Modern Bio-filtration Farming Base To Treat Aquaponic Water

Prof. R.R. Shaikh[1]Chandan Kumar[2], Sunny kumar[3], Amit kumar[4], Manoj kumar[5], Manoj kumar[6].

Lecture Department of Civil Engineering Navsahyadri Institute of Technology Polytechnic, Maharashtra, India

Students, Department of Civil Engineering, Navsahyadri Institute of Technology Polytechnic, Maharashtra, India

ABSTRCT

Aquaponics is a recirculating aquaculture system. This is a new technology in Indian agriculture for fish farming. In this plants fish are produced from the same water. In these systems the plant acts as part of the biological filter. Aquaponics is made up two words aqua plus phonics aqua means fish production and phonics means vegetable and any plant production. In this, we give daily food to the fish. After eating the fish, we send that waste water to the root of our plant through a lifting water machine. Due to which the plant gets food and the water gets filtered. Again, the same water is released into the fish tank. Due which 95% water is saved which is very important for our country. Iridescent shark was selected as aquaculture species. The biofilter consist of natural biomaterials such as coconut husk, coco peat, and coarse aggregates. The experiment was carried out for three short water recirculation durations of 2, 3, and 4 h/day. The influent and effluent ammonia NH_3, total ammonia nitrogen (TAN), nitrites NO_2 and nitrates NO_3 levels were measured and analysed.

INTRODUCTION

Aquaponics is an innovative agricultural production technique that combines two major components named aquaculture (fish tank) and hydroponics (soil less media). Unlike in hydroponics, the aquaponic method is capable of avoiding the complete dependence on nutrients and its sources. It has the potential to solve the water scarcity problems and its hazardous effects. The world's western part like US at Woods Hole Oceanographic Institute done strong developments in aquaponics since the 1960s. Since then, the developed and developing countries like America and Australia adopted this system and carried out major research projects and programs on aquaponics. These projects focused major objective of reducing the load of nutrient wastes and their environmental effect to increase the efficiency of nutrients for production of edible plants. The less availability of water is making the aquaculture production costlier and the only possible solution to overcome this problem is the effective recirculation of aquaculture wastewater to produce edible crops and fish. The closed loop technique of aquaponic includes the recirculation of aquaculture water allowing the interaction of aquatic species, nitrifying bacteria and plants. This method is capable of minimizing the need of micro and macronutrients essential for plant growth.

LITERATURE SURVEY:

The idea of combining fish and vegetable production into an integrated system is far from new. Ancient precedents for integrated aquaculture include the chinampas of Mexico and the integrated rice paddy systems across part of Asia.

But how did gate from these sorts of ancient land-based systems all the way to backyard aquaponics

Aquaponics is a term that was coined in the 1970s, but the practice has ancient roots although there is some debate on its first occurrence.

The earliest example of one branch may be the lowland Maya, followed by the Aztecs, who raised plants on rafts on the surface of a lake in approximately 1,000 A.D. The Aztecs cultivated a system of agricultural islands knowns chinampas in a system considered by some to be first form of aquaponics for agricultural use. Chinampas are networks of canals and stationary artificial and water from the canals.

In the early chinampa systems, plants were raised on stationary (and sometime movable) island in lake shallows. Nutrient-rich waste materials dredged from the chinampa canals and the surrounding cities was then used to manually irrigate the plants above.

Methods:

Sustainable alternatives to conventional farming are in higher demand then ever as being environmentally friendly gain popularity.

Traditional field farming has a reputation for damaging natural ecosystems.

Concerns about the impact of harmful chemical soil erosion and heavy water consumption on the environment motivate the development of sustainable alternatives.

Sustainable on environmentally friendly farming refers to conservative water use maintaining soil health and minimizing air and water pollution.

In this article well compare the environmental aspects of three types of sustainable farming: organic, permaculture, hydroponics and fish farming.

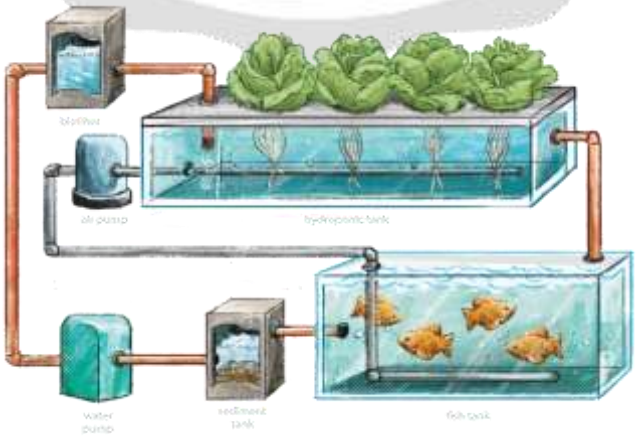

Fig: -aquaponics system

Organic farming: -

Organic farming refers to cultivating crops without the use of harmful chemicals, such as synthetic pesticides.

These toxic chemicals make their way into our air, ground and water when they are sprayed, run off with field water and are not discarded properly.

Organic farming is incredibly popular because it doesn't use too many different farming approaches then conventional farming.

However, this is also a downside as this means it still employs damaging farming techniques like tilling. Telling is common practice for traditional and organics farms alike.
It's when soil is prepared for agriculture by digging, stirring and overturning it, like when using a hoe or rake.

But it damages the soil by destroying its natural structure, which makes soil erosion too much tillage even causes the soil to lose nutrients and organic matter.

In sum, while organic farming may limit the earth's exposure to harmful chemicals, it still subjects the land to other harmful practices.

Permaculture:

Permaculture focuses on designing farms to mimic natural ecosystems.

It's set of principles used to minimize human intervention in food cultivation while maximizing harvests.
Part of permaculture means using only renewable energy and wasting nothing.
Because permaculture aims to maximize the natural features earth, such as collecting and using rainwater, it's a popular option for those searching for sustainable farming solution.

Like organic farming, it doesn't use harmful chemicals.

Permaculture also allows insects to naturally pollinate plants, while using companion planting to protect crops from infestations.

However, there isn't much credible research to suggest it's viable option for commercial farming.

And critics question the effectiveness of permaculture when it comes to growing substantial food crops.
As a result, permaculture is better in theory than on paper, offering small solution to a big problem.

Fig: - Permaculture

Hydroponics:

Hydroponic farming cultivates plants without the use of soil.

It does this by dissolving nutrients in water and delivering that water to the plants.

Hydroponic is already frequently used in large-scale commercial farms, especially for growing lettuce and tomatoes.

It's thought to be one of the most sustainable farming systems due to its emphasis on water conservation, lack of harmful chemicals and lack of soil damages.

Even thought hydroponic farms rely on water to deliver nutrient to plants, they actually use up to 95% less water than conventional farms.

This is because hydroponic systems are able to collect water for reuse, whereas traditional farms cannot.

Additionally, hydroponic farms are typically indoors, so pests are much less of an issue making it easier to control pest invasions without the use of pesticides.

Plus, because it doesn't use soil, there is no risk of soil damage from unsafe practices like tilling.

However, critics argue that because indoor hydroponics farms tend to use a lot more energy to operate than traditional farms they are not completely environmentally friendly.

But it's important to note that studies show this issue is easily solved by using renewable energy sources, like electricity.

Obviously, hydroponics is the strongest competitor when it comes to environmentally friendly farming.

Water:

Rainwater and potable pH neutral well water are the best choices for filling an aquaponic system. Many of us, though, are limited to our city tap water to charge the system. While in some regions this water may be ready to use right out of the tap, most municipal sources add chlorine and chloramine to the water for disinfectant purpose. These compounds make the water safe for use to drink, but unfortunately, they are toxic to fish and to the nitrifying bacteria in the bio-filter. In the old days we could just let the water sit overnight with a bubbler and the chlorine would dissipate right out chloramine (chlorine and ammonia bonded together), however, has been in use since the 1980s and requires a little more effort to gate it out of the system.

There are a number of water conditioners available through aquarium and pond supply shops normally these are the go-to for aquarists and pond keepers. Most of this product, however, are not certified for use with fish and plants that are intended for human consumption, and it says just that right on the bottle.

Fish growth:

The iridescent shark is used as fish species in this experiment. The habitat of fish was not changed. The growth of fish was never the objective of the study. But being an important part of the system, the fish growth in terms of length and weight was noted at the end of each recirculation duration. The average length and weight of the fish at the end of recirculation durations were as shown in Table 4. The reduced activity of the fish due to the periodic decrease in oxygen levels affected the length of fish. The fish become less activity to prevent energy loss and to reduce the oxygen demand. The percentage of weight gain by fish was 47 %, 52 %, and 56 %, respectively, at 2, 3, and 4 hr/d. These results showed that the fish growth was steady at increased recirculation duration and high levels of DO. But the fish can still easily adjust when DO drops below 4 mg/l. The levels were maintained above 3 mg/lit in the study by using an air bubbler whenever required. Some of the fish gained more weight than some low active fish, but there was no fish death recorded duringthe study.

Table 4: Average length and weight gain at the end of each recirculation duration.

Sr. No.	Parameter	Flow duration		
		2 [h/d]	3 [h/d]	4 [h/d]
01	Number of fish	30	30	30
02	Avg. initial fish length [cm]	6	8	11
03	Avg. final fish length [cm]	8	11	15
04	Avg. initial weight [g/fish]	40	76	160
05	Avg. final weight [g/fish]	76	160	370

Advantage:

- Aquaponics is a way to grow fish and vegetables at the same time you feed the fish and the fish wheel feed your plant through there waste output.
- They feed on various diets, including fish, insects, and soft-bodied invertebrates.
- You can grow plants in very small space and have a great harvest .
- It is easily movable on any surface.
- It also saves water.
- This result in healthier and organic vegetables.

Disadvantage:

- It is costly to set up and maintain.
- Some crops as well as fish are not available for this method.
- It consumes a lot of electricity.
- Its very important monitor PH level each day and to keep it within neutral range.

Conclusion:

Aquaponic farming in India is still at a nascent stage. One of the factors influencing the low adoption rate of this technique is its high initial capital investment. However, once the initial investment is done, the operating cost of running the system is comparatively lower than that of the conventional farming system. There are fewer risks involved in aquaponics in terms of pest and disease attacks, weeds, climate uncertainty, etc. Hence, it drastically decreases the cost of cultivation.

As we are going towards urbanization, the food demand is constantly increasing in these areas. While on the same side, the average landholding of the farmers is decreasing. Hence the gap between supply and demand is anticipated. In this scenario, growing food in urban areas in closed conditions to fulfil the demand gap makes sense. The future of aquaponic farming in India seems to be bright. It is just a matter of time when people slowly turn towards growing their food at their house, terraces and balconies and Aquaponics makes this possible

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