeding site.

3.2.11. Daily management

- 1 Monitor the pond in the morning to measure dissolved oxygen, water colour, water quality and fish activity, to determine the amount of feed required, fertilizer amount and the need to add water, as well as to check if there's any water leakage and if fish have escaped.
- 2 Remove frog spawn and weeds whenever these are seen.
- 3 During the rainy season, pay attention to the water level and inspect the fish and remove any materials that may block the water outlet.
- 4 Add fresh water when it is necessary, screening with a 180 micrometer mesh to keep out wild fish.

4. Harvesting of seedlings

After one month of rearing, the sex reversed seed shall reach up to 5g in weight while mixed seed should reach 3-4g and can be used for grow-out culture.

5. Fish Seed Transportation

There are basically two transportation methods i.e. open and closed methods. Choice of transport depends on the facilities, distance, number and size of fish species

a) Open system

Open system consists of water filled containers in which oxygen is supplied continuously from the outside source e.g. tanks, plastic containers, buckets etc. it is the ideal way of transporting fingerlings within the farm or over short distances.

b) Closed system

A closed system uses sealed containers and it is by far most ideal method for live fish transportation for long distances. Suitable containers include oxygenated polyethylene (plastic) bags or tanks.

Standard procedures in fish transportation

- 1 Pre –transportation handling activities such as harvesting, packaging and loading into vehicle must be carried out without waste of time to minimize mortalities
- 2 Remove weak and dead fish before packing
- 3 Stop feeding 24 to 48 hours prior to transporting fish
- 4 Prepare all transport containers, oxygen and other equipment before setting out
- 5 Harvest fish for transport during the cooler part of the day (i.e. very early in the morning).
- 6 Quickly, but gently put fish into the transport container.
- 7 Insulate fish from heat during transport
- 8 Transport fish using the fastest means of transport available
- 9 When travelling long distances, make sure there is a separate source of oxygen in case fish develop signs of oxygen stress before reaching destination.
- 10 Transport fish when temperatures are cool (morning or late afternoon)

- 11 Upon arrival, adjust fish to their new environment slowly by gradually exchanging water to avoid temperature shock
- 12 Allow fish to swim from the container into the new pond or cage. Never throw or pour fish into pond

6. Record keeping

Keep records during the whole rearing period, including, species name, stocking details, feeding times, drug use, water temperature, dissolved oxygen, acidity level, and pond patrol observations.

Date	Pond/ Tank/Hap a No.	Water Condition				Stocking		Mortality (No.)	Feeding Amount (kg)	Medicati on use	Remarks
		Temp	pH	D.O.	Level (cm)	Species	Density				

Table 1: Records kept during fingerling rearing