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SOIL-LESS CULTURE FOR HORTICULTURAL CROP

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Under horticultural crop production, soilless cultivation is defined as all methods that enable plant management in soilless culture using nutritional solution as the source of water and minerals, with or without the use of a growth media (e.g. rockwool, peat, perlite, pumice, coconut fibre, etc.). It is divided into the following sections: 1) systems in which plant roots are supported only by liquid medium and no additional media 2) systems in which the plants are supported by a substrate in a solid medium. The hydroponic system is made up of two types of systems: liquid medium and inert substrate. Furthermore, soil-free substrate cultures are divided into two categories: i) open systems (in which the nutrient solution that drains from the roots is not reused) and ii) closed systems (in which the surplus nutrient solution is collected, rectified, and reintroduced) (Winsor and Schwarz, 1990).

Key words : nutrient solution, growing media, root

Historical background

The word “hydroponics” first said by Gericke in 1929.
Nurtient solution first developed by Sachs and Knap in 1929.
Hydroponics was first started in India in 1947 at Kalimpong, Darjeeling.
In India nutrient Film Technique was developed by Sachs and Knap in 1938

Why soilless culture

Plants require nutrients from the soil to grow. It promotes plant development with anchoring, nutrients, air, and water, among other things. However, compared to mineral soils, Soilless media are lighter in weight, more widely available, and more consistent (Yuan et al., 1996). Fertile arable lands are scarce in urban and industrialised areas. As a result, there is need of soil less cultivation. Another thing that must be done on a regular basis is to fumigate the soil, which might create health issues. Climate change has a negative impact on soil health, which has an impact on plant growth and quality.

Techniques of hydroponics

Solution culture and medium culture are the two primary forms of hydroponics.

A. Solution culture

It is also known as Liquid Hydroponics method. The roots of grown plants in solution culture are suspended in a nutritional solution. It's further divided into two categories: I Circulating techniques (closed system)
a) Nutrient film technology b) Deep flow technique
II) Static solution culture/non-circulating technique (open systems)
a) Method of dipping roots
b) Floating technique c) Capillary action technique

Circulating technique: Here nutritional solution is circulated.

Non circulating technique: The nutritional solution is not circulated, but used only once. When its nutrient concentration decreases or pH or Ec changes, it is replaced.

Technique of root inserting (dipping) : Plants are grown in small pots which are filled with a little amount of growth media, and the pots are kept in such a way that the top of the pot (2-3 cm) are submerged in nutritional solution.This method does not need the purchase of expensive goods such as power, a water pump channel, and so on.

Floating technique : In this operation, shallow containers (10 cm deep) can be used. Plants in tiny pots are suspended in a nutritive solution that has been artificially aerated in the container and linked to a Styrofoam sheet or other light plate.

Capillary action technique : Planting pots of varying shapes and sizes are utilised, each with a hole at the bottom. Fill the containers with an inert medium and the seedling will be planted in it. Capillary action transports the nutrient solution to the inert media.

B. Culture with media

The media culture method employs a solid medium for the roots and is named after the inert medium used, such as sand, gravel, or rock wool. Sub-irrigation and top-irrigation are the two basic variants for each medium. It is, nevertheless, classed as follows:

1. Using a hanging bag
2. Using a grow bag
3. The trenching method

Solid growing media:

Perlite: It is the most often utilised media in soilless culture containerized systems. It is made of a mineral of silicone that occurs in volcanoes and are incredibly light.

Coconut Coir: Cocopeat, and Coco-tek are some of the commercial names for coconut coir. It combines vermiculite's water retention with perlite's air retention. It's an all-natural media comprised of shredded coconut husks. The coconut husk serves two objectives for the seed, one is protection from the sun and salt while floating in the water, and another, it is rich in hormone and fungus-free medium to promote germination and roots.

Vermiculite: Potassium and magnesium are both present in vermiculite. It holds water and help in aeration and drainage of soil, but it's not as long-lasting as other media (sand, perlite).

Peat Moss: Peat moss helps to keep growth media wet.

Hydrogel: Hydrogel is used as a growth medium was said by Schzmt and Graham. Plants grown in hydrogel media can withstand any amount of salt.

Nutrient supply to the plants

In hydroponics, because of the system's low nutrient-buffering capacity and ability to make quick adjustments, constant monitoring is required in hydroponics. The optimal time to provide the nutritional solution is between 6 and 8 a.m., however water requirements will change during the day and from one day to the next. To minimise damage and the emergence of illnesses, the solution administered to the roots while avoiding soaking the leaves. Plants should not permit to experience water stress since it will impact their eventual yield. It is normally advised that you water your plants only one time in a week. From 20 to 50% of nutritional solution drained-off for prevention of toxic ion accumulation.(Chapman, 1996 and Jones *et al*., 1991).

Control of contaminant : Wilt, caused by Fusarium and Verticillum, is a common disease in hydroponic solutions. All save the major roots are destroyed by Pythium and Phytophthora species. There are no effective fungicides that may use safely in hydroponics. Metalaxyl has been demonstrated to be extremely effective for Pythium management on vegetable crops, however it is not approved for usage. Heat treatment of nutritional solution has also been shown to be useful

in pathogen removal. Pythium root death in tomatoes was prevented by heating nutrient solution (20-22oC). (Davies, 1980).

Advantages of soilless culture : Growing plants in soil-less culture has several benefits over soil-based culture. Because nutrients are delivered to the roots directly plants develop quicker with fewer roots, plants grown closer together, and soil-less culture requires only 1/5th of the overall space and 1/20th of the total water. There are no soil-borne insect pests, diseases, or weed infestations to worry about. Overall, soil-less culture enables effective nutrient management, higher planting density, and enhanced yield per acre, as well as improved product quality. It is also useful in areas of the world where there is a lack of arable or fertile land for agriculture.

Limitations of soil-less culture

Despite its numerous benefits, soil–free cultivation has certain drawbacks. Commercial application necessitates technical expertise and a significant initial investment, but the return is substantial. Soil-less culturing is only suitable for high-value crops. extreme caution is essential.

CONCLUSION

In a nation like India, where urban concrete conglomerate is expanding by the day, soil-less culture to assist more yield and greater quality of products which secure our country's food security. Government action and research institute interest may help to increase the adoption of this technology.

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