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Review Paper Based On Organic Vertical Farming With Aquaponic Model In Urban Areas

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Abstract

The modern agriculture is an evolving approach to new farming practices and agricultural innovations. Vertical and organic farming have gained significant attention due to their potential address the challenges of limited space, water scarcity and the need for sustainable food production whereas hydroponics, aeroponics and aquaponics are innovative cultivation methods that offer efficient and environmentally friendly solutions. Hydroponics involves growing plants in a nutrient water rich water solution, eliminating the need for soil. Aeroponics takes the concept further by suspending plant roots in a moist environment, where nutrient rich solutions are directly sprayed onto the roots. Aquaponics combines hydroponics with aquaculture, creating a symbiotic system where fish or aquatic animals provide nutrients for the plants, while plants filter and purify the water for fish. The combination of this new innovative agricultural practices offers numerous benefits includes higher crop yield, reduce water consumption etc. Further research and development in these areas are essential to optimize system designs, increases productivity and make these methods more accessible.

Keywords: Sustainable, Hydroponics, Aeroponics, Aquaponics, Symbiotic, Productivity, Agriculture

INTRODUCTION

Modern agriculture is an evolving approach to agricultural innovations & farming practices. As the World population continues to grow the demand for food is also increasing which resulted in development of modern farming methods in order to ensure maximum yield and efficiency that to by reducing the dependency on natural resources. The term "modern farming" refers to the application of modern technology, techniques, experiment and science. In traditional farming traditional methods are used to cultivate the land, select and plant seeds, protect plants from competing species, harvest the harvest. The production of such systems is largely determined by the inherent fertility of the soil, which is improved by the farmers through skill management and generally the productivity grows slowly. In modern farming the use of improved genetics crops, effective irrigation, well improved harvester, technology and techniques are used to protect the environment and attain high productivity. Some of the techniques used in modern agriculture includes precision farming, hydroponics, aeroponics, organic farming, vertical farming, regenerative agriculture and others. These methods have evolved over time and help farmers produce food with less land, water, and other resources. The main advantages of moder farming includes higher productivity, improves efficiency, lower prices,

environmental benefits. Modern farming can be sustainable to some extent as these methods have led to significant increases in food production. This has helped to reduce hunger and poverty in many parts of the world. Advances in technology have made it possible for farmers to use resources more efficiently, reduce waste, and increase productivity. To be truly sustainable, modern farming need to prioritize the long- term health of the environment and communities.

HYDROPONICS

The word "hydroponics" is derived from the two Greek words "hydro" meaning water and "ponos" meaning labor respectively. Hydroponics or hydroponic farming is the technique of cultivating plants in a nutrient medium solution of water without the presence of soil. Hydroponic flowers, herbs, and vegetables are planted in inert growing media and supplied with nutrient-rich solutions, oxygen, and water. The main components of hydroponic farming include a growing tray, air stone & pumps, reservoir, light, temperature control, nutrients solution, delivery system. Hydroponics operates under a very simple principle: provide plants exactly what they need when they need it. Hydroponics administer nutrient solutions tailored to the needs of the particular plant being grown. They allow to control exactly how much light the plants receive and for how long. pH levels can be monitored and adjusted. In a highly customized and controlled environment, plant growth accelerates (Gericke, William F.1945 & Jones, J. B. Jr. 2004).

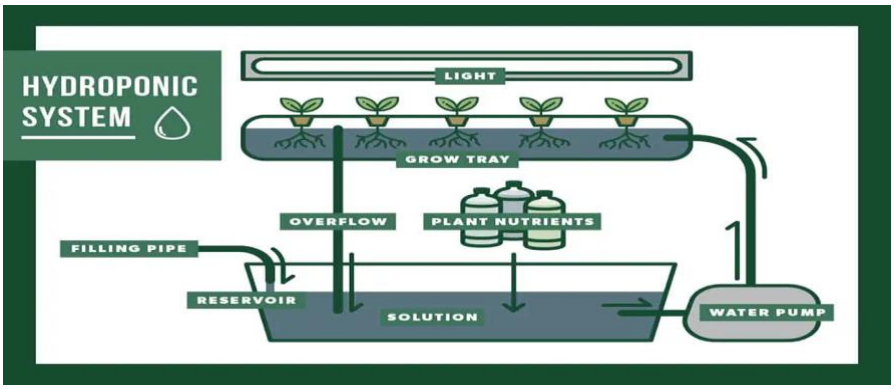

Fig: System diagram of hydroponics

There are 6 main types of hydroponic system. Meanwhile, the plant roots need 3 things, water/moisture, nutrients, and oxygen. So, what differs in the 6 methods is the way the systems deliver these 3 important things to plant roots. The six system: Wick system, Nutrient film technique system (NFT), Deep water culture (DWC), Ebb and flow system, Drip system & Aeroponics. The key benefits of hydroponic farming i.e. it provides higher yield, plants are healthier & mature faster, weeds can be eliminated easily, susceptibility to pest and diseases is negligible, water present in the system can be reused, easy harvesting. But there's a drawback of using hydroponics is initially it requires high upfront investment (Soffer, H.; Burger, D. W.1988).

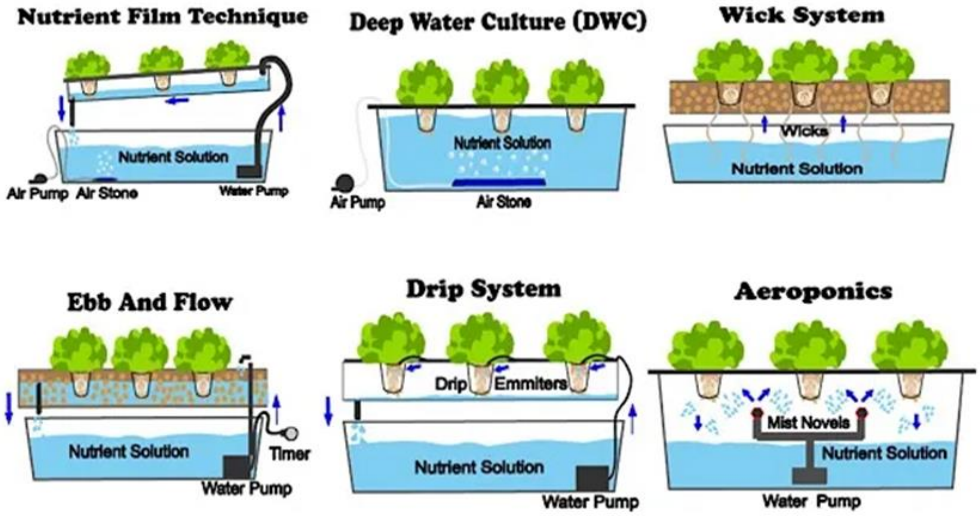

Fig: Different types of Hydroponic Systems

AEROPONICS

Aeroponics is an advance type of hydroponics. The term "aeroponic" originates from two Greek words “aer” means air and “ponos” means work. Aeroponics is a method of growing plants without soil, roots are suspended in the air and irrigated with a nutrient-dense mist. In aeroponic plants are held in large vertical grow rack, plants do not have to go looking for sustenance as this nutrient-rich mist is delivered directly to the root zone. The concept builds off that of hydroponic systems, in which the roots are held in a soilless growing medium, such as coco coir, over which nutrient-laden water is periodically pumped (Stoner, R.J. 1983). Aeroponics simply dispenses with the growing medium, leaving the roots to dangle in the air, where they are periodically puffed by specially-designed misting devices. Two types of aeroponics model: Low-Pressure Aeroponics & High-Pressure Aeroponic. Some advantages of aeroponics it saves space, moisture control for better growth, closed-loop system conserves water and much more. But to run an entire aeroponic system a high level of technical knowledge is required. (Carter, W.A. 1942)

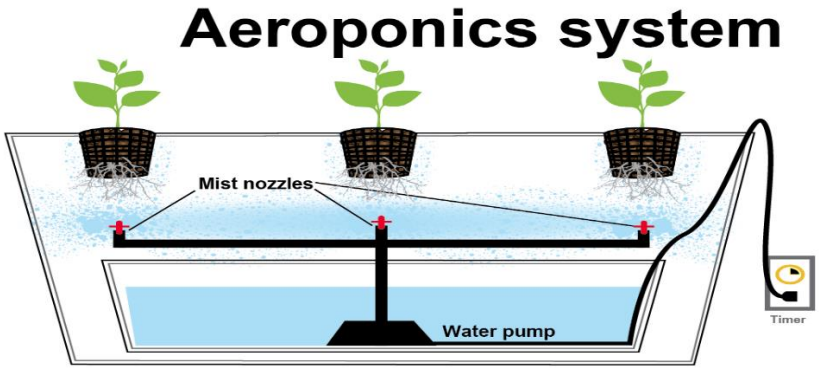

Fig: Aeroponics Farming

AQUAPONICS

The word “aquaponics” is derived by uniting two words “aqua” from “aquaculture” (practice of raising fish) & “ponos” from “hydroponics” (growing of plants in soil less environment). An aquaponics system has three parts: a fish tank, grow beds and a small pump between the two. The principle behind system, is water from the fish tank is rich with nutrients from fish waste is pumped into the grow beds and plant extract the nutrients cleaning the water before it is returned to the fish tank. Aquaponics represents the relationship between water, aquatic life, bacteria, nutrient dynamics, and plants which grow together in water ways all over the world. The main components of aquaponics are the fish, plants and bacteria (Rakocy, James E. 2012-03-23). In modern aquaponics 3 specific methods of aquaponic system is primarily emerging in industry; the Media based aquaponic system, Raft system and Nutrient film technique (NFT) system. Aquaponic is a part of modern farming technology that is a subset of the larger discipline of integrated aquaculture systems, which seeks to combine animal and plant culture technologies to confer benefits and conserve nutrients and other biological and economic resources. Aquaponic employs several principles like efficient water use and nutrient use, reduce environmental impact & the use of biological and ecological approaches to agriculture and fish production (Rogosa Eli. 2013).

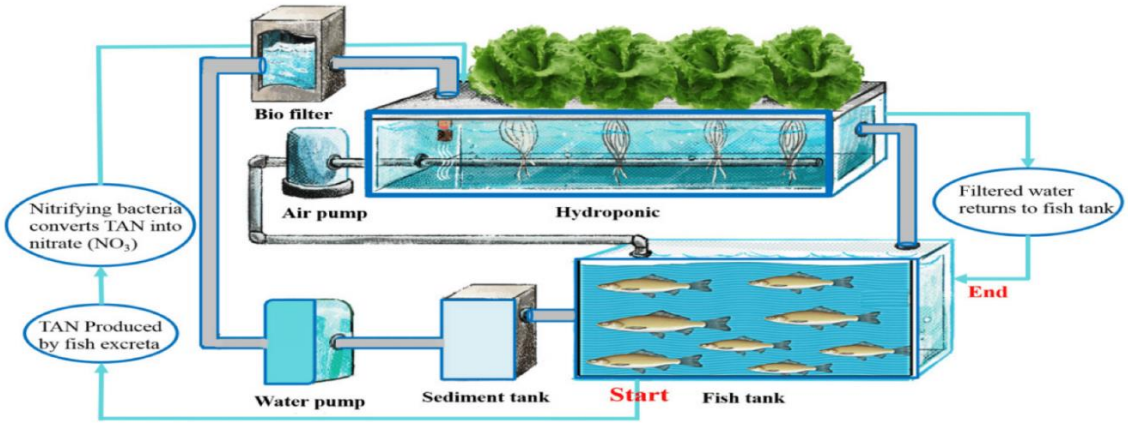

Fig: System diagram of Aquaponics

CONCLUSION

Hydroponics, aeroponics & aquaponics are all innovative methods of growing plants without traditional soil-based cultivation. These methods offer several advantages, such as efficient use of water, space and nutrients as well as the ability to grow plants in urban environments or areas with limited access to fertile soil. They are becoming increasingly popular for sustainable agriculture, research, and even home gardening. All these new innovative agricultural practices hold great potentials for sustainable and efficient food production, contributing to a more resilient and environmentally conscious agricultural future.

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