

Chapter 2

Introduction to Nutrient Film Technique



The nutrient film technique is considered the most widely used system in hydroponics. The main theory involved in the NFT is the principle by which nutrient solutions in the form of a thin film is fed through the system and re-circulated for crop production. The system is widely accommodated for a variety of crop production and is ideal for short term crops such as lettuce, leafy crops and herbal vegetables.

The larger NFT systems are adaptive for more long term crop production such as cucumbers and tomatoes [24, 25]. This makes hydroponics economically attractive and with such outstanding advantages it is ideal for protection of degradation of natural resources which makes the culture efficient to countries.

2.1 Advantages and Disadvantages of Hydroponics

In any form of agriculture, there are always positive and negative aspects to growing. The margin between these is what determines the most suitable design and growing technique in order to achieve the maximum output production.

The overall advantages of hydroponics are:

- No need for soil contaminated with diseases – Soil has various associated characteristics depending on its location. Some environments are more polluted than others and this may be expressed in the soil in the form of chemical, microbial or physical contaminants. This in can result in the texture of the soil changing, the ability for it to retain nutrients are affected and chemical reactions among both wanted and unwanted chemicals can drastically affect what is feed to plants.
- Labor for field management is reduced or eliminated – In hydroponics there is less manual work as now there is no need for preparation of land such as plowing, digging holes or even banking. The construction of the system is the maximum amount of work that will ever occur.

- Economically feasible system with high yields – The output is far much greater than the input.
- Better control of nutrients and lower concentration of nutrients required as there are no losses of nutrients from leaching- When growing in the ground, nutrients are lost easily. However, in hydroponics, there is TOTAL control of the nutrients being fed to the system.
- Use of disease treated seeds – Since there is total control in hydroponics and no soil is being used, the reduction of diseases is drastically cut down. So by using disease treated seeds, the production of healthy plants is increased greatly.
- Water conservation – Water is being recycled.
- Constant statistics - As market prices fluctuate continuously due to various factors such as flooding, pest and disease and proper portions of nutrients the market price of selling your produce becomes more controlled.
- Eliminates environmental problems such as excessive cold and heat and wind and rain.
- Increases yields, size, quality and taste of products grown, color and shelf life- Healthier plants are produced as there is total control of the system.
- Boost the insect/disease resistant of the plants.
- Eliminates water quality and soil contamination (major sources of microbial contamination).
- Less space required – More plants are now grown in less space
- Less growing time required.
- Labor and garden maintenance is reduced – In hydroponics labor is greatly reduced as the skills required are more technical. There is no need for weeding or molding.
- Nutrients are recyclable- Nutrients are no longer lost as they are circulated through the pipes back to the reservoir and again through the pipes.
- Transplanting shock is reduced for seedlings – Plants can be grown from seedling stage in the hydroponic system. As they grow, adjustments can be made to the nutrient solution so there is no sudden shock in the plant.
- No crop rotation necessary- It is now a soilless environment and you are no longer dependent on nutrients from the soil. The nutrient solution is now mixed and added directly.
- Less impact on the environment (less pesticides and insecticides)- The use of pesticide is reduced and this makes the environment happy.
- Allow customers to see where and how their foods are grown – Hydroponics is such a beautiful art form of growing plants as it is clean and flawless. People would be delighted to see their food grown in such a majestic environment.
- Shelf life of produce is much longer – The use of a wide range of chemicals can affect the ability of plants shelf life. Weather disturbances also decrease the shelf life of plants as they are more susceptible to damages.
- GREENWAY OF LIFE (reduce, reuse, recycle) e.g. Water, nutrients.

2.1.1 Disadvantages

There are few disadvantages associated with hydroponics such as:

- **Cost** – The cost of systems can be very cheap but also extremely expensive. However, it all depends on the level of production wished to achieve, the location, the design, the seasonal changes and most of all the cost willing to invest.
- **Trained personnel** – The knowledge of chemistry and agriculture is very important in hydroponics. The preparation, and mixing of nutrients must be accurate, along with the analyzing of the pH and EC content.
- **Rapid spread of a disease** once it enters the system- Since the nutrients are always flowing and circulated, once a disease enters, it will be distributed quickly to all other plants.
- **Initial cost setup** can be high if not consulted properly – There are many companies willing to market their products. Since hydroponics involves the use of technology for growing, it can become very expensive if proper consultation is not given
- **Pump failure** can lead to a loss of crops if there is no backup system – If there are no backup pumps or generators, then this can lead to serious loss in production. The system must be monitored to avoid electrical failures as electricity is very important for the circulation of nutrients throughout a system.
- **Clogging of system** because of immense plant roots [15, 16, 17, 18].

Overall the advantages of hydroponics outweigh the disadvantages. Hydroponics has been constantly changing to adapt to the needs of those investing.

The elimination of soil in this form of growing has brought countless of benefits by the reducing cost and time associated with all the disadvantages from soil. It has grown from a single man practice to a commercial business.

2.2 Variety of Crops That Can Be Grown Hydroponically

A variety of crops can be grown hydroponically. However, plants have different roots and so they must be fostered to a production system that will ensure proper oxygen is available to them. Some of the crops include: herbs such as basil, chive, celery, rosemary, sage, oregano, mint and lavender; vegetables such as cabbage, cucumber, eggplant, lettuce, peas, potatoes, cauliflower, cabbage and asparagus; fruits such as tomatoes, watermelon, blue berries, straw berries, black berries and grapes. Below also highlights some of the major vegetables grown with hydroponics and the type of systems recommended. Table 2.1.

Table 2.1 Showing crops grown hydroponically and the best suited system

Crop	Type of System
Vegetables	
Lettuce, Patchoi, cabbage	NFT- easy to manage leafy vegetables
Tomatoes, sweet pepper	Drip system – These plants grow tall and troughs may not be able to hold them because of the roots
Celery	Ebb and flow – They have shallow roots and respond well to this system
Radishes	Water culture – They are best suited for this
Cucumbers	Drip system irrigation
Fruits	
Strawberries, blue berries	NFT – They require special conditions such as humidity
Water melon	NFT – Ebb and flow
Herbs	
Chive, Celery	NFT

2.3 Practice of NFT Worldwide

Hydroponics is practiced worldwide and used for the growth of countless of plants and vegetables. This culture has been implemented for both home gardening and commercial production. The size and design can be adapted to suit the needs of the investors.

In urban countries hydroponic systems can be intensive and expensive as compared to the rural areas where the operation and maintenance cost are more reduced. In simplified hydroponics, it is easy for untrained personnel to be successful as compared to the more advanced practices. However, the production is greater in the advanced systems.

Various vegetables are grown such as tomatoes in Egypt [26], lettuce and chive in Trinidad [27], Blueberry in Taiwan [28] and multiple crops in Greater Gaborone Botswana [29].

In the mainland of China, hydroponics has been introduced to maintain a good production environment [30]. It has also become increasingly popular in the United States, Canada, Western Europe and Japan where the people are highly conservative and protective of their environment [31].

Countries such as Pakistan where there are great challenges to increasing food production while maintaining the ecosystem stability and rehabilitation of the environment have implemented the use of hydroponics as the most ideal solution for overcoming their problem [24]. In the Gulf Corporation countries where water is a limited resource, hydroponics has been used for the successful growth of vegetables [32].

Overall there has been growing awareness on the environment and ecosystem in terms of the agriculture industry. Hydroponics has become a source of food security regardless of climatic changes.

Regardless of the size of operation, hydroponics is beneficial to those invested in it as the outcomes outweigh the regular farming production.