# High Performance of Aquaponic System - Farmers Guide

## Introduction

This guide is designed to assist farmers to construct a small scale aquaponic system that can produce fish for domestic consumption as well as provide vegetables for household consumption. The system is efficient in water utilization, has a high production rate and is suitable for fingerlings production as well as grow out when up-scaled to medium level. The materials required for the construction of the system are locally available and a wide range of materials can be adopted for construction. Plastic tanks are locally available in the market and can replace rectangular tanks. Metal drums are discouraged due to their rapid rusting while costs have to be kept low by avoiding the expensive and permanent and ferre-cement based structures.

## Materials Required

1. Platic/metal drum of 200 litres
2. Rectangular plastic tank of 180-200 litres
3. Electric pump of 1.5 HP 240 V 50-60 Hz
4. A fabricated filter (plastic chippings) for denitrification
5. A sump to hold water for re-circulation pumping
6. Piping and fitting (25 mm diameter)
7. Electricity supply
8. Preferably a green house (can be fabricated locally)
9. *Oreochromis niloticus* fingerlings (preferably monosex)
10. Suitable plant such as spinach (*Spinacea oleracea)*

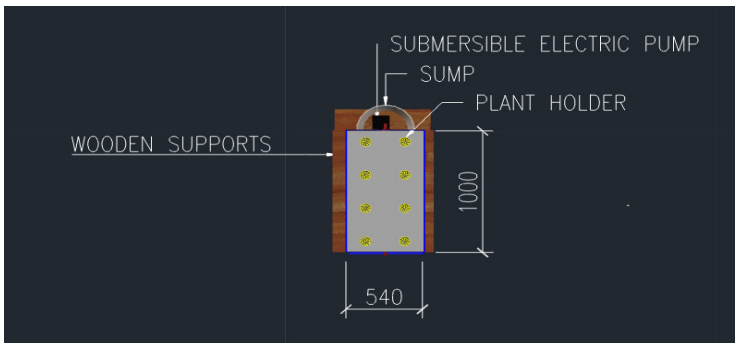
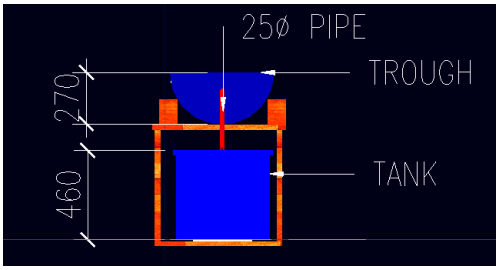



***Figure 1: Top view of the aquaponic system showing floating styrofoam***

## Construction of Aquaponic System

1. The design can be adopted to use either plastic or metallic drums of capacity 200 litres each for the hydroponic system.
2. Fish rearing unit is designed to use rectangular tanks that can hold about 250 litres of water.
3. The unit require 25 mm piping with the necessary fittings. A lift/air pump should be provided for re-circulating the water.
4. Electric water pump of 1.5 – 2.0 HP for re-circulating the water.
5. Styrofoam of dimensions 1m x 0.5m x 0.03m (length, width and thickness) for suspending the plants in the hydroponics system.
6. Each Styrofoam sheet should have 8 evenly drilled holes of diameter 4 cm.
7. The sheets are placed on in the hydroponic system. This is where the plants are anchored using a plastic plant pot
8. Plastic plant pot to support and suspend the plants. The pots should have 6-9 open strips to allow plant roots to freely develop and tap the nutrients
9. A filter is provided between the water pump and the fish rearing unit for denitrification and nitrification



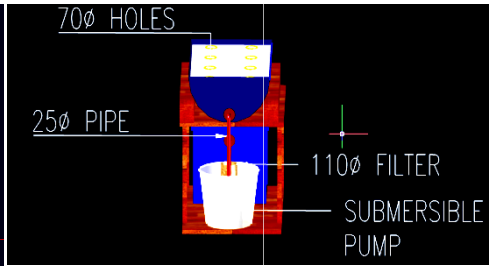
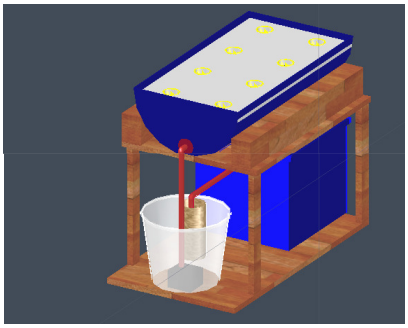




**Plate 1 - Far Left:** Cross-section view showing the rear side of the aquaponic system

**Plate 2 - Left:** Cross-sectional view showing the sump with submersible pump

***Plate 3 - Right: Showing the full aquaponic system assembly with filter, sump, water pump, plant and fish units. The fish unit is stacked under the hydroponic unit to save space***

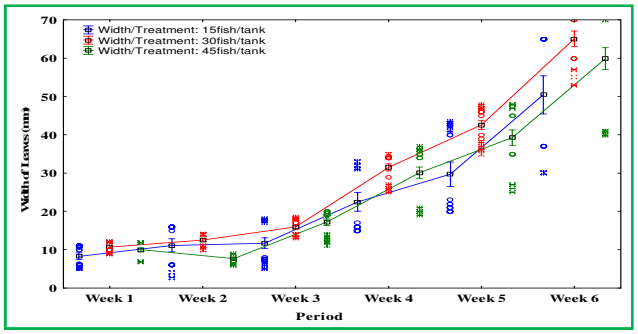


## Stocking Density and Efficiency

a) The appropriate stocking density is 60 to 80 fry of 5 g per fish rearing unit
b) The plants should be about 3 cm height when the system is set up
c) Water pumping rate is set at 2 L $hr^{-1}$
d) no ammonia is detectable in the fish rearing unit after 35 days of operation

***Plate 4:***

***Physical appearance of the aquaponic system in the background. The plant units have been covered by a 2 mm mesh sized net to prevent insect infestation***




## Expected Production

For fingerlings production, the fish will grow on average to 60 mm or 35 g in 6 weeks and the fish would be ready for stocking in ponds

## Advantages of the System

1. The system is efficient and eliminates ammonia wastes that are known to be toxic to fish
2. The system is suitable in areas where there is water scarcity since the water is re-circulated with very minimal top-up
3. Additional production of vegetables for household use is cost saving
4. Se-up costs are minimal at about US $ 100 per unit
5. It is easy to manage the system due to elimination of toxic wastes

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