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International Commission on Irrigation and Drainage (ICID)

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Resource to Root:
The Integrated Irrigation Solution

2nd Indo Global Irrigation Summit
24-25 June 2026, New Delhi India

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The Integrated Irrigation Solution

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Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

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About Jain Irrigation Systems Ltd. (JISL)

Who We Are

Jain Irrigation Systems Ltd. (JISL) is a global leader in micro-irrigation, food processing, and agri-technology. Founded in India, JISL operates in over 120 countries and is the world's second-largest drip irrigation company, driving agricultural transformation with sustainable solutions.

Our Credentials

120+ Countries

Global presence across six continents, impacting agriculture worldwide.

50+ Years

Decades of innovation in sustainable agriculture and water management.

World's Largest

Executed the world's largest drip irrigation project, covering 12,300 hectares.

ISO Certified

Products and processes meet rigorous international quality standards.

The Problem with Traditional Irrigation

The Challenge

Conventional surface irrigation loses enormous volumes of water to evaporation, seepage, and uneven distribution — with overall project efficiencies as low as **35–40%**. Tail-end farmers receive far less water than those at the head of a canal, creating inequity and crop failure.

The Vision

To transform agricultural productivity by delivering water with precision — directly to the root zone — without increasing pressure on finite water resources

The Solution

An integrated system combining pressurized pipe networks, automation, and micro-irrigation to eliminate losses at every stage.

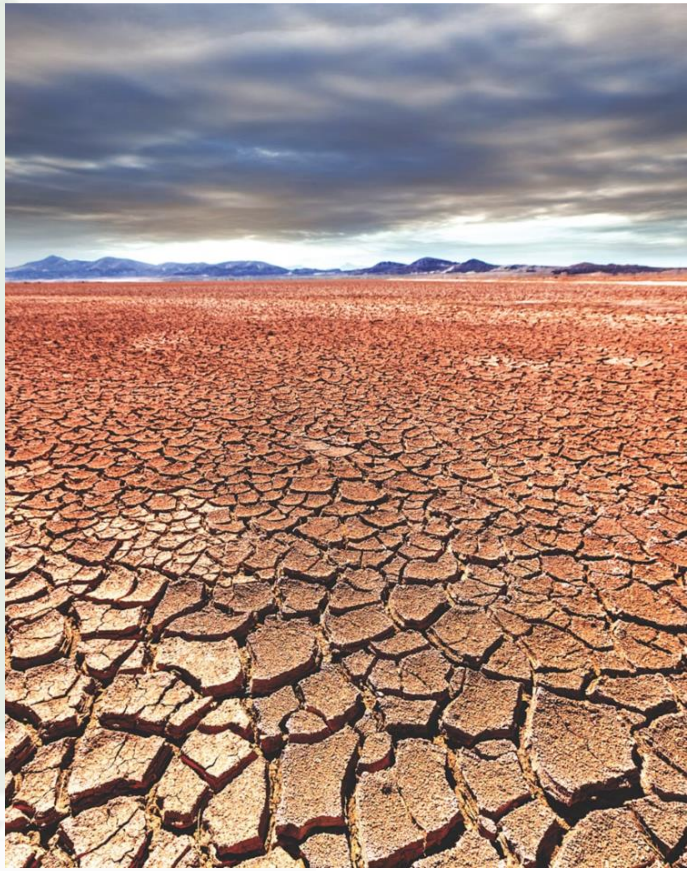
Global Water Crisis: The Urgency Behind R2R

A World Running Dry

Agriculture accounts for **70% of global freshwater withdrawals**. By 2050, water demand is projected to exceed supply by **40%**. Over **2 billion people** already live in water-stressed regions, facing dire consequences for food security, health, and economic stability.

Why Irrigation Must Change

- Conventional irrigation wastes 60–65% of water drawn.
- Groundwater depletion is accelerating in key agricultural zones.
- Climate change is intensifying droughts and reducing snowmelt, exacerbating scarcity.
- Population growth demands 50% more food by 2050, requiring innovative water management.



Transforming irrigation efficiency is not optional — it is the defining challenge of our generation.

How R2R Works: The End-to-End Flow

The Resource to Root (R2R) system is a comprehensive, multi-stage process designed for maximum water efficiency and nutrient delivery.

Water Source

Water is drawn from a canal, reservoir, or borewell, ensuring a consistent and reliable supply.

Pumping Station

Automated pumps pressurize the water to move it efficiently through the entire system.

Main Pipeline

A closed-pipe network of HDPE/PVC carries water underground, preventing evaporation and seepage.

Filtration Unit

Sand or disc filters remove sediments and impurities, protecting the drippers and ensuring clean water delivery.

Fertigation System

Precisely measured nutrients are injected directly into the water stream, nourishing plants efficiently.

Sub-main & Laterals

A detailed distribution network carries the water and nutrients to every plant row in the field.

Emitters / Drippers

Micro-emitters deliver water and dissolved nutrients directly to the plant's root zone, drop by drop, maximizing absorption.

Every stage of the R2R system is engineered to eliminate losses — from the moment water leaves the source to the moment it reaches the plant root.

Sprinkler Irrigation: Precision Above Ground

What is Sprinkler Irrigation?

Sprinkler systems distribute water through a network of pipes and rotating heads, simulating natural rainfall. This method is ideal for crops that benefit from overhead watering, cultivation on uneven terrain, and sandy soils with high infiltration rates.

Types of Sprinkler Systems

- Mini sprinklers
- Micro-jets
- Rotating sprinklers
- Fixed-head sprinklers

Key Benefits

- Achieves up to 75% water use efficiency.
- Ensures uniform water coverage across irregular terrain.
- Significantly reduces soil compaction compared to flood irrigation.
- Versatile for a wide range of crops including vegetables, orchards, and field crops.

Drip Irrigation: The Gold Standard

Why Drip is the Most Efficient Method

Drip irrigation stands out as the most advanced and water-efficient irrigation technique, delivering unparalleled precision and resource conservation directly to the plant's root zone.

Root-Zone Delivery

Water is delivered drop-by-drop directly at the plant root, minimizing evaporation and runoff, and ensuring optimal absorption.

Clog-Resistant Design

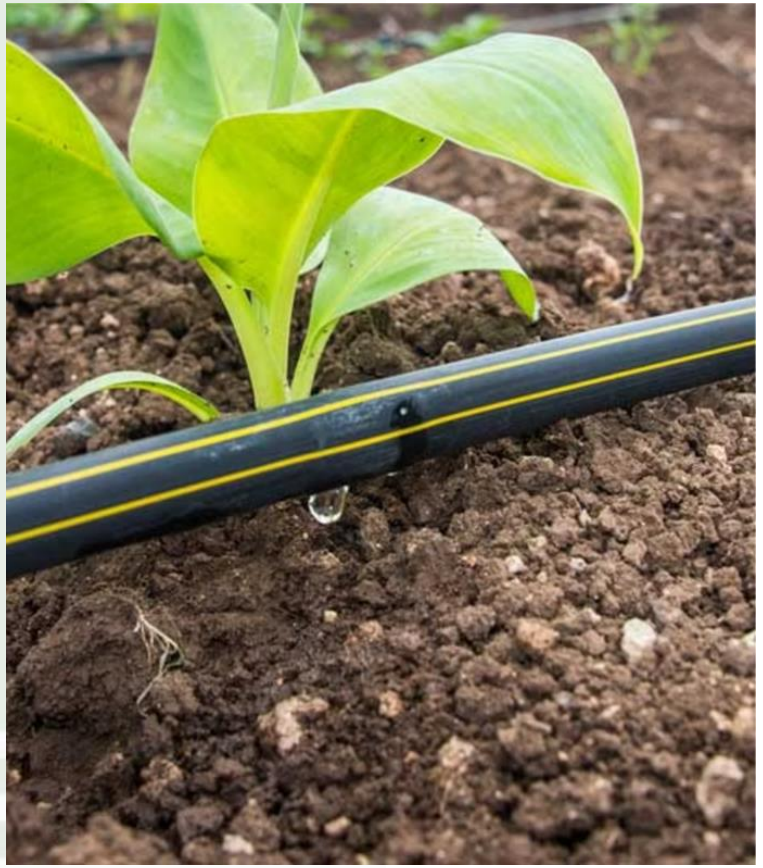
Features 5-star rated driplines with turbulent flow emitters that prevent blockages, even with marginal water quality.

Pressure Compensating

Ensures uniform emission rates and consistent water distribution, regardless of field slope or pressure variations across the system.

Inline & Online Options

Offers flexible configurations suitable for a wide array of agricultural applications, including row crops, orchards and greenhouses.



Crop-Specific Applications of R2R

Resource to Root is not a one-size-fits-all solution — it is tailored to the specific water, nutrient, and growth requirements of each crop.

Sugarcane

Drip irrigation reduces water use by 50% and increases sugar yield by 20–30%.

Cotton

Precision delivery reduces boll drop and improves fiber quality.

Banana

Consistent moisture at root zone boosts bunch weight and reduces crop cycle time.

Vegetables

Fertigation enables precise nutrient timing for high-value produce.

Rice

Alternate wetting and drying (AWD) with drip reduces methane by up to 60%.

Orchards & Vineyards

Micro-sprinklers and drip lines support fruit quality and frost protection.

Economic ROI for Farmers

Investing in R2R is not just an environmental decision — it is a sound economic one. Farmers who adopt integrated irrigation systems consistently report significant improvements in income and cost efficiency.

3x

Yield Increase

Farmers can triple their crop output with consistent, targeted irrigation and fertigation.

50%

Input Cost Reduction

Fertilizer and water costs drop significantly through precision delivery.

2 Yrs

Payback Period

Most R2R installations recover their investment within 2 growing seasons.

30%

Fertilizer Efficiency Gain

Fertigation improves nutrient absorption by up to 30% vs. broadcast application.

R2R in India: A National Transformation

India, with 18% of the world's population but just 4% of its freshwater, faces immense water-agriculture challenges. R2R is central to India's irrigation transformation.

Scale of Opportunity

India's 140M hectares of farmland has only 10 M under micro-irrigation, signaling massive untapped potential for R2R.

JISL's Contribution

Jain Irrigation has installed R2R systems across millions of Indian hectares, partnering with state governments under PMKSY and other schemes.

Impact on Farmers

Smallholder farmers in Maharashtra and Gujarat report 40–60% less water use and 2–3x net income increase with drip irrigation.

Global Adoption: R2R Across Continents

Resource to Root principles are being adopted globally, from water-scarce regions in Africa to high-value agriculture in Europe and the Americas.

India & South Asia

Largest micro-irrigation market globally, with extensive government-backed programs.

Sub-Saharan Africa

R2R enables smallholder farmers to grow through dry seasons, enhancing food security.

Middle East & North Africa

Drip irrigation is standard for water-scarce desert agriculture in Israel, Jordan, and Egypt.

Latin America

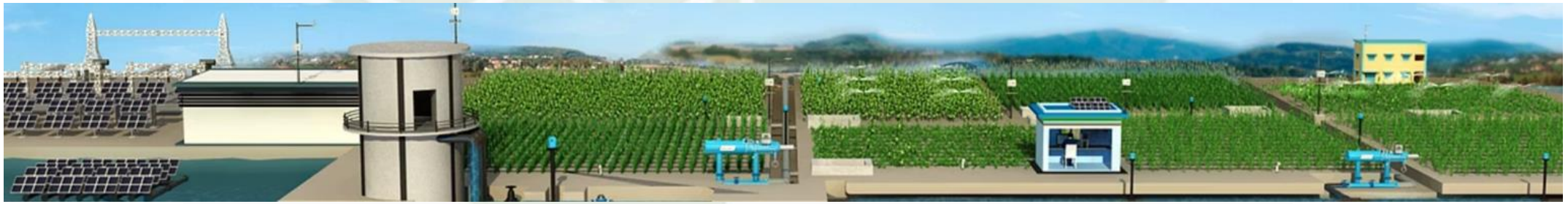
Brazil and Mexico utilize large-scale drip for sugarcane, citrus, and avocado production.

Europe

Spain, Italy, and France employ precision irrigation for vineyards, olives, and greenhouse crops.

USA & Australia

Advanced automation and sensor-based irrigation are key for high-value commodity crops.



Solar-Powered Irrigation: Energy Independence

The Energy-Water Nexus

Traditional irrigation relies on diesel or grid electricity for pumping, adding cost and carbon emissions. Solar-powered irrigation systems (SPIS) eliminate fuel costs and reduce the carbon footprint of water delivery.

How It Works

Solar panels generate DC power → Converted to AC via inverter → Powers submersible or surface pumps → Water stored in tanks or delivered directly to drip/sprinkler systems.

Key Benefits of Solar Irrigation

- Zero fuel cost after installation.
- Reduces CO_2 emissions by 1–2 tonnes per hectare per year.
- Ideal for remote areas without grid connectivity.
- Can be combined with battery storage for 24/7 operation.
- Qualifies for additional government subsidies in India and globally.

Installation & Commissioning Process

A successful R2R installation follows a structured, expert-led process — from initial site assessment to full system commissioning and farmer training.

1

Site Assessment

Soil testing, topographic survey, water source analysis, and crop mapping.

2

System Design

Hydraulic design of pipe network, pump sizing, emitter selection, and fertigation unit specification.

3

Civil Works

Pump house construction, main pipeline trenching, and header tank installation.

4

Pipe Laying

HDPE/PVC main and sub-main installation, lateral placement, and emitter fitting.

5

Automation Setup

RTU installation, valve wiring, sensor deployment, and cloud platform configuration.

6

Training & Handover

Farmer training on system operation, maintenance, and digital platform use. Ongoing agronomic support provided.

Maintenance & Long-Term System Health

A well-maintained R2R system delivers consistent performance for decades. Jain Irrigation provides comprehensive after-sales support to ensure system longevity.

Routine Flushing

Lateral lines and sub-mains should be flushed periodically to remove sediment buildup and prevent emitter clogging. Frequency depends on water quality.

Filter Maintenance

Sand media and disc filters require regular backwashing. Automated backwash systems can be integrated for large installations.

Emitter Inspection

Annual inspection of emitters for clogging, damage, or uneven distribution. Replacement of worn emitters ensures uniform application.

System Audit

Annual hydraulic audit by Jain agronomists to assess pressure uniformity, distribution efficiency, and fertigation accuracy. Adjustments made as crops and conditions change.

Water Productivity: More Crop Per Drop

The ultimate measure of R2R's value is Water Productivity — the amount of crop produced per unit of water consumed. R2R dramatically improves this metric across all crop types.

R2R consistently delivers 2–3× more crop per drop of water — the most critical metric for a water-scarce world.

Challenges & How R2R Overcomes Them

Adoption of precision irrigation faces challenges. R2R is designed to provide practical solutions for each barrier.

High Upfront Cost

Challenge: Prohibitive installation costs for smallholder farmers.

Solution: Government subsidies (up to 90%), microfinance, and cooperative models reduce effective cost to near zero.

Technical Complexity

Challenge: Farmers may lack technical knowledge for automated systems.

Solution: Jain's agronomist network provides hands-on training; IrriConnect's mobile interface requires minimal skill.

Water Quality Issues

Challenge: Turbid or saline water can clog emitters.

Solution: Multi-stage filtration and clog-resistant emitter designs handle varied water quality.

Maintenance Burden

Challenge: Systems require regular upkeep.

Solution: Automated backwash filters, remote diagnostics via IrriConnect, and annual service contracts minimize effort.

R2R Impact: A Decade of Data

Jain Irrigation's R2R implementations across India and globally have generated a rich body of impact data — demonstrating consistent, measurable outcomes at scale.

5M+

Hectares Under Micro-Irrigation

Total area covered by Jain Irrigation's drip and sprinkler systems globally.

30K+

GWh Energy Saved

Cumulative energy savings from R2R implementations compared to conventional pumping.

120+

Countries Served

JISL's global footprint spans six continents and over 120 nations.

85%

Peak System Efficiency

Achieved in the world's largest drip irrigation project (12,300 ha).

60%

Methane Reduction

Demonstrated in rice cultivation using drip irrigation vs. flooded paddy methods.

The R2R Partnership Model

Scaling R2R requires more than technology — it demands a collaborative ecosystem of government, private sector, financial institutions, and farming communities working together.

Government

Policy frameworks, subsidies, and infrastructure investment create the enabling environment.

JISL / Technology Provider

Design, supply, install, and maintain the integrated irrigation system.

Financial Institutions

Provide affordable credit, microfinance, and insurance products for farmers.

Farmers & Cooperatives

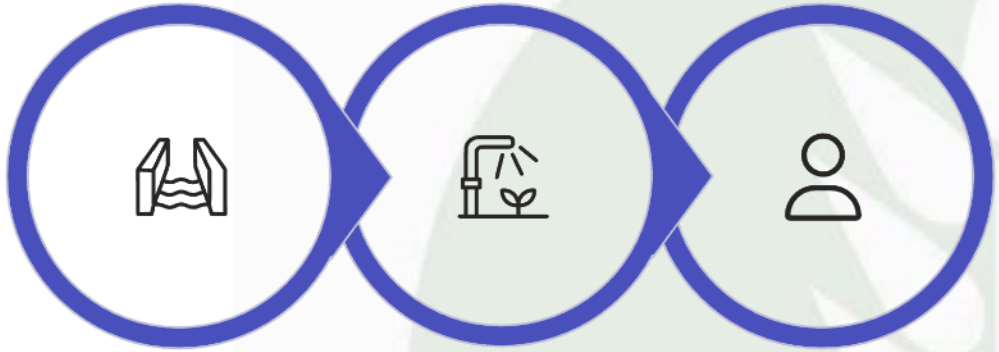
Adopt the system, manage operations, and share knowledge within communities.

Agronomists & Extension Services

Provide ongoing technical support, crop advisory, and system optimization.

When all partners align, R2R becomes a self-sustaining engine of agricultural transformation.

Implementation Framework



Source to Pipe | **Pipe to Root** | **Nutrient Management**

The R2R framework follows a seamless three-stage pathway — from water source to pressurized pipe network to precision root-zone delivery — integrating fertigation to maximize nutrient absorption and minimize waste.

Piping Infrastructure: Built to Last

Main & Sub-Mains

High-grade **HDPE** (High-Density Polyethylene) or **PVC** pipes form a pressurized underground network, eliminating surface-level water losses entirely.

100+ Year Durability

HDPE pipelines are engineered for a service life exceeding **100 years** — significantly outlasting traditional open-canal infrastructure and reducing long-term maintenance costs.

Automation & Smart Control

Wireless RTUs

Automation valves receive commands via wirelessly controlled Remote Terminal Units (RTUs) like the **IrriConnect** system, enabling remote field management.

Cloud Integration

Jain Irricare provides web-operated irrigation management, sending weekly schedules and valve status updates directly to farmers via mobile or web.

Smart Sensors

Soil moisture sensors and weather stations collect real-time data on humidity, temperature, and rainfall to dynamically adjust irrigation schedules.

Precision Components: Emitters & Fertigation

Clog-Resistant Emitters

5-star rated driplines are engineered to prevent blockages, ensuring consistent and uniform water delivery across the entire field — regardless of terrain or pressure variation.

Automated Fertigation

Systems like **Argus Controls** or **Jain Fertigation** inject nutrients directly into the water stream, tailored to specific crop growth stages — delivering the right nutrient at the right time, right to the root.

Why Fertigation Matters

Traditional fertilizer application results in high wastage through leaching and runoff. Fertigation delivers nutrients dissolved in irrigation water straight to the root zone, improving absorption efficiency by up to **30%** while reducing environmental contamination.

Case Study: Kandi – World's Largest Standalone Solar Powered Micro Irrigation Project

Kandi Belt, Talwara and Hajipur Blocks, Hoshiarpur District, Punjab

Kandi CMI (Community Micro Irrigation) project is a unique irrigation project where solar PV energy is used for pumping water from a canal to irrigate 1642 acres under command with micro irrigation — either by sprinkler or drip irrigation. Canal water is lifted with solar pumps. HDPE pipes are used for the rising main and PVC pipes for the distribution network.

1,642
Area Irrigated

1,200
No. of Beneficiaries

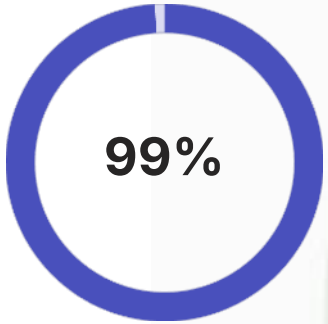
Kandi Canal (Mukherian Canal)
Water Source

Rs. 40.93 Crore
Project Cost

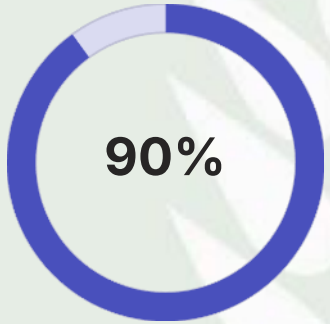
7 Years
Maintenance Contract

Solar Powered Pressurised Sprinkler/Drip
System Type

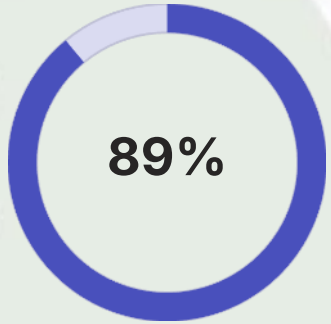
Kandi Project: Efficiency Highlights



Water Conveyance Efficiency



Field Application Efficiency (Up to)



Overall Project Efficiency

Average efficiency reflects 50% area under drip irrigation and 50% under sprinkler irrigation. On-farm drip efficiency considered at 90% for calculation.

Kandi Project: Two-Stage Implementation

01

Stage I:

- Intake from Canal by Siphon using HDPE pipes at 3 pumping locations along Canal
- R.C.C. Sumps at 3 pumping locations
- Pump Houses at 3 Canal Pump Stations
- HDPE Rising Main 180 mm to 450 mm, total length 8,160 Rmt
- Solar Pumping System with Solar PV panels for 560 KW

02

Stage II:

- Solar Pumping stations at pond intermediate stage at 11 locations
- Sumps and pump room at 11 pump stations
- PVC pipe distribution network 359,152 Rmt of 63 mm to 180 mm diameter
- Solar Pumping System with Solar PV panels for 320 KW
- Operation, control & monitoring through IrriCare automation solution

Kandi Project: Special Features

- Solar Pumping LIS with MIS
- Solar pumping with 1,000 KW PV panels
- Complete Concept-to-Commissioning Project
- Web-based, wireless irrigation management via Jain IrriCare
- 7 Years Operation and Maintenance
- Farmer training for advanced farming and cropping patterns

Kandi Project: Key Insights & Assumptions

Key Insights

10.3% Lower Life Cycle Cost

Solar saves Rs. 184 lakh over 25 years despite higher upfront capital investment

Zero Grid Dependency

100% off-grid operation; immune to power cuts, tariff hikes, and grid failures

12.6% Fewer Units Consumed

Solar requires only 15,93,600 units vs. 18,24,000 for electrical, due to higher system efficiency

Assumptions

100% Off Grid Solar Pumping Systems

Option independent of grid

Insolation is 5.4 kWh/m²/day

Land cost is not included

Solar pumping Life Cycle Cost (Rs. 1,594 lakh) is lower than Electrical pumping (Rs. 1,778 lakh) over a 25-year life, with zero electrical charges — making it the economically superior choice.

R2R as Climate Smart Agriculture

Resource to Root is a core component of **Climate Smart Agriculture**, directly addressing two of the most urgent planetary crises: water scarcity and soil degradation. By combining precision delivery, automation, and fertigation, R2R simultaneously improves yields, conserves resources, and reduces the agricultural carbon footprint — aligning food production with long-term environmental sustainability.

R2R transforms agriculture from a resource-depleting industry into a regenerative, climate-resilient system.

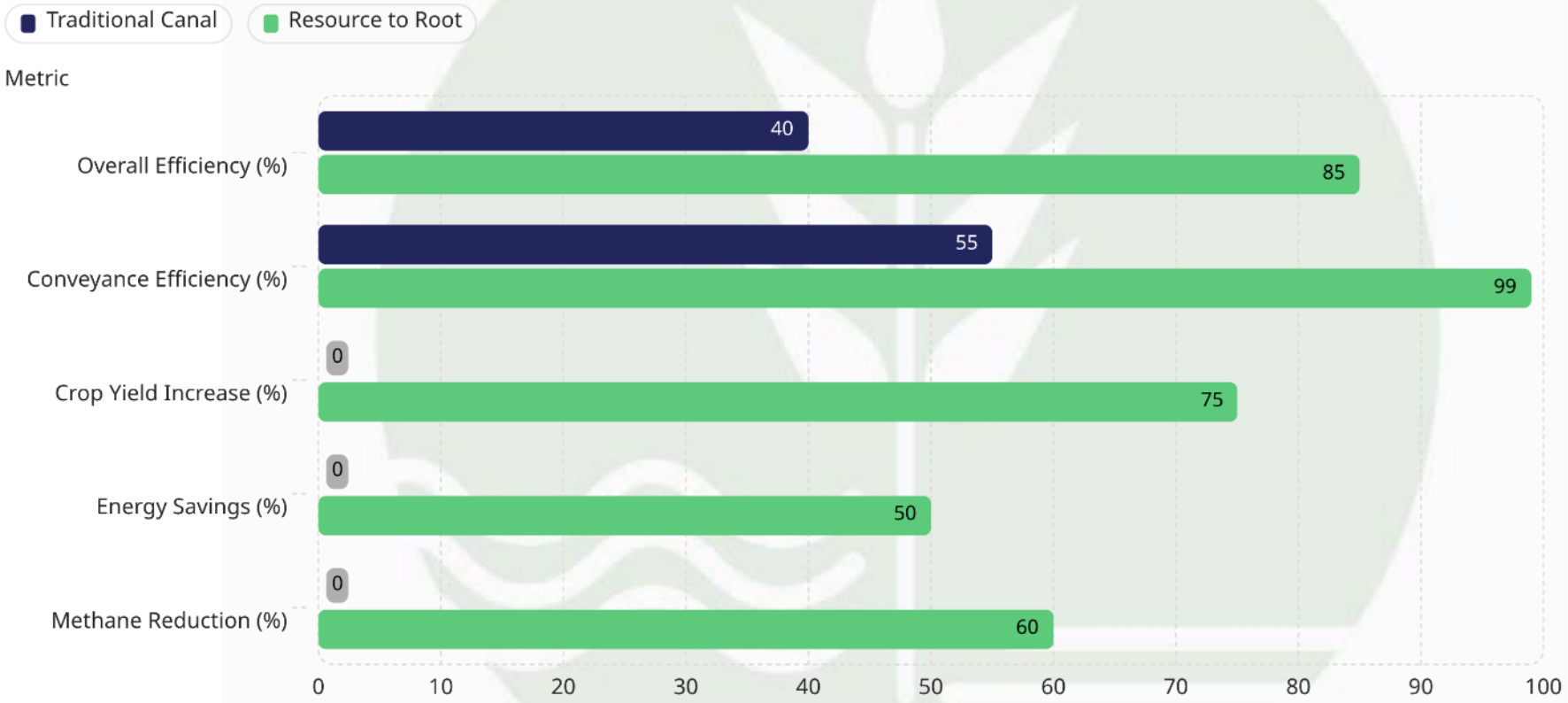
Head-to-Head: Traditional vs. Resource to Root

Feature	Traditional Canal Irrigation	Resource to Root (IIS)
Conveyance System	Open unlined/lined canals	Underground pressurized pipe network
Water Loss	High (seepage, evaporation, theft)	Minimal (near-zero evaporation/leakage)
Efficiency	35% – 45%	75% – 95%
Water Distribution	Uneven (head-reach farmers get more)	Equitable (tail-end farmers get same)
Land Usage	Large land acquisition for canals	Negligible (pipes are underground)

Comparison Continued: Yield, Labor & Soil

Feature	Traditional Canal Irrigation	Resource to Root (IIS)
Energy Impact	High pumping for low output	Energy efficient with precision pumps
Soil Health	Risk of waterlogging & salinity	Prevents erosion; maintains aeration
Fertilizer Use	Manual (high wastage/leaching)	Fertigation (direct to roots; 30% saved)
Crop Yield	Moderate/Standard	50% – 100% increase
Labor Requirement	High (manual field prep/watering)	Low (automated/mobile controlled)

Efficiency Gap: A Visual Comparison



Across every key performance metric, Resource to Root dramatically outperforms conventional canal irrigation — delivering more with less water, less energy, and less environmental impact.

Scaling R2R for Global Food Security

The Imperative

With global water scarcity intensifying and food demand rising, scaling Resource to Root solutions is no longer optional — it is essential to meeting global food security goals while protecting finite freshwater resources.

What Scaling Requires

- Policy support for infrastructure investment in pressurized pipe networks
- Farmer education and access to automation technology
- Public-private partnerships modeled on JISL's benchmark project
- Integration with national climate and sustainability frameworks

Key Takeaways

1

Efficiency Leap

R2R raises irrigation efficiency from 35–40% to 75–95%, saving up to 85% of water used in traditional systems.

2

Proven at Scale

Jain Irrigation's 12,300-hectare project proves R2R works at national infrastructure scale with 85%+ efficiency.

3

Climate Impact

Reduces energy use by 50%, methane emissions by 60%, and preserves soil health for future generations.

4

Equitable & Automated

Pressurized systems ensure fair water access for all farmers, managed remotely via cloud and mobile platforms.

The Future of Agriculture Starts at the Root

Resource to Root represents more than a technology upgrade — it is a fundamental reimagining of how humanity manages its most precious resource. By moving from wasteful open-canal systems to intelligent, precision-driven irrigation, we can **triple productivity, protect water supplies, and build a climate-resilient food system** for generations to come.

- Scaling these solutions is essential to meet global food security goals while protecting finite water resources.

Thank You

RESOURCE TO ROOT®
Integrated Irrigation Solutions

JAIN®
Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

We appreciate your time and interest in the Resource to Root integrated irrigation solution.

To learn more about how R2R can transform your agricultural operations and contribute to a sustainable future, please contact us:

Email: info@resourcetoroot.com, **Website:** www.resourcetoroot.com