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Hydroponics: Future Perspective

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"Hydroponics: The future of soilless farming for a greener tomorrow"

Today, several obstacles stand in the way of land-based agriculture, such as industrialization, urbanization and environmental degradation. The decrease in land available per person is the most important problem. With a world population of 6 billion people, only 0.16 hectares of land per person will be available in 2050, compared to 0.25 hectares today. These adverse effects will be exacerbated by urbanization, industrialization and climate change. Due to its effective resource management, hydroponics has proven to be a viable solution to these challenges and is now gaining traction globally. As hydroponic farms have a regulated framework and strict certification requirements, they offer a realistic approach to more sustainable food production that avoids hazardous chemicals.

Introduction

Currently, 55% of people on Earth live in cities; by 2050, that number is predicted to rise to 68%, requiring the conversion of 593 million hectares of uncultivated land into farms to meet the population's projected calorie needs. In addition, the emergence of second-generation issues including excessive soil nutrient mining, a drop in factor production, a reduction in groundwater levels, and an accumulation of pests like weeds, illnesses, and insects present significant issues. In this situation, soil-less culture, or hydroponics, might be effectively introduced and taken into consideration as a substitute method for producing high-quality food plants, crops, or vegetables. The capacity to produce crops in almost ideal circumstances utilizing Controlled Environment Agriculture technology is one of the biggest benefits of hydroponic farming. It doesn't care about the climate, the availability of cultivable land, or the quality of the soil; it can be cultivated anywhere in the world at any time of year. Crop production may be maintained in a controlled environment where skilled workers can use

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cutting-edge climate control systems to optimize the amount of water, nutrients, and light that reaches the plants. Hydroponics makes more space accessible on the ground by piling horizontal racks on top of one another.

History of hydroponics

The science of growing plants without the need for soil is known as hydroponics. The Greek terms "Hydroponics," which means "water cultivation," and "Ponos," which means imply labor, are combined to form the word. The first recorded instance of a plant cultivated without soil dates back to 600 BC and is found in the Hanging Garden of Babylon, one of the Seven Wonders of the Ancient World. The Aztec Indians developed increasingly creative gardening methods about 1100 BC, producing gardens that seemed to float and these "floating gardens," also called "chinampas,".

Types of hydroponics

Growers, farmers, and academics have identified the most popular varieties of hydroponic systems and their corresponding attributes. The types of hydroponics are listed below:

i. **Nutrient film technique**

The nutrient film technique was developed by Allen Cooper in the middle of the 1960s. A nutrient-rich fluid is constantly running through the plant-containing conduits. Once the solution reaches the end of the channel, it is recirculated back to the system's beginning.

ii. **Deep water culture**

In a hydroponic system known as deep water culture, plant roots are suspended in nutrient-rich water with air delivered straight to the roots via an air stone.

iii. **Wick system**

The wick System runs without the need for power, pumps, or aerators. The roots of the plants are connected to a nutrient-rich fluid reservoir via a nylon wick in a porous media such as coco coir, vermiculite, or perlite. It is appropriate to use this approach for tiny plants, spices, and herbs.

iv. **Ebb and flow system**

It is made up of a nutrient-rich fluid reservoir and a grow tray. The solution is periodically flooded into the grow tray by a pump, and it then gently drains. This system may be used to cultivate a variety of crops

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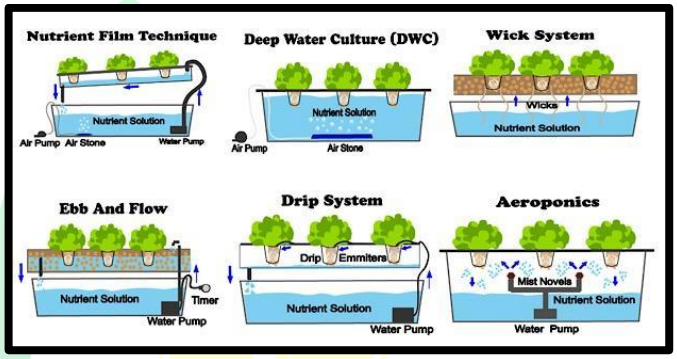
v. Drip system

The drip method keeps the nutrient solution in a reservoir while the plants are grown independently in a soilless media. The gradual release of nutrients makes it possible to gather extra solutions and either circulate them again or release them.

vi. Aeroponics

This water-based technology works without a medium, much like the nutrient film technique. A misty application of the mineral solution is made on the plants.



Future perspective

Many academics are looking into new ideas and possibilities in the field of hydroponics, which egetableshas the potential to completely change the way we produce food in the future. One area of emphas.

The need for hydroponics will rise as more people become conscious of the detrimental effects that pesticides have on their health and realizis is the application of hydroponic systems for urban agriculture, where conventional farming is impractical due to space constraints. Hydroponics will be essential for the future of the space program as well. Major hydroponics research projects are being carried out by NASA to support current space exploration as well as potential long-term Mars or Moon settlement. Hydroponics may be the key to the future of space travel since we have yet to find dirt that can support life in orbit and because it is impractical to deliver soil via space shuttles. Hydroponic systems might be installed in urban settings, such as vertical gardens and roofs, to provide year-round access to fresh, locally grown ve that this method does not require the use of dangerous chemicals. Soon, it is anticipated that technologies like as climate control, nutrient film methods, and sensor technologies will drive market expansion. Remote and independent data collection and monitoring are made possible by the sophisticated usage of IoT. It is anticipated that the hydroponics solutions market will expand rapidly between 2021 and 2028 as a result of these technical advancements.

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Advantages of hydroponics

Growing plants in a soilless culture has numerous benefits over soil-based culture. These gardens dependably give the healthiest crops in large quantities; gardening is clean, simple, and requires very little work. Because nutrients are supplied straight to the roots in this instance, plants may be grown closer together, develop quicker with fewer roots, and use just one-fifth of the total area and one-twentieth of the water required for soil-less growth as opposed to soil-based culture. There is also no risk of disease attack, weed infestation, or insect pests that are carried by the soil. All things considered, soil-less culture offers effective fertilizer management, denser planting, and an increase in output per acre as well as superior quality food.

Limitations of hydroponics

Although soil-less cultivation offers several benefits, it is not without restrictions. Although there are significant rewards, commercial use necessitates technical expertise and a large initial investment. Only high-value crops can be grown in soilless cultures because of their high cost. Controlling plant health requires extreme caution. In the end, energy inputs are required to operate the system.

Conclusion

Hydroponics is becoming increasingly popular as it plays a crucial role in promoting sustainability and environmentally friendly activities. It offers a potential solution to polluted soils and prevents further environmental degradation. The running costs of this method are very low, making it superior to conventional farming even with a significant initial investment. The installation of state-of-the-art monitoring technology reduces labor and maintenance costs. In addition, hydroponics has solved significant problems with soil pollution and chemical residues. As a result, hydroponic production will increase exponentially worldwide in the coming years.