Scaling Up NUTRITION
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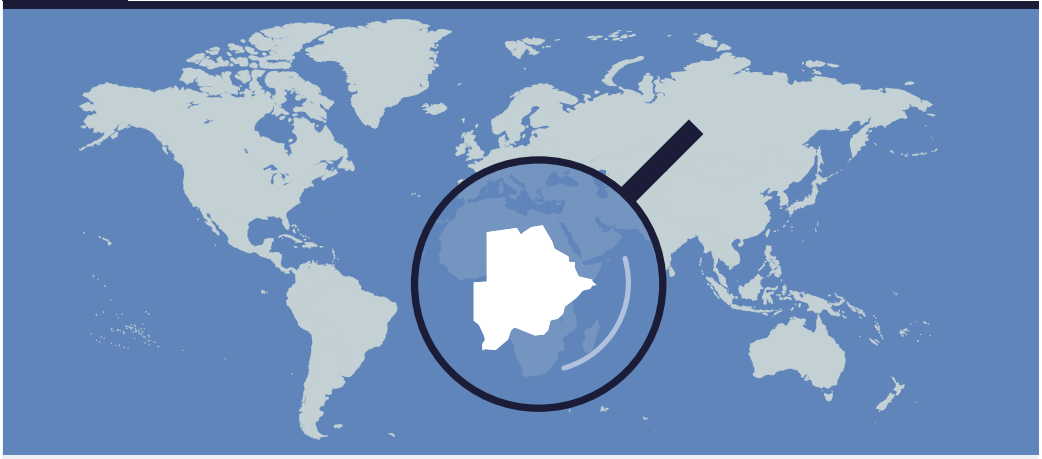
Action brief

Climate-resilient technology helps boost horticulture production in Botswana

Country: Botswana
Topics: Nutrition Sensitive
Sub-topics: Climate change

Date: 2023

Overview



Botswana, with its arid and semi-arid lands and inconsistent rainfalls, experiences multiple and regular droughts. The latest, in 2018 and 2019, led to the loss of 75 per cent of the nation's crops, according to the World Bank.

Hydroponic and aquaponic agriculture are innovative and sustainable agricultural practices that can boost horticulture production and help combat the impacts of climate change in arid and semi-arid settings. Addressing the issue of water scarcity, the techniques use much less water than conventional farming – a crucial fact for sustainable agriculture in arid regions like Botswana.

Though the agriculture sector in Botswana represents just 2 per cent of the country's gross domestic product, 70 per cent of rural households depend on agriculture for their livelihoods. Horticulture production currently meets just 54 per cent of the national demands, according to the United States of America Department of Commerce International Trade Administration, so the country

SDGs

relies largely on imports of vegetables, fruits and herbs, mainly from South Africa.

After the COVID-19 pandemic led to border closures that restricted the movement of people and goods, Botswana looked at increasing and diversifying local production to improve food security. When it reopened the borders, Botswana declared a ban on vegetable imports to encourage domestic production.

The Government of Botswana has developed a set of tools to encourage local production, including incentive packages offered by the National Development Bank for a green transition to sustainable agriculture, an impact accelerator programme to promote green technology, and the revitalization of the National Agricultural Research and Development Institute.

Objectives of the action brief

This action brief aims to show how hydroponics and aquaponics can be adapted to help grow products in arid and semi-arid settings.

Period covered

This action brief covers 2020 to 2023.

What action was taken?

Local producers have had to adapt their working techniques to Botswana's climate constraints. To help tackle the climate issue, the Green Gem company in Botswana has invested in hydroponics and aquaponics for its horticulture activities.

Hydroponics, a method of growing plants in a water-based, nutrient-rich solution, allows the production of quality vegetables, fruits and herbs with just 20 per cent of the water used in conventional farming. The advantages listed by Green Gem are numerous:

- **Better use of space.** Most hydroponics structures are vertical and therefore use less space. The indoor implementation protects from extreme weather, particularly flooding or violent winds. This system can be set up in both rural and urban areas.
- **Reduced dependence on rainfall and soil quality.** This method also helps prevent erosion and biodiversity degradation.
- **Faster growth.** The growth cycle is shorter than in conventional agriculture, leading to increased production and a more regular and reliable harvest.
- **Less water usage.** Hydroponics require a change of water about every month. 80 per cent of that water is used again (and can be reused, for example, on a small plot of conventional agriculture).
- **No pesticide usage.** Hydroponics facilitates the production of organic produce with no toxic pesticide residue.
- **Reinforced biosecurity.** Because the producing environment is controlled, there is low risk for disease and contamination.

Green Gem has been working on hydroponics since its creation in 1999. When new owners took over the company in 2016, they invested in **aquaponics**, a blend of aquaculture and hydroponics that is used to tackle the high prices of the nutrients needed in hydroponics.

In aquaponics, fish raised in tanks produce waste that can provide nutrients for plants. The plants absorb the nutrients and act as a biofilter to clean the water, which can be returned to the fish tanks. The vegetables and fish raised via aquaponics are highly nutritious and organic, providing vitamins, protein and fiber.

Green Gem is now producing several vegetables (lettuce, cherry tomatoes and green peppers) and herbs (oregano and parsley) relying entirely on these techniques. With 500 sq. m of land, Green Gem can produce 2 tonnes of vegetables every two weeks, all year long. The efficiency of aquaponics and hydroponics in this process not only ensures a consistent and

abundant harvest but also highlights its instrumental role in maximizing productivity within limited space, showcasing its unparalleled contribution to sustainable and year-round agricultural practices.

The company's units are in the capital, Gaborone, so they are as close as possible to markets. Herbs are harvested and delivered every day to ensure quality.

Green Gem also sells to restaurants and hotels to ensure stability, while individuals also are welcome. Clients have access to local and fresh products all year round, as hydroponics and aquaponics allow for the production of vegetables and herbs without respect to season or climate. People in Botswana appreciate having access to local products that meet international standards, and demand is high.

To reach people living in remote areas, the company partnered with the Government of Botswana and the non-governmental organization Palms for Life, from the United States of America. Some of the produce also is sold to local schools.

Green Gem acts as a service provider in installing and equipping the hydroponics units in 11 rural settlements. Hydroponics is particularly adapted to villages with little water and limited access to electricity, as most of the water is reused, and the pumps operate with solar panels. In partnership with the Botswana University of Agriculture and Natural Resources, Green Gem provided training to 111 students (most of them women) in the communities, including on the management and maintenance of the systems to ensure the sustainability of the project.

What would the country do differently?

Green Gem encountered several challenges while conducting activities:

- **Culture shock.** Particularly in rural areas, there was a need to showcase the work to convince people that the technique is working. The population needed to see that the produce was growing and that the process used less water.
- **Land adaptation.** Water salinity is of great importance in hydroponics. In several parts of Botswana, the high levels of sodium and bicarbonate in the water reduce the growing potential of plants. In addition, it is recommended that greenhouses be built around trees to provide shade and protect from violent winds. Some structures needed to be relocated to ensure the most efficient use of hydroponics.
- **Delivery.** The delivery of small quantities of items drastically increased transportation costs. That is why Green Gem chose to rely on restaurants and hotels to sell their production. The company also welcomes walk-in clients.
- **Startup costs.** In general, hydroponics and other climate-smart technologies require initial costs that can be difficult to absorb by small-scale farmers. That is why the Government of Botswana developed a package aimed at improving access to resources and funding.

Adaptation and applicability

While hydroponics and aquaponics can be adapted to arid and semi-arid settings, some factors need to be considered:

- **It is important to conduct a proper feasibility study, particularly regarding water salinity and the presence of trees in the selected area. Directly choosing the right location would have avoided the loss of seeds.**
- **Training is critical to ensuring the sustainability of the systems. Setting up and maintaining hydroponics and aquaponics units require skilled personnel to ensure the efficiency of the systems.**

Further information

References:

- https://knowledge4policy.ec.europa.eu/sites/default/files/sadri_drought_resilience_profile_botswana.pdf)
- https://www.trade.gov/country-commercial-guides/botswana-agricultural-sectors
- https://www.fao.org/3/br812e/br812e.pdf
- Botswana — Palms for Life (palmsforlifefund.org)

Useful links:

- https://www.ccardesa.org/green-gem-grow-365-days-botswana
- https://www.ndb.bw/green-energy-transition-sustainable-agriculture
- https://www.ndb.bw/ias
- https://research.biust.ac.bw/ws/portalfiles/portal/36893711/2020.09.19_Determining_the_efficiency_of_hydroponics_against_conventional_farming_systems_under_Botswana_conditions.pdf
- https://www.facebook.com/groups/1846238898809933/
- https://www.pressreader.com/botswana/the-voice-botswana/20210326/282376927360438

Next steps

- Green Gem would like to open a research centre focused on aquaponics and the use of organic and nutritive water.
- The company also is encouraging banks and funding institutions to learn more about climate-smart technology to allow the expansion of hydroponics and aquaponics activities in the country.

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