

IWMI technologies toolkit

5 TECHNOLOGIES | CREATED ON OCT 22, 2025 BY TAAT PROFILING TEAM | LAST UPDATED NOV 14, 2025


TECHNOLOGIES IN THIS TOOLKIT

- **Chameleon Sensor**: Soil Moisture Monitoring Sensor
- **Soil Moisture Monitoring**: Wetting Front Detector
- **Check dam**: Runoff Water Harvesting
- **Drip Irrigation**: Drip Irrigation System
- **AWD**: Alternate Wetting and Drying Irrigation System

https://taat.africa/mxh

Chameleon Sensor: Soil Moisture Monitoring Sensor

Simple signals, smarter farming

The Chameleon Sensor is a device the is used to measure and monitor soil moisture in the soil. It mimics the way a plant experiences the amount of water in the soil, measuring the effort (tension) roots need to extract moisture. Because the Chameleon Sensor measures tension, it does not require calibration for different soil types.

International Water Management Institute
Adebayo Oke

This technology is **not yet validated**.

Scaling readiness: idea maturity 8/9; level of use unknown

Inclusion assessment 4

Climate impact 7

Problem

- **Over-irrigation** wastes water, reduces fertilizer efficiency, increases costs, and can even lower yields.
- **Under-irrigation** leaves crops water-stressed, slowing growth and reducing productivity.
- **Soil degradation and salinization** happen when too much water leaches nutrients and builds up salts.
- **Pests and diseases** are encouraged by overly wet conditions.

Solution

- **Optimized irrigation**: Ensures water is applied only when crops need it, improving yields and avoiding waste.
- **Efficient fertilizer use**: Keeps nutrients in the soil for plants instead of being washed away.
- **Soil health protection**: Prevents nutrient leaching and salt build-up, keeping soils productive.
- **Pest and disease reduction**: Avoids overly wet conditions that encourage harmful organisms.

Key points to design your project

The **Chameleon™ Soil Water Sensor** is a low-cost, colour-coded tool that shows farmers when to irrigate (blue = wet, green = good, red = dry). It prevents over- and under-irrigation, saving water, protecting soil health, and boosting yields.

For projects:

- **Costs**: USD 66 (Card kit) or USD 200 (Wi-Fi kit), sensors last 2–4 years.
- **Procurement**: Source via licensed manufacturers (e.g., RIEng, South Africa).
- **Training**: Extension agents and farmers need guidance on installation and use.
- **Outreach**: Posters, radio, and demos encourage adoption.
- **Installation**: Sensors placed at 20–60 cm depths depending on crop.
- **Partnerships**: Work with research institutes, NGOs, and extension services to scale.

Chameleon sensors help governments strengthen **water management, food security, and climate-smart agriculture**.

2 - 4 Years
Typical lifespan of a sensor

IP
Open source / open access

Commodities

Sustainable Development Goals

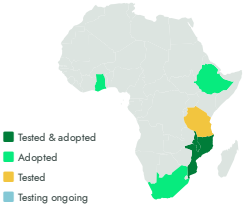
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

Categories

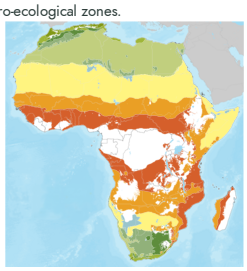
Production, Equipment, Water management

Tested/adopted in



Where it can be used

This technology can be used in the colored agro-ecological zones.

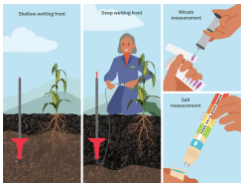


Target groups

Farmers, Soil scientists

Soil Moisture Monitoring: Wetting Front Detector

Wetting Front Detector



International Water Management Institute

Adebayo Oke

The Wetting Front Detector is a simple mechanical tool buried in the soil root zone to detect how deep irrigation or rainwater has infiltrated. When the wetting front—the boundary between wet and dry soil—reaches the device, water collects in a funnel, activating a float that raises an indicator flag above the soil surface. This shows that the soil at that depth is saturated, signaling when to stop irrigation. The device requires no electronics or power and also collects a small water sample for testing soil salinity or nutrient levels.

⚠ This technology is **not yet validated**.

Scaling readiness: idea maturity 8/9; level of use unknown

Inclusion assessment 👍 4

Climate impact 👍 5 👎 1

Problem

- Over-irrigation: Avoids excess water use and waterlogging.
- Under-irrigation: Detects insufficient watering that reduces yields.
- Invisible soil moisture: Makes root zone water movement visible.
- Nutrient and salt monitoring: Enables soil water sampling to manage fertilizer and salinity.
- Uneven irrigation: Identifies soil moisture variability for uniform application.
- Inefficient water use: Improves irrigation scheduling to save water, energy, and labor.

Solution

- **Visual guidance**: Shows when the root zone is fully watered.
- **Ease of use**: No power or electronics required.
- **Accurate timing**: Indicates when to stop irrigation.
- **Soil water sampling**: Enables nutrient and salt testing.
- **Versatile**: Works with drip, sprinkler, and furrow irrigation.
- **Resource savings**: Reduces water and energy use.
- **Learning tool**: Gives farmers immediate feedback to improve practices.

Key points to design your project

- Simple, power-free device that shows how deep water penetrates in soil to guide irrigation.
- Suitable for drip, sprinkler, and furrow irrigation systems.
- Costs about USD 36 per box containing two pairs of detectors.
- Installation depth varies by irrigation type (15-50 cm range).
- Requires proper installation, training for farmers, and communication support.
- Collaboration with local agricultural institutes and agro-dealers recommended.
- Supports sustainable, efficient, and climate-smart agricultural water management.

16 - 44 %

Range of water savings

IP

Open source / open access

Commodities

Vegetable crop

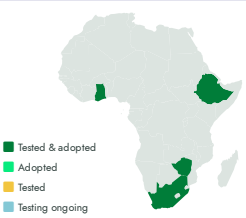
Sustainable Development Goals

Categories

Pre-production, Practices,

Water management

Tested/adopted in



Where it can be used

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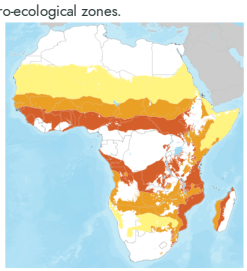


Target groups

Farmers

Check dam: Runoff Water Harvesting

The sustainable solution for irrigating your crops and watering your livestock using rainwater collected on your farm.

Water harvesting infrastructure is a practical solution for water scarcity in dry and irregular rainfall regions. It uses structures like farm ponds, check dams, and small reservoirs to capture and store water from streams and surface runoff. These systems range from small natural depressions and dug-outs to large embankment dams, providing flexible options for storing water. By collecting water that would otherwise be lost, this method ensures reliable water supply for agriculture and improves soil moisture, helping crops grow better.

International Water Management Institute
Adebayo Oke

This technology is **not yet validated**.

Scaling readiness: idea maturity 9/9; level of use unknown

Inclusion assessment 5

Climate impact 7

Problem

- **Water Scarcity:** In dry areas, farmers struggle with limited water for irrigation and livestock, causing crop losses and declining groundwater.
- **Water Waste:** Rainfall and runoff are often lost, increasing soil erosion and reducing water availability.
- **High Costs:** Traditional irrigation systems are often too expensive for small farmers.
  Need for Conservation: Affordable water harvesting structures like ponds and dams are essential to capture and store water for sustainable farming.

Solution

- Farmers, especially in drylands, face limited water availability for irrigation and livestock.
- Water harvesting structures (ponds, dams, reservoirs) capture and store runoff and streamwater, preventing its loss.
- These flexible and cost-effective systems increase irrigation, livestock watering, groundwater recharge, and erosion control, thereby strengthening climate resilience and agricultural sustainability.

Key points to design your project

Runoff Water Harvesting supports sustainable agriculture and several Sustainable Development Goals by improving productivity, water management, and land health. To integrate it into a project, follow these key steps:

1. Raise awareness and train farmers and extension agents on benefits and construction techniques suited to local conditions.
2. Select optimal sites based on topography, soil, and rainfall, and mobilize necessary tools, materials, and skilled labor.
3. Construct appropriately sized ponds or dams for efficient water storage.
4. Monitor, maintain structures regularly, manage sediment, and involve the community to ensure sustainable management and ownership.

%

IP
Open source / open access

Commodities

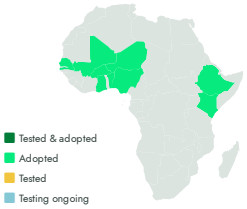
Vegetable crop, Rice, Maize, nursery

Sustainable Development Goals

Categories

Pre-production, Practices

Tested/adopted in



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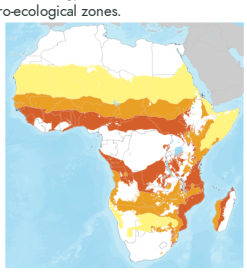


Target groups

Farmers, Governments, Fish Farmers, Cooperatives and Agribusinesses

Drip Irrigation: Drip Irrigation System

Drip Irrigation

Drip irrigation delivers water slowly and directly to plant roots using drippers placed according to plant spacing. This precise, continuous watering keeps roots moist, minimizes water loss, and can achieve up to 95% water use efficiency, making it the most efficient irrigation method.

International Water Management Institute
Adebayo Oke

This technology is **not yet validated**.

Scaling readiness: idea maturity 5/9; level of use unknown

Inclusion assessment 4

Climate impact 6 1

Problem

- Traditional irrigation wastes large amounts of water through runoff and deep infiltration.
- Open channels and broad-surface watering cause water loss during distribution.
- Surface watering exposes soil to high evaporation, increasing water demand.
- Aggressive water application in traditional methods leads to soil erosion.
- Emitters and drip hoses often clog due to debris, minerals, or algae.
- Leaks and damages in the irrigation system cause water waste.
- Overwatering or underwatering can harm crop growth and yield.

Solution

- Applies water slowly and directly to root zones, reducing water use by 30-70%.
- Uses closed tubing and precise drippers to minimize conveyance losses.
- Limits soil surface wetting, decreasing evaporation losses.
- Delivers water gently, preventing soil erosion and maintaining soil health.
- Incorporates filtration and regular maintenance to avoid emitter clogging.
- Implements leak detection and prompt repair systems to prevent waste.
- Employs smart irrigation controllers to optimize water supply and avoid over/underwatering.
- Supports fertigation for precise nutrient delivery, improving crop health and efficiency.

Key points to design your project

- Define project goals aligned with national priorities (water conservation, food security, climate resilience).
- Engage local farmers and communities for ownership and sustained use.
- Secure funding via government schemes, grants, and cooperative models.
- Assess technical capacity and provide training on design, installation, and maintenance.
- Conduct site analysis: soil, crop water needs, water source quality, topography.
- Design system layout matching crop spacing and water requirements.
- Select appropriate components: pipes, emitters, valves, filters, pressure regulators.
- Follow best installation practices: setting up water source, piping, emitter placement, testing.
- Implement monitoring for water use, crop performance, and maintenance.
- Evaluate project impact regularly and adapt based on data and feedback.

50 – 300 USD

Drip kit covering an area of approximately 100-500 m²

8,000 - 10,000 USD/Ha	500 - 700 USD/Ha	1,000 - 5,000 L	0.2 - 0.3 Bar	IP
Cost range of commercial drip irrigation systems.	Estimated energy cost for commercial drip irrigation systems.	Volume range of PVC storage tanks.	Pressure generated by storage tanks at 1-2m height.	Open source / open access

Commodities

Vegetable crop, Bananas & plantains, Pepper, Tomato

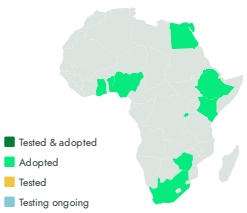
Sustainable Development Goals

2 ZERO HUNGER · 6 CLEAN WATER AND SANITATION · 13 CLIMATE ACTION

Categories

Production, Practices, Water management

Tested/adopted in



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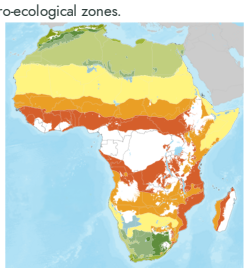


Target groups

Farmers, Advisory and Extension Services

AWD: Alternate Wetting and Drying Irrigation System

Dry Out the Methane. Green Up Your Harvest.

Alternate Wetting and Drying is a scheme-ready water-management protocol for irrigated rice. It replaces continuous flooding with controlled wet–dry cycles triggered by a subsurface water threshold, improving water productivity, maintaining yields, and reducing methane.

International Rice Research Institute

CGIAR

International Rice Research Institute (IRRI)

Adebayo Oke

Commodities

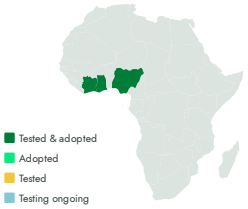
Rice

Sustainable Development Goals

Categories

Production, Practices, Water management

Tested/adopted in



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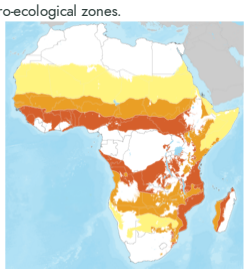

Target groups

Farmers

⚠ This technology is **not yet validated**.

8·5 Scaling readiness: idea maturity 8/9; level of use 5/9

Inclusion assessment

Climate impact 6

Problem

- Existing schemes cannot serve all farmers/hectares with current water under continuous flooding.
- Over-extraction of canals/groundwater threatens long-term water security.
- Rice methane is a significant source of national greenhouse gases, undermining climate targets.
- Public costs rise with pumping/electricity for irrigation service.
- Lack of a simple, standard water-management protocol reduces scheme efficiency.

Solution

- **Boosts Water Security** by maximizing rice production with less water.
- **Achieves Climate Goals** by cutting methane emissions by 30–50%.
- **Supports Food Security** by maintaining stable yields despite limited water.
- **Aligns with Sustainable Policies** (e.g., climate adaptation and resource management).
- **Improves Irrigation Management** by providing a protocol for controlled wet–dry cycles.

Key points to design your project

Alternate Wetting and Drying (AWD) is a **water-saving** rice irrigation method that reduces **methane emissions** by **30–70%** and **irrigation water use** by **15–30%**. It supports **climate action (SDG 13)**, **clean water (SDG 6)**, and higher **farmer income (SDG 1)**. With inclusive training, it also strengthens **women's roles** in **water management** (**SDG 5**).

To implement AWD, start by supporting **national strategies**, updating **irrigation quotas**, and aligning **agriculture** and **water institutions**. Basic **monitoring systems** and **financial incentives** like **carbon credits** help track and reward adoption.

Field-level work includes improving **irrigation infrastructure**, **land leveling**, and using simple **field tubes** to monitor water. Farmers irrigate only when the water drops **15 cm below** the surface. Training should cover this tool, **straw** and **fertilizer management**, and be inclusive of both **men and women**.

Work with partners like **IRRI**, **AfricaRice**, **local extension services**, and **farmer cooperatives**. Use **demo plots**, **visual tools**, and **simple messaging** to show farmers that AWD protects **yields**, reduces **water costs**, and increases **net income**.

15–30 %	48 %	IP
Water use reduction	Greenhouse Gas Emissions Reductions	Open source / open access

IWMI technologies toolkit

https://taat.africa/mxh

ABOUT US

TAAT

TAAT, Technologies for African Agricultural Transformation, is an African Development Bank initiative to boost agricultural productivity by rapidly rolling out proven technologies to more than 40 million smallholder farmers.

TAAT aims to double crop, livestock, and fish productivity by 2025 by engaging both public and private sectors to expand access to productivity-increasing technologies across the continent.TAAT advises African government who receive funding from international financial institutions such as the African Development Bank to help them integrate the best agricultural technologies in their development projects. TAAT also offers technical assistance for the integration of these technologies, when needed.

TAAT Technologies

TAAT definition of agricultural technologies is very broad: they include improved varieties, inputs, equipment, agricultural infrastructure, practices and agricultural policies. In short, any solution to an agricultural constraint. TAAT technologies have been developed by a wide variety of organizations: the CGIAR, other international research institutions, national research organizations, or the private sector.

TAAT Clearinghouse

Within TAAT, the Clearinghouse has the remit to select, profile and validate agricultural technologies, and showcase them in online catalogs to support the advisory role that the Clearinghouse offers to governments and the private sector. The Clearinghouse strives to be an 'honest broker' of technologies through its selection, profiling, validation and advice.

TAAT e-catalogs

The e-catalogs are designed to be used by decision-makers within governments, private sector companies or development organizations. They facilitate the search for appropriate solutions that are adapted to local conditions and requirements, and provide all necessary information, presented in jargon-free and easy to analyze technology profiles. Once a decision-maker has selected a technology of interest, the e-catalogs facilitate their direct contact with those who can help them implement the technology, whether they are a research group or a private company.

TAAT Technology Toolkits

Technology toolkits are hand-picked selections of technologies from the TAAT e-catalogs. We offer some curated toolkits for specific cases, and registered users can create their own toolkits, showcasing their selection of technologies. Toolkits can be used online and shared as links, as mini e-catalogs, they can also be downloaded, saved, shared or printed as collections of technology pitches in PDF format (pitches are one-page summaries of technology profiles, available for all technologies on the e-catalogs).

CONTACT

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