# DRIP IRRIGATION SYSTEMS FED BY RAINWATER HARVESTING

TECHNOLOGY DESCRIPTION

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Sprinkler and drip irrigation technologies allow for enhanced efficiency in the application of water for irrigation in agriculture and reduce loss of water. Drip systems apply water and minerals evenly across crops, thus helping to reduce wastage and increase crop yields. It involves the application of water at a determined rate to the root zone of crops. This significantly reduces water run loss through deep percolation or evaporation. Required minerals can also be added to the water, thus allowing for increased efficiency, minimized oversaturation, and improved productivity. Drip irrigation is most suitable for rows, field and tree crops that are grown closely together (Figure 3-1).

**Figure 0-1: Drip irrigation system in crops grown in rows in Spring Plain Agro Park, Clarendon, Jamaica.**

The benefits of each of these technologies include: -

- Supply of water to farms whenever required by crops, thereby reducing dependence on rainfall.
- Efficient drawdown on water thereby minimizing loss and conserving resources. Where groundwater is the source, efficient irrigation systems can reduce withdrawal particularly during more sensitive dry months, thus minimizing depletion of ground water levels and reducing saline intrusion in the case of coastal aquifers.
- Drip irrigation which increases the efficiency of chemical fertilizer application through fertigation and prevents resource waste and pollution of waterways from chemical residue. In general, it minimizes adverse environmental impacts such as pollution of water bodies and biodiversity loss. The improved efficiency of fertigation is also particularly beneficial to small and medium-sized farmers.

- Reduction in soil degradation and erosion associated with channel and flood irrigation, thereby reducing water sources degradation and siltation of runoff.

In Jamaica, the technologies are well known, and local supply chains are present for the supply and installation of sprinkler and drip irrigation technologies. However, there is generally low uptake by small and medium-sized farmers.

## CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The Technology Readiness Level (TRL) outlines the current state of the technology in the country. In Jamaica, sprinkler and drip irrigation are used in several farming communities and components could be sourced locally from various suppliers. Several projects have also provided efficient irrigation systems and rainwater harvesting systems to small and medium-sized farmers. These include: -

- The distribution of 2000 drip irrigation systems to small farmers across Jamaica in 2020 to help ensure that the agriculture sector continues to grow, despite the shift in rainfall pattern due to climate change.
- The Yallahs-Hope On-Farm Water Management Project quipped 315 farmers were with rainwater harvesting sheds, drip irrigation systems and critical skills to improve irrigation.

Based on the availability of material, parts, and components locally and the use of efficient water systems across the country, this technology is rated at a '*TRL 9 – System is proven in operational environment*'.

## CLIMATE RATIONALE OF THE TECHNOLOGY

Changes in Jamaica's climate over the years have led to several extreme climate events which have in turn impacted the agriculture sector (Beckford, Narker, & Bailey, 2007). Since the early 2000's, there have been notable increases in the frequency and severity of hurricanes and drought which seem to interchange from one extreme to the other, causing significant losses to the sector. Between 1994 and 2010, these events have incurred an estimated J$14,390 million in agricultural losses (RADA, 2011). High value crops like bananas, coffee and sugarcane are more vulnerable to hurricane and drought risks.

The impacts of prolonged drought periods on agriculture are also exacerbated in areas where there are poor irrigation water systems, inefficient water management and inefficient use of runoff for storage and later use, due to reliance on mainly rainfall for irrigation. Consequently, reduced rainfall periods due to climate change add more pressure since there are no alternative irrigation water sources.

Sprinkler and drip irrigation technology is seen as one of the most efficient ways to adapt to effects of climate change. Rainwater supplied systems allows farmers the opportunity of diversification of water sources and the efficient use of this increasing scarce resource, especially during times of drought. Benefits of rainwater supplied sprinkler and drip irrigation system for climate change adaptation include: -

- Efficient use of water for irrigation in agriculture thought improved timing and application of water directly to roots of the crops. Therefore, conserving water supplied for longer periods.
- Eliminates use of water conveyance channels therefore reducing water loss thought evaporation and perculation.
- Distributes water more evenly across crops, thus helping to avoid wastage and increases crop/farm yields.
- Increased water supply through the capture and stroage of rainwater for periods of drought or low rainfall.

# AMBITION OF THE TECHNOLOGY

## SCALE FOR IMPLEMENTATION AND TIME-LINE

The provision drip irrigation and rainwater harvesting systems to vulnerable farmers across Jamaica. These farmers will be required to be registered with Ministry of Agriculture and Fisheries and RADA. The project should see: -

- The provision of twenty (20) drip irrigation and rainwater harvesting system to small-sized crop farms with a lot size less than ¼ acre each year from 2022 to 2024.
- The provision of twenty (20) drip irrigation systems and rainwater harvesting systems to medium-sized crop farms with lot size between ¼ acre and 5 acres each year from 2024 to 2025.
- The provision of five (5) drip irrigation and rainwater harvesting systems supported with SPV systems for large-sized crop farms with lot size greater than 5 acres by 2025.
- Training of at least 105 farmers for the installation, operation, maintenance of drip irrigation and rainwater harvesting systems from 2022 to 2025.
- The training exercise will also include data collection component for farmers to collect and submit information on water collection and use, crop yields and production during the period 2022 to 2025.
- Data collection and analysis from farmers will allow to the success of drip irrigation and rainwater harvesting systems across Jamaica in various farm sizes and settings.
- Report on the success, benefits and challenges of drip irrigation and rainwater harvesting systems in Jamaica.
- Promotion of project successes and benefits and ways to address identified challenges among farmers through the Ministry of Agriculture to encourage farmers to implement and use such systems.

# EXPECTED IMPACTS OF THE TECHNOLOGY

- Increased water use efficiency which would also save time and money since rainwater harvesting infrastructure secures water resources to be used during periods of water stress.
- Lowers the demand on treated water while making use of nutrients such as nitrates from rainfall for farming.
- Prevent disease such as mould, plant root injury, wet melt nutrient deficiency, fungus, and insects by minimizing water contact with the leaves, stems, and fruit of plants.
- Eliminates use of open water conveyance channels therefore reducing water loss.
- Reducing weed growth in rows and conveyance channels due to decrease in water run-off.
- Distributes water more evenly across crops, thus helping to avoid wastage while increasing crop/farm yields.
- Decreases demand for labour and labour cost.
- RWHS also reduces the cost for delivering water, thus improving the economics of operations.
- Solar pumping avoids the emissions from diesel water pumps and have lower operating costs

# POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

## EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

- **Agriculture Sector Plan (2019):** The plan describes that to create an efficient and competitive commercial agriculture sector in Jamaica, systematic application of modern technology will be required in all areas of agriculture production. Therefore, it considers the use of successful practices for water management systems that are not dependent on seasonal rainfall.

- **Food and Nutrition Security Policy (2013):** The policy highlights the need for adequate provisions to of water resources by increasing funding for water use efficiency across irrigated agriculture.
- **National Water Sector Policy and Implementation Plan (2018):** The plan sets a target for the irrigation of all lands that are economically viable for irrigation to be irrigated. However, the policy highlights the use of least-cost irrigation schemes as to ensure the cost to farmers is not prohibitive.

### PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

- Sustainable water supply is key to agriculture sector and therefore policies that address best use, conservation and optimal collection and distribution should be developed.
- Integrated Water Management Policy specific to agriculture: This should consider efficient water management practices such as improved water collection and storage, water reuse and recycling, water monitoring (quantity and quality), the increased use of technology (hardware and software) for modelling and management of water for irrigation in the agriculture sector.

### COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

- Consultancy to develop recommended policy (USD $30,000.00) includes consultation with key stakeholders.
- Individual consultant to guide policy acceptance by Cabinet and integration (USD $15,000.00).
- Micro-Sprinkler: Cost for purchase and installation of a micro-sprinkler irrigation system for a ¼ acre property is US$150 to US$400.
- Drip Irrigation System: Cost for purchase and installation of a drip irrigation system for a ¼ acre farm is US$200 to US$500.
- Cost for 10 kW solar PV system approximately US$30,000 and US$250,000 for a 10 100-kW system.
- Training and Development: US$150 to US$200 to train each farmer.

# USEFUL INFORMATION

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## LINKS TO TNA REPORTS

All reports can be found at:

https://tech-action.unepdtu.org/country/jamaica/