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Aquaponics: A boon for food security

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Need : As the population continues to grow, the ability to produce food will become more difficult due to limited land and water resources globally. The present methods to grow and food have many negative impacts on environment and ultimately to the human health. An alternative food production method such as aquaponics provides an option to minimize those negative effects to the environment. Therefore, an introduction to aquaponics system, the combined production of fish in recirculated aquaculture systems and hydroponically grown plants, has gained popularity over the last several years due to its sustainability and less requirement of water and space. Thus, an aquaponic system can benefit the aquaculture operation by improving the quality of recirculated water or by reducing costs associated with treating effluent from flow-through raceways. A harmful faecal matter of fish becomes a beneficial input for plant production in aquaponic system. There is no requirement of fertilizers (may be harmful chemicals) and extra labour input in hydroponic culture system to maintain adequate nutrient level for plant growth. Thus, the merger of fish culture with plant culture in aquaponics system allows both operations to reduce inputs enhance the farmers income and makes the enterprise more sustainable.

Principle : Aquaponics is the integration of aquaculture and hydroponics, a soilless culture of growing plant. Aquaculture is the traditional way of culture of aquatic organisms. As soil provides nutrients to the plants grown, a plant can be nourished if nutrients for its growth can be provided through recirculated water. Thus, the concept of aquaponics came into existence. In an aquaponic system, nutrient-rich fish culture water from fish tanks is used to provide nutrients required to vegetables and herbs grown in soilless system. Nitrifying bacteria in the soilless system converts ammonia and other toxic pollutants to an usable form of nutrients to be taken up by the plants.

Types : There are three general types of aquaponics systems: a) media-filled bed system, b) nutrient film system and c) raft or deep water culture system.

Media filled bed based aquaponic system : In this type of aquaponic system, plants are grown in the media bed where water from the fish culture tank is supplied. Plants absorb nutrients from water as it flows through plant roots. There are various media most commonly; construction gravel and activated clay used for plant production in aquaponic system. A good medium for plant growth creates a nutrient pool around the plant root zones and provides sufficient air space for respiration.

Fig. 1 : Media filled bed based aquaponics system

This system requires less management practice and the minimum moving parts. It is the best type for the beginners and hobbyists. There is no need of separate biofilter in such type of system.

Nutrient Film Technique (NFT) System : The nutrient film systems are limited to growing light weight leafy green vegetables along with fish. NFT (Nutrient Film Technique) is a method in which the plants are grown in long narrow

channels or pipes. Small holes are made into pipe where perforated plastic glass/ cups are placed. Plants are grown in perforated glasses allowing their roots to access the water and absorb the nutrients. A thin film of water continuously flows to the channel which provides water, nutrients and oxygen to the plant roots. Plant roots are being exposed to nutrient rich running water that provides continuous supply of nutrients to the plants. In this technique, the bio-filter becomes crucial as there is no large surface area whereby bacteria communities can develop.

Fig. 2 : Nutrient film base aquaponics system

Floating raft technique : In this system the plants are grown on Polystyrene boards (rafts) that float on top of water. Holes are made into boards and net pots (Perforated plastic glass may also be used) are fitted. Plants are either grown directly into the bed, or transplanted from other place. The roots are continuously submerged in water and there may be a problem of oxygen starvation and as the roots remains exposed in the water which can also be damaged by clogging by pollutants and by other aquatic organisms. This system is profitable when used in large commercial scale

Fig. 3 : Floating raft based aquaponics system

Conclusion : In this article, the emphasis has been laid on highlighting different aquaponics techniques in growing plant and fish to save water and land resources. It can be inferred that among all the techniques media filled bed sytem may be successful in growing plants like; tomato, chili, lady finger, beans etc. as the plant growing media is fixed and bear the weight of these plants on it. There is no requirement of a separate biofiltration system in this technique. Hence, the cost of operation can also be minimized.

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