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DESIGN OF AQUAPONICS SYSTEM OF IRRIGATION

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Abstract:- *Aquaponics as a vertical farming technique has undergone various development to make it an efficient replacement for conventional farming methods. Hydroponics, a soil-less farming method has been combined with aquaculture (fish farming) to obtain a system with its own ecological balance. The disadvantages of these systems overcome by symbiotic relationship between them. As a result aquaponics has better production and growth rate than other farming methods. The aquaponics systems focused on increasing economically and sustainability of indoor and outdoor fish farming. Aspect like sustainability, development and economically efficiency improve of farmer health we must reconsider the agriculture sciences, by this we understand that we must develops technologies friendly for the environment. Combining aquaculture with hydroponics we obtain a new innovation named aquaponics which respects principles of sustainable agriculture (wastewater bio filtration by plants) and gives us the possibility to increase economic efficiency with an additional production (organic vegetables) to produce the nutrient rich food.*

The various parameters that are to be considered during the design and implementation of an aquaponic system have been discussed in this paper.

Keyword*:- Aquaponics, Hydroponics, Aquaculture, Canal irrigation, Organic Production, Recirculating system, Profitability, Sustainable Agriculture, Marketing Strategy.*

I. Introduction

Aquaponic systems combine the two forms of agricultural production mentioned above, recirculating aquaculture and hydroponics. In an aquaponic unit, water from the fish tank cycles through filters, plant grow beds and then back to the fish. In the filters, the fish waste is removed from the water, first using a mechanical filter that removes the solid waste and then through a bio-filter that processes the dissolved wastes. The bio-filter provides a location for bacteria to convert ammonia, which is toxic for fish, into nitrate, a more accessible nutrient for plants. This process is called nitrification. As the water (containing nitrate and other nutrients) travels through plant grow beds the plants uptake these nutrients, and finally the water returns to the fish tank purified.

By 2050, world's population is estimated to increase to 9 billion. The expansive numbers of people are expecting to rely on agricultural sector including farming, fisheries, woodcrafts, and livestock. Natural calamities and crisis affect millions of people who depend on primary sector. For reducing poverty and attaining food security, expansion of agriculture sector is the most efficacious means. As per there port of the State of World Fisheries and Aquaculture, experts suggest that an increase in the consumption of fish will override the safety issues that have affected it negatively. Small farmers are the major contributors to the World's food, but they are the poorest people in the developing countries.

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II. METHODOLOGY

General

A media-based aquaponics system, also called flood and drain, is the most common small-scale aquaponics system popular with do-it-yourself (DIY) backyard home systems. Media-based systems designs are simple and efficient with space and have a low initial cost suitable for beginners in aquaponics.

Methodology of work

1. Media based system

1.1 Working of media based aquaponics system

The media-based consists of a grow bed filled with grow media (expanded clay pebbles, gravel, lava rock) into which the vegetables are planted. The water from the fish tank is pumped or flows by gravity into the grow beds so that the plants can access the nutrients. The grow media are porous to allow them to hold the water longer for more efficient nutrient uptake and filter out the water to prevent solids materials and other organisms from entering the fish tank.

The grow bed serves as both the mechanical and biological filter and location for mineralization. The grow beds also host the colony of nitrifying bacteria and provide a place for the plants to grow.

On exiting the grow beds, the water flows to the sump tank by gravity. At this point, the water is clean and free of solids and then pumped back into the fish tank. The water entering the fish tank causes the water level to rise and overflow from the fish tank back into the grow beds, completing the cycle.

Grow-bed irrigation methods use a constant water flow, either entering one side of the bed and exiting the other or distributed through a drip irrigation array.

1.2 Info graphic Filtration

The grow media can serve as very efficient filters for mechanical and biological filtration in a media-based aquaponics system. The media-based system utilizes the combination of filters for the water and plant growing area for the plants.

In addition, it also provides a place for mineralization to occur. However, high stocking densities can overwhelm the mechanical filtration that can risk having the media clogged and producing dangerous anaerobic spots.

1.3 Mechanical Filter

The grow media functions as a large filter, capturing and containing the solid fish wastes, and other floating debris. The captured solid wastes will break down over time and be mineralized. A properly balanced media-based aquaponics system will process all the solid wastes. When the grow bed and grow media are not appropriately sized for the stocking density, the grow bed can be clogged with solids. To avoid clogging, be sure that the stocking density, feeding ratio, and feed rate are in the right ratio.

1.4 Biological Filtration

Of all aquaponics methods, the media-based system has the most biological filtration because of the growing media's presence on which the bacteria can grow. However, the bio-filtration capacity will be lost or limited if the grow bed and grow media become anoxic if the temperatures drop or if the water quality is low.

2. Component

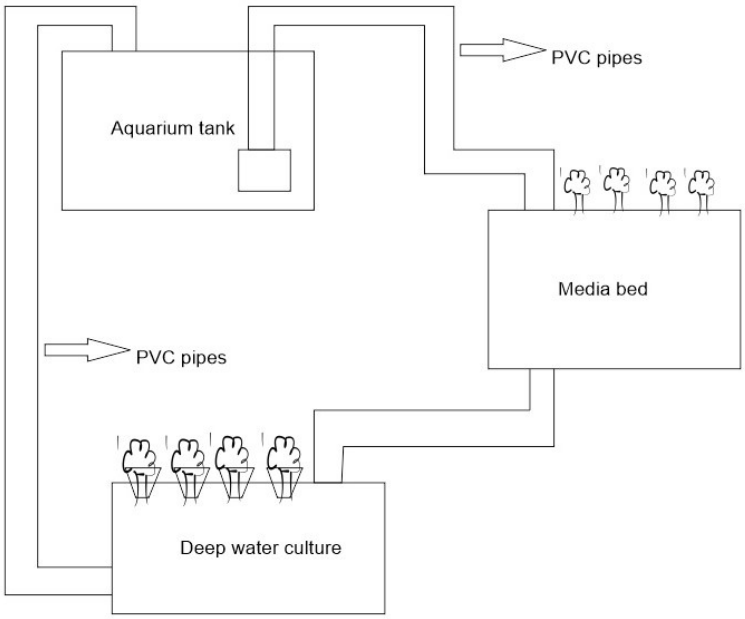

Figure 1.5 components

2.1 Aquarium Tank

There is circular rectangular tank, we kept fish in them this fish are fed . Fishes produce ammonia which settled at the bottom of tank. This ammonia changes the water parameter and it harmful to fishes. It needs to check out the ammonia amount. It has to filter out from water. If we don't do that fishes can die.

2.2 Grow Media Tank

The filtered out ammonia, we release water in plant bed. This water first goes a mechanical filter and then biological filter. The mechanical filter removes solid impurity. Ammonia in the water convert into nitrites and nitrate after it passes through the bio filter. So in these gravel bed ammonia has been converted into nitrates. These nitrate acts as fertilizer to the plant. Plant grows using this as fertilizer.

3. Floating raft system

The raft system also is known as Deep Water Culture or Floating System. Plants are grown on rafts (polystyrene or foam boards) that float on top of the water in the raft tank. The nutrient-filled water flows continuously from the fish tank through the filtration process, then to the raft tank where the plants are grown, and then back to the fish tank. Most often, the raft tank is separate from the fish tank. Plants grow very fast in a raft system and can be an easy aquaponics system for the beginner aquaponics gardener to set up and maintain.

Many commercial aquaponics farms utilize this system because it allows the plants to grow faster and yield more crops

4. Proposed design of aquaponic system

This discusses the theory and design of aquaponic systems. There are many design aspects to take into consideration, as virtually all environmental and biological factors will have an impact on the aquaponic ecosystem. The aim of this chapter is to present these aspects in the most accessible way and to provide a thorough explanation of each component within an aquaponic unit .About 200 houses are in amgaon, wada taluka. More population, market is far long so by considering such points we take plant area of aquaponics system 200sq.m.Basic system was designed with material locally available. system which is very simple can be economically affordable

1.1

2.1

3.1

5. Calculation

5.1 To calculate the size of tank

Assume capacity of tank = 20000 liter
We know
1 liter = 0.001 m3
20000 liter = 20 m3
Assume depth= 1.5 m
Area=volume of tank /depth
=20/1.5
=13.33 m3
Length × width =13.33 m2
Take length = 2 × B

Therefore,
2B × B = 13.33 m2
B^2 = 13.33/2
B = √6.655
B = 2.58 m
Length = 2 × B
= 2 × 2.58
L=5.16 m
Take tank size = 5.2 × 2.6 × 1.5 m

5.2 Quantity of fish required

= (Volume of water/weight of fish) × density factor
= (20m^3/0.5kg) × 25
=1,000 fish

5.3 Feed rate

80 % need food to fish
20 % produce waste

Fish eat 2 % of their body weight per day
Therefore
(2/100) × 0.5 = 0.01 kg
= 10 gram

5.4 Size of media bed

Feed rate 1000 gm. /day = 10 m^2 area per grow bed

Quantity of fish in our tank= 1000 fish
1000 fish= 1000 × 10
= 1000 gram = 10 kg
1000 gm. /day = 10 m^2
10000 gm. /day = 100 m2
i.e. 1 Guntha
bed size=10×10 m
Quantity of gravel / pebbles in media bed
Tank size =10×10 m

Depth of material=10 inch=0.254 m.

Volume of material required=10m ×10m ×0.254m

= 25.4 m^3

III. Figures and TABLES

Study area-Amgaon map

- Description of study Area

1. Study area

At Amgaon, Taluka Wada, Dist. Palghar.

2. Description

Amgaon, Wada Taluka is 30 km away from palghar station. These is gaon region and as topic discussion, farmers facing water problems in summer season. There is no any option to farmers in summer season. The average annual rainfall of Wada Taluka has been 2293mm and receives adequate sunlight throughout the year which requires to plant production. Own wells, bore wells are only source of drinking water their people. Precipitation during monsoon season is still used upto winter season but latterly people, farmers faced an lot of problems to get water and thus cropping system till only winter season. After that farmers have no any option regarding the farms.

Amgaon has one river name as Deherja which is 1 km far away from amgaon. In rainy season it flows with full discharge. Winter season farming depend on these source of water .Major types of crops system are follow in these Taluka. Geographic condition in the gaon is favorable for growing fish and plant. Altitude, rainfall, soil type and topography these are suitable to growing fish and plant.

In the Amgaon 500 houses located .80% peoples do farming. Manor market and Kanchad market are nearby market of Amgaon. The normal farming problems of water, large area of gaon, market, farmers earning such problems in that location have been. To overcome these problems our aquaponic farming system project is best suited in that area.

IV.Conclusion

The significance of the study can be seen that when the country is facing the many problems in farming because of scarcity water and land. Therefor the aquaponic can prevent the various problems occurs during farming, as it requires the less space as compare to other normal farming.

The future scope aquaponics:-

1. It prevents the scarcity of water in farming.
2. It gives the high crop yield.
3. Land conservation.
4. Increase income of farmer by both fish and vegetables yield simultaneously.
5. Health and natural benefits

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