



UNLEASHING FEMALE POTENTIAL THROUGH AQUAPONICS

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Abstract

Aquaponics combines hydroponics and recirculating aquaculture in a single production system. The filters, plant beds, and fish tank are filled with water, and then cycled back through them. With the help of this system, fish, plants, and microbes may coexist in a healthy environment where they can all prosper. Integrating the systems eliminates some of the unsustainable aspects of running aquaculture and hydroponic systems. Aquaponics is more productive and financially viable when there is a shortage of both land and water. Aquaponics is an innovative approach to food production that combines aquaculture and hydroponics in a symbiotic relationship. It is a sustainable and efficient way to grow food, as it requires a fraction of the water and land needed for traditional farming. Furthermore, it is an ideal way to empower women, as it requires minimal physical labor and provides a reliable source of income.

Women are often the primary caregivers in many communities, and aquaponics provides them with an opportunity to become financially independent. It allows them to work from home and generate a steady income, while still being able to care for their families.

History of aquaponics:

Aquaponics is the term coined in 1970's but the practice has ancient roots. 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 1000 A.D. the agricultural lands cultivated by the Aztecs are known as Chinampas, the first form of aquaponics for agricultural use. These were the network of canals and stationary artificial islands in which they cultivate crops using nutrient rich mud and water from the canals. Aquaponics is a method that dates back to the 1970s; however, it has long been employed. The Aztecs and lowland Maya are perhaps the first known members of one lineage. A lake's surface was used for growing plants on rafts in the year 1000 A.D. The Aztecs cultivated in chinampas, the first kind of aquaponics ever employed in agriculture. This was the system of fixed-constructed islands and canals where they grew crops in nutrient-rich mud and canal water. Modern aquaponics was developed in the aquaculture sector when fish producers looked at different ways to raise fish while attempting to use less space, water, and other resources. The New Alchemy Institute's and Dr. Mark McMurthy's research at North Carolina State University are the sources of "aquaponics." John and Nancy Todd, William McLarney, and they constructed "The Ark," a self-sufficient shelter that harnesses solar energy to supply fish, vegetables, and safety all year round. Rakocy and his colleagues had developed a deep-water culture system with a hydroponic grow bed by 1997. At the middle of the 1980s, Professor Doug Sanders and Mark McMurthy created the first closed-loop aquaponic system.

Materials for Aquaponic unit:

The fish tank, the filters, and the hydroponic container are some of the typical and crucial



elements of an aquaponic system. There are growing beds, pipes, and canals in the plant-growing region.

Fish tank:

Fish tank is the important component in the aquaponic unit. Fish tank has to be chosen wisely, as the fish requires optimum conditions to tolerate and survive. Fish tank should be in the geometric shape which is suitable for easy circulation of water and removal of the solid waste materials from the tank. The materials used for the construction of fish tank must be durable and have long life span. Fibre glass and plastic are convenient to install and must be light and easy to move.

Filtration:

The method of filtering is used to remove solid waste particles from liquids by passing the liquid through a filter media while keeping the solid particles in place. Aquaponics uses both mechanical and biological filtration methods to clean the water.

Mechanical filtration:

Mechanical filtration is the separation and removal of solid suspended fish waste from the fish tank. This process helps in maintaining the good healthy environment for fish and this removed waste is further used for the plants as a source of nitrogen in aquaponic system. Mechanical filters are of several types, the simple method is the screen or filter placed in between the fish tank and the grow bed for separation of the solid waste, which is rinsed periodically and this method is useful for small scale aquaponic systems.

Bio-filtration:

Bio-filtration is the conversion of ammonia and nitrite into nitrate by live bacteria. Mechanical filtration cannot remove the solid waste completely as they get dissolved in the water, so the bio-filtration is essential to remove dissolved particles and small concentrations of ammonia and nitrites, which are toxic to fish, are being utilized by the plants. The commonly used ideal bio-filter medium is the bioballs, with large surface area for their volume. Biofilters require stirring or agitating occasionally to

prevent the clogging by the solid wastes. These filters require adequate aeration in order to oxidize the ammonia by using the nitrifying bacteria. Air pumps and air stones are placed at the bottom of the container.

Nitrogen cycle:

The nitrogen cycle is a biogeochemical process done by live bacteria. The waste removed from the fish tank, which includes ammonia and nitrites, is converted to nitrates, which are helpful for the plants. The nitrification process has two steps. The initial step involves the ammonia-oxidizing bacteria converting the ammonia to nitrite by the bacteria belonging to the group Nitrosomonas. The next step is the conversion of the nitrite to nitrate, which is done by the nitrite-oxidizing bacteria, which is bacteria belonging to the group Nitrobacter.

Plant varieties used in aquaponics:

The wastewater from the fish tank helps nitrify the plants. The bacteria present in the soil help the process of utilizing the ammonia and nitrites. The plant seedlings are majorly used in aquaponics as the nutrient uptake is high compared to the seed. The plant species that can be grown in aquaponics include lettuce, basil, ginger, watercress, tomato, parsley, spinach, cabbage, beans, mint, etc.

Fish species used in aquaponics:

Aquaponics supports raising a variety of fish species, but the species must be able to withstand and survive the fluctuations in the surrounding environment. The fish produce waste, which is sent to the soil for utilization as fertilizer. The fish species used for aquaponics include a few species of tilapia, i.e., *Oreochromis niloticus* (Nile tilapia), *Oreochromis aureus* (Blue tilapia), and *Oreochromis mossambicus*, (Mozambique tilapia). Ornamental species like koi carp are used for the aquaponics system. Among catfish species, *Ictalurus punctatus* (Channel catfish), and *Clarius gariepinus* (African catfish), are used for aquaponics.

Small-scale aquaponics:

The small-scale aquaponics unit comprises a fish tank with a capacity of 1000 liters and a plant growing space of 3m that



simultaneously produces vegetables and fish for serving the household. Unemployed women can carry out the system as backyard farming, which ensures economic enhancement, nutritional security, and women's empowerment. The system is beneficial because it provides chemical-free vegetables and good returns for a low investment. The system contributes good health and wealth to the household.

Empowering women through aquaponics:

Aquaponics empowers women by providing self-employment, which reduces the unemployment rate, gives them the personal satisfaction of earning, and supplies the nation with cheap and high-quality vegetables and fish, the primary protein sources. This system is a small-scale business sector, but long-term utilization helps earn and increase household revenues.

Benefits of Aquaponics for Women

Aquaponics provides women with a steady source of income. It requires minimal physical labor and can be done from home, allowing women to maintain their traditional roles as caregivers. Furthermore, it enables them to become financially independent and gain control over their lives.

Aquaponics also has environmental benefits. It is a sustainable way to produce food, as it requires a fraction of the water and land needed for traditional farming. It is also a great way to reduce food waste, as it is easy to monitor the crops and harvest them at the right time.

Safety in aquaponics:

The system needs to follow good aquaculture practices to avoid the contamination; equipment and tools used for the aquaponic system must be kept clear and hygienic. To avoid electrocution on the electric components, residual current device (RCD) is used and these electrical connections are sheltered from the rain and humidity by using equipment. The care must be taken to hands using gloves while using the tools and chemicals. If in case of any injury, it should be washed with disinfectants.

Advantages in aquaponics:

Aquaponics is a sustainable system with intensive food production as it produces

vegetables and fish grown from one source, i.e., nitrogen. The system doesn't require chemicals or artificial fertilizer. The system utilizes less water and is water efficient, producing excellent quality and a higher yield. Various materials are used for the construction, and the system is easy to manage.

Disadvantages of aquaponics:

The installation of the system is initially very high and expensive. This system requires basic knowledge to understand the relationship between fish, plants, and bacteria.

The Future of Aquaponics

Aquaponics is a rapidly growing industry, and it is expected to continue to expand in the coming years. It is becoming increasingly popular as a sustainable and efficient way to produce food, and it is an ideal way to empower women and provide them with a reliable source of income. In the future, aquaponics is expected to become even more widespread, as it is a great way to reduce food waste and provide communities with a reliable source of fresh, healthy food.

Conclusion

Aquaponics is an innovative approach to food production that combines aquaculture and hydroponics in a symbiotic relationship. It is a sustainable and efficient way to grow food, and it is an ideal way to empower women and provide them with a reliable source of income. It requires minimal physical labor and can be done from home, and it has environmental benefits as well. Aquaponics is a rapidly growing industry, and it is expected to continue to expand in the coming years. It is becoming increasingly popular as a sustainable and efficient way to produce food, and it is an ideal way to empower women and provide them with a reliable source of income.

References:

1. Goddek, S., Joyce, A., Kotzen, B., & Burnell, G. M. (2019). Aquaponics food production systems: combined aquaculture and hydroponic production technologies for the future (p. 619). Springer Nature.



2. Khater, E. G. (2006). Aquaponics: the integration of fish and vegetable culture in recirculating systems. Benha, Egypt.
3. König, B., Junge, R., Bittsanszky, A., Villarroel, M., & Kőmíves, T. (2016). On the sustainability of aquaponics. *Ecocycles*, 2(1), 26-32.
4. Kyaw, T. Y., & Ng, A. K. (2017). Smart aquaponics system for urban farming. *Energy procedia*, 143, 342-347.
5. Rakocy, J. E. (2012). Aquaponics—integrating fish and plant culture. *Aquaculture production systems*, 344-386.
6. Somerville, C., Cohen, M., Pantanella, E., Stankus, A., & Lovatelli, A. (2014). Small-scale aquaponic food production: integrated fish and plant farming. *FAO Fisheries and aquaculture technical paper*, (589), I.