BAOBAB
HOLDING GROUP

GREEN HOUSE INTERGRATED

AQUAPONIC SYSTEM

NIANING, SENEGAL

2022/23

CONCEPT AND DESIGN

Project : GREEN HOUSE AQUAPONIC SYSTEM

Location: NIANING, SENEGAL

Estimated produce:

Vegetables: Ocra, Cassava, broccoli, tomatoes, tamarind, chilies, parsley, spinach, chard, pepper, lettuce, coriander, basil, onions
Fish: Nile Tilapia, African Catfish quantity 3000
Chicken: 200 Free roam

Project duration: 8-12 months to complete full harvest

Introduction:

Aquaponic system:

The aquaponic culture basically integrated fish farming with crop cultivation for subsistence and economic sustainability. It can trace its origin thousands of years back from the Chinampas of Mexico to the Chinese. It is believed that the Chinese used Fish to fertilize their paddy fields by introducing fingerlings during the planting of rice. This resulted to plenty in harvest. This culture basically integrates;

- Fish rearing
- crop cultivation

This integrated mixed farming is ideally established over a small area of land but with maximum productivity.

This farming practice can be established in small area about 16 square meters like the backyard space or expanded to cover acres of land.

How it Works

The project requires minimum space but can also take a large space depending space availability. The aquaponic culture creates a symbiotic relationship between fish and plants. The water in the fish pond tank is high in nutrients and debris. Instead of using a traditional filter, we pump the water into a specially modified grow beds filled with gravel that feeds and waters the plants.

In turn, the vegetable plants obtain the nutrients they need from the water, and return the filtered clean water to the fish tank. A tap will be put to provide iron and nutrient enriched water to a water trough to the chicken. The water will be filtered by the gravel and flow back into the fish tank as clean oxygenated rich water. Growing in this nutrient rich water the vegetables experience accelerated growth rates, are stronger and healthier and use about 10% of the water it takes to grow vegetable plants in soil.

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The Science

Fish excrement (faeces) becomes ammonia. In the pond, the ammonia is oxidized to nitrite and further to nitrate by bacteria that are natural in the system. The nitrate is transformed in 2 ways;

1. Anaerobic bacteria can reduce nitrate to nitrogen.

2. Algae and plants feed on nitrate and grow in sunlight.

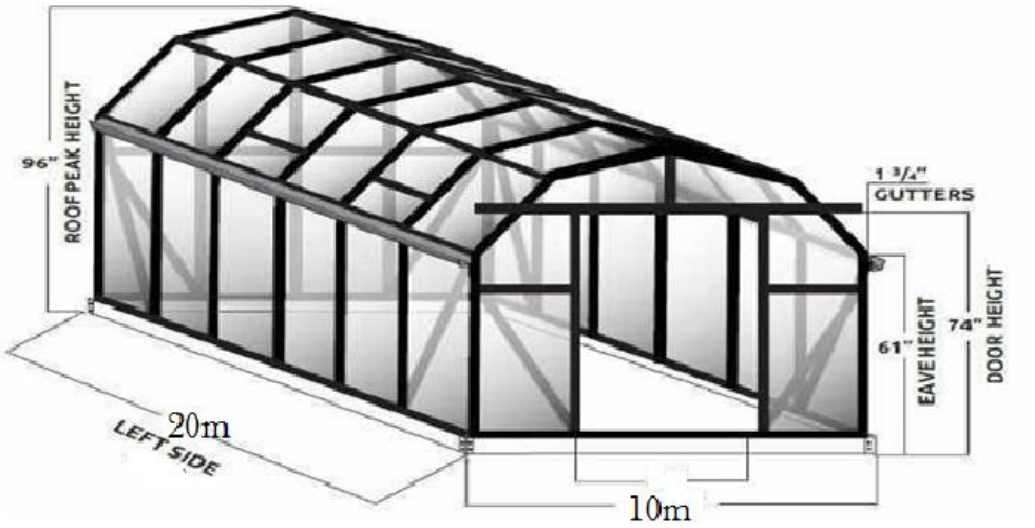
The major problem that farmers have is when the ammonia that is transformed into nitrates actualizes growth of algae. Most farmers suffer loss of fish or have fish that have stunted growth because of infiltration of algae. In presence of sunlight, the algae produce oxygen but in the night they turn coats and remove the oxygen. The fish could get killed because of this. In nature, the algae is eaten by the fish as a part of its food chain. Moreover, the algae is from water and to water it returnest creating a vicious circle. Thus algae is more of an impediment than a help in removing nitrogen and adding oxygen.

With introduction of plants into the aquaponic system, ammonia rich water from the pond is channeled to the root of the plants and through bio filtration system and the breaking of ammonia into nitrates by bacteria, the plants absorb the nitrates directly into the root system. This leaves purified water back into the system.

With gravity, the water splashes back into the system and this impact oxygenates the water. To achieve this, a special pump is fitted into the system and pumps water into the individual grow bed. Through the power of gravity, the water gets back to the pond with impact creating air bubbles that provides oxygen to the system.

Layout

The system will include free standing Green house. A Single Green house system will have a dimension of 20m by 10m



Greenhouse details and approximation in price

Polythene 200 micron 115m2
Insect Net (70%) 2.5 * 44
Posts 42mm
Arch 38mm
Perlin 32mm
Profiles
Tapping Screws
Gutters
Storage tanks (10,000lts)

Approximate price 1,300,000fcfa

Within the green house an aquaponic system will in comprise of columns of grow beds made of marple troughs or wood tanks filled with pumise that acts as growth anchor for the plants.

The fish pond will be connected to grow beds. Each grow bed will hold the variety of vegetables to maturity on the rocks.

Grow Bed

Again each grow bed has an inlet and an outlet. The medium will be pumice ballast (3/4') that will act as a natural bio filter and at the same time also act as an anchor to the plants – more or less the same purpose as to soil.

Pond

In the green house the aquaponic incorporates deep water culture(DWC) method. This is a dug out pond.

The pond dimension will be 8m by 10m by 2 m = 160 m3 ie 160,000 liters of water.

Water flow

In the deep water culture unit technology, water flows by gravity from the grow bed, through from the pump, and into the fish tank. From the fish tank using gravity, the water moves into a biofilter/sump where sold waste is further filtered. The rocks in the grow bed acts as a natural filtration system biofilter/sump.

The flow rate of the water entering each canal is relatively low. Generally, every canal has 1–4 hours of retention time. Retention time is a similar concept to turnover rate, and refers to the amount of time it takes to replace all the water in a container. For example, if the water volume of one canal is 600 litres and the flow rate of water entering the container is 300 litres/h, the retention time would be 2 hours (600 litres ÷

300 litres/h).Through filtration the water will thence move to from each grow be to the pond.

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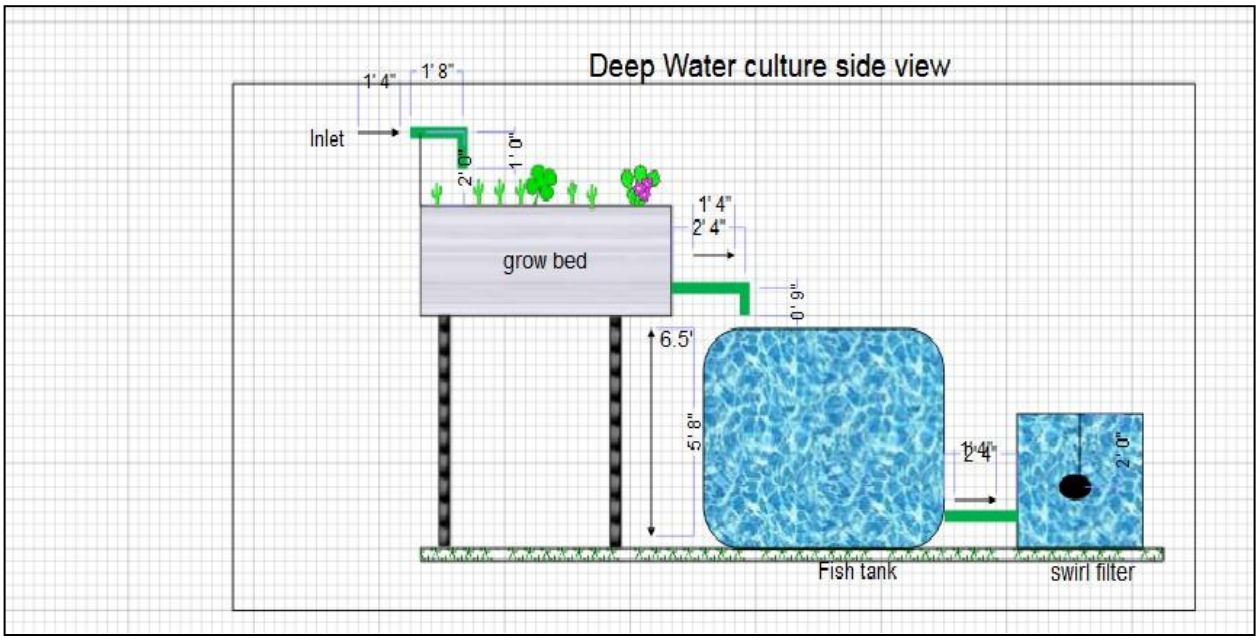
The water volume will be able to stock about 2000 congo tilapia.



Solar powered system

The project will require solar power of 700 watts per day. This will enable facilitation of pump rate of about 60 – 100 liters per minute, to pump for 45 minutes every hour.

The pump required for the system is a 0.5 HP Motor Pump

Business Model

The project's expected outcome is equated to the current market price of the produce.

The produce include:

1. Fish – Nile Tilapia
2. Vegetable – Basil

A single green house aquaponic will be able to produce upto 2-6 tonnes of assorted vegetables. Depending with the current market trends, this can transform into market any time of the year.

Fish sales
1 kg Nile Tilapia In the world market price is 5$ - 7$ depending on the demand and supply scale.

Assuming total harvest of 1kg tilapia for each ponds is 1000 in 7 months therefore projected outcome is 1000(84) which totals to 84,000 tilapia in 1 ha. European demand for fish is high surpassing supply which comes from far East countries like China. Therefore I ha will fetch 84000 (5) = 420,000$ in 7 month with proper maintenance and care.

In summary with proper management and care of the system, the project can be a viable economic endeavor and has worked in several parts of the world.

Project Implementation Matrix

Below is the implementation plan for the projecty

Project Phase	Details	Period of Implementation
Phase I	Arrival Ground research and market research –basic survey of the region and locality,	3 days
Phase II	Resource mobilization – includes members of the project meeting and setting up work plans and division of labor and Trainings	2 weeks (on the ground working with the community members)
Phase III	Budgeting stage and competitive bidding	1 week
Phase IV	Construction of greenhouse, excavation of pond and assembling of materials and Grow Beds and pumise	2 weeks
Phase V	Assorting growbeds, plumbing, filling pond with water, and electrical	2 weeks
Phase VI	Planting vegetables, introduction of fingerlings	2 days

Table 1: The Aquaponicpoultry implementation phase matrix

Budget Requirement

Roberts Travel Ticket apprx 1144.29 euro return (paid online)

Roberts allowance 750 euro – to facilitate travel and stay in Senegal

750 euro on project actualization.

Solar system with pump	2000
Greenhouse	1300
Labor and wages	500
Transportation of materials	200
Seedling and fingerlings	200
Any other expenses	1000

Total estimated budget for the system 7,844.00 euros subject to market prices.