

Fluid Farms: Elevating Agriculture through Hydroponics

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Abstract

A contemporary agricultural method that is becoming more and more well-liked is hydroponics, which produces large yields of crops in a small amount of space and with little input. Growing plants without the need of soil is possible using hydroponics, a cutting-edge method of growth. A nutrition solution with vital minerals dissolved in water is instead given to plants. Plant development may be supported with ideal circumstances provided by this technology, which gives exact control over the growing environment. Hydroponic farming technology has advantages, particularly in regions with severe soil erosion and little water resources. Unpreventable natural disasters, urbanization, climate change, and increasing fertilizer use are a few. In contrast, the hydroponic farming system may be made into a multi-story farming system simply by anchoring the stands, therefore it is not required to overcome any of the above-mentioned difficulties. When comparing hydroponic farming systems to soil-based farming systems, a minimum water savings of up to 70–80% may be guaranteed.

Key Words: Hydroponics, Soilless agriculture, Minerals, Modern cultivation

Introduction:

Since food is the most fundamental human necessity, we must first modernize farming practices to generate higher-quality results in shorter amounts of time and space. In this case, the hydroponic farming method is useful and satisfies practically all of the needs of the contemporary farming system. The word “hydroponics” is derived from the Greek words, “hydro” which means water, and “ponos” which means labor. Soil is the most readily available growing medium for plants because it offers them nutrients, water, oxygen, and most importantly an anchor for healthy plant growth. However, some of the major obstacles to plant growth are unfavourable soil composition, soil erosion leading to deterioration, inadequate drainage, inappropriate soil reactivity, presence of disease-causing organisms, and nematodes (M Kannan et.al.,2022). The word “hydroponics” is derived from the Greek words, “hydro”

which means water, and ponos which means labor. When compared to soil-based farming systems, we can guarantee minimum water savings of up to 70–80% with hydroponic farming systems. There is less water evaporation than its counterpart since there is no water loss due to the bacteria and other microbes found in water. Hydroponic plants are exposed to light so that photosynthesis can occur, and they are also exposed to air so that their roots can take up the oxygen necessary for growth. Three nutrients are added to water: calcium, phosphorus, and nitrogen.

Classification of Hydroponics:

Hydroponics are classified into mainly two types, Passive system and Active system.

- ✚ **Passive System:** The plants in this system are sustained by the suspension technique, and the plant roots stay in touch with the nutritional solution. The main drawback of this approach is that it becomes increasingly difficult to sustain your plants as they develop and get heavier. However, it is very straightforward to set up. One example of a hydroponics passive system is the wick system.
- ✚ **Wick System:** Most convenient hydroponic farming technology in which no electricity system is required. The pot is already filled with an inert material, such as coco peat, and plants are inserted within. A nylon wick connects the plant roots to the container holding the nutritional solution. Plant roots receive the required quantity of nutritional solution through the capillary action of this nylon wick. This kind of hydroponic farming system is ideal for little plants, such as some spices or herbs.
- ✚ **Active system:** Electric pumps are utilized in active systems to provide nutritional solutions to the roots of the plants, while a gravity system removes surplus solutions that may be recovered and utilized again. These systems are therefore more productive and efficient.

Types of Active System

1. Nutrient Film Technique (NFT)
2. Deep Water Culture
3. Ebb and Flow System
4. Drip System
5. Aeroponics
6. Dutch Bucket Method



- 1. Nutrient Film Technique (NFT):** Plants are placed in a slightly slanted trough suspended on a floating platform. The top portion of the root system is exposed to air (oxygen) while the plant roots dangle. Water that is rich in nutrients and pushed into the trough at the top (higher) end exposes the lower portion of the roots. After passing (down) the other root systems, the water returns to a water reservoir.
- 2. Deep Water Culture:** The roots of the plants in a deep-water culture hydroponic system are suspended directly in the nutrient solution, and air stone is utilized to provide the roots oxygen. Roots of plants floating in nutrient-rich water are cultivated in net pots. To prevent the formation of mould and algae in the reservoir, it is essential to keep an eye on the salinity, pH, and concentrations of oxygen and nutrients. Deep water culture is the main hydroponic production system of cherry tomatoes.
- 3. Ebb and Flow System:** The roots of plants develop through a medium. Pumped often (every 30 minutes, for example) to the root zone region, nutrient-rich water is permitted to drain back into a water reservoir.
- 4. Drip system:** The main benefits of a drip system are its increased water conservation over other options and its resilience to sudden power outages or equipment failures. The fact that the solution supply is timed makes this system potentially highly costly and challenging to set up. Using a water pump, the nutrient solution is delivered in the right amount to each plant root from the reservoir. It is frequently used to grow peppers and tomatoes, producing exceptionally high-quality yields.
- 5. Aeroponics:** Plant roots are placed in an area with air (oxygen) and exposed to the elements. Water that has been enriched with nutrients is sprayed or flows through the area often (e.g., every 30 minutes).
- 6. Dutch Bucket Method:** The Netherlands was the first country to cultivate tomatoes, cucumbers, and roses using the Dutch bucket method. Plants are grown in this technique using a 2.5-gallon bucket. The extra nutritional solution is recycled using a pump.

Benefits of hydroponics

- **Enhanced plant yields:** Because plants are more closely spaced in a hydroponic system than would be required to cultivate the same number of plants on the same amount of land, hydroponic plants generate more fruits and vegetables. Many other factors that might



promote plant development in a hydroponic system include the water's pH level, nutritional content, quantity and kind of light, etc.

- **Less water:** Because water in a hydroponic system is caught and reused rather than left to runoff and drain to the environment, hydroponic systems use up to ten times less water than standard field crop watering methods.
- **Locally grown:** With indoor hydroponic systems, plants may be grown nearly anywhere, year-round.
- **Less Space:** There are numerous designs for hydroponic systems, one of which is the vertical stacking system, which requires less room.

Conclusion:

We all know that there are a lot of soil-less farming systems out there, but the hydroponic farming system is becoming more and more popular, and this is how most food is produced. Since poor land management is likely to cause a shortage of farming land shortly due to population growth, our only option will be to look for methods that can give us more yield in smaller areas and of higher quality.

Reference

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