



DRIP IRRIGATION FOR YEMEN

TECHNOLOGY DESCRIPTION

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Drip irrigation is one of the most useful water-saving methods, that has the potential to save water and nutrients by allowing water to penetrate slowly to the roots of plants, which reduces evaporation that occurs in some other irrigation systems. The principle of this method depends on supplying the crops with water in very small and continuous quantities, as a network of pipes is distributed above the surface of the soil and sometimes under the surface of the soil. The discharge from a single emitter of water ranges between 2 to 10 liters per hour. Advanced drip irrigation systems, equipped with tensiometers or programmed tools to monitor and optimize irrigation quantity and frequency, can save up to 80% of water compared to traditional methods while significantly enhancing crop production when properly installed and managed by trained technicians. Installation of this technology requires the following:

- Pumps or pressurized water systems that take water from the source and provide pressure for delivery into pipe systems. Pressure varies from 2-3 bars to more than 10 bars.
- Filtration system.
- Pipes (including main pipeline and tubes);
- Control valves and safety valves.
- Drip emitters or mini-sprinklers and their variances.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

Drip irrigation technology is widespread in Yemen, and despite some barriers, it has spread well, especially with some international organizations adopting this technology in their projects. In Yemen, drip irrigation has spread, especially in flat plain areas and areas with water scarcity, and it has been integrated with other technologies such as plastic tunnel farming or farming in greenhouses.

The technology readiness level (TRL) in Yemen is level 7 because it has already been tested and operated on several scales. Drip irrigation is currently at level 2 in the Commercial Readiness Index (CRI), because it is commercially available in the market and locally manufactured. There is competition between locally made and exported drip irrigation materials but the cost of technology is still the main influencing factor along with low awareness and technical expertise.



CLIMATE RATIONALE OF THE TECHNOLOGY

Terracing is a time-tested agricultural practice that plays a vital role in climate change adaptation, especially in arid and semi-arid regions like Yemen. By slowing down water runoff, terracing enhances water infiltration, reduces soil erosion, and preserves soil fertility, which are critical under conditions of unpredictable rainfall and increased drought frequency. These benefits not only improve agricultural productivity but also strengthen the resilience of vulnerable communities against climate-induced risks.



Water scarcity and rainfall fluctuations in Yemen threaten livelihoods, reduce agricultural productivity, and exacerbate insecurity for vulnerable communities, particularly in rural areas. Drip irrigation is a crucial technology for efficient water use, reducing evaporation losses, and minimizing excessive water demand. It complements solar-powered water pumping by controlling water consumption, mitigating overuse. Additionally, drip irrigation reduces soil pollution by regulating fertilization, limits weed growth, and saves time and effort for farmers, making it essential for sustainable agriculture and climate adaptation.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIMELINE

The goal is to expand drip irrigation across Yemen's 22 governorates, targeting smallholder farmers, especially those with solar-powered water pumps, and key crops like coffee. Four pilot sites (12 hectares each) in Al-Mahweet, Taiz, Abyan, and Lahej will cover 192 hectares annually, reaching 576 hectares over five years (2025-2030). The program will build on successful drip irrigation projects and gradually expand, including farmer training, and will be implemented with key stakeholders, particularly the agriculture ministry. The program can be integrated with terrace technology because the coffee production is concentrated in the terrace's areas at an altitude of 100-2500 m asl. According to Al-Hakimi (2012), Yemen's total coffee cultivation area is approximately 35,000 hectares, with only 5% of coffee farmers currently using modern irrigation systems. In 10 years, According to (Al- Hakimi A., 2012)¹ Yemen can cover the total area of coffee in Yemen is 35,000 hectares, 5% of coffee farmers use modern irrigation so there are 1650 hectares covered by modern irrigation – the average size of agriculture holding 1 hectare², or less than 2 hectares³, within 9 years (three phases each 3 years) the program can cover 1728 hectares doubling the area irrigated by modern irrigation.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The ambition for drip irrigation is to achieve a TRL of 9, ensuring widespread operational deployment across Yemen. This includes adapting the technology for diverse agricultural conditions, integrating it into rural and urban farming systems, and scaling its use to support water efficiency in the agriculture sector. The ambition for the Commercial Readiness Index is to reach CRI level 5-6, indicating a mature market with competitive pricing, increased local manufacturing capacity, improved affordability, and widespread adoption. This requires reducing the cost of locally produced materials, enhancing awareness through education campaigns, and building technical expertise among farmers and technicians.

EXPECTED IMPACTS OF THE TECHNOLOGY

Drip irrigation is a technology known for saving water by up to 70% compared to traditional methods such as flood irrigation, and these will lead to:

- Expanded agricultural areas with more water available for agriculture.
- Increased crop yields -in many ways, it helps expand the cultivated area, saves water, reduces crop's diseases, and facilitates the use of fertilizers and pesticides when needed.
- Soil conservation that prevents soil erosion and nutrient leakage.

¹ Al- Hakimi A., 2012. Coffee cultivation and production in Yemen, Book published by Participatory foundation for research and dissemination, Sana'a, Yemen. in Arabic

² Yemen information Center

³ Yemen Country profile, FAO 2008



- Diversification of agriculture production because drip irrigation technology can be used for different crops and in different environments.
- A system that is easy to modify, and maintain.
- Development of sustainable income for smallholder farmers and reducing poverty through assistance from the government and relevant national and international organizations in assisting them in the initial steps of establishing a drip irrigation system - the technology is expensive for small farmers, but this support can help farmers in the future to rely on themselves in expanding, modifying and maintaining the drip irrigation system from the income obtained from crop production.
- Integration of women into irrigation operations, which were previously largely confined to men because the technology is easy to learn it by farmers
- Creation of new jobs and investment, by establishing new factories, as is currently the case in Yemen, where there are factories to produce all components of the system except for the pumping mechanism, new jobs in maintenance, and technical training.

All these factors help to obtain higher and faster returns, improve family income, fight poverty and better returns from agricultural investment.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES ABOUT THE TECHNOLOGY

There is no clear classification of the position of drip irrigation within the governmental institutional structure, but it falls within the General Administration of Agricultural Irrigation under the irrigation sector in the Ministry of Agriculture, Irrigation and Fisheries. There are many strategies, legislations and plans related to the subject of irrigation, some of which simply indicate the importance of modern irrigation methods and irrigation efficiency, including drip irrigation. The main effective policies related to drip irrigation are:

1-National Irrigation Policy (2001) includes plans for ensuring the sustainability of the country's water resources, increasing the productivity of irrigated agricultural land, and reducing governmental involvement and relying more on user groups to manage the resource

2-National Water Sector Strategy and Investment Program 2004: focusing on sustainability through water resources protection and reduction of groundwater extraction; improving farmer incomes through increased water use efficiency; enhancing water supplies; and improving institutional performance to support the farmers.

3-Water Law 2002, its amendment in 2006, and by law 2009: Encouraging farmers to use modern irrigation methods and targeted technologies that achieve savings in water use.

4-National Adaptation Programme of Action 2009; Water conservation through the reuse of treated wastewater and grey water from mosques, and irrigation saving techniques. Apply the new technology (drip techniques) into different climatic zones.

5-National Agriculture Sector Strategy 2013: Seek to more efficient agricultural water management through the adoption of modern irrigation techniques and agronomic packages within sustainable water resources management plans, and increased efforts to improve productivity in rain-fed agriculture through investment in all forms of water harvesting and through adoption of crop packages adapted to the arid environment and resilient in the face of prospective climate change.



6-Ministry of Agriculture, Irrigation and Fishery plan to enhance the role of the agricultural and fisheries sector in improving food security 2022-2027: The sub-objectives of the plan include rehabilitating irrigation infrastructure and improving water use.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

- Strengthen coordination for implementation of drip irrigation: One of the most important factors that help spread drip irrigation technology is strengthening the relationship between the main stakeholders, namely the Ministry of Water and Environment, the Ministry of Agriculture, the Chamber of Commerce, the Ministry of Industry and Trade, and the Customs Authority, as they help facilitate the import and local manufacture of drip irrigation systems, as well as their major role in supporting farmers with policies, guides, guidance, and technical support. The issue of funding is important, so coordination must include funding sources, including donors, international organizations, national financial institutions, and the national private sector.
- Improve drip irrigation-related tools and policies: Although there are many laws regulating water and the irrigation sector, these laws do not cover the issue of modern and effective irrigation techniques well. Therefore, these strategies, legislation and laws must be updated to integrate the topic of effective irrigation, including drip irrigation. Guides and procedures can also be developed to regulate work in the modern irrigation sector, especially in manufacturing, importing and marketing processes, as well as monitoring and technology support processes, as well as supporting projects aimed at spreading technology.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

<https://tech-action.unepccc.org/country/yemen/>