Left: Close view of the sprinkler system head promoted by IDE (Juerg Merz)
Right: Low cost sprinkler in operation (Juerg Merz)

Low cost micro-sprinkler irrigation

Nepal: फोहरा सिंचाई

An irrigation system that delivers small-sized water droplets through a rotating head allowing longer watering time with less runoff

Micro-sprinkler irrigation is an efficient and alternative method of irrigation for high value cash crops. It has been demonstrated in the Jhikhu Khola watershed (JKW) in Nepal's middle mountains by the People and Resource Dynamics in Mountain Watersheds of the Hindu Kush-Himalayas Project (PARDYP). The NGO International Development Enterprises (IDE-Nepal) has assisted private companies to assemble and market micro-irrigation systems.

Micro sprinklers are available in a variety of configurations. They operate at a low-pressure, with water delivered at a pressure equivalent to 10-20m of head, and at a low discharge rate of 0.1-0.2 lps – equivalent to the average discharge of a 1/2 inch size public tap. A pre-assembled micro-irrigation system generally consists of 4 to 8 sprinkler heads at 4m intervals connected by half inch piping. Micro sprinklers are most suitable for closely cropped vegetables like onion and garlic.

PARDYP demonstrated, tested, and promoted the system to show land users the potential to use irrigation water very efficiently, which is important because water is in short supply for much of the year after the monsoon finishes in September. In the test area, much of the land is left fallow after the monsoon crops have been harvested as it is difficult to grow winter crops because of the lack of irrigation water.

The system is easy to install and move around. It needs a reliable source of water, such as a water harvesting tank or a tap, located about 10-20m above the field to be irrigated. A water tank can be installed at the appropriate height to give an adequate water head. The preassembled micro-sprinkler heads are inserted into the ground on a support stand and are connected to the water source via a conveyance pipe. The water passes through a filter before entering the sprinkler heads to prevent the sprinklers becoming clogged up; the system needs regular cleaning.

WOCAT database reference: QT NEP21
Location: Patalekhet VDC and Kuttal village of the Jhikhu Khola watershed, Kabhrepalanchok district, Nepal
Technology area: 0.1-1 km^2
SWC measure: Management
Land use: Annual cropping
Climate: Humid subtropical
Related approach: Not described
Compiled by: Madhav Dhakal, ICIMOD
Date: November 2006

The technology was documented using the WOCAT (www.wocat.org) tool.

ICIMOD

Swiss Agency for Development and Cooperation SDC

WOCAT

Classification

Land use problems

Insufficient irrigation water during winter and the pre-monsoon season (November-May). Insufficient farm income due to small landholdings, and soil health deterioration due to increased inputs of chemical fertilisers and agrochemicals.

Land use

Annual crops: vegetables

Climate

Humid subtropical

Degradation

Physical: deterioration soil moisture problem

Water erosion: topsoil washed away by water

SWC measures

Management: from traditional to improved irrigation

Technical function/impact

Main: - spreading water (efficiently)
- increase/maintain water stored in soil

Secondary: - none

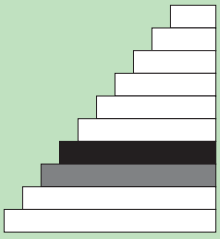
Environment

Natural environment

Average annual rainfall (mm)

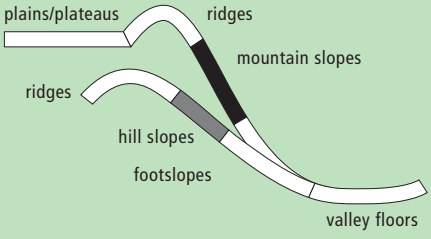
>4000
3000–4000
2000–3000
1500–2000
1000–1500
750–1000
500–750
250–500
<250

Altitude (masl)

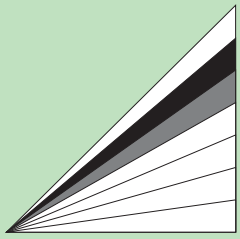


>4000
3500–4000
3000–3500
2500–3000
2000–2500
1500–2000
1000–1500
500–1000
100–500
<100

Landform



Slope (%)



very steep (>60)
steep (30–60)
hilly (16–30)
rolling (8–16)
moderate (5–8)
gentle (2–5)
flat (0–2)

Applied (large extent) Applied (medium extent)

Soil depth (cm)

0–20
20–50
50–80
80–120
>120

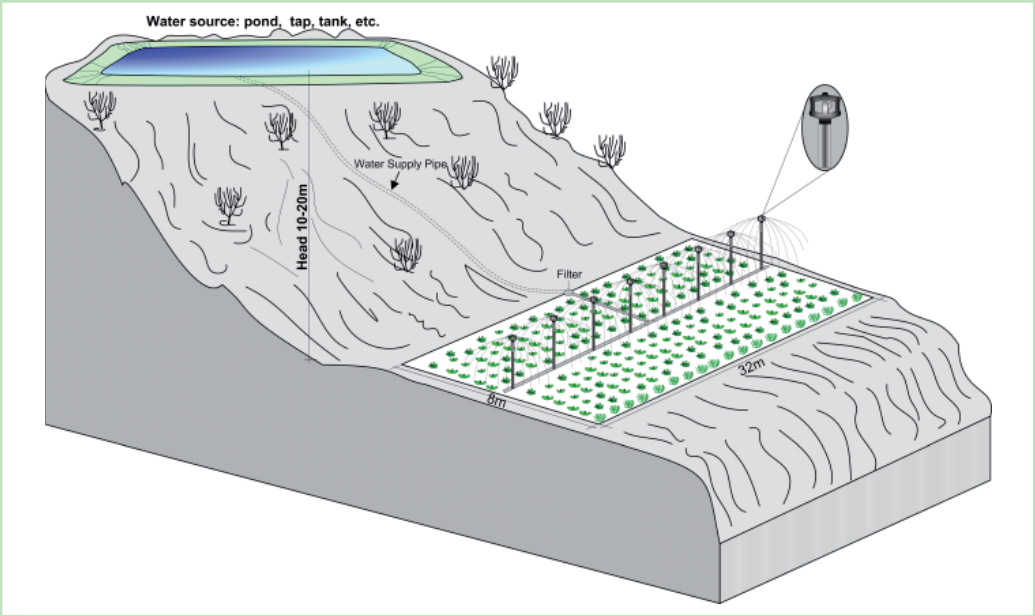
Growing season: 150 days (June to October) and 120 days (November to February)
Soil fertility: low
Soil texture: mostly fine (clay) to medium (loam)
Surface stoniness: no loose stone
Topsoil organic matter: medium
Soil drainage: medium
Soil erodibility: high

Human environment

Cropland per household (ha)

<1
1–2
2–5
5–15
15–50
50–100
100–500
500–1000
1000–10000
>10000

Land use rights: individual
Land ownership: individually owned/titled
Market orientation: mixed (subsistence and commercial – only vegetables)
Level of technical knowledge required: field staff/extension worker: low, land user: low
Number of livestock: not relevant
Importance of off-farm income: in most farm households, off-farm income plays at least a minor and increasingly a major role. Occasional opportunities for off-farm income present themselves in the form of daily labour wages. Some households' members receive regular salaries, whilst an increasing number of Nepalis are working in India, the Middle East, Malaysia, and elsewhere and sending remittance incomes home.



Technical drawing
Micro-sprinkler irrigation system and technical specification

Implementation activities, inputs and costs

Establishment activities

The establishment activities are performed with manual labour and using tools including a measuring tape and hammer, and are done at the beginning of the growing season. Major steps include:

1. Identify an appropriate water source (water harvesting tank, tap, pump) located about 10-20m above the irrigation site, or install a tank at the appropriate height
2. Fix the micro-sprinkler heads in the ground with their support stands
3. Connect sprinkler system with water source through conveyance pipes

Establishment inputs and costs per unit technology (2006)

Inputs	Cost (US$)	% met by land user
Labour (2 person days)	4.2	100%
Equipment		
- sprinkler heads	12.2	0%
TOTAL	**16.4**	**25%**

Maintenance/recurrent activities

1. Regular monitoring of the sprinklers' performance
2. Cleaning nozzles if clogging problem occurs

Maintenance/recurrent inputs and costs per growing season (2006)

Inputs	Cost (US$)	% met by land user
Labour (1 person day)	2.1	100%
TOTAL	**2.1**	**100%**

Remarks: The cost was calculated per unit of the technology with all necessary components (pipes, filter, fittings, and stand) and 4 micro-sprinkler heads, which is sufficient to irrigate an area of 250m^2. Exchange rate US$1 = NRs 73 in 2006

Assessment

Acceptance/adoption

Fifteen households accepted the technology with a 100% subsidy of the cost of the system. About 500 households in Patalekhet VDC have adopted the technology without subsidies by buying and using the sprinklers.

Drivers for adoption

- Efficient use of water
- Simple and cost-effective
- Leads to better crop production

Constraints to adoption

- Increased maintenance due to extra supervision, checking and cleaning of sprinkler system
- Many farmers do not have enough knowledge about the technology

Benefits/costs according to land users

The table shows the perceptions of land users who accepted the technology with incentives from the PARDYP project. The short-term benefits are positive even if users have to buy the system themselves.

Benefits compared with costs	short-term	long-term
establishment	slightly positive	positive
maintenance/recurrent	very positive	very positive

Impacts of the technology*

Production and socioeconomic benefits

+ + Increased farm income due to increased vegetable production

Production and socioeconomic disadvantages

none

Socio-cultural benefits

+ + + Improved knowledge of soil and water conservation and erosion: user group started sharing their knowledge on micro-irrigation

+ + Community institution strengthening: an informal network of sprinkler users formed

Socio-cultural disadvantages

none

Ecological benefits

+ + + Increased soil moisture due to precise delivery of water (0.1 - 0.2 lps)

+ Reduced soil loss due to uniform application of water to crops grown on sloping land

Ecological disadvantages

none

Other benefit

+ + Made the irrigation of multiple vegetables possible on a rotational basis as users can shift the system around to irrigate more than one plot

Other disadvantages

none

* All changes in technology may have gender and equity implications and potentially affect the members of disadvantaged groups differently. This has not been assessed here but should be considered when recommending technology use.

Concluding statements

Strengths and ➔how to sustain/improve	**Weaknesses** and ➔how to overcome
Extremely useful for closely spaced, leafy vegetables such as onions, garlic and spinach grown in small areas ➔Suitable for row crops like bitter gourd during their initial stage of growth; and also good for a wide range of row crops (tree crops and vegetables) that require low-flow irrigation	Sometimes sprinklers stop functioning as they do not rotate and can become disconnected from the pipe ➔Regular checking and cleaning
Most appropriate for sloping land ➔Can be used on level land if tank placed at appropriate height	Are susceptible to being stolen as they can be easily dismantled ➔ Regular site visits by the farmer
Easy to transport, and possible to use for different crops in rotation ➔ Position of the sprinkler head should be changed to acquire 100% overlap of watered areas	
Allows uniform distribution of water and longer watering time with less runoff; therefore reduces soil loss from sloping land and increases soil moisture status ➔The technology should be shared with a wider audience	
Sprinkler showers drive away insects ➔ As above	
Is equally useful to irrigate fallow land to increase soil moisture ➔ As above	

Key reference(s): ICIMOD (2007) *Good Practices in Watershed Management, Lessons Learned in the Mid Hills of Nepal.* Kathmandu: ICIMOD

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