

FACT SHEET ON: Hydroponics

Water is not a plentiful resource in Namibia. With the use of hydroponics, Namibia would be able to optimize their food production and limit the amount of water consumed. It could result in higher food security as well as growth within the agricultural sector of the economy in terms of livestock feed or other products. The purpose of this fact sheet is to share information on hydroponics and why it is a practice that can benefit the agricultural industry in Namibia.

Introduction

Hydroponics is the growth of plants without soil, achieved through a non-soil media and nutrient rich water mixture to encourage plant growth. It is a form of climate-smart agriculture that can provide a sustainable method for obtaining food security in the face of climate change. Hydroponics relies on reusing the same nutrient water for many cycles to minimize excess water usage while also potentially increasing crop yields.

A major benefit of hydroponic systems come from its water efficiency compared to traditional methods for growing crops, making it especially useful for agriculture in arid regions. Several countries around the world have been using hydroponics as a way to get around low rainfall and natural water reserves, with countries in the Middle East setting up hydroponic complexes combined with desalination units to meet local needs for food and water (Stauffer, 2006). This water efficiency comes from the fact that most of the water remains in the system and is recycled. Namibia is another country greatly impacted by limited water resources. In 2019, Namibia entered a Drought State of Emergency where nearly 556,000 individuals are expected to be impacted by a lack of water (UNICEF, 2019). Hydroponics systems provide an additional method of agriculture that is not as dependent on water inputs and can increase production. Sustainable systems such as this have the potential to greatly improve food security within the country as access to water becomes more challenging.

“Hydroponics is a method for cultivating plants without soil, using only water and chemical nutrients.” - Sylvia Bernstein (Bernstein, 2011)



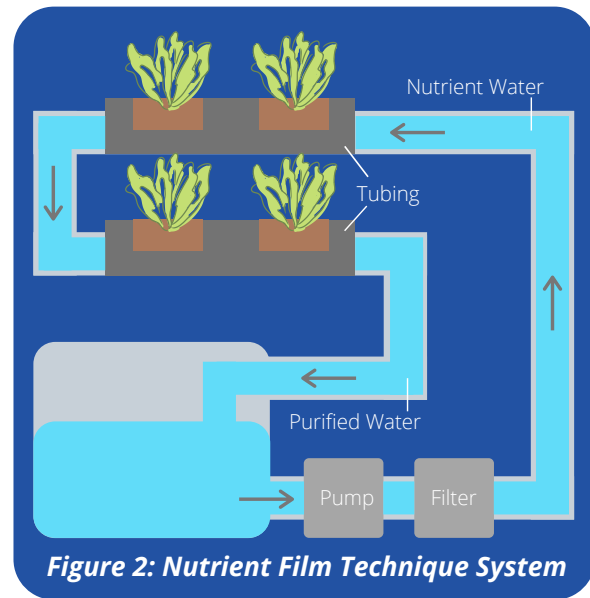
Figure 1: A-Frame NFT Hydroponic System

(Source: *Build an efficient A-frame hydroponic system*, 2017)

Hydroponic Systems

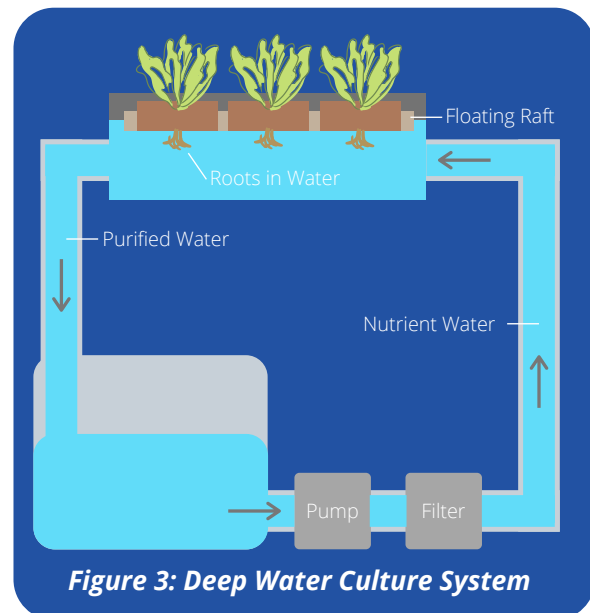
Nutrient Film Technique System

A Nutrient Film Technique System is a very common hydroponic technique for growing different types of greens. The system is typically made of a long piece of enclosed tubing with a pump that allows water to flow through it and holes cut in the top of the enclosed tubing. Small baskets with grow media are placed into the holes and this is where the plants will grow. They will be suspended above the water with their roots growing downward into the water as it flows through the pipe. The nutrient rich water will flow through the roots of each plant, providing them with their necessary nutrients. This system allows for the plants to have their ideal climate along with access to enough moisture and oxygen. Important factors to consider are the depth of the water, the flow rate and the slope of the system. This system is great because they are quite minimal and are very easy to control ((N.F.T. (nutrient film technique) system, n.d.).



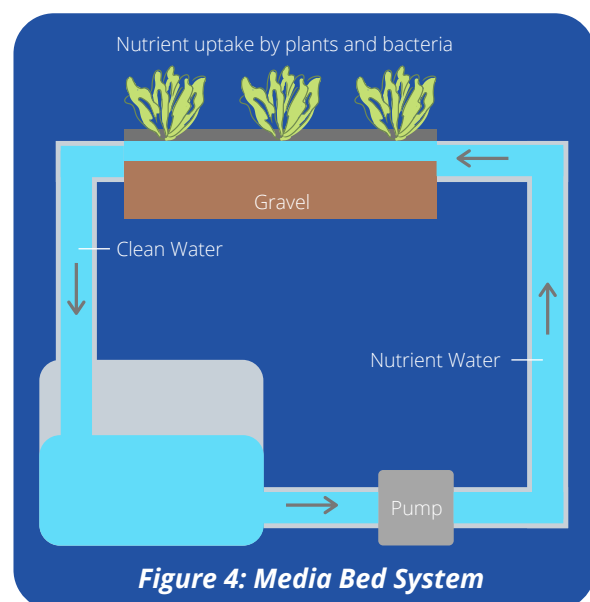
Deep Water Culture System

A Deep Water Culture System is a great and simple hydroponic system that provides plants with the necessary oxygen, water and nutrients to grow. All that is needed is a deep reservoir/container, an air pump, an air stone, tubing, net pots, growing media and hydroponic nutrients. The nutrients are mixed into the water and the deep reservoir/container is filled. The pump is connected with tubing to the airstone which sits at the bottom of the container. The net pots with growth media are then placed at the top of the container with the plants. Once the plants germinate, their roots will extend downward into the water and grow, getting their necessary nutrients from the water. The roots will be submerged 24/7. The air stone and air pump will allow for the water to be properly oxygenated for plant growth. This system will allow plants to grow twice as fast as they would if grown in soil and are quite simple to construct with very low maintenance ((DWC): What is it and how to get started, 2019).



Media Bed System

It is important to consider the location of the system with media beds because it will be largely affected by temperature, climate and light. Within this hydroponic system, the plants will be grown in media beds. These beds are typically a plastic, leak-proof box that can either be constructed or bought. The bed should be filled with growing media that allows for proper drainage, airspace and water holding capability. There are many different types of growth media to choose from that will depend on the amount of money one is willing to spend. The plants will be placed into the grow media within the beds. There is tubing on one end of the bed, attached to a pump that will fill the media bed with water until just below the top of the media. There is typically a net riser with a grate, to prevent media from interfering, that determines the water level and allows drainage of excess water back into the water source. This will control the amount of available nutrients to the plants. The water will be pumped through the system and provide the plants with their necessary nutrients. The size and depth of the media bed will depend on the type of plant that is being grown and the price point of the system (Hydroponic grow bed setup, n.d.).



Hydroponic Yield

Determinants

The crop yield of a hydroponics system is determined by a variety of factors that all must be accounted for to make a system maximize it's yield. We must first go back to the principle regarding what all plants need to grow: water, light, aeration, and nutrients.



Water: Water is essential and can be found in abundance in hydroponic systems as it is constantly cycling through the system. One thing to consider with water is filtration as, over time, minerals and other small solids can build up and clog the piping or pump, thus it is highly recommended to include some form of fine filtration to minimize this.



Light: Plants require a substantial amount of light throughout the day and for a specific time depending on the plant. In some areas of the world, this does not come naturally. This can be easily supplemented through the use of grow lighting in a greenhouse for hydroponics. Therefore, hydroponics can allow growing in areas where it would traditionally be difficult to get enough light for large crops.



Aeration: This is oxygen flow to the root systems. As in many of the designs shown above, the roots are constantly submerged in water so air becomes an important component to consider. Many systems will either have all the water discharge from the grow beds for a few minutes per cycle or use air stones which actively release dissolved oxygen into the water over time.



Nutrients: Many hydroponic mixes can be found online though some do miss out on several micronutrients plants require to grow well. To solve this, hydroponic farmers can use the Mittleider Method which involves mixing soil into your nutrient fluid to try and gain some of the more minute particles that aren't typically mixed into the fluid (Stauffer, 2006).

Food Security

Countries around the world are facing devastating challenges due to changing climates. Countries such as Namibia are greatly impacted by dry periods and severe droughts. In 2019 the Ministry of Agriculture reported that due to the ongoing drought, there was a drop in the average harvest production by 42% (UNICEF, 2019). As a result of this drop in production, nearly 18% of Namibia's population is critically food insecure, meaning that there is not a reliable access to a sufficient quantity of affordable and nutritious food. With the unemployment rate within the country at 34%, it is unrealistic for most of the population to be able to afford imported food from South Africa when their crops suffer (Central Intelligence Agency, 2020).

Food insecurity is currently being addressed in a variety of ways such as Namibia Vision 2030, Namibia's Climate Change Policy, the United Nations Sustainable Development Goals, and through Namibia's Ministry of Agriculture. Hydroponics is a sustainable tool that can be implemented within ongoing programs working to make Namibia's population food secure. It provides a resourceful method of agriculture to reduce water usage as well as increase food production. When implemented in addition to traditional agriculture there is an opportunity for communities to become food secure and therefore less reliant on imported food.

Pros and Cons of Hydroponics

Pros

- Hydroponics Systems allow for higher yield
- Allows for growing in traditionally non-arable climates
- Allows growing of plants not native to the region
- Productive from small to commercial scale
- Allows for a much faster harvest period

Cons

- Water must be occasionally changed
- Temperature and nutrient content of the water must be checked
- Certain plants are incompatible with certain systems

Conclusion

Namibia's agricultural system could benefit highly from using hydroponic systems. They greatly reduce water consumption compared to typical soil-growing agricultural techniques. Hydroponics also allows for plants to grow more effectively, with less pests, weeds and lack of nutrients or water, getting in their way (5 reasons hydroponic growing is more profitable than soil growing, 2017). They would also allow for Namibia to grow foods that otherwise wouldn't be abundant in their region. Currently, Namibia relies on South Africa for nearly 70% of their food. By implementing additional agriculture practices, there is great potential for Namibia to reduce this number (BBC News, 2019). This would allow for Namibians to have a more diversified diet with affordable options. All of this could greatly impact the nearly 430,000 individuals currently suffering from food insecurity in Namibia (Food and Agriculture Organization of the United Nations, 2020).

Glossary

Nutrients

Refers to the vitamins and minerals that plants need in order to sustain life and grow.

Cultivations

Refers to the act of caring for a plant in order to aid in its growth.

Airstone

Refers to a porous stone that diffuses large air bubbles into the water of the system. Aerating the water and allowing the plants to receive oxygen.

Food Security

The state of having reliable access to a sufficient quantity of affordable, nutritious food.

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