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Hydroponics and Its Benefits

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Introduction:

Hydroponics is defined as the "cultivation of plants in water" since determined that many different aggregates or media will support plant growth. Therefore, the definition of hydroponics has broadened to read "the cultivation of plants without soil".

Hydroponics derived from the Greek words hydro (water) and ponos (labor) means "water-working." Simply stated hydroponics involves growing plants with their roots in solution alone or in an inert or non-reactive media; that is no soil. The plants nutrition requirements are provided through a liquid media or nutrient.

The Concept of Hydroponics: -

Soilless planting is a method of growing plants using clean water or clean organic matter with or without additional plant nutrients. When clean water and nutrients are used, it is called *hydroponics*. When clean organic matter like peat, compost, organic extracts are used, it is called *organics*.

Why use hydroponics:

Each year three million acres of farmland are lost to urbanization in the form of homes, factories, and roads. The population increases each day by 5,000 people. This means we will have to produce more food on less land. Three million acres of farmland are lost jointly by erosion and poor land management annually.Hydroponics is the answer. There is no need for soil, it can be used in any climate, it only uses 1/25th the amount of water as conventional farming and can be grown virtually anywhere. Even rooftops of buildings and factories are being used for vegetable production. Hydroponics system may be divided in to different forms.

Nutrient solution:

Many formulae for hydroponic nutrient solutions have been given but they are all quite similar, differing mostly in the ratio of nitrogen to potassium. Plants need less nitrogen during short or dark days and more nitrogen during long days, bright sunlight, and higher

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temperatures. Smaller operations often buy ready- mixed nutrient formulations, only water need be added to prepare the nutrient solution. Larger facilities prepare their own solutions to standard or slightly modified formulae.

Growing Medium

- Growing medium is used to lend support to the roots and plant.
- A variety of growing medium are utilized for their individual qualities in various types of hydroponic systems.

pH:

- The acidity or alkalinity of the nutrient solution
- pH readings run from 0-14
- 0-6 acidic, 7 neutral, 8-14 alkaline
- The recommended pH is between 6-6.5

Few popular examples of growing medium are: Sand, Brick shards, Vermiculite/Perlite, Gravel, Rock wool, Sawdust Polyethylene Sheeting

Yield of vegetable crops grown hydroponically in desert green houses (CEA) and in open fields (OFA)

Crop	Yield/ crop(MT/ha)	No. Crops/year	Total yield (MT/ha/year)	Total yield MT/ha/year
Broccoli	32.5	3	97.5	10.5
Cabbage	57.5	3	172.5	30.0
Chinese Cabbage	50.0	4	200.0	-
Cucumber	250.0	3	750.0	3.0
Egg plant	28.0	2	56.0	20.0
Lettuce	31.3	10	313.0	52.0
Pepper	32.0	3	96.0	16.0
Tomato	187.5	2	375.0	100.0

Source: Knott, 1966

As per the data indicate that yield are usually higher in hydroponic CEA (controlled environment Agriculture) than in OFA (open Field Agriculture) because of the optimal growing conditions, balanced plant nutrients, etc., provided in control environments. (Knott, 1966)

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Sources of pathogen introduction in hydroponics

Source	**Pathogen**	**Disease**
Air	*Fusarium oxysporum* f.sp. *radici-lycopersici*	crown and root rot of tomato
Seed	*Clavibacter michiganense*	Root infection of tomato
	Melon necrotic spot virus	Melon necrotic spot
Soil	Pythium spp., *phytophthora spp.* Etc	Damping off, root rots
Sand	*Pythium aphanidermatum, P. dissotocum*	Root rot of spinach and lettuce
Peat	*Thielaviopsis basicola*	Black root rot of citrus
Water	*Pythium dissotocum*	Root rot of spinach and lettuce

Stanghellini and Rasmussen (1994)

Methods of control:

1.Biological control:

A. Use of resistant cultivars:

B. Use of antagonistic microorganisms.

2. Cultural control:

Sanitation, removing trash, dead plant material, and other debris that may shelter pests, should be practiced.

3. Physical control:

Certain kinds of interior lighting (UV or yellow mercury vapor) can be used as insect traps, and objects painted certain colors and sprayed with adhesive materials serve as trap for some pests.

4. Chemical control:

If all else fails, chemical controls are used as a measure of last resort in an IPM program.

Effect on farmers:

- If hydroponics becomes a major part of the agricultural world then farming as we know it today will no longer be.
- All the tractors and farm equipment will be gone and the farm land will become houses.
- All of our food as in veggies will be grown in water and a greenhouse**.**

Disadvantages of hydroponics

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- Hydroponic production is management, capital and labour intensive.
- A high level of expertise is required.
- Daily attention is necessary.
- Specially formulated, soluble nutrients must always be used.
- Pests and diseases remain a big risk.
- Finding a market can be a problem.
- Set up cost can be high.
- Skill and technical knowledge are required.
- Disease and pest can spread quickly to plants using shared nutrient solutions.
- Not all plant varieties are suitable for hydroponics.
- Plants have quick reaction to both good and bad

Future thrust:

- Development of new temperature- tolerant, disease resistant hydroponics cultivars.
- Root temperature studies to determine influences on growth rates and plant development.
- Disease control of water – borne pathogens in closed hydroponic system. Further development of the application of solar heating in hydroponic greenhouses will reduce cost and economic impact of hydroponics.
- Currently, plans are being drawn for using the techniques of soil-less culture on space stations, and perhaps one day on surfaces of other celestial bodies (planets, moons, etc.) that don't have soil.
- In the future, developing countries, along with all other nations, will be able to feed many people using less land than current farming techniques.
- Advances in lighting technology will lead to a more widespread use of hydroponics in areas with limited seasonal sunlight.
- In the future, the application of hydroponics in providing food in areas having vast regions of non-arable land, such as deserts and mountainous terrain, will be more heavily used.

Conclusion:

Hydroponics is no miracle. It is the result of hard work on the part of numerous scientists, amateurs and entrepreneurs in their quest to perfect the crop production technology.

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It is now undergoing rapid development. In a few years time, the productivity and quality of most crops should be increased many fold by employing hydroponic technology. This technique, together with other biotechnology techniques, will contribute greatly to new developments in plant breeding, seed technology, nursery management, agronomy and pre- and post-harvest technologies. Healthy and hygienic crop produce will become within easy reach of every citizen

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