

Drip Irrigation For Water Scarcity In Niger

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Summary:

In Niger, 54% of the population lacks access to clean sustainable water (Reid 2023). To combat this, we propose implementing a drip irrigation system to deliver fresh clean water for agricultural purposes. This method has been proven successful in many nations such as India, where the on-farm productivity increased to 90% (Narayanamoorthy 2021). Drip irrigation is known for numerous benefits such as water conservation, crop quality, soil protection, and labor/energy efficiency. For above-ground drip irrigation systems, the pricing varies anywhere from \$223-\$2000 depending on the size of the field. For underground drip irrigation systems, the pricing varies from \$815-\$4335 depending on the size of the field (Lawn Love 2023). Although it may be expensive at first, it reduces overall costs for farmers. Farmers will save tremendously due to lower labor costs and energy efficiency. The drip irrigation system is always monitored, thus it will only turn on when the crop needs water.

Introduction:

Water scarcity is a problem that communities in Niger face constantly. Water is essential to sustain ecosystems, and maintain hygienic/sanitation purposes, and agriculture. Depending on your environment, you may believe that fresh water will still be readily available for the foreseeable future but to put it bluntly that just isn't true. Only 3% of the Earth consists of fresh water, while 8 billion people rely heavily on this resource (Water scarcity 2023). This fact coupled with an increasing population has led up to an estimated 3.6 billion people living in areas that could potentially be water scarce for at least one month per year and that number is expected to rise to 5.7 billion by 2050. The lack of fresh water for agricultural and drinking purposes forces people to travel long distances creating a waste of time. As a result, an estimated \$260 billion is lost globally every year due to this (Water & the economy 2023).

In this modern day and age, no person should have to worry about attaining fresh and clean water. Although there is no one magical solution to solve this issue entirely there are steps we can take to help ease the burden by implementing a drip irrigation system for Niger. Drip irrigation systems have been implemented and proven successful in the Middle East. This system is versatile, thus it can be used for communities and agricultural purposes. In order to argue for our proposal, we will include a project description that will describe the technical aspects of the proposal, its advantages, and disadvantages, along with a budget to put into perspective the resources needed for this type of project.

Project Description:

Drip irrigation is an advanced method that delivers fresh clean water directly to a plant's root zone in small precise amounts. It is able to do this through a network of pipes with emitters. This system can be modified to deliver water at different rates and frequencies depending on the crops' needs such as water requirements, soil type, or climate conditions.

Technical Aspects:

1. **System Design:** The design includes determining the crop water requirements and soil type that affect water delivery. The system needs to ensure each plant receives the same amount of water while minimizing water losses.
2. **Water Source and Delivery:** The water source for these systems can come from a river or pond. The water must be filtered first to remove any impurities that can clog the emitters. After the filtration system, the water is delivered to the plants through a piping system that can be placed either above or below the ground.
3. **Emitters:** Emitters need to be placed within the system to regulate the flow of water. They vary in different size and type. Emitters must be selected depending on numerous factors such as the crop's water requirements and soil type.
4. **Controllers and Sensors:** This system can be controlled and monitored using technologies such as timers, sensors, and remote monitoring. The controllers have to be programmed to turn off and on depending on the crop's water needs and climate conditions.
5. **Maintenance and Operation:** A drip irrigation system must be regularly maintained to ensure its best performance. This form of maintenance includes checking for leaks or clogs that can affect water delivery.

Is Drip Irrigation Feasible?

Drip irrigation is a practical method of irrigation that is successful in many developing and developed nations that face water scarcity. An example of successful drip irrigation techniques was in Israel, where 80% of their agricultural land is thriving through these systems. Drip irrigation is known to be cost-effective as it can decrease water consumption and reduce labor costs (Constantinoiu 2023).

Benefits of Drip Irrigation:

There are many benefits to implementing drip irrigation systems in Niger such as water conservation, improved crop quality, reduced labor costs, fertilizer use, soil erosion, and energy savings (Gregg.dayley 2023).

Resources Needed:

A drip irrigation system needs several resources to ensure its success. These resources include a water source and a pumping system. The type of pump will vary depending on the size of the system. The tubing that will be used to deliver water to the crops needs to be made from polyethylene, or PVC depending on the pressure requirements of the system (Drip irrigation for vegetable production 2023). Filters will need to be included to avoid clogging the emitters and ensure an equal amount of water is delivered to the plants. There will need to be several fertilizer injectors to add nutrients to the water before it enters the system.

Potential Obstacles With Resolutions:

1. Clogging: To prevent clogging, filters need to be installed with periodic maintenance.
2. Uneven Water Distribution: Pressure regulators need to be implemented to maintain consistent water pressure.

3. Training: Farmers will need to attend training sessions to learn about the design and maintenance of drip irrigation systems.
4. Maintenance: Farmers will need to schedule routine inspections and perform maintenance tasks regularly depending on the system's recommendations.

Budget:

Total Budget: \$100,000				
System Type	Estimated Cost Per System	Estimated Coverage Per System (Sqft)	Proposed Quantity to Be Installed	Cost
Above Ground	\$1,250	7,500	70	\$87,500
Under Ground	\$2,335	16,000	5	\$11,675

Conclusion:

Drip irrigation is essential in combatting water scarcity in Niger, especially in areas that rely heavily on agriculture. Due to population growth, industrialization, and climate change, there has been an increasing demand for water. Many of the methods currently used are becoming unsustainable, inefficient, and expensive. Implementing drip irrigation offers a solution to this issue by delivering water directly to the roots of the plant at a steady pace, thus minimizing evaporation or water loss. This results in farmers having significant water savings, which allows an efficient use of limited water resources. Drip irrigation will improve crop yields, thus Nigerians won't have to import resources from another nation. This will help Nigerians save costs in the long run since they won't need to pay more for the same agriculture they have

in-house. This system has made a tremendous decrease in energy as high as 50%. Studies from UC Agriculture and Natural Resources' Desert Research and Extension Center have determined that drip irrigation has reduced soil carbon dioxide emissions by 59% (Watermaster 2022).

Considering the current climate change crisis our world is in, it is important to implement sustainable water solutions like drip irrigation. Drip irrigation has helped the Middle East and now it's time for Niger to get a chance.

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