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Drip irrigation for orchard crops

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Quick Facts

Drip irrigation is a system that applies water and fertilizer directly to individual trees in an orchard instead of irrigating the entire orchard area with flood or sprinkler irrigation.

If managed properly drip irrigation can increase yields and decrease water, fertilizer and labor requirements.

Drip irrigation saves water because only the plant's root zone is supplied with water.

Drip irrigation can irrigate sloping or irregularly-shaped pieces of land that cannot be flood irrigated.

Any water soluble fertilizer may be injected through a drip irrigation system.

Drip irrigation is a system that applies water and fertilizer directly to individual trees in an orchard instead of irrigating the entire orchard area with flood or sprinkler irrigation. This system uses laterals that run along each tree row and "emitters" or "drippers" that supply each tree with the daily water requirement.

Drip irrigation has gained attention during recent years because of it's potential to increase yields and decrease water, fertilizer and labor requirements if managed properly.

Water is provided on a high-frequency basis, and creates a near optimal soil moisture environment for the crop. A wetted profile (the shape depends on soil characteristics) develops in the plant's root zone beneath each emitter. This profile often is onion-shaped as shown in Figure 1.

Ideally, the area between trees and tree rows is dry and receives moisture only from incidental rainfall.

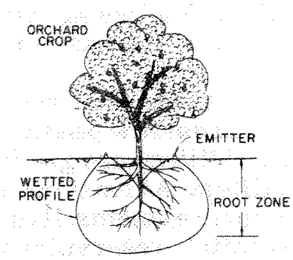

Figure 1: A wetted profile develops in the root zone below each "emitter" or "trickler."

Under proper management, drip irrigation saves water since only the plant's root zone is supplied with water and little water, if any, is lost to deep percolation, consumption by non-beneficial plants, or soil surface evaporation. Some movement of moisture below the crop roots is necessary to prevent excessive salt buildup in the root zone.

tion in Colorado is that sloping or irregularly shaped pieces of land, which would be impossible to flood or sprinkler irrigate, can be drip irrigated easily. Also, these parcels of land often are located at higher elevations along the side of a valley where frost danger is less.

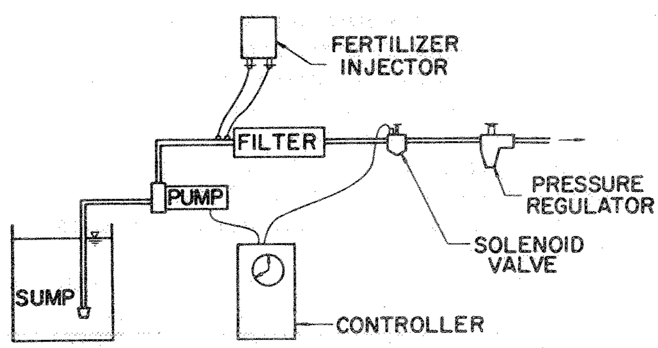

Figure 2: Typical trickle system "head."

[1]Original text by Wynn R. Walker and Stephen W. Smith, former Colorado State University faculty. Revised by Israel Broner (Israeli), Cooperative Extension agricultural engineer and assistant professor; agricultural and chemical engineering (7/89)

System Layout and Equipment

A drip irrigation system consists of a system "head" and a distribution network. A pump, filter, flow meter, pressure gauges, fertilizer injector, pressure regulator and controller generally make up a system head as shown in Figure 2.

The flow meter and fertilizer injector are optional equipment but highly desirable. A controller is necessary only if the system is automated. The distribution network consists of pipes usually made of polyethylene (PE), pipe fitting, drippers and valves. Valves are actuated electrically by a solenoid in the case of an automated system.

Filtration is a must in drip irrigation systems because of the small narrow passages of drippers. Two basic types of filters are graduated sand filters and screen filters. At least one stage of filtration is needed for drip systems. If the water source is surface water (ditch, reservoir) use both filtration stages. The required screen size and/or sand filter size is determined by the type, size and concentration of contamination in the water source, required quality of filtered water, flow rate, and cost analysis. Filters require periodic backflushing depending on the amount of contamination in the water. Backflushing can be done manually or automatically.

Any water soluble fertilizer may be injected through the drip system. A pressure differential can be used to cause flow through a tank as shown in Figure 2, or a nutrient metering pump can be used to carefully control fertilizer applications. In either case, fertilizer should be injected in advance of the filter to filter out undissolved chemicals.

Drip systems operate at relatively low pressure as compared to sprinkler irrigation. For this reason, pumping costs are substantially less than sprinkler systems. A pressure regulator is used to control the lateral line pressure. Multiple pressure regulators may be desirable for locations with large elevation changes.

Small diameter, polyethylene pipe generally is used for the system laterals that are laid on the soil surface along each row or are buried to facilitate tillage operations.

The lateral is connected to a manifold that is supplied with water through a submain and main. A typical 15-acre layout is shown in Figure 3. Manifolds, submains and mains usually are buried.

The purpose of the lateral is to supply water to one or more emitters located near each tree. One emitter may be adequate for newly planted trees with additional emitters added as the trees mature. However, the lateral should be sized for the maximum water application.

The purpose of the emitter is to cause a large pressure drop so that a small flow of water is able to pass through. The flow through a particular emitter is dependent primarily on lateral pressure and may vary from as low as 0.5 gallons per hour to as much as 8 gallons per hour.

Different types of emitter are available and vary from 15 cents for an orifice emitter to 60 cents for a pressure compensated emitter that can pass relatively large suspended solids.

The necessary initial investment will vary due to water source, water quality, filtration requirements, emitter choice, tree spacing, soil characteristics and degree of automation. A manual system could range in price from $800 to $1200 per acre and an automated system could range from $900 to $1500 per acre. This includes installation costs.

Water quality and filtration are important considerations with drip irrigation. Inadequate filtration will result in clogged emitters and excessive labor requirements. These and other design factors can be the downfall of any drip system no matter how well managed it may be.

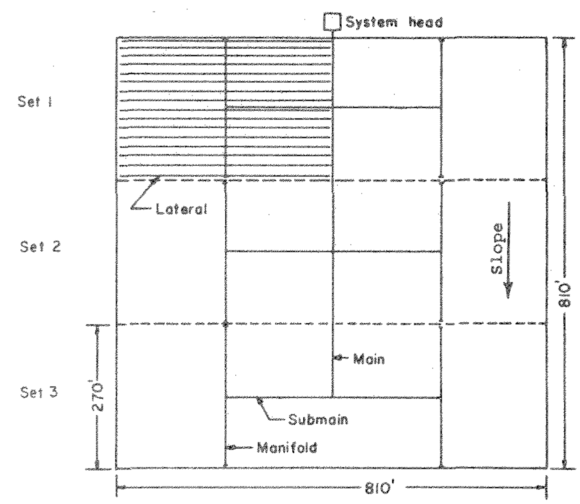

Figure 3: A typical 15-acre (6-hectare) system layout showing various system components.

System Management

Drip irrigation systems offer flexibility in water management. One of the main advantages of drip irrigation systems is the ability to apply frequent light irrigations. Different methods of water management methods are described in Service in Action sheet 4.708, *Irrigation scheduling*. However, because drip irrigation systems can apply daily irrigations, it is desirable to use the water balance approach and calculate the daily water use by the crop (ET) and replenish it on a daily basis. The water balance approach is described in "Irrigation Scheduling: A Guide for Improved Water Mangement through Proper Timing and Amount of Water Application," which is available at Cooperative Extension offices.