#2

Project Logo

FACT SHEET ON:

Aquaponics

The purpose of this fact sheet is to share information on the benefits of aquaponics to address the food insecurity challenges that Namibia currently faces.

Introduction

Namibia has a very arid and dry climate, which limits the types of crops grown in the country. Further strain has been put on the agriculture industry by climate change (Elkan, 1992). Namibia has been facing a very long drought, the worst in many decades. In May 2019, President Dr. Hage Geingob declared a Drought State of Emergency due to the drought conditions in the country. It was estimated that some 556,000 people will be affected by this drought (UNICEF, 2019). As well, the effects of this drought is causing Namibia to become very dependent on food imports. As climate change continues to impact Namibian agriculture in the form of droughts and flooding, food security is at a great risk (Goddek & Keesman, 2017).

To improve food security in Namibia in the face of climate change, new and innovative agriculture practices are needed. One practice that could help is aquaponics, a sustainable method for farming fish and growing produce. This method of agriculture can work to supplement the diets of many Namibians and provide an opportunity to sell crops by providing them with protein, vegetables and starches (Goddek & Keesman, 2017).

What is Aquaponics?

Aquaponics is the combination of aquaculture and hydroponics to produce fish and plants in a constructed ecosystem.

Aquaculture refers to the raising of fish in tanks and hydroponics refers to growing plants in water (Bernstein, 2011). The basic setup of an aquaponics system includes a fish tank connected to a grow bed for the plants.

Aquaponics Cycle

This is the cycle of how the system works:

1. The fish eat the food
2. The fish create waste in the water
3. The waste water gets pumped up to the grow bed with the plants
4. The plants take the nutrients from the waster water to grow
5. The clean water is returned to the fish tank

This cycle continually repeats, allowing the plants to get the nutrients they need to grow and the fish to have clean water in their tank.

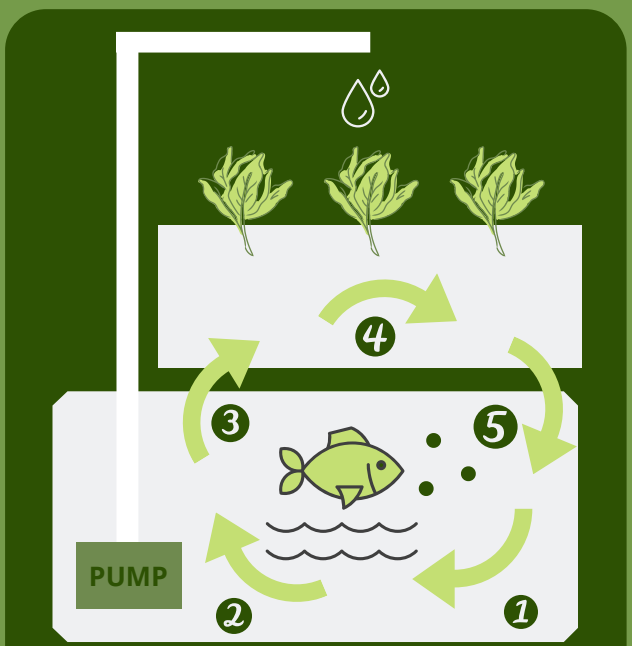

Figure 1: Aquaponics Cycle

Action Taken in Namibia

Climate change has had a huge impact on agriculture in Namibia. Rain-fed agriculture produces the bulk of the world's food yet is the most susceptible to climate change, greatly affecting food security. Namibia's Climate Change Policy strives to protect this vulnerable industry by achieving sustainable agricultural production. This is done through several steps, such as promoting highly adaptive breeds of livestock and crop cultivars, promoting conservation agriculture and ecologically compatible cropping systems, and promoting agricultural production to best maintain and improve household income (Ministry of Environment & Tourism, 2011). These steps will also help Namibia develop climate-smart agriculture (CSA) as promoted by the Food and Agriculture Organization of the United Nations. CSA aims for agricultural methods that can provide sustainable food security in the face of climate change (Food and Agriculture Organization of the United Nations, 2020). Every Namibian can help work towards sustainable agricultural production, by implementing CSA systems like hydroponics and aquaponics.

Advantages

- **Water Efficient:** Aquaponics is much more water efficient than traditional agriculture methods, with 95% of the water put in being reused.
- **Organic Ecosystem:** Aquaponics creates a closed system that balances the nutrients naturally. No chemicals or fertilizers are needed to maintain an aquaponics system. The nutrients come from the fish waste and then are used up by the plants.
- **Low Maintenance:** The main maintenance involved in aquaponics is feeding the fish everyday. There is no need to clean or change the water or add fertilizers to the system.
- **Space Efficient:** Aquaponic systems can be adapted to fit almost any space by growing plants vertically or horizontally or stacking them on top of the fish tank.
- **Sustainable:** Aquaponics is an extremely sustainable way to grow food. It is very water efficient and, because there is no need for soil, it is suitable for dry areas without much water or nutrient rich soils. There is also very little waste produced. Any waste can be used as a fertilizer for soil-based agriculture, put in a compost pile, or if it is unharvested food it can be fed to the fish (Bishakha, 2020; Woods, 2019).

Disadvantages

- **Limitations:** Not everything can be grown through aquaponics. It is difficult to grow large crops that require many nutrients and root vegetables that need to grow in soil.
- **Set-Up Costs:** Aquaponics can be costly to set up. You must purchase parts and materials for the system, fish, and plant seeds. However, some of these costs can be reduced by reusing old materials to create your system.
- **Electricity Consumption:** The water pump for the system must run all day which can lead to high electricity costs. This can be minimized by using renewable sources such as wind or solar power. As well, the fish tank must be kept at a certain temperature. To avoid having to heat the water, you can use a greenhouse for heating.
- **Unexpected Issues:** As with starting anything new, you may run into issues. Aquaponics is more complex than traditional agriculture because you must take care of the fish and the plants. If one part of the system is not happy, the whole system will fail. It can also be difficult to balance the nutrients of a new system, which can harm the fish and the plants (Bishakha, 2020).

Fish & Crops

Aquaponics is best suited for growing leafy greens, herbs, fruits, and vegetables. Depending on the size of your system, different types of plants will grow better. This is because the larger your system is and the more fish you have, more nutrients will be produced for the plants to use. Certain plants require a higher amount of nutrients to properly grow. Some common plants that work well for small systems that produce less nutrients are lettuce, kale, spinach, mint, basil, watercress, and many other herbs. Some common plants that work well for large systems that produce more nutrients are strawberries, melons, tomatoes, peppers, cucumbers, and beans (Wood, 2019).

In an aquaponics system, there are several different types of fish you can use. However, you want to use a fish that will provide enough nutrients to the water and can also be added into your diet. The best types of fish for Namibians to use would be tilapia or koi. Tilapia provides a cheaper option compared to koi, but either can be used based on what you are more likely to consume. Fish farms in Namibia provide easy access to these fish, that can be easily bought from local markets.



Hydroponics

Aquaponics differs from hydroponics because it adds in the benefits of aquaculture.

In hydroponics, plants are grown without soil. The plants are grown in a growing media, such as gravel or clay balls, with water flowing through. The disadvantages of just hydroponics is that expensive nutrients must be put in the water and that the water must be periodically replaced to avoid buildups.

By combining hydroponics with the production of fish, aquaculture, you can solve many of these problems.

Many of the disadvantages in hydroponics and aquaculture are overcome when you combine them and use aquaponics. This is because in aquaponics, you create a self-sustaining ecosystem. This means you do not need to add chemical nutrients to the water and rarely have to replace the water. The system works together to maintain itself (Bernstein, 2011; Stauffer, 2006).

Figure 2: Leafy Greens in a Hydroponic System

Conclusion

Aquaponics provides Namibians with a sustainable and climate smart method of agriculture to implement as a tool in addition to their current methods of agriculture. Floods and droughts have severe impacts on traditional methods of agriculture. With food insecurity predicted to worsen due to the impact of climate change, there is a great need for sustainable agriculture such as aquaponics.

The opportunity aquaponics provides to supplement current diets will work to address food insecurity within the country.

Glossary

Aquaculture

Aquaculture is the method of cultivation for aquatic animals and plants in a natural or controlled environment (Bernstein, 2011).

Aquaponics

Aquaponics refers to a system where fish and plants are grown together. Fish waste in the water produces nutrients for the plants and the plants use the nutrients and provide clean, filtered water for the fish (Bernstein, 2011).

Ecosystem

An ecosystem refers to interaction of a community of organisms with their environment. When talking about aquaponics, this forms an ecosystem of fish, plants, and bacteria (Bernstein, 2011).

Food Security

Having reliable access to a sufficient and healthy quantity of food (Government of the Republic of Namibia, 2004).

Hydroponics

Hydroponics is a method of growing plants without any soil. The plants are placed in grow beds and use only water and chemical nutrients (Bernstein, 2011).

Sustainability

Sustainability in this context refers to the ability of aquaponics to protect and restore the environment, rather than harm it (Bernstein, 2011).

References

Bernstein, S. (2011). Aquaponic gardening a step-by-step guide to raising vegetables and fish together. Gabriola, B.C: New Society Pub.

Bishakha, A. (2020). 14 pros and cons of aquaponics. Retrieved April 13, 2020, from https://honestproscons.com/pros-and-cons-of-aquaponics/

Elkan, W., van der Linden, E., Andima, J., Sherbourne, R., & Amutenya, P. (1992). Namibian agriculture: Policies and prospects. Retrieved April 13, 2020, from http://econpapers.repec.org/paper/oecdevaaa/73-en.htm

Food and Agriculture Organization of the United Nations. (2020). Climate-Smart Agriculture. Retrieved April 27, 2020, from http://www.fao.org/climate-smart-agriculture/en/

Goddek, S., & Keesman, K. (2017). Aquaponics - climate smart solution to enhance food security in namibia. Wageningen University & Research.

Government of the Republic of Namibia. (2004). Namibia Vision 2030: Policy Framework for Long-Term National Development. Windhoek, Namibia: Office of the President.

Ministry of Environment & Tourism. (2011). National Policy on Climate Change for Namibia - 2011. Retrieved April 21, 2020, from http://www.met.gov.na/files/files/National%20Policy%20on%20Climate%20Change%20for%20Namibia%202011(1).pdf

Stauffer, J. (2006). Hydroponics. Cereal Foods World, 51(2), 83. doi:10.1094/CFW-51-0083

Wood, F. (2019). Top 38 best plants for aquaponics. Retrieved April 16, 2020, from https://www.aquaponicsdiyer.com/best-plants-for-aquaponics/

Woods, R. (2019). Seven benefits of having an aquaponics garden at home. Retrieved April 13, 2020, from https://www.euractiv.com/section/agriculture-food/opinion/seven-benefits-of-having-an-aquaponics-garden-at-home/

Author:
Nick Merianos, Sarah Strazdus, Sophie Antoniou, Mary Rego
Worcester Polytechnic Institute
April, 2020

Hanns Seidel Foundation

WPI

Finland-Namibia 150 years of friendship #FinNam150

Project Logo

FOR MORE INFORMATION CONTACT THE AQUAPONICS PROJECT:
Hanns Seidel Foundation Namibia, House of Democracy,
70-72 Dr Frans Indongo Street, Windhoek West
P.O. Box 90912, Klein Windhoek, Windhoek, Namibia
Tel: +264 (0) 61 237373 Fax: +264 (0) 61 232142 Email: sustainability@hsf.org.na
www.thinknamibia.org.na