IRRIGATION FOR PEACHES
Irrigation Systems for Peaches

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Irrigation improves fruit size and yield, while reducing year-to-year variation in the production of southeastern peaches. Irrigation is a major investment; systems should be carefully planned and designed. Consult with growers who have experience irrigating orchard crops, with university personnel, and with several irrigation vendors. This process usually requires many months of preparation. Therefore, planning and installation schedules should begin early enough to assure systems will be operational for the coming season. Purchase irrigation equipment from a respected dealer or distributor who carries a good supply of repair and replacement parts.

Irrigation systems for peach fall into one of several categories. Over-tree systems may be center pivots; traveling guns, either cable or hose tow; or solid set. Under-tree systems are either microsprinkler or drip. Flood or furrow irrigation systems that use gravity to distribute surface water to precision-graded orchards are rarely used in the Southeast. One irrigation system may fit a given orchard or use better than another. An overview of irrigation system options for southeastern peaches follows.

OVER-TREE IRRIGATION SYSTEMS

Center pivots are self-propelled irrigation systems that rotate around a central pivot point, hence the name center pivot. Rotation time varies with system size, pump or well capacity, and the amount of water that is to be applied. A larger system generally requires more time to make a revolution than a smaller system. Orchard pivots are tall units (up to 18 feet) specifically designed to pass over the trees.

Pivot sprinklers take water from the pivot mainline and distribute it in droplet form uniformly over an area. A range of sprinkler options is available; sprinklers with a low run-off and erosion potential require higher pressures and are more expensive to operate. Pivot systems apply a certain depth of water (inches) over the entire irrigated area. Soil erosion potential must be considered when selecting pivot nozzles. If the application rate is greater than the soil’s intake rate, run-off and possibly erosion will occur. To cover large areas and reduce erosion potential, sprinklers must throw water a considerable distance, which requires high operating pressure and considerable energy in the form of pump horsepower.

Low-pressure sprinklers operate at less than 30 PSI. Commonly called spray nozzles, they deliver water in either 180-degree or 360-degree patterns. They operate upright or upside down on extension pipes or drops. Low-pressure sprinklers usually have the lowest energy (horsepower) requirements. They wet small areas with a high application rate. Low-pressure sprinklers should be used only on sites with coarse (sandy, sandy loam, loamy sand) soils that provide excellent water infiltration. Sites should be relatively flat (slopes not greater than four to five percent) to minimize run-off.

Intermediate-pressure sprinklers (low-pressure, low-angle impact sprinklers) operate at pressures of 30 to 65 psi. Energy requirements and operating pressures are moderate. Intermediate-pressure sprinklers are widely used on soil textures and fields that are too erodible for low-pressure sprinklers.

High-pressure sprinklers are high-energy components that operate at pressures greater than 65 PSI. On center-pivot systems, their use is limited to the finer textured (clay) soils and fields that have slopes exceeding 10 to 15 percent.

Irrigation manufacturers typically offer computer programs to custom fit the site with a system and sprinkler package, and cost of operation estimates. With most center-pivot installations, the cost of operation will be the major expense associated with the system.

Traveling gun irrigation systems feature a single large, high pressure (~80 PSI) sprinkler that pulls itself through the orchard. **Cable-tow travelers** have a large gun (sprinkler) mounted on a two-, three-, or four-wheel chassis. One end of the hose is attached to this chassis and the other end to a riser in the field. Cable-tow travelers propel themselves through the field by winding a steel cable around a drum or pulley on the machine. An auxiliary engine, water motor, water piston, or water turbine can supply the power to propel the power unit. Hoses come in sizes from two and one-half to six inches in diameter. Hose lengths vary from around 300 to 1,200 feet, with the shorter hoses usually having the largest diameters. The hose is stored by winding it onto a reel on the machine. The multi-strand, high-strength cables must be attached to an immovable object for operation, usually a tractor or "deadman" at the far end of the row. Use of a tractor for the static chore of anchoring a cable-tow system can be a major disadvantage. Cable-tow systems water approximately an acre of orchard per hour.

Hose-pull travelers have a large trailer-mounted hose reel, which is stationary at the end of the field. Water is pumped through the hose to an over-tree, gun-type sprinkler on a cart. The sprinkler cart is pulled along by the hose. The trailer-mounted hose reel winds itself up while irrigation water is being applied. The hose reel is driven by a turbine, a "bellows" water piston, or an auxiliary engine. The hoses are hard, usually polyethylene, from two to five inches in diameter and from 600 to 1,200 feet in length. Hose-pull travelers use large, top-heavy hose reels, some having a height of 12 feet. Transport speeds should not exceed three miles per hour under the best field conditions.

The following comparisons can be made of the cable-tow traveler and hose-pull travelers:

(1) Cable-tow travelers take longer to move because the hose must be reeled in and the cable unwound.
(2) Hose-pull travelers require more pressure to operate at comparable gallonages and hose lengths.
(3) Uniform speed throughout the run may be more difficult to obtain with the hose-pull traveler. Speed compensation options are sometimes available.
(4) Hose-pull travelers are easier to use on short runs, because only the amount of hose that is needed must be wound off the reel, whereas all of the hose of the cable-tow machine must be wound off the reel and the hose stretched out to allow free flow of water.
(5) Cable-tow travelers require an anchor, such as a tree, tractor, or deadman, to which the cable is attached.
(6) Hose-pull machines are pulled in a relatively straight line. On the cable-tow machine, the hose is pulled in a loop, which can make orchard operation more tedious.
(7) Connecting or disconnecting the hose to the supply line is faster with hose-pull units.

Solid-set irrigation systems consist of permanent, above-ground sprinkler risers connected by aluminum or PVC pipe. Solid-set orchard irrigation systems are typically engineered to provide frost/freeze protection, as well as irrigation. Frost/freeze protection requirements are considerably more stringent than irrigation requirements. Frost/freeze protection irrigation must be applied to the entire area continuously until temperatures rise above critical levels following the cold event. The sprinkler spacing for solid-set irrigation is critical for uniform delivery of water. Solid-set systems are quite energy intensive and they can require very high volumes of water. Solid-set systems are normally used on small acreages and/or crops that have a high cash value. The labor requirements for a solid-set system are usually low (unless a portable pipe system is used).

UNDER-TREE IRRIGATION SYSTEMS

Under-tree irrigation systems, either microsprinkler or drip, distribute water directly to the soil in the root zone of the tree. Under-tree systems provide needed irrigation without the increased disease pressure that often comes with wetting of foliage and fruit. In peaches, under-tree sprinkler systems use microsprinklers; drip systems use emitters. The pumping plant and water source are critical components of under-tree systems.

Microsprinkler irrigation is the system of choice for most southeastern peach production sites. Small, under-tree sprinklers strategically target large portions of each tree's root zone. In peaches, microsprinklers normally apply 8 to 14 gallons per hour, providing some four to seven times greater gallons per hour (GPH) than is applied by drip irrigation. This allows for less frequent applications and longer drying periods between applications, which can offer advantages to long-term tree health. Microsprinklers can also be modified to provide as needed above-tree frost/freeze protection. Dual-purpose systems that provide irrigation and frost/freeze protection must have considerably more capacity than those being used to just supplement natural rainfall.

Drip irrigation systems make frequent, slow applications of water to the soil through emitters (drippers or applicators) located along the water delivery line (Figure 1). To meet the tree's moisture requirement, drip systems frequently must be run for long periods of time. Unfortunately, this allows limited opportunity for soil to dry between waterings, which can be detrimental to long-term tree health. The percent of the root system covered by drip irrigation depends on the number of emitters per tree.

Drip irrigation eliminates spraying and supplies filtered water under low pressure directly onto or into the soil. Water is carried through a pipe network to each tree. Emitters dissipate pressure, thereby discharging at low volumes of water per hour. Water is distributed by its normal movement through the soil profile, primarily downward. The area wetted from each emitter is small, being limited by the water's modest horizontal movement in the soil and may vary among soil types.

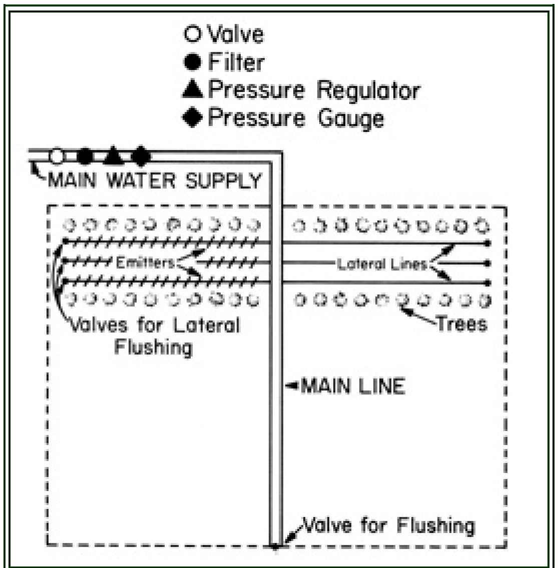

Figure 1. Schematic layout for drip irrigation.

COMPONENTS COMMON TO MICROSPRINKLER AND DRIP SYSTEMS

Lateral lines are small, 3/8- to 3/4-inch diameter, polyethylene (PE) material placed one or two per tree row. Lateral lines may be buried prior to planting or run on the surface of the soil.

Main lines are large PVC pipes that carry water to the lateral lines from the pump. Because PVC is rigid, it must be installed deep enough to withstand heavy surface loads such as sprayers. It should also be below the frost-line so that the stress of freezing and thawing water will not burst the pipe. The frost-line in much of the Southeast is shallower than the depth required for withstanding heavy surface loads. Main lines are usually placed deeper than the lateral lines.

Control valves of several types are used in drip and microsprinkler systems. Pressure regulator valves (either brass or plastic) are often required to regulate and maintain the system near the design pressure. On/Off valves control the flow of water from one zone to another. Clean-out valves at the ends of PVC lines are used to flush-out sediment.

Screens and filters are imperative in drip and microsprinkler systems, as sand, algae, and other contaminants can plug lines and emitters. Drip systems require exceptionally clean water. Screens and filters are generally used in a sequential, complementary fashion.

Screens, which are the simplest filters, efficiently remove very fine sand from the irrigation water but will rapidly become clogged by algae and other organic material. They should be cleaned whenever the pressure drops more than 7 to 10 PSI. Regardless of the cleaning method you use, extreme caution must be taken to prevent dirt from bypassing the screen during cleaning. Cleaning options include: (1) manually removing the screen and washing; (2) repeatedly washing (blowing-off) the screen without dismantling; and (3) automatic cleaning on a time schedule or whenever the pressure loss reaches a certain level.

Media filters consist of fine gravel and sand particles of selected sizes placed inside a cylindrical tank. Media filters remove heavy loads of very fine sand and organic material. They can be automatically backwashed as needed. Media filters are almost always recommended when surface water, such as from a pond or stream, is used for drip irrigation. A screen should be placed downstream from the media filter to pick up particles that escape during backwashing.

Vortex (centrifugal) sand separators remove up to 98 percent of the sand particles that would be retained by a 200-mesh screen. They depend on centrifugal force to remove and eject high-density particles from the water. Vortex separators do not remove organic materials. They are typically used to eject large quantities of very fine sand before further screening.

Settling ponds or reservoirs serve to remove extra-large volumes of sand and silt. However, algae growth and windblown contaminants cause other filtration problems. Avoid open water areas if possible.

Maintenance. Filters and screens must be kept clean to function properly. Cleaning schedules vary with system, but must be adhered to. The clamp or valve at the end of each lateral line should be released to flush out accumulated sediment monthly.

WATER SOURCES

Surface water and groundwater are used for irrigation. System design should carefully assess water sources, because irrigation water is needed most when supplies are lowest.

Surface water is available from ponds and streams (rivers). Irrigation from streams is less common because they are seldom located near orchards. "Riparian rights" may govern the use of the stream water. This doctrine gives property owners adjacent to a stream reasonable use of that stream, but irrigation may not appreciably diminish the flow of water. Volume requirements for irrigation often exceed flow rates of streams during periods of drought.

Ponds are often used for irrigation. Recharge rate and pond size are key considerations. The general rule is one acre-foot of water storage for each acre of land to be irrigated. Thus, a 10-acre pond with an average depth of 10 feet would be needed to irrigate 100 acres. This example assumes no recharge to the pond.

Groundwater is an important resource for irrigation. Depending on the location and well type and size, capacities up to 3,000 gallons per minute are possible. In the Southeast's coastal plain, groundwater is generally available in large quantities. In piedmont and mountain areas, groundwater is often less available.

Wells are expensive. There are generally two purchase options. Lump sum contracts guarantee a certain quantity of water for a fixed cost. The driller takes all the risk. Unit price contracts are less expensive because the purchaser pays for the capacity provided. However it is imperative to know the driller's performance record and reputation. Although it is an extra cost, well testing is advised to determine well capacity, pumping depth, and the correct size of pump to install. An inefficient pump or one that is too large can add greatly to the cost of the system. The horsepower required to operate the unit can be reduced if a high-efficiency pump is used.

The following are some ways to save money when constructing a well:

(1) Have the work done in the off season; avoid rush jobs.
(2) Provide a road to the site, water for drilling, and mud pits.
(3) Contract only for the quantity of water needed. A 1,000 gallon per minute (GPM) well is of questionable merit when only 500 GPM is required.
(4) If possible, have several neighbors drill wells at one time. This will reduce the travel time for the driller.
(5) Do not ask for a guarantee of quality. This is expensive insurance.
(6) Contract with a reputable driller.

Once the well is completed and before the irrigation season starts, check out the pump and power unit. A well without an operational pump is of little value. Work closely with your irrigation dealer and well driller to make sure these specifications are met so that the system will operate properly.

IRRIGATION PLANNING SUMMARY

To adequately plan and design an irrigation system, certain basic information is needed. The basic steps include evaluation of the following:

1. *Field Information*

   This is best determined by a visual inspection of the area along with a map showing field boundaries, water sources, natural or manmade obstructions, and relative elevation points.

After evaluation of this basic field information, the most desirable irrigation system may be selected.

2. *Soil and Water Data*

Include:

a. Soil profile and texture classification,
b. Soil depth,
c. Water intake rate, and
d. Soil water holding capacity or available soil moisture.

3. *Plant Data*

Include:

a. The type of cropping system,
b. Crop rotation plans, and
c. Peak rate of water use by crops.

The peak water use usually occurs during the maximum growth-foliage cover period, particularly during hot, dry periods. This peak water use rate or design moisture withdrawal rate is used to determine the irrigation frequency and maximum water requirements of the irrigation system. Peak water use rates vary for different crops but usually range between .25- and .30-inch per day for peaches.

4. *Water Availability/Legal Concerns*

The water source must be evaluated to determine if adequate water is available to meet the requirements of the irrigation system. Large water withdrawals in some states are regulated. A water use permit must be obtained from the regulatory agency before pumping can begin. Check with local sources (county agent, NRCS, etc.) to determine what is required in your state.

5. *System Design*

After determining the basic information described in 1 through 4, the system may be selected and designed. Water and horsepower requirements can be determined using the following formulas:

$$Q = \frac{453 \times A \times D}{F \times H}$$

where: Q = flowrate in gallons per minute
A = area to be irrigated in acres
D = depth of water applied in inches (usually peak water demand)
F = frequency of depth applied in days
H = hours per day that system can operate

Once the water requirements have been determined, the horsepower (HP) needed to pump the water can be calculated from the following equation:

$$HP = \frac{Q \times H_{ft}}{3960 \times P_{eff}}$$

where: HP = Continuous horsepower needed
H_{ft} = Total dynamic head in feet
P_{eff} = Pump efficiency in decimal form