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Hydrophonic: A Review on Plant without Soil

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ABSTRACT
Open field/soil-based agriculture has faced significant difficulties since the dawn of civilization, the most significant of which is a reduction in per capita land supply. In 1960, when the population of the planet was 3 billion people, per capita land was 0.5 hectares; currently, with 6 billion individuals, it's really only 0.25 hectares, and by 2050, it will be 0.16 hectares. As a consequence of increased urbanization and industrialization, and also cultural group melting, or icebergs (as just a planet warms), arable land under cultivation will continue to diminish. Fertility of the land comes up again. Food production is threatened by inadequate water management and massive water waste, as well as a decrease in ground water levels. In the context of traditional soil-based agriculture.In such conditions, feeding the whole population will become difficult in the near future. Only the open field method of agricultural production is used by the people. Naturally, soilless culture is gaining in popularity. In the current situation, to meet these difficulties Plants are grown without soil in soil-less cultivation. Improved water and space Using soil-less culture to save food production techniques has shown some encouraging outcomes all around the world.

Keywords
Agriculture, Crops, Hydrophonic, Soil.

1. INTRODUCTION
For most crops, soil is the most readily accessible growth medium. It supports plant development with anchoring, nutrients, air, and water, among other things. Soils, on the other hand, impose significant constraints.At times, plant growth is involved. The presence of a disease-causing agent Unsuitable soil reaction, organisms and nematodes soil compaction, inadequate drainage, and deterioration owing to Some of them are prone to erosion, for example. Additionally, traditional soil-based agricultural farming (Open Fields Agriculture) is indeed a relatively recent notion. It's difficult since it requires a large amount of space, effort, and money. The quantity of water Moreover, in certain situations, such as metropolitan areas, soil is not suitable for crop development in some sections, while in others, soil is not suitable for crop cultivation at all. Due to the lack of rich cultivable arable soils in certain regions, their adverse topographical or geographical circumstances Another significant issue that has arisen recently is the Traditional open-field agriculture has a labor shortage. Soilless culturing may be used in these situations successfully introduced[1].

The term "soil-less culture" refers to methods that do not need the use of soil. Hydroponics and Aeroponics are two types of hydroponics and aeroponics, respectively. The word "hydroponics" was coined in the 1960s derived from the Greek words hydros and ponos, which both imply water. Means to work. It's a technique for cultivating plants that makes use of minerals fertilizer solutions in the absence of soil Plants that grow on the ground are called terrestrial plants growing with just the mineral nutrition solution in their roots or Perlite, gravel, or mineral wool are examples of inert media. The term "hydroponics" refers to a technique for growing plants even without soil. They should have their roots soaked in a nutritious solution. This method may help with climate change challenges and also production system management for efficient natural resource utilisation and hunger reduction. Aeroponics is a technique that is similar to hydroponics. Hydroponics, with the exception that plants in aeroponics are smaller are cultivated using tiny nutrient droplets (a mist or aerosol) solution. Hydroponics was first used in India. ShaltoDuglas, an English scientist, founded a laboratory in the West Bengal town of Kalimpong He's also done Hydroponics The Book is a book on hydroponics. Bengal System is a system that was developed in Bengal, India[2-4].

During the 1960s and 1970s, commercial Abu Dhabi, Arizona, and other cities have established hydroponics farms. Belgium, California, Denmark, Germany, Holland, Iran, and Italy are just a few of the countries involved. Japan, the Russian Federation, and other countries are among the others. Back in the 1980s, A large number of automated or computerised hydroponics farms were present. Hydroponics kits again for home have become more popular all over the world. It was highly popular in the 1990s.

1.1. Various Soilless Culturing Methods Are Available
There are several hydroponic/soils-less cultivation methods to choose from. However, the following criteria are taken into account while choosing a technique:

- Available space or additional resource.
- Production projections
- Access to appropriate growth media
- Expected produce quality – color, look, pesticide-free, and so forth.
- The methods may be classified as follows:
- Hydroponics Techniques
- The method is also known as Liquid Hydroponics. Plants that are cultivated
- Their roots are suspended directly in a solution in solution culture.
- solution of nutrients It is further divided into two categories:

1.1.1 Methods of Circulation (Closed Systems) the Flow is Unbroken

- Using a nutrient film (NFT)
- Technique of deep flow (DFT)

Figure 1: Illustrate the Nutrient film techniques and Deep flow techniques

Methods of circulation (closed system) A stable nutrient environment is beneficial to CoRoots in moving solution culture systems. They are very receptive to automated control, but they are subject to fast plant desiccation if continuous flow is not carefully maintained. For whatever reason, the flow of solution comes to a halt. As a result, there are a lot of it is necessary to pay attention.

2.1.1 Static Solution/Non Circulating Method (Open Systems) Culture

- Technique for dipping roots.
- Floating method.
- Technique of capillary action.

Polythene beakers, polypropylene beakers, and polypropylene beakers are all good options for static systems. Black plastic sheeting film lined pots, glass jars, and containers
B. The media culture method, which has a solid medium and is called for the inert medium used, such as sand culture, has a solid medium and is named after the inert medium used. There are two forms of culture: gravel culture and rock wool culture. There are two important considerations. Variations in sub-irrigation and top-irrigation for each medium However, it is categorised as follows:

- Technique for hanging a bag
- Using a grow bag.
- Techniques of trenching and toughing.
- Technique with a pot

1.2. Aeroponics Techniques

Aeroponics is a techniques of growing crops in which the origins are suspended in air beneath the panel as well as the plants are anchored in holes in expanded polystyrene panels. Aeroponics culture is typically used in enclosed structures and is best suited for low-leafy vegetable matter such as lettuce and spinach. There are two of them.
This group's techniques include:

- The root mist method.
- Feeding with fog.

1.3. Nutrient Supply to the Plants

Because of the system's low nutrient capacity and ability to make rapid changes, hydroponics requires caution. It is necessary to monitor the system. There are two aspects of nutrients to consider: the supply of nutrients from food and the supply of nutrients from the environment. The plant's nutrient response as well as the nutrient delivery system most nutrients have critical levels for most common crop plants have been established. Sources of nutrients elements or their concentrations characteristic[5].

1.4. Nutrient Solutions with a Desirable Range

The pH of a plant in a hydroponic system changes all the time as it grows. pH changes of less than 0.1 unit are not considered significant. As a consequence, pH regulation in hydroponic solutions is critical. The pH range of 5.5 to 6.5 is ideal for nutrient availability from most nutritional solutions for most species, although species vary widely, and some may grow outside of this range.

1.5. Contaminant Management

A sterile root-zone environment is necessary for optimum plant vigour in soil-less cultivation. It is highly difficult, but critical, to reduce the number of plant pathogens inside the root zone. Wilt is a frequent disease in hydroponic systems caused by Fusarium and Verticillum. Pythium and Phytophthora species kill everything except the major roots. In hydroponics, there have been no effective fungicides that could be utilised safely. Metalaxyl has been discovered to be quite successful in controlling Pythium in vegetable crops, however it is not authorised for usage. The use of heat to sterilise liquid fertilizer also has been found to keep viruses out of the root zone. Heating fertilizer solutions to 20- 22 degrees Celsius prevented Pythium root mortality in tomatoes.In an aeroponic system with warmed nutrient, all roots of ginger plants matured faster and produced somewhat fun and engaging rhizome yields than plants in the very same medium with bottom heat.

1.6. Soil Less Culture Benefits

Plants grown in soil-free culture have a number of benefits over plants grown in soil. These gardens provide the healthiest crops with the largest yields and are reliable; gardening is straightforward and requires little effort. Plants develop faster with fewer root, seedlings may be grown closer together, and soil-less culture consumes only 1/5th of the overall space and 1/20th of the total water of soil-based culture. There are no insect pests, illnesses, or weed infestations that may be found in the soil. Overall, soil-less culture provides excellent fertiliser management, higher planting density, higher yield per acre, and better product quality. It's also important in places of the globe where arable or productive land for agriculture is scarce.

1.7. Soil-less Culture Limitations

Despite its numerous benefits, soil–free cultivation has significant drawbacks. Technical skill and a hefty initial investment are required for commercial use, but the reward is tremendous. Soil-less farming is only suited for high-value crops due to the high cost. Extreme vigilance is required when it came to plant health management. Ultimately, to keep the system working, energy inputs are necessary.

1.8. The Technology's Future Applications

Hydroponics is the fastest-growing agricultural sector, with the potential to take over food production in the near future. As the population rises and arable land declines due to poor land management, people will switch to novel technologies including hydroponics or aeroponics to build alternate food production channels.People just need to look at some of the early adopters of hydroponics to get a sense of what the future holds for this technology. Land in Tokyo is highly expensive due to the city's rapidly growing population. The nation has resorted to hydroponic rice cultivation to feed its people while conserving precious land mass. Rice is harvested without the need of soil in subterranean vaults. Because the atmosphere is completely regulated, instead of the usual single harvest, four harvest cycles may be conducted yearly. Hydroponics has been shown to be effective in Israel, which has a dry and arid environment. Organitech has been growing vegetables in 40-foot (12.19-meter) cargo containers using irrigation systems. They cultivate a lot of berries, citrus fruits, including bananas, which would also be difficult to grow in Israel's climate [6].

Hydroponics methods produce 1,000 times more than a similar-sized plot of land could produce in a year. The technique is also totally automated, with robots working on an assembly line-style program similar to those used in factories. After that, the cargo containers are moved throughout the nation. The possibility for using hydroponics in third-world nations with inadequate water sources has already generated a lot of excitement in the scientific community. Though the initial capital expenses of installing hydroponics systems are presently prohibitive, as with any technologies, prices will decrease with time, making this alternative far more viable.Hydroponics has the ability to feed millions in countries of Africa or Asia that both water and crops are scarce. Hydroponic gardening also will play an important part in the future of the space program. NASA has established large hydroponics research initiatives to aid current space travel as well as long-term settlement of Mars or even the Moon.Because no soil has yet been identified that can support life in space, and transferring soil via space shuttles seems to be impractical, hydroponics might be critical to the future of space travel. In space, there seem to be two benefits to adopting hydroponics: It can generate a broader variety of foods and contains a biological factor called a bio-regenerative life - supporting system. Briefly said, the plants will gather carbon dioxide and inadequate ventilation as they grow or replacing it with a new oxygen as part of the natural development process. This is crucial for long-term settlement on both space stations or other worlds [7].

2. LITERATURE REVIEW

R.Vidhya1 et al. studied about There has been a significant reduction of agricultural acreage as a result of increased industrialization. In day-to-day living, the human population is growing, which raises demand. For the sake of food is the main source of sustenance for all living things. On this planet, there are humans. In most cases, conventional soil planting is used and takes longer to complete. There is a lot of technology nowadays. Hydroponics has made significant progress in the agricultural industryconcept. It is possible to enhance the yield of a plant by growing it without soil. Crops for a brief period of time under any climatic situation As a result of this, the aim is to manage pests and weeds while lowering labor costs. A survey regarding technologies and methods is addressed in order to gather data. IoT-enabled automated monitoring of hydroponics farms[8].

Girma F et al. studied about Hydroponics is a cutting-edge technique in agriculture. Hydroponic cultivation is utilized to provide a consistent supply of high-quality green fodder for animal feed at reasonable costs throughout the year. As a consequence, the purpose of this research is to see how hydroponic feed affects livestock productivity. Hydroponics is a way of growing plants in water. This fodder may reach a height of 20-30cm when cultivated in a greenhouse without soil but in water or perhaps a nutrient-rich solution. Roots, seeds, and plants make up the height. One kilogram of fresh vegetables requires about 1.50-3.0 liters of water. Since water can be reused, hydroponics fodder can be produced in seven days. However, 11-14 percent DM content is typical for Maize grown in hydroponics produces 5-6 times more than fresh maize. Fodder has become more appetizing as a result of hydroponics. Digestible and nutritious, while also providing additional health advantages to the animals and boosting output livestock's performance.In circumstances when traditional green fodder cannot be grown effectively, producers may create hydroponics fodder to feed their dairy cows utilizing a low-cost diet. As a result, additional research and development efforts are required in the future for greater use.

3. DISCUSSION

Additional fertilizer application does not improve production because the situation has reached a saturation point. Furthermore, there is a lack of natural soils fertilizer buildup by microbe in some cultivable regions, as well as a reduced likelihood of the natural soils fertility buildup by microorganisms as a result of continuous cultivation. Droughts are common, and weather patterns and climate are unpredictable. Temperatures are rising, and rivers are becoming increasingly polluted. Inadequate water management and massive water waste, as well as a drop in ground water levels, are threatening food production. In the context of traditional agriculture based on soil, feeding the entire population will become difficult in the near future under such circumstances. The people only use the open field method of agricultural production. Soilless culture is becoming increasingly popular[9,10]. As soil growing conditions become more challenging, the industry is likely to increase greatly in the future. In a nation like India, where the urban cement conglomerate is rising by the day, there is no alternative but to adopt soil-less culture to help enhance yield but also product quality while also ensuring our country's food security. Government involvement and knowledge societies interest, on the other hand, may help to accelerate the adoption of this technology. As soil growing conditions become more challenging, the sector is likely to expand greatly in the future. In a nation like India, wherein urban concrete conglomerate is increasing with each day, there is no choice but to embrace soil-less culture to assist enhance yield but also product quality while also ensuring our government's food security. Government engagement and research institution interest, on the other hand, may aid to accelerate the implementation of this technology.

4. CONCLUSION

In a country such As India, where the urban concrete conglomerate is increasing by the day, soil-less culture is the only way to boost yield overall quality of products while also assuring our country's food security. Government involvement and research institution interest, on the other hand, may help to accelerate the adoption of this technology. As soil growing conditions become more challenging, the sector is anticipated to expand substantially in the future. In a country like India, where the urban concrete conglomerate is growing by the day, there is no alternative but to adopt soil-less culture in order to help enhance yield overall product quality while also assuring food security. Government participation and research institution interest, on the other hand, may assist to accelerate the implementation of this technology. As soil growing conditions become more challenging, the sector is projected to expand tremendously in the future. In a country like India, where urban cement conglomerate is growing by the day, there really is no alternative but to adopt soil-less culture in order to help enhance yield as well as product quality to ensure our country's food security. But at the other hand, government engagement as well as research institution interest may assist to speed up the deployment of this technology.

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