Effect of irrigation methods on nutrient use efficiency

nutrient	Nutrient use efficiency (%)		
	Soil application with flood irrigation	Soil application with drip irrigation	Drip fertigation
Nitrogen	30-50	65	95
Phosphorus	20	30	45
Potassium	50	60	80

Payback period of micro irrigation for sugarcane & benefit cost (B:C) ratio

Spacing of crop (meter)	Cost of the system (Rs/ha)	Payback period	B:C ratio
0.83x1.66 paired row	47500	2-3 years	3.45

Effect of drip irrigation on water saving, yield and profit in sugarcane in Tamilnadu

Yield (t/ha)		Profit (Rs/ha)		Water saving over flood irrigation (%)
Flood irrigation	Drip irrigation	Flood irrigation	Drip irrigation	
120	160	30000	47000	29

Performance of sugarcane at Rahuri with sprinkler irrigation

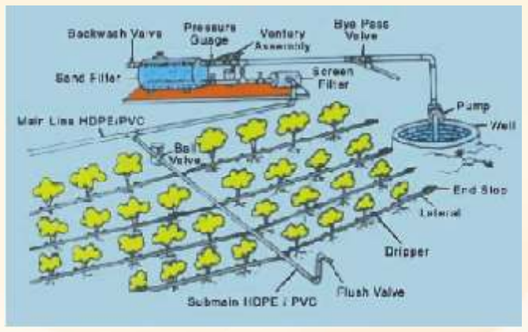
Yield (t/ha)		Irrigation water (cm)		Advantage of sprinkler irrigation	
Flood irrigation	Sprinkler irrigation	Flood irrigation	Sprinkler irrigation	Water saving (cm)	Yield increase (t/ha)
79.21	86.63	245	188	57	7.42

Benefits of drip irrigation in comparison to surface irrigation in Ahmednagar District, Maharashtra

Increase (%) in			Saving in		
Cropping intensity	Irrigation intensity	Sugarcane yield	Water (%)	Electricity (%)	Human labour (Man days/ha)
20.65	24.68	27.66	40	28	87

Source : Waykar, K.R., Shinde, H.R., Sale, Y.C., and Kasar, D.V. 2003, Indian Sugar 53 (4) : 251-259

Placement of drip laterals between sugarcane rows



Typical layout of drip irrigation system

Soil wetting pattern in drip irrigated field

MICRO IRRIGATION IN SUGARCANE

Sponsored by :
Government of India
Ministry of Agriculture
(Department of Agriculture & Cooperation)
Directorate of Sugarcane Development
8th Floor, Hall No. 3, Kendriya Bhawan, Aliganj, Lucknow - 226 024 (U.P.)

Developed, Designed and Published by Director
Indian Institute of Sugarcane Research
Rae Bareili Road, Dilkusha, Lucknow-226002

MICRO IRRIGATION IN SUGARCANE

The water availability for agricultural production is a limitation and therefore, judicious use of water is essential. Micro-irrigation techniques are now being used to mitigate water scarce situation in the water scarce sugarcane growing areas of the country in a big way.

What is micro irrigation

Micro irrigation is the frequent application of small quantities of water on, above or below the soil surface, by surface drip, subsurface drip, micro sprayers or micro sprinklers. Water is applied as discrete or continuous drops, tiny streams or miniature sprays through emitters or applicators placed along a water delivery line near the plant. Micro irrigation is characterized by low flow rate; long duration irrigation; frequent irrigation; water applied near or into the root zone of plants and low pressure delivery systems.

Micro irrigation system components

Different components used in a typical micro irrigation system may be classified in three groups:

1. Head control unit: This unit includes pump, air release valve, vacuum gauge, pressure gauge, filtration unit (Gravel/Hydro cyclone/Disc/Screen), fertigation unit, throttle valve, water meter, other fittings and accessories.
2. Water carrier system : This unit includes PVC pipeline for main and sub-main, control valve and flush valve.
3. Water distribution system: This unit includes lateral pipe and drippers, spagetthi (for connecting emitter to lateral), barbed connecter, grommet, nipple, start connector, and end cap.

The selection of the appropriate components depends on crop condition (row to row and plant to plant spacing), environmental demand for water, water quality, and availability of labour.

Why to use micro irrigation

Improved plant response: with micro irrigation crop can be irrigated frequently, enabling the soil moisture to be maintained at optimum levels for plant growth. Crop yields increase 50 to 100 per cent mainly because plants are conditioned with proper air water balance and are free from low and high water stresses and shocks. The plant growth is faster and vigorous resulting in early yield. Purity and sucrose content in juice also improves.

Increased irrigation efficiency: Micro irrigation systems make irrigation more efficient and, therefore, require less applied water.Improved irrigation efficiency is achieved due to the following factors and conditions:

- Reduced soil evaporation losses due to a smaller portion of the soil surface area being wetted
- Reduced or eliminated run off
- Minimized deep percolation due to more precise water control
- Enhanced uniformity of water application

For sugarcane crop, water utilization efficiency can be improved from 50-60% in flooding method to 90-95% in micro irrigation method. Due to water saving, 40 to 60 per cent more land can be irrigated with the same amount of irrigation water.

Improved chemical application : The consumption of fertilizers and chemicals can be reduced by up to 30 per cent, by using micro irrigation system since these are applied through water directly at the root zone of the plant in a uniform and effective way.

Reduced weed growth: Since water is applied directly to the base of the plant, weed germination between plants and plant rows is less to the extent of 50%

Decreased energy requirements: Since less water is pumped for micro irrigation, energy requirements are reduced. By irrigating one hectare sugarcane crop with micro irrigation, 1059 kwh energy is saved when compared to flood method.

Adaptability: Micro irrigation can be used on steep or undulating topography and on soils that have low infiltration rates or low water holding characteristics. Saline soils and saline water can also be used for irrigation.

Maintenance

Occasional maintenance should be carried out on all micro irrigation systems. To do this, it is needed to inspect the emitters, flush the lines by opening the end cap, and clean the filter. Depending on water quality, the frequency of filter cleaning may vary. The design of the system using filtration and quality emission components will make maintenance a simple annual task. Visual inspection of the system is the best way to observe performance. Injection of 30 per cent HCl is recommended for removal of precipitated calcium salts on the inner surface of the drip system. When the source of irrigation water is river, canal, open well etc., chlorination at the rate of 1 ppm is recommended to kill bacteria, algae etc. The frequency of acid treatment and chlorination depends on the quality of irrigation water.

Tips for trouble free irrigation with micro irrigation system

Head Assembly

- Pump's suction pipe is elevated above bottom of water source (Float the foot valve 45 to 60 cm below the water surface.)
- Water source should not contain excessive amounts of algae. If so, then treat with a non-phytotoxic algaecide like chlorine.
- Record water meter reading because decreased flow mean blockage and increased flow means leakage.
- Once the pipes filled up, check all gauges. Check pressure reading on gauges on either side of primary sand filters and if the difference in pressure is 0.35 kg/cm^2 or greater, the filters need to be backwashed.
- Check pressure reading on gauges on either side of the secondary filter. If there is more than 0.35 kg/cm^2 pressure difference between the gauges, clean secondary filter.
- Watch thread combinations and make sure that the same kinds of threads are put together. These are pipe thread and hose thread. The threads of different types are not compatible and one will strip out if forced together.
- Check the water flow direction on each component. Water must flow in the correct direction for most items to work properly. Items that should be mounted in a certain direction, have marking on the body.
- Use only teflon tape to seal connections.
- Do not over tighten. Hand tight will be just fine on most items.
- Test for water flow on the head assembly before connecting to the poly tubing.
- Any head assemblies connected directly to a hose bib / hose faucet should be supported properly to prevent breaking of components.

Filtration

- Clean the screen inside the filter as often as needed. Having too much debris on the screen will hinder the water flow or block it completely.
- With extremely dirty water multiple filters might be needed.
- Use only teflon tape for the threaded connections to prevent leakage of water.
- Make sure the water flow is in the same direction as the arrow on the filter.

Drippers

- Mounting drippers on the side of the lateral tube works best. Having them on the side allows for water to spill out easy and keeps hard water deposits from collecting. By placing emitters so, soil particles cannot enter into the system and also inspection becomes easier.
- In undulated fields use of the pressure compensating drippers is preferred in order to ensure uniform discharge along the laterals.

Microsprinklers

- Take care when placing sprinklers so they will not be blocked by future growth of plants right next to them.
- Wind can affect the spray from microsprinklers. Try to water during a part of the day when there is normally no or very little wind.

Valves

- To extend the life of valves, they should be installed after filter.

Fertilizer applicators

- The fertilizer applicators should always be installed after a backflow device.
- Fertilizers, which are completely water-soluble, should only be used.