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Hydroponics v/s Geoponics

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ABSTRACT

Since the advent of the civilization the open field method of farming has been used for agriculture. In a country like India where agriculture yields about 23% of the GDP employing 59% (FAO 2018) of the total work force, it is of significant importance that the farming techniques should be more up to date and that the country should take a stance on this serious issue. Day in and day out sustainability issues in land-based farming have been arising either due to poor harvest or because of insufficient profits caused by the lack of agricultural marketing. In such an environment, the paper thus explores hydroponics (a new farming technique) that can be implemented instead of geoponics (the traditional soil-based farming method).

Keywords: Agriculture, Hydroponics, geoponics, future farming, sustainability

1. INTRODUCTION

The words 'hydro' and 'ponics' are combined to form the term 'Hydroponics'. Putting together the meaning of these two words, a rough idea of water-based farming is laid out. Although today hydroponics seems a new idea, its history dates back to 600 BC where the Hanging Garden of Babylon had this farming technique. Also, in 1000AD similar characteristics to hydroponics was found in the floating gardens by the Aztecs. In the 1940's many types of hydroponic methods had been introduced and since then this method had got recognition.



Figure 1 & 2: Showing hydroponics and geoponics side to side
Source: Gardenerdy and NPR respectively

As aforementioned, geoponics (soil-based farming method) has been the main method of agriculture farming across the globe: farmers having been growing crops on soil since centuries. However, with time, newer and efficient ways of farming are making a mark. Hydroponics for instance is one of the innovative farming method that covers majority of the problems encountered with geoponics and could be an asset to the agriculturally driven places. In a place like Rajasthan where it barely rains and where

farmers face numerous problems, hydroponics can be a game changer. Thus, the focus of the paper is to explore how hydroponics can be looked as a strong option for future farming by looking at both its pros and cons.

2. LITERATURE REVIEW

Hydroponics is a Latin word meaning “working water”. In this soil less and modern farming technology, the plants are grown in water. However, the water used isn’t normal water, but one comprising different nutrients. Few of the key nutrients for hydroponics are: Nitrogen (N), Potassium (K), Phosphorus (P), Calcium (Ca), Magnesium (Mg), Sulphur (S), Iron (Fe), Manganese (Mn), Copper (Cu), Zinc (Zn), Boron (B) and Chlorine (Cl) (Uponics 2016). In addition to this, hydroponics is seen to be in the forefront in terms of commercial prospects. Keeping in mind both the commercial and environmental perspectives the paper aims to weigh hydroponics against geonics.

3.BACKGROUND HISTORY

The hydroponic farming technique has 6 different methods. These include the wick system, water culture, Ebb and Flow system commonly known as the flood and drain system, drip, N.F.T system and aeroponics.

Hydroponic systems can be divided upon their delivery of oxygen and nutrients to the roots: oxygen delivery by saturating the solution with air (classical hydroponics), by not submerging the roots at all times, or by allowing the roots to be completely exposed to the air (aeroponics).

The *wick system* is described as a passive system where nutrient solution is drawn up through a number of wicks into the growing medium. Additionally, the *water culture system* is an active system with the roots of the plant totally immersed in the water which contains the specific nutrient solutions and an air pump helps oxygenate the water and allow the roots to breathe. (Growth Technology 2018).

4.RESEARCH METHODOLOGY

To collect data, I used several sources. For the field research or the primary data collection, I carried out a small experiment wherein I compared the cost of growing a single plant by geonics to that of hydroponics. The experiment conducted was done keeping all things in the minimalistic possible i.e., using the cheapest method in hydroponics to grow the plant. On the other hand, for secondary research I read several articles in the newspapers and also scrapped e-articles to get further data and knowledge on this topic. To support the claims, I also used a few experiments and research papers done by professionals in the field.

5.FINDING AND ANALYSIS

The data collected from the above research was complied and organized. The results of the study are presented below.

6. ADVANTAGES OF HYDROPONICS OVER THE TRADITIONAL FARMING METHOD

Surplus and Scarcity: With more and more urbanization, the already scare land is getting scarcer. People are not getting adequate amount of space to stay in the city. Additionally, as the population of cities is increasing minute by minute the demand for food is growing. Mike Segar from Reuters has even termed this as “People are hungry everywhere.” (Mike Segar 2018). This clearly signifies the gap in between the demand and supply for food and also brings out the most important fact of arranging for more food. In such an instance, geonics, i.e., farming with lots of land doesn’t seem a viable option. Thus, to curb this people are trying to shift to hydroponics with the advantage of growing crops in a comparatively smaller space. This is to be further explored in the next point.

Farming at heights: Farming at heights means that less space available also can be used to generate high amount of outputs. This is possible via the fact that hydro farms can be extended vertically in even places such as marginal lands, inside warehouses, water scarce areas. The possible way of doing is putting them rack by rack vertically and giving each rack or tier equal amount of care and UV, light and other facilities. This is not possible with geonics for obvious reasons and thus if comparing both the situations then it can be evident that per cubic feet hydroponics generates more output turning out to be more profitable and fruitful.



Figure 3: Farming at heights

Source: Hudson Valley News Network

Costs: Hydroponics farming has a one time cost. By one time cost it means that it is a type of capital expenditure as once the entire plant is set up, configured, personalized with items such as Air conditioner, light and has the amenities of light then there is no need to purchase these things again. The only cost that the firm will incur is the running cost by which I mean the electricity cost and the nominal seed costs. This is different to geponics as after 3-4 years of crop cutting when the lands gets less fertile the farmer needs to redo the soil for the next harvest and also a lot of hard-work goes into it which costs in terms of money and time. To prove further comparative analysis:

Table1: Cost comparisons of Geponics and Hydroponics (Jawaid Alam)

<i>Geponics</i>		<i>Hydroponics</i>	
<i>Pot</i>	10.00 Rupees	<i>Pot (Bottle)</i>	0.50 Rupees
<i>Soil</i>	5.00 Rupees	<i>Water</i>	0.00 Rupees
<i>Manure</i>	5.00 Rupees	<i>Bio-Fest-M</i>	0.00 Rupees
<i>Plant</i>	15.00 Rupees	<i>Plant</i>	15.00 Rupees
<i>Per plant Rs.</i>	35.00 Rupees	<i>Per plant Rs.</i>	16.00 Rupees

Pesticide Free: In geponics farmers generally use fertilizers and pesticides for improving the crop quality that makes the produce un-organic, medicated and of not the best quality. In hydroponics, this problem doesn't pop up. This is because there is no need for the farmer to add any kind of fertilizer to the nutrient rich water the crop extracts the required minerals and also it has been proven that hydroponically greens are better to taste. Thus, this is another aspect in which hydroponics wins over geponics.

Better Growth Rate: If you give a plant exactly what it needs and when it needs, the plant is likely to grow as healthy as genetically possible. In hydroponics, this is exactly the case as it is very much possible to create an artificial environment with the addition of light or air conditioning in an area enclosed between 4 walls. As the environment created will be suited best according to the different plants needs they'll give better results in terms of turning out to be fresher, greener and tastier to eat. This isn't possible with geponics as here the plants are exposed to the natural environment that means that no one has control over the weather: it can either rain all day or probably be too sunny for a plant like strawberry to grow. In a research conducted, it was concluded that when same quantities of tomatoes were grown in geponics and hydroponics (where the conditions were what best suited the tomato plant), the latter generated growth rate 10 times more than the former (Muhammad Umar Nadeem Qureshi 2017).

Less effort for a farmer: Once the entire system is setup the farmer doesn't have to go to different areas of a large area to water the plants or to take care of the weed. Any such problem is resolved through this modern farming. The plants in the aeroponic system for example are misted irregular intervals. This allows the farmer to concentrate on other tasks rather than water the crops.

Saves topsoil: The water compensates for the soil. For instance, the main job of the soil is to act as a support by giving grip, helping transport the water and nutrients to the leaves. In hydroponics all this is done with the use of water. (Agrifarming 2017). Large tracts of fertile land suffer from soil erosion by wind and water in geponics; however, as there is no soil in hydroponics neither there will be any issue of soil erosion nor will there be requirement for the topsoil.

Less use of water: Another environmental benefit that this modern day farming technique offers is that the built of this system enables using recycled water. Unlike geponics, here the same mineral rich water can be used for the plants again and again. This way less water is needed and thus the water is conserved. The Ebb and flood system is somewhat based mainly upon this as the unused water in it is drawn back up by the pipes for use. Additionally, it has been proven that hydroponics uses 70% less water than geponics while growing crops. This plus point of hydroponics makes it very environment friendly and incline water scarce places to adopt it. CEO and founder Manvitha Reddy uses a proprietary soil formula "that needs 60 to 70% less water and can hold moisture, releasing it slowly. A concept imported from Cuba after the Soviet Union, was forced to become self-reliant in food production." (Shobita Dhar 2013)

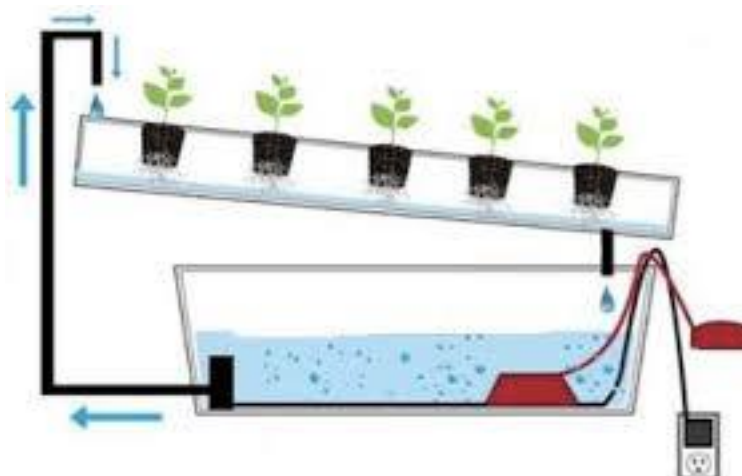


Figure 4: NFT system showing the recycling of water

Source: ResearchGate

7. DRAWBACKS OF HYDROPONICS

Expensive equipment: The equipment along with the other accessories required to set up the system are costly. First and foremost is the fact that the technology in itself is very expensive as the regulated timers along with different minerals and sensors add up to the cost. Secondly, for a farm that grows fruits or vegetables in all season will need to put air conditioners, lights, heaters, etc. in order to create a suitable environment for a plant growth. This again means it is a high cost method

Requires extensive technical knowledge: Setting up the entire plant, understanding all the operations from knowing when to water the plants to know the technicality of the sensors all is required for the system. In reality, setting up a plant will mean that the person will have to go through a lot of practical experiments and conduct a lot of trails in order to avoid an mishap or to face any emergency situation at a later stage.

8. CONCLUSION

Agriculture plays an important role across the globe and especially in countries like India, where agriculture has a huge economical impact. With rapid changes taking place in all sectors it was of prime importance to bring out hydroponics to compare it with geponics. This paper will allow people to judge this new farming technique and studying the effects allow for its implication in the real world for a futuristic farming world. As explored above, hydroponics advantages outweigh its drawbacks and the only limit to this type of farming is one's imagination.

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