

Hydroponics As An Advanced Technique For Vegetable Production

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Introduction:

Hydroponics is a system of agriculture that utilizes nutrient-laden water rather than soil for plant nourishment. There-use of nutrient water supplies makes process-induced eutrophication (excessive plant growth due to overabundant nutrients) and general pollution of land and water unlikely, since runoff in weather-independent facilities is not a concern. Hydroponics was derived from the Greek words *hydro* ' means water and *ponos* ' means labour and literally means water work. The word hydroponics was coined by Professor William Gericke in the early 1930s; describe the growing of plants with their roots suspended in water containing mineral nutrients. Most hydroponic systems operate automatically to control the amount of water, nutrients, and photoperiod based on the requirements of different plants.

Why hydroponics Use?

Due to rapid urbanization and industrialization not only the cultivable land is decreasing but also conventional agricultural practices causing a wide range of negative impacts on the environment. To sustainably feed the world's growing population, methods for growing sufficient food have to evolve. Modification in the growth medium is an alternative for sustainable production and to conserve fast depleting land and available water resources. In the present scenario, soilless cultivation might be commenced successfully and considered as an alternative option for growing healthy food plants, crops, or vegetables. Agriculture without soil includes hydro agriculture (Hydroponics), aqua agriculture (Aquaponics) and aerobic agriculture (Aeroponics) as well as substrate culture. Among these hydroponics, techniques are gaining popularity because of its efficient management of resources and food production. Various commercial and specialty crops can be grown using

hydroponics including leafy vegetables, tomatoes, cucumbers, peppers, strawberries, and many more.

Media used in hydroponics

Substance that is used to substitute the soil and provide support to the plant is termed as medium. The growth medium helps in the anchorage of the plants so that they do not fall over and also plays a significant role in bringing water and dissolved nutrients in contact with roots. The different types of media are Rockwool, Coco – Peat, Expanded clay Pellets: Most popular media, Vermiculite, Sand, Perlite, Gravel.

Table 1. Bulk density and Porosity of Important Soil – Less Media.

Soil – less media	Bulk Density (kg / m³)	Total porosity (% v/v)
Coco peat	80-100	90-95
Perlite	80-120	85-90
Vermiculite	90-150	90-95
Rock Wool	80-90	95-97
Expand Clay	600-900	85-90

Advantages of Hydroponics

- Recently hydroponic technique is becoming popular because this is a clean and relatively easy method and there is no chance of soil-borne disease, insect or pest infection to the crops thereby reducing or eliminating use of pesticides and their resulting toxicity.
- Besides, plants require less growing time as compared to crop grown in the field and growth of the plant is faster as there is no mechanical hindrance to the roots and the entire nutrient are readily available for plants. This technique is very useful for the area where environmental stress (cold, heat, desert etc) is a major problem.

- Crops in hydroponic system are not influenced by climate change, therefore, can be cultivated year-round and considered as offseason.
- .Further, commercial hydroponic systems are automatically operated and expected to reduce labor and several traditional agricultural practices can be eliminated, such as weeding, spraying, watering, and tilling.
- Hydroponics saves a large amount of water as irrigation and other kind of sprays is not needed and water logging never occurs.
- The problem of pest and disease can be controlled easily while weed is practically non-existent. Higher yields can be obtained since the number of plants per unit is higher compared to conventional agriculture.
- Although soil-less cultivation is an advantageous technique but some limitations are significant. Technical knowledge and the higher initial cost is a fundamental requirement for commercial-scale cultivation.
- It is the best way to overcome global food and water shortages and produce the highest quality, nutritious produce in any type of climate.
- Fertilizer usage is usually much lower than with soil growing. The full nutrition is immediately available to the plant in the hydroponic system.

Global Hydroponic Market and Commercial Hydroponic Production

The global hydroponics market is projected to reach USD 395.2 Million by 2020, growing at a CAGR of 16.8% from 2015 to 2020. Global hydroponics crop value is anticipated to grow from USD18.8 billion in 2014 to USD27.29 Billion by 2020 at an estimated CAGR of 6.39% from 2015 to 2020. By crop type, global hydroponics market includes tomato, cucurbits, lettuce & leafy vegetables, peppers, and other food crops. Tomato forms the largest market segment and it accounts for a 30.4% share of the global market, during 2018. Hydroponics crop production is expected to be more in tomatoes, lettuce, and other leafy vegetables. As the consumers are becoming increasingly aware of the superiority of quality greenhouse-grown vegetables, the demand for hydroponics culture is rising in Europe and Asia-Pacific. Europe is traditionally the largest market that is implementing advanced techniques in hydroponics.

Asia-Pacific forms the second largest market for hydroponics, which is expected to grow at a steady pace. Leading countries in hydroponic technology are Netherland, Australia,

France, England, Israel, Canada, and the USA. Dutch is the world leader in commercial hydroponic having a total area of 13000 ha under tomato, capsicum, cucumber, and cut flowers (Netherlands Department of Environment, Food, and Rural Affairs, NDEFRA) and this account 50% of the value of all fruits and vegetables produced in the country. Australian hydroponic production of vegetables, herbs and cut flowers of system valued about 300-400 million dollars which is approximately 20% of the total values of vegetables and cut flower production in Australia reported by Rural Industries Research and Development Corporation (RIRDC).

Australia is the largest hydroponic lettuce producers in the world, and having strawberry cultivation is larger than the USA and cut flower production is almost equal to USA. Canada and Spain are also expanding the area under a commercial hydroponic system. Japan has started rice production by hydroponics technique to feed the people. Israel grows large quantities of berries, citrus fruits and bananas in the dry and arid climate. Currently, demand of hydroponics cultivation has been increased in all the developing and developed countries.

In India, several tracts of wastelands having poor quality soil but plenty of water can be brought under hydroponics. Now a day's peoples in various big cities like Delhi, Chandigarh, Noida and Bangalore are growing some leafy greens and small herbs and spices on their rooftops and balconies for fresh consumption.

Conclusions

In recent years hydroponics is seen as a promising strategy for growing different crops. As it is possible to grow short duration crop like vegetables round the year in very limited spaces with low labour, so hydroponics can play a great contribution in areas with limitation of soil and water and for the poorer and landless people. In India, the hydroponic industry is expected to grow exponentially in near future. To encourage commercial hydroponic farm, it is important to develop low-cost hydroponic technologies that reduce dependence on human labour and lower overall start up and operational costs.