IRRIGATION

Subsurface Drip (SDI)

no. 4.716

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Quick Facts....

Subsurface drip (SDI) is a low-pressure, low-volume irrigation system that uses drip tubes buried below the soil surface.

Subsurface application of water aimed directly at the root zone improves yields by reducing the incidence of disease and weeds.

SDI is suitable for almost all crops and especially for high-value fruit and vegetable crops, turf and landscapes.

Research shows the yield and quality of produce improves with a buried drip system. Normal life expectancy of a system is 12 to 15 years.

Colorado State University Cooperative Extension

Putting Knowledge to Work

Subsurface drip (SDI) is a low-pressure, low-volume irrigation system that uses buried drip tubes. Farm operations become free of impediments that normally exist above ground with any other pressurized irrigation system.

Subsurface application of water aimed directly at the root zone improves yields by reducing the incidence of disease and weeds. Germination of annual weed seed is reduced, which lowers weed pressure. Water is conserved, fertilizer efficiency is enhanced, and labor needs are reduced. In addition, field operations are possible, even when irrigation is applied.

The applied water moves by soil matrix suction, eliminating the effect of surface infiltration characteristics and saturated condition of ponding water during irrigation. Application is uniform and highly efficient. Wetting occurs around the tube and water moves out in all directions.

A subsurface-drip or microirrigation system is flexible and can provide frequent light irrigations. This is especially suitable for arid, hot and windy areas with limited water supply. Since SDI is under the surface, repairing tubes is difficult and cumbersome. Rodents tend to chew the tubes therefore precaution should be taken to prevent rodent damage. Clogging is not apparent. Close monitoring of the system is a must.

Crops

SDI is suitable for almost all crops. It is used mostly for high-value fruit and vegetable crops, turf and landscapes. Strawberry, tomato, potato, cantaloupe, onions and other vegetables have shown increase in yield, both in quantity and quality. Cantaloupe tends to mature early and uniformly. Rots, molds or blemishes from hard water are eliminated. Alfalfa regrowth after a cut may be encouraged by subsurface irrigation without allowing shallow-rooted weeds to emerge. Spacing of the burial tubes is a critical issue for normal crops such as alfalfa.

Materials

A large variety of drip tubes are available on the market. The polyethylene tubes have built-in emitters set at certain intervals along the tube. Water drips out of the emitter opening at the end of a turbulent pathway, where the pressure is dissipated and water just dribbles out.

The spacing and the flow rate of the emitters in subsurface drip tubes are variable according to the product. Products are available at variable wall thickness. The higher the MIL number, the thicker the wall, which extends the life of the tube. The cost also goes up with the increase in wall thickness. The polyethylene tubes fitted with pressure-compensating emitters make them suitable to distribute water uniformly in sloping fields. Pressure differential due to ground slope is avoided. Naturally, these tubes cost more.

Layout

A typical system layout consists of a settling pond (where possible), pumping unit, a hydrocyclone separator (when a pond is not feasible to take out the coarse materials), chemical injection unit, filtration unit equipped with back-flush control solenoid valves, pressure regulators, air vent at manifold, and PVC delivery system to carry the water to the field.

It is essential to have a filtration unit for a drip system, irrespective of whether the dripper is used above ground or below the ground surface.

The delivery system is composed of main, submain and manifold, to which the lateral drip tubes are attached. Optional items like a flow meter and a pressure gauge are essential to monitor the performance of the system.

It is essential to provide an air release/vacuum breaker valve at the manifold for easy drainage of the tubes when the pump is shut off. Determine valve placement according to the topography. The air release valve should be placed at the highest point of elevation at the delivery pipes. This will allow release of trapped air. The vaccum breakers help prevent suction development due to the partial vacuum created as the water leaves the tube. In a freshly installed system, the loose soil may settle around a collapsed tube, making it difficult for the tube to regain its shape in absence of an air vent. A typical field layout is shown in Figure 1.

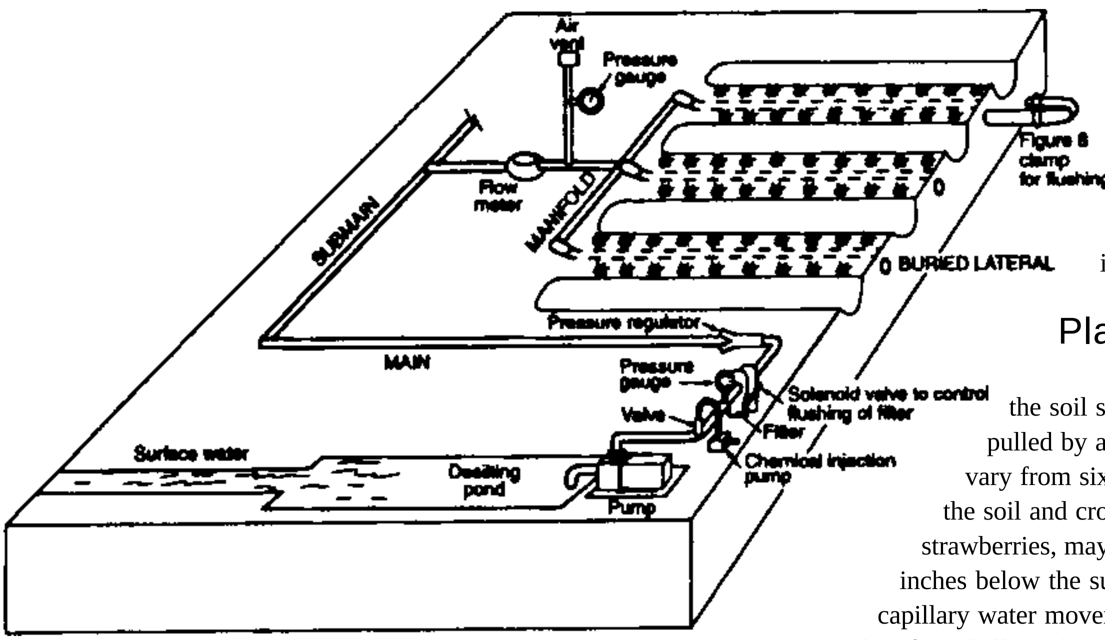

Figure 1: A typical subsurface microirrigation field layout.

Placement

The tubes are injected below the soil surface, using an attachment pulled by a tractor. The placement depths vary from six to 24 inches, depending on the soil and crop. Shallow-rooted crops, like strawberries, may require placement at six to 10 inches below the surface, depending on soil type: capillary water movement is limited in sandy soils therefore shallow placement is recommended. In heavier soils, water moves upward easier and can reach higher levels thus tubes can be placed deeper. The emitters on the tube should face upward at installation. Placement at a uniform depth is essential and proper soil moisture facilitates the process.

Filtration

It is essential to have a filtration unit that will filter all the particles that are bigger than the emitter openings. A 200 mesh filter is usually adequate for most types of emitters. Filtration can be viewed as the heart of a SDI system and should be designed properly to fit the level of contamination of the water source. Filtration may not be a concern where domestic water is used around the house or in city landscaping.

Operation and Maintenance

The performance and life of any system is dependant on how well it is designed and operated. When operated by automatic controls, the system needs to be inspected from time to time. The back-flush system needs to be checked and the laterals flushed at regular intervals.

The quality of water affects the system. High pH water will tend to precipitate calcium salts. High salinity or iron will cause precipitates. The situation is aggravated by organic matter, bacteria and algae present in the water. The scum material formed by the combination of organic matter and fine clay particles may clog the emitters. Deep well water may be free of scum, but the pH need to be checked to avoid precipitate.

Occasional injection of acid, acid-forming chemicals or chlorine may help to stop precipitate and scum formation.

N-phuric, a commercial mixture of acid and N-fertilizer available in the market, may be useful. In addition to lowering the pH to reduce precipitate formation, the product will provide nitrogen fertilizer to the crop. The system should run for awhile after injection of any chemical to remove residual chemicals. It is essential to winterize the system at the end of the cropping season by thoroughly draining all pipes and appurtenances. An air compressor may help blow out the residual water, especially from the above ground fixtures. Polyethylene tubes are flexible and won't break due to freeze.

Rootguard products may be used to prevent root growth into the emitter openings which can cause clogging.

Cost

A subsurface drip system may require higher initial investment and cost will vary due to water source, quality, filtration need, choice of material, soil characteristic and degree of automation desired. System cost, including installation, may range from $800 to $1500 per acre.

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References

For additional information on irrigation management and scheduling, see Colorado State University Cooperative Extension fact sheets:

- 4.707, *Irrigation Scheduling: The Water Balance Approach,*
- 4.708, *Irrigation Scheduling,*
- 4.702, *Trickle Irrigation for the Home Garden,*
- 4.703, *Microirrigation for Orchard and Row Crops.*

Additional Information on the Web:

- www.oznet.ksu.edu/sdi/
- www.oznet.ksu.edu/sdi/Reports/2002/ADofSDI.pdf
- www.cprl.ars.usda.gov/wmru/wmpubs.htm#2001
- www.geoflow.com/rootguard

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