Hydroponics

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Sustainability of agriculture has been the main concern of Indian agriculture. Due to climate change and reducing land availability, it may become increasingly challenging to grow crops using traditional methods of growing outdoors on expansive farmland. Hydroponics offers a way to work around these constraints.

In news: Coimbatore's hydroponic farm delivers fresh greens within three hours of harvest
Placing it in syllabus: Agriculture
Dimensions

- What is Hydroponics?
- Techniques in Hydroponics
- Advantages of Hydroponics
- Challenges for adoption in India

Content

What is Hydroponics?

- Growing plants without soil is known as hydroponics.
- Terrestrial plants are grown with only their roots exposed to the nutritious liquid.
- Sometimes a special growing medium such as coconut coir, perlite, or limestone gravel is used.
- The nutrient-rich water contains macronutrients like nitrogen, potassium, phosphorous and calcium nitrate, and micronutrients like manganese and zinc to nourish the roots of the plants.
- It is a type of horticulture and a subset of hydroculture.
- The nutrients used in hydroponic systems can come from many different sources, including fish excrement, duck

manure, chemical fertilizers, or artificial nutrient solutions.
- It is one of the more accessible forms of modern agriculture, tackling the dual problems of water scarcity and shortage of farmland.
- Hydroponic agriculture has existed for over 3,000 years. The Hanging Gardens of Babylon being one of the often quoted examples of this technique.

Techniques in Hydroponics

Static solution culture

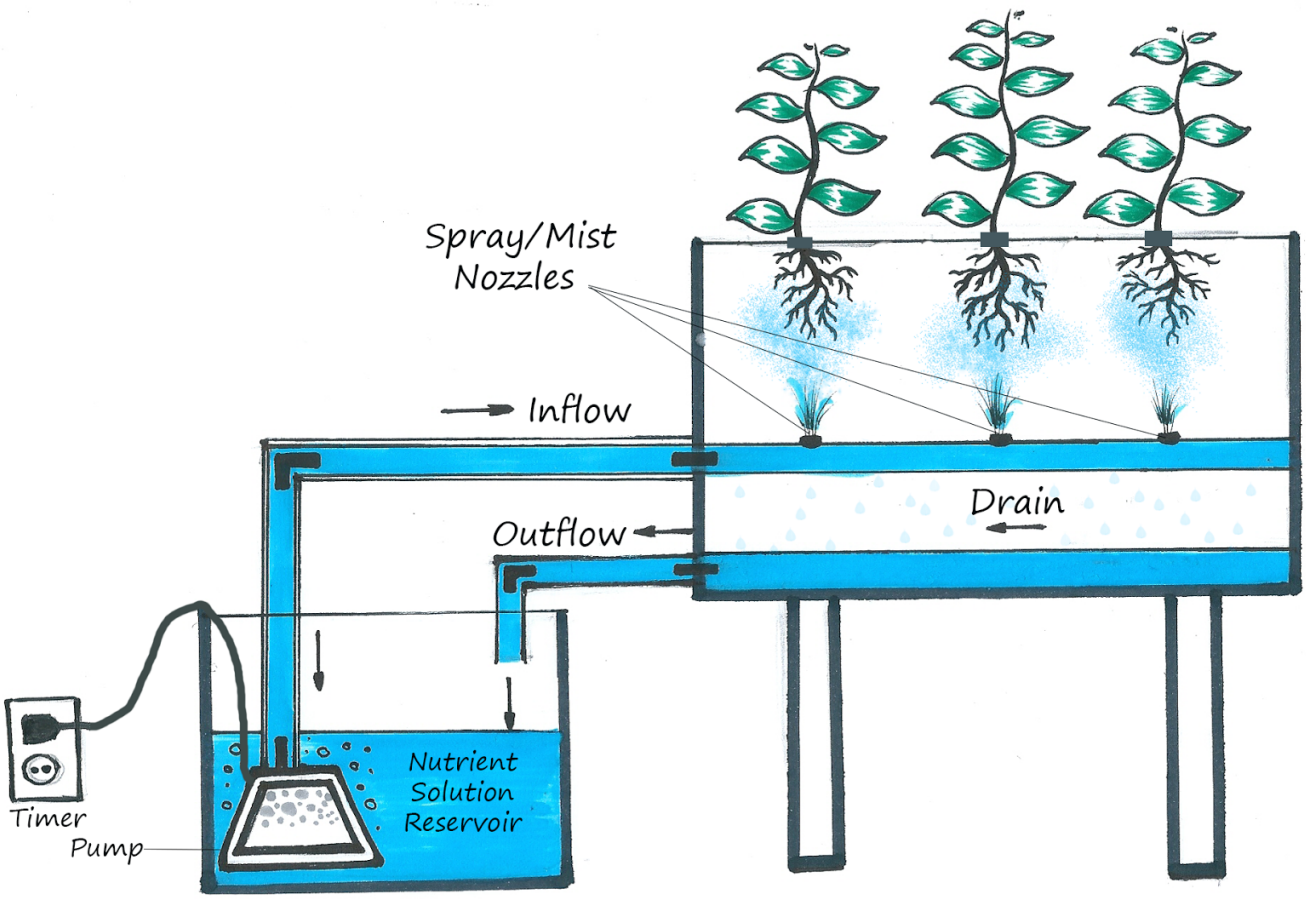
- Here, plants are grown in containers of nutrient solution, such as glass Mason jars, pots, buckets, tubs, or tanks. The solution is usually gently aerated.
- This methods is used on a small scale home-based systems

Continuous-flow solution culture

- Here, the nutrient solution constantly flows past the roots.
- It is much easier to automate than the static solution culture because sampling and adjustments to the temperature, pH, and nutrient concentrations can be made in a large storage tank.
- So it has potential to serve thousands of plants.

Aeroponics

- It is a system wherein roots are continuously or discontinuously kept in an environment saturated with fine drops (a mist or aerosol) of nutrient solution.
- It has proven to be commercially successful for propagation, seed germination, seed potato production, tomato production, leaf crops, and micro-greens.



Advantages of Hydroponics:

Hydroponics combines both sustainability and technology. The following are the advantages to hydroponic growing systems compared to conventional farming systems:

Higher Crop Yield:

- In a controlled environment hydroponics is roughly 10 times more efficient than traditional farming.
- The control on nutrient supply ensures more quality produce, for example improved oil content in herbs, as well as better crop yield.

Efficient land use:

- Hydroponics is a good method of growing food where arable land is scarce.
- Food can be grown much more densely using a fraction of the land that is required to grow crops traditionally on

large expanses of farmland.

Water Conservation:

- In hydroponics, the water used is up-cycled for reuse.
- Therefore it uses **80% less water** than conventional agriculture.

Reduces soil-borne pests and diseases:

- Many pests are carried in soil.
- Because hydroponics systems don’t use soil, it gives a more hygienic growing system with fewer problems of disease.

Year round production:

- Since hydroponics is ideal for indoor growing, it can be used to grow plants all year round.
- Automated systems controlled by timers and computers make the whole thing easier.

Mitigating climate change:

- Traditional outdoor farming may become increasingly challenging due to climate change effects such as increased erratic weather patterns, floods, and droughts.
- Hydroponics offers a way to work around many of those negative climate change impacts by growing food within a controlled environment which is often indoors.

Urban local farming:

- Hydroponic indoor growing is one way to help localize food systems in cities, where food is typically imported into cities long distances from the rural areas or from other countries.

Challenges for adoption in India

Requires precise growth monitoring:

- Hydroponic plants can not be left unattended or they will die, as they are reliant on the operator for water and nutrients.
- Farmers need to check them constantly to make sure they're growing in exactly the conditions they need.
- In conventional farming, if weather and other conditions are favourable, plants will still thrive.

High energy Requirements:

- In general, hydroponics systems can require a lot of electricity to run, especially indoor systems that rely on fluorescent lighting.
- On average, it uses 100 times more kilojoules per kilogram of energy than traditional farming.

High capital cost:

- Although hydroponics has lower costs resource wise during operation, the start-up costs of a hydroponic system are considerably more than conventional soil based planting.
- Capital costs are high because there is a requirement to buy equipment such as fans, pumps, lights, solutions, timers, growing containers and other instrumentation.

Limited Crops grown:

- Certain plants either take up too much space, or cannot thrive without soil and are unsuitable for hydroponics.
- Commercial crops can't be grown because of the high start-up costs.

Requires technical knowledge:

- A hydroponic system requires extensive technical knowledge and training in order to operate. Indian

farmers presently lack such technical knowledge.

Mould your thought: Explore the potential of hydroponic systems in Indian Agriculture.

Approach to the answer:

- What is hydroponics?
- Its advantages for Indian agriculture
- Challenges for its adoption in India
- Conclusion