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Providing Environmentally and Economically Sustainable solutions for Food Production

THE AQUAPONICS GREENHOUSE

1. **Defining Aquaponics:** *Aquaponics* is the hybridization of *aquaculture* and *hydroponics*. Hydroponics is the practice of growing plants without soil, and aquaculture is the production of aquatic animals such as fish. As the global population increases there is a need for increasing food production which has a heavy reliance on resources such as water, land, fertilizers, and energy. There are fewer fish in the sea than ever before with aquaculture accounting for over 50% of the world seafood production, however aquaculture can pose environmental issues. Aquaponics addresses these issues and is the most sustainable method of producing food.

    - (*Water*) Aquaponics and hydroponics utilize 95% - 98% less water compared to conventional agriculture while getting both fish and vegetables out of each gallon of water
    - (*Land*) Aquaponics and Hydroponics produce 5-10 times more food per area compared to conventional agriculture
    - (*Fertilizers*) Multiple uses of waste streams in the form of aqueous dissolved nutrients for hydroponics and solid waste streams for soil amendments and fertilizers
    - (*Energy*) Utilize same equipment such as pumps, aeration, and greenhouses equipment for producing fish and plants
    - (Environment) Reduce the water/fertilizer discharge into aquatic ecosystems from aquaculture thus reducing eutrophication
    - (Economics) Efficient use of resources leads to increased margins and diversified revenue streams
        - Fish, Shrimp, Vegetables, Fruits, Fertilizers, Algae, Soil Amendments, Nutraceuticals, Bioenergy, Bioplastics…..
        - Quality and Consistency (predictable consistent production)

Aquaponics = *Aquaculture + Hydroponics + Microbial Communities*

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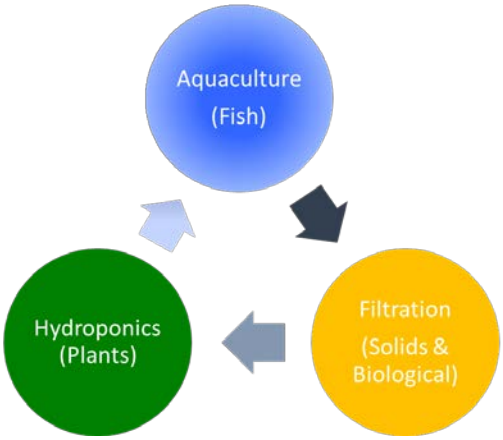
2. **How it Works:** In an aquaponics system the fish are fed a sustainable fish food then excrete solid and aqueous wastes. The fish waste is filtered and transformed into fresh organic nutrients that is fed to the plants. The plants then consume the fertilizers cleaning the water before it is returned to the fish. The water in aquaponics systems is recirculated and the optimum water chemistry is maintained for the crops. Aquaponics systems are closed loop and recirculate the water while producing nutritious meals consisting of fish and vegetables.



In aquaponics systems the amount of fish feed, handling of solid wastes, and microbial communities are the key factors to the successful sustainable production of nutrient dense foods.

The goal of aquaponics is to create a living ecosystem by maintaining an ecological balance within the system. This is achieved by maintaining optimal water chemistry, pH, and organic loading within the system.

3. **The Science Behind Aquaponics:** Research has been conducted on the water chemistry, crop diversity, and mass balance of aquaponic systems to deliver repeatable and consistent methods of producing nutrient dense foods in an environmentally and economically sustainable method.

(Licamele, 2009; Licamele, 2017 US20150305313; Licamele, 2017 WO2016172702)