

Low Cost, High Return: Smallholder Success with Drip Irrigation

Hari Krishna. B^{*1}, A. Sairam², Chilakamari Lokesh², Kadam Praveen Kumar¹, Manu S. M¹ and Machanuru Raviteja¹

¹ICAR- Indian Agricultural Research Institute, New Delhi, India

²Professor Jayashankar Telangana State Agricultural University, Hyderabad, India

Citation: Hari Krishna. B, A. Sairam, Chilakamari Lokesh, Kadam Praveen Kumar, Manu S. M and Machanuru Raviteja (2020). Low Cost, High Return: Smallholder Success with Drip Irrigation. *Environmental Reports; an International Journal*.

DOI: <https://doi.org/10.51470/ER>

Corresponding Author: Hari Krishna. B | E-Mail: (hari.agricos07@gmail.com)

Received 19 January 2020 | Revised 13 February 2020 | Accepted March 20 2020 | Available Online April 21 2020

ABSTRACT

Drip irrigation offers smallholder farmers a cost-effective solution for improving water use efficiency and crop productivity. By delivering water directly to the root zone, it reduces water loss, enhances nutrient uptake, and supports higher yields with lower input costs. This review examines the economic and agronomic benefits of adopting low-cost drip systems for small-scale farms, highlighting case studies from diverse cropping regions. It also addresses challenges such as system maintenance, initial investment, and farmer training, and presents strategies for promoting adoption and maximizing returns. The potential of drip irrigation to improve food security and livelihoods for smallholder farmers is emphasized.

Keywords: Drip irrigation, smallholder farming, water use efficiency, crop productivity, low-cost technology.

Introduction

1. The Small Farmer's Big Challenge

Smallholder farmers form the backbone of Indian agriculture, accounting for nearly 86% of all farm holdings. Yet, their challenges are immense — shrinking landholdings, erratic rainfall, depleting groundwater, and soaring input costs. For these farmers, every rupee and every drop of water count.

In this context, drip irrigation—once seen as a technology for large or commercial farms—has quietly become a game-changer for smallholders. With the right design, training, and support, drip systems are proving that you don't need deep pockets to achieve deep water savings and high returns.

2. What Makes Drip Irrigation Ideal for Small Farms?

Drip irrigation is built on a simple yet powerful idea: deliver water slowly and directly to plant roots. This eliminates wasteful losses from evaporation and runoff, ensuring that crops receive just what they need, when they need it.

For smallholders who manage less than 2 hectares, drip irrigation offers multiple advantages:

- **Efficient Water Use:** Saves up to 50–70% of irrigation water compared to flood systems.
- **Lower Energy Bills:** Reduced water pumping translates to 20–40% savings in electricity or diesel costs.
- **Higher Yields:** Improved soil moisture and nutrient availability can boost yields by 25–60%.
- **Less Labour Intensive:** Once installed, drip systems minimize the need for manual watering.
- **Precision Fertilization:** Allows direct delivery of nutrients through irrigation water, reducing fertilizer waste.
- **In short, drip irrigation helps turn limited resources into sustainable productivity—a lifeline for marginal and small farmers.**

3. Making Drip Affordable: Low-Cost Innovations

One of the biggest barriers to micro-irrigation adoption has been initial investment cost.

However, recent innovations are making drip systems more accessible than ever:

a) Gravity-Fed Drip Systems

Low-cost models operate without electricity—using small tanks or elevated drums to create pressure. These are ideal for vegetable and fruit crops in hilly or off-grid areas.

b) Sub-Unit Design for Fragmented Landholdings

Drip layouts can now be customized for small, irregular plots using simple PVC and LDPE tubing.

c) Community-Based Drip Systems

Farmers in villages share a single water source and pump, with individual outlets connected to drip laterals—reducing per capita cost.

d) DIY (Do-It-Yourself) Kits

Companies and NGOs like Jain Irrigation, Netafim, and PRADAN promote “drip kits” costing as low as ₹3,000–₹5,000 for 500 m² plots, allowing farmers to irrigate vegetables, spices, or nurseries.

These models have helped thousands of small farmers experience the benefits of micro-irrigation without heavy capital burden.

4. Real-World Success Stories

Case 1: Kitchen Garden to Commercial Crop – Jharkhand

Sunita Devi, a farmer from Gumla, installed a gravity-fed drip kit supported by NABARD's Micro-Irrigation Fund. With minimal training, she started growing vegetables year-round. Her yield increased threefold, allowing her to sell in local markets and double her family income.

Case 2: Precision in Peanuts – Gujarat

In Junagadh district, smallholder groundnut farmers adopted low-cost lateral drip lines under the “Per Drop More Crop” scheme.

They achieved 35% water savings and 28% higher yields, paying back their investment within one season.

Case 3: Group Farming for Efficiency – Tamil Nadu

A farmer group in Dindigul created a shared micro-irrigation network for 12 members. Maintenance and fertigation were handled collectively, reducing costs and improving productivity for all participants.

These cases highlight that drip irrigation is not a luxury—it's an empowerment tool for smallholders.

5. Government Support and Subsidy Programs

The Indian government has recognized that small farmers need both financial and technical support to adopt micro-irrigation.

a) Per Drop More Crop (PDMC)

Under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), farmers receive subsidies up to 55% (and up to 75% for small/marginal farmers).

b) Micro-Irrigation Fund (MIF)

Established with NABARD, this fund helps states promote micro-irrigation through cluster and community models.

c) State-Level Missions

Maharashtra, Gujarat, Telangana, and Tamil Nadu have launched special micro-irrigation missions focusing on smallholder inclusion.

These policies have made it possible for over 20 million hectares of land to be covered under drip and sprinkler irrigation across India, with smallholders leading much of this expansion.

6. Economic Returns: The Numbers Speak

According to studies by ICAR, FAO, and the World Bank, smallholder drip adoption can yield remarkable results:

Crop	Water Saved (%)	Yield Increase (%)	Payback Period (Months)
Tomato	55-60	40-50	8-10
Cotton	45	25-30	12-15
Banana	50	30	10-12
Vegetables (Mixed)	60-70	35-45	6-8

On average, the benefit-cost ratio (B:C) of drip irrigation ranges from 1.8 to 3.0, depending on crop and local conditions. For smallholders, this means the investment often pays back within one crop season.

7. Challenges Still Persist

While success stories abound, challenges remain:

- **Maintenance and Clogging:** Poor-quality water or lack of filters can block emitters.
- **Knowledge Gap:** Farmers need training on fertigation, scheduling, and troubleshooting.
- **Fragmented Land:** Tiny, irregular plots complicate design and installation.
- **After-Sales Service:** Access to spare parts and skilled technicians is often limited in rural areas.

These issues highlight the importance of capacity building and technical support alongside subsidies.

8. The Way Forward: Drip for Every Farmer

To make micro-irrigation truly inclusive, the focus should be on:

- **Scaling Community Drip Models:** Encouraging cooperative and cluster-based approaches.
- **Training Farmers:** Through Krishi Vigyan Kendras (KVKs), NGOs, and agri-startups.
- **Affordable Financing:** Expanding micro-credit and pay-per-use models.
- **Smart Add-ons:** Integrating low-cost moisture sensors and timers for automation.

When combined, these strategies can make precision irrigation a reality for every Indian farmer, regardless of land size or income.

9. Conclusion

Drip irrigation embodies the spirit of "Doing more with less". For smallholders, it is not just a water-saving tool—it's a gateway to financial independence, climate resilience, and food security. By ensuring that every drop of water produces value, India's small farmers are not just adapting to change—they're leading a quiet revolution in sustainable agriculture.

References

1. Postel, Sandra, Paul Polak, Fernando Gonzales, and Jack Keller. "Drip irrigation for small farmers: A new initiative to alleviate hunger and poverty." *Water International* 26, no. 1 (2001): 3-13.
2. Maisiri, N., Senzanje, A., Rockstrom, J., & Twomlow, S. J. (2005). On farm evaluation of the effect of low cost drip irrigation on water and crop productivity compared to conventional surface irrigation system. *Physics and Chemistry of the Earth, parts A/B/C*, 30(11-16), 783-791.
3. Polak, Paul, Bob Nanes, and Deepak Adhikari. "A low cost drip irrigation system for small farmers in developing countries 1." *JAWRA Journal of the American Water Resources Association* 33, no. 1 (1997): 119-124.