

Drip Irrigation

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Overview

Drip, or **trickle irrigation**, is a type of irrigation that slowly applies small amounts of water to part of the plant root zone. Water is applied frequently, often daily, to maintaining a favorable soil moisture condition and prevent moisture stress in the plant. In an effective irrigation system, water is distributed as close as possible to the plant's root system. When compared with overhead irrigation systems, drip irrigation accomplishes this process more efficiently. Furthermore, drip irrigation requires less water and less labor than other forms of irrigation.

Advantages

1. Smaller water sources can be used. Drip irrigation requires about half of the water needed by sprinkler or surface irrigation.
2. Lower operating pressures and flow rates result in reduced energy costs.
3. A higher degree of water control is attainable. Plants can be supplied with more precise amounts of water.
4. Disease and insect damage is reduced because plant foliage stays dry.
5. Labor and operating costs are usually reduced. Moreover, extensive automation is also a possibility.
6. Field operations may continue during the irrigation process because rows between plants remain dry.
7. There are fewer weed problems and less need for cultivation. Water is applied directly to the plant root zone. Therefore, water is not lost to weed growth in unproductive areas, resulting in both better weed control and significant water savings.
8. Fertilizers can be applied through this type of system. This can result in a reduction of fertilizer and fertilizer costs.
9. When compared with overhead sprinkler systems, drip irrigation leads to less soil and wind erosion.
10. Drip irrigation can be applied under a wide range of field conditions.

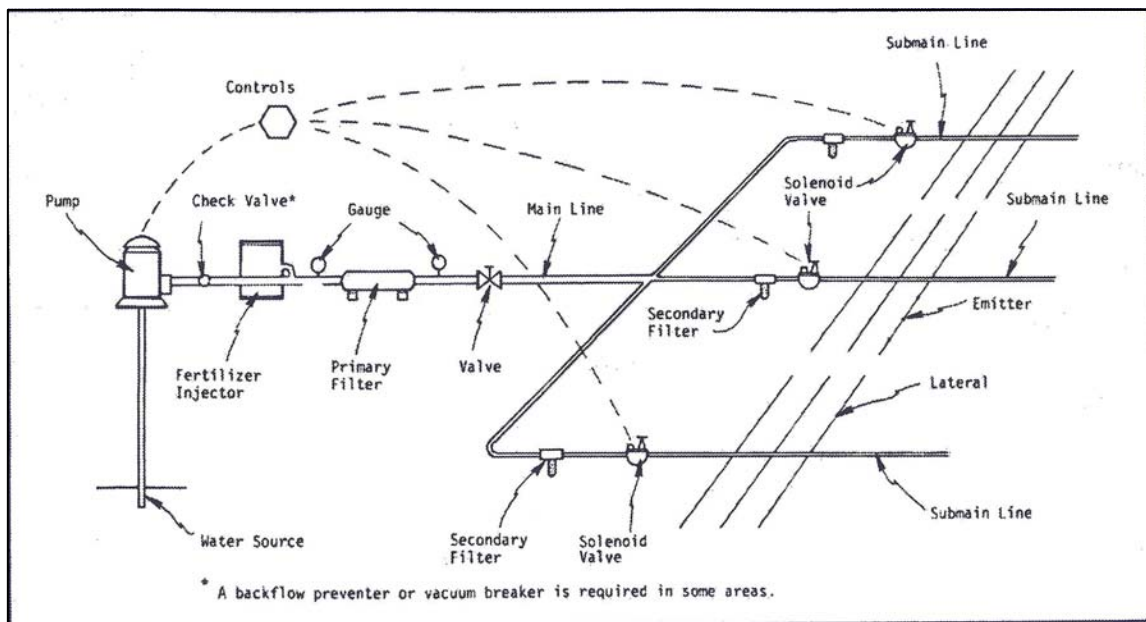
Disadvantages

1. Initial investment costs per acre may be higher than for other forms of irrigation.
2. Management requirements are higher.
3. Drip irrigation is not adaptable for frost protection.
4. Rodent, insect, and human labor may cause damage to components and create potential sources of leaks.
5. When compared with sprinkler irrigation, water distribution in the soil is limited. Distribution of moisture should be a major design consideration.
6. Water filtration is a must. Clean water is necessary to prevent clogging of the small emission holes found in this system.
7. Drip irrigation is not suitable for closely planted crops such as alfalfa or cereal grains.

Components

A drip or trickle irrigation system includes the following six major components:

1. **Delivery or Distribution System**
 - *Mainline distribution to field* – underground PVC pipe or above-ground aluminum pipe
 - *Sub-main or header line* – vinyl “lay-flat” hose
 - *Feeder tubes* – small plastic tubes
 - *Drip lines* – turbulent flow drip tape or drip tape with internally attached emitters
2. **Filters**
 - *Sand* – separate sand and heavy matter by swirling the water passing through them
 - *Media* – most common; can filter poor quality water at high flow rates, but are expensive, heavy, and large
 - *Screen* – most commonly used if the water source is relatively clean, but they are not capable of removing as much debris as a media filter
 - *Disk* – possess the traits of both media and screen filters
3. **Pressure Regulators**
 - *Fixed Outlet*
 - *Adjustable Outlet*
4. **Valves or Gauges**



5. Chemical Injectors

- *Positive displacement injectors* – externally powered diaphragm, gear, piston, and roller pumps powered by gas, diesel, or electric; medium to high in cost
- *Pressure differential injectors* – pressurized mixing tanks and venturi injectors; often simple in design
- *Water-powered injectors* – driven by the pressure of the irrigation system; piston and diaphragm types are available

6. Controllers

- *Manual*
- *Computer*

Water Sources

Water sources may include municipally treated water, well water, pond or reservoir water, and ditch, stream, or river water. Clean water is especially important to successful drip irrigation. The small orifices found in the trickle emission devices can be clogged easily by physical and chemical contaminants found in the water. Groundwater from wells is generally of good quality and should be used when possible. Groundwater may contain sand or chemical precipitates. Surface water can be used but often contains bacteria, algae, and other aquatic life. Multistage filtration or chemical treatment of surface water is generally required. Usually, fast-moving water contains higher levels of suspended particles, and reservoirs or ponds contain a relatively small amount of these particles. For small drip irrigation operations, the water source does not have to be excessively large. Most small systems require only 2 to 5 gallons per minute per acre.

Maintenance

Line flushing is standard maintenance for drip irrigation systems. The amount of particle buildup in the lines will depend on the amount of suspended solids found within the

water source. Periodic flushing of the lines will help to eliminate this buildup. A routine maintenance schedule of line flushing and inspection will aid in preventing emitter blockages. In addition, periodic flushing of the system during the off season will also help eliminate blockages.

Plasticulture (Black Plastic Mulch)

In an efficient system, drip irrigation, when used with black plastic mulch, can help retain moisture for the crop. Furthermore, both water and nutrients can be introduced into the crop root zone with very little loss. However, clear plastic mulch should not be used because it transmits light, which stimulates weed growth. Drip irrigation also works well with organic mulches such as straw or grass clippings.

For More Information

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- Elliot, K. C., A. W. Selders, R. K. Zimmerman, B. L. Meadows. "Mobile Water Supply for Small Plot Trickle Irrigation." West Virginia University Cooperative Extension Service.
- Keesen, Larry. "The Complete Irrigation Workbook." pp. 83-88.
- Lamont, W. J. Jr. "Proceedings of the Drip Irrigation of Vegetable Crops Short Course." Pennsylvania State University.
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- "Saving Water One Drop at a Time." Aquapore Moisture Systems. Phoenix, Arizona.
- "Trickle Irrigation in the Eastern United States." NRAES-04.