ISSN 2582- 564X
AEXTJ
AGRICULTURAL EXTENSION JOURNAL

Available Online at www.aextj.com
Agricultural Extension Journal 2021; 5(1):1-7

REVIEW ARTICLE

Making Livelihood through Tilapia Farming in Countries like Ethiopia

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Received: 25-11-2020; Revised: 30-12-2020; Accepted: 15-01-2021

ABSTRACT

Fish are popular sources of high-quality nutrients such as protein and white meat in many parts of East Africa. However, the gap between supply and demand for fish is expanding. Almost all natural fish stocks in the region, as usual to the world, become overexploited yet human populations and hence demands continue to increase. To establish and run a small-scale fish farm it needs: Labor, land, machetes (pangas), hoes, shovels, pickaxes and wheelbarrows, measuring tapes, wooden pegs, string, lime, fingerlings, fertilizer, weighing scale, and scoop nets. Fish (tilapia) grow best and mature fast when the water temperature is between 25 and 28°C. Record keeping helps fish producers to track the major activities undertaken from the start of fish farming business. Keeping simple records of costs and income from sales will allow you to work out whether your fish farming business is profitable.

Key words: Farming, Fish, Tilapia

INTRODUCTION

Fish are popular sources of high-quality nutrients such as protein and white meat in many parts of East Africa. However, the gap between supply and demand for fish is expanding. Almost all natural fish stocks in the region, as usual to the world, become overexploited yet human populations and hence demands continue to increase. In contrast, fish farming is limited in attributes to lack of awareness, technological hardware and software, and mismanagement.

The best option for producing more fish in East Africa is fish farming. This paper explains how can make a living from fish farming, focusing on rearing tilapia.

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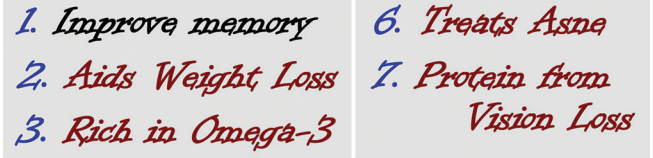
WHAT NUTRITIONAL ROLE OF FISH TO PUBLIC HEALTH?

- Fish contain high-quality protein such as lysine, methionine, and tryptophan which are highly deficient in other human foods items
- Fish are a desirable food primarily because of its high contents of protein critical essential amino acids (Lysine, methionine, and tryptophan) which is high proportion in dry matter weight
- Fish oil is nutritionally important both quality (high proportion of Omega-3 polyunsaturated FAs), quantity, and oxidizes easily.



WHY FARM FISH?

- Fish grow quickly and make a return on investment fast: A tiny fingerling is ready to eat as 6–8 months when it can fetch money more than the cost price
- Fish can meet demand in a timely and efficient manner, harvesting only what can sell to avoid wastage
- Fish rarely suffer from diseases unlike other livestock animals
- Once established, fish farms are easy to maintain leaving you with more time for other tasks
- Fish is very nutritious, providing a good source of high-quality protein and other essential nutrients, which are especially important for mothers and growing children
- A farmer can often integrate fish farming into existing farm to create additional income and improve its water management
- Fish growth in ponds can be controlled: Farmers can select fish species they wish to raise
- Fish produced in a pond are the owner's property; they are secure and can be harvested at will. Fish in wild waters are free for all and make an individual share in common catch uncertain
- Fish in a pond are usually close at hand
- Effective land use: Effective use of marginal land, for example, too poor or too costly to drain for agriculture can be profitably devoted to fish farming provided that it is suitably prepared.

WHY FARM TILAPIA?

Tilapia is a best option due to its excellent traits for farming. Tilapia now so domesticated that they have earned a title "the aquatic chicken." It is fast growth and maturity, able to survive in poor water conditions, eats a wide range of food types, and breed easily with no need for special hatchery technology.
Tilapia is one of the best recommended species for aquaculture. It is tough and tolerates a wide range of environmental conditions, so little environmental modification is needed and aquaculture systems can be low tech. Earthen ponds in non-flood prone areas will be sufficient. Concrete tanks or raceways can be used, but are more expensive to build and usually cannot be justified. Cages in lakes or rivers can also be used.
Tilapias also have some bad characteristics for aquaculture. Uncontrolled breeding in ponds can lead to overcrowding and stunted growth. Once tilapia are present in a pond, they are difficult to get rid of except by poisoning or by draining the place and leaving it to dry until the bottom has baked hard in the sun. They need to live in warm water and do not grow well if water temperature is <22°C.[1]

REQUIREMENTS

To establish and run a small-scale fish farm it needs: Labor, land, machetes (pangas), hoes, shovels, pickaxes and wheelbarrows, measuring tapes, wooden pegs, string, lime, fingerlings, fertilizer, weighing scale, and scoop nets.
Fish (tilapia) grow best and mature fast when the water temperature is between 25 and 28°C.[2-4]

Step 1: Pond site selection

Tilapia is fish hardy to grow in very harsh environments. However, for successful farming, it is necessary to ensure the site can provide an environment where the water quality factors can be maintained in the range known to be good for tilapia. The important factors to be checked are water temperature, dissolved oxygen, acidity (pH), and salinity.
Ideally, one should observe different possible farm sites and choose one that not only meets the needs of tilapia culture but is a place where the farmer can live close. Having the ponds near the farmer's house will give easy access for carrying out daily activities and also reduce losses to poachers. Factors considered in pond site selection:

- Gently sloping land, large enough to allow pond construction
- Pond must be in full sun and unsurrounded by trees as this invites predators, like fish eating birds
- Soil should not allow water to seep away (check this by digging a test hole, filling it with water, and checking the next day to see whether the water has seeped away)
- A reliable and convenient source of clean, unpolluted water is essential as it should continuously flow through the pond. Water sources include underground springs, streams wells, lakes, and/or river diversions (make sure having permission from local authority). Use of borehole and piped water is unlikely to be cost effective. Chlorinated water is poisonous to fish.

Step 2: Pond construction

- Clear the site of vegetation
- Measure pond size and mark it out with sticks and string to see how big it will be before starting construction
- Ponds should be rectangular or square with a minimum size of 10 m by 10 m. Bigger ponds, up to 50 m by 100 m, are easier to manage. The sides should slope outward
- Pond must be 0.5 m deep at shallow (water inlet) end and 1.5 m at deep (water outlet) end and have a sloping floor
- Dig out the pond using hoes, spades and shovels, and heap soil around the pond to form dyke.

Step 3: Pond fertilization

Pond fertilization encourages the growth of tiny plants (algae) and tiny animals that provide food for younger fishes. Algae turn the water green, which makes it harder for predators, such as birds and snakes, to see and catch your fish. To fertilize a pond, one may use animal manures or chemical fertilizers.

Tips

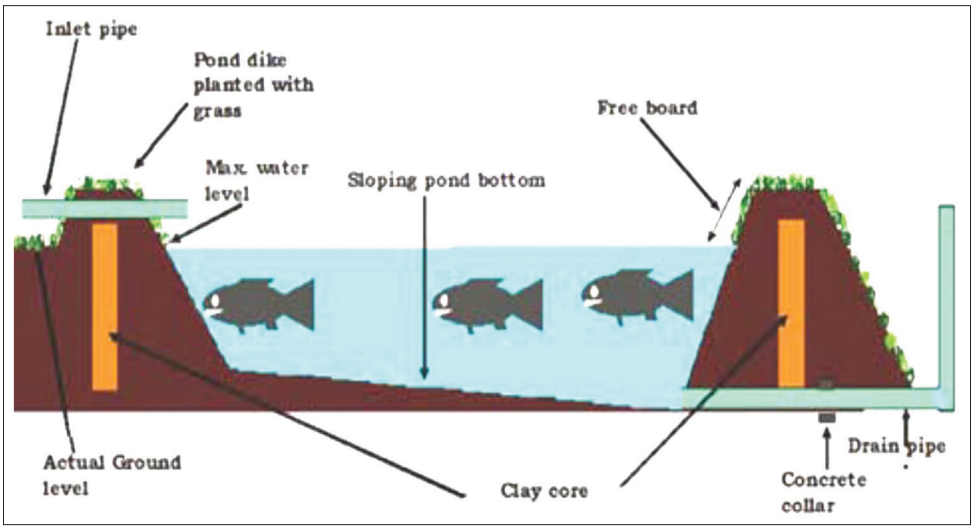
- Rectangular ponds are easier to build and the fish are easier to catch compared to round ponds
- Never dig ponds in pathway of a river to avoid flooding and washing away of fish

Step 4: Seed selection

- A fingerling seed is a tiny, newly hatched fish weighing between 20 and 80 g
- Purchase tilapia fingerlings from an established fish farm within your area
- Place fingerlings in a bucket of fresh water
- Move the fingerlings to your fish pond as soon as possible (within 6 h).

Step 5: Pond stocking density

- Put 3 tilapia fingerlings per square m of pond area. A pond has an area of 100 (or 10×10) m2 and so would need 300 fingerlings
- To stock the pond with fingerlings, gently lower bucket containing fingerlings into pond's shallow end
- Gradually tip the bucket to allow the fingerlings to swim into the pond



- Apply a thin layer of agricultural lime to the pond bottom. This will help to eliminate pests like leeches
- Fill the pond with water so that the shallow end is 0.5 m deep and the deep end is 1.5 m deep.

Step 6: Supplementary feeding

- For the 1st month, the young fingerlings will eat the natural food in the pond
- After the 1st month, feed the fingerlings twice daily
- Suitable foods include rice, maize, or wheat bran (a quarter of a kg fed twice daily). Other foods include:
  - Sliced kale (sukuma wiki) or chopped sweet potato vines
  - Termites and ants
  - Small lake shrimps
  - Small leftover of fish caught by the fishermen
  - Local fishmeal (omena/dagaa/mukene dust).

Step 7: Fish sampling

- Check on your fish regularly and weigh them monthly to see how they are growing. Catch some fish using a scoop net by placing some feed inside the bowl portion of the scoop net to act as bait. The fingerlings should have increased in weight by at least 10 g in the 1st month
- The fish should continue to grow steadily each month.

Step 8: Pond maintenance and management

- Keep area clear around pond and free of weeds and pollutants
- Fence the pond to keep-out children and animals
- Keep the water levels between 0.5 and 1.5 m deep
- Keep the pond bottom fertile to grow natural fish feeds (microscopic organisms).

Step 9: Fish harvesting, storage, and preservation

Harvesting

Fish can be harvested partially (leaving at least 10 fish in the pond to breed) or totally (harvesting all fish and cleaning the pond) 6 months after stocking [Tables 1-3].

Table 1: Types of fertilizers and application rate into fishpond

Type of fertilizer	Application rate (kg) for 100 m² pond area
Natural	
Animal (cow, goat, or sheep) dung	6.0
Chicken, duck, or goose droppings	2.5
Chemical	
Urea	1.0
DAP (diammonium phosphate)	1.0
TSP (triple superphosphate)	1.0

Table 2: A guide for supplementary feeding of tilapia

Body weight of fish (g)	Number of fish/kg	Feeding rate (%)	No. of feeds per day
1–5	1000–200	10–6	4–6
5–25	200–40	5	4
25–150	40–7	4–3	4
150–250	7–4	3	3-4
250–450	4–2	2–3	2–3

Table 3: Records keeping tips

What can go wrong	Cause	What to do
Contaminated water	Pollution at water source	Ensure water is clean and safe before building pond
		Contact local water authorities
Stunted growth of fish	Underfeeding	Feed regular with recommended feeds
Fish poisoned	Tephrosia bark	Clear Tephrosia trees from area around the pond.
		Add more water to dilute poison as soon as possible
Loss of fish to: Snakes and monitor lizards fish eating birds (kingfisher, herons)	Bushy pond site	Clear the pond site
	Water too clear	Fertilize the pond to make water green
Thief	Unprotected ponds	Fence the pond
		Keep watch on pond when fish mature
Fish deaths	Leeches	Apply lime at the pond bottom before stocking
	Fishes washed away by floods	Ensure that maximum water level in the pond does not exceed 1.5 m
	Long, dry spells – shortage of water supply	Harvest the fish and sell before drought

- Lower the fishing net into the pond at the deep end. Ideally, have two people on either side of the pond holding the net
- Press the net to the bottom of the pond to ensure you catch all the fish. This can best be done by having three people in the pond
- Gradually pull the net toward the shallow end
- Gather the net to one corner, making sure you retain all fish captured
- Pull out the net
- Place fish in a container of clean water
- Sort fish. Return any underweight fish to the pond
- Depending on demand, market all fish or return some to the pond.

Fish storage and preservation

- Immediately cut the fish open along underside and pull-out the guts which can be dried, mixed with bran, and fed to livestock animals, including chickens
- Wash the fish with clean water and place in cooler boxes
- Sell or cook and eat fresh fish as soon as possible, otherwise preserve fish by salting, smoking, or sun drying.

RECORD KEEPING

Record keeping helps fish producers to track the major activities undertaken from the start of fish farming business. Keeping simple records of costs and income from sales will allow you to work out whether your fish farming business is profitable.

FURTHER INFORMATION

Books

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Videos

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CONCLUSION

Fish are popular sources of high-quality nutrients such as protein and white meat in many parts of East Africa. However, the gap between supply and demand for fish is expanding.To establish and run a small-scale fish farm it needs: Labor, land, machetes (pangas), hoes, shovels, pickaxes and wheelbarrows, measuring tapes, wooden pegs, string, lime, fingerlings, fertilizer, weighing scale, and scoop nets. Fish (tilapia) grow best and mature fast when the water temperature is between 25 and 28°C. Record keeping helps fish producers to track the major activities undertaken from the start of fish farming business. Keeping simple records of costs and income from sales will allow you to work out whether your fish farming business is profitable.

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APPENDIXES

Appendix 1: Pond Record Sheet

- Name of farm: _____ Pond No.:_____ Pond-Area: _____m^2
- Fingerling source: _____ Stocking date:_____ No. stocked: _____
- Stocking density: _____per m^2
- Average body weight (ABW): _____gm, Total Wt: _____ kg
- Feed supplier: _____ Type of feed: _____ Type fertilizer: _____
- Daily feed ration (DFR) _____kg; Fertilizer (kg per week):_____

Appendix 2: Fish sampling data

Sampling date	From last sampling	ABW of fish (g)	New DFR (g)

Harvest date	No. days of grow-out	No. of fish	ABW of fish (g)	Weight harvested (kg)

Appendix 3: Fish harvesting data

- Total fish harvested: _____ kg; Selling-price: ___per kg; Total sales: _____
- Total feed used: _____ kg Feed price: _____per kg Total feed cost: _____ FCR: _____
- Total fertilizer used _____ kg; Fertilizer-price _____ /kg, Total fertilizer-cost:_____
- Fish survival: _____ %Fish-losses: _____ kg. Fish given free: _____ kg
- Market fee: _____ Transport-cost: _____ Labor cost:_____ Other costs:_____

Appendix 4: Useful formulae

Percentage survival can be calculated as:

$$\%\text{Survival} = \frac{\text{Number of fish harvested} \times 100}{\text{Number of fish stocked}}$$

Example 1. If you put in 1000 fish and harvested 900, then % survival was 900/1000 x 100 = 90%. A good survival rate is 90% or more.

Average body weight (ABW):

$$\text{ABW} = \frac{\text{Total weight of fish in a random sample}}{\text{Number of fish in sample}}$$

Example 2. If you caught 500 fish and the weight of the fish was 75 kg, then ABW was 75/500 = 0.150 kg, thus ABW is 150 g.

Daily feed ration (DFR):
DFR= Feeding rate × ABW × Total number of fish
Note: Feeding rate is the %fish average body weight to be given as food daily (e.g., 5% of body weight).

Total feed requirement (TFR):
TFR = DFR × Feeding duration

Food conversion ratio:

$$\text{FCR} = \frac{\text{Amount of food given}}{\text{Fish weight increase}}$$