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Agriculture & Natural Resources

COOPERATIVE EXTENSION • YOLO COUNTY
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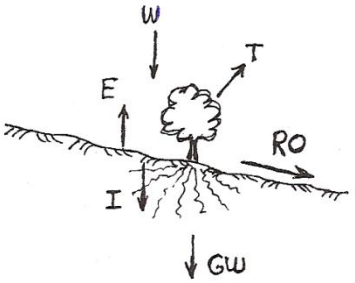
# Water-Conservation Irrigation Practices

## 1. Water Movement through Plants and Soils

Plants take in water in the root zone and move it up through the plant to the leaves where it transpires as vapor. Water (**W)** applied to the soil/plant goes to: infiltration (**I**), evaporation (**E**), runoff (**RO**), plant materials, plant breathing/transpiration (**T**), and groundwater (**GW**).




Infiltration, **I**, moves vertically and horizontally through the soil depending on the type of soil:

Sand: fast vertical, little horizontal
Loam: moderate vertical, some horizontal
Clay: slow vertical, more horizontal

Check your soil's infiltration rate. Dig a hole 6-12" deep and at least 4" in diameter. Fill with water, wait an hour or so, fill with water again and then measure how much the new water level drops in an hour. That is your soil infiltration rate in inches/hour. Soils vary quite a bit spatially so check other locations in your yard too.

## 2. When and How Deep to Water

a. Water deeply but infrequently. This encourages deep root growth. In heavy clay soils, you may need to water more frequently for shorter periods of time to avoid excessive runoff.
Water early in the morning to minimize evaporation and potential for diseases. Check your local area's watering recommendations. Some cities ask that you avoid certain watering windows due to low water pressure.
Follow the ET chart below as a general guide for how much water is needed.

Observe plants closely to learn their water needs. Most plants show common symptoms of water stress when too dry: wilting or folded leaves, dull or gray-green foliage, leaf drop, new leaves smaller than normal. Common signs of overwatering include: lower leaves that are yellow, plants that look wilted, and rotting or stunted roots. A soil moisture probe can be used to check available moisture at root level.

b. Water to the root zone. Rooting depth depends on plant species and soil. Assuming plant/root growth is not impeded by unusual soil conditions, the following are general rooting depths:

Leafy vegetables and annual bedding plants: 6 in. to 1 ft.
Small shrubs, cool-season turfgrass, corn, and tomatoes: 1 to 2 ft.
Large shrubs, trees, and warm-season turfgrass: 1.5 to 5 ft. or more.

Remember not to apply water faster than your soil's infiltration rate that you calculated above. Use a trowel, shovel, or probe to see how far the water has infiltrated; record the time it takes to reach the root depth.

## 3. How Much Water Plants Require

Generally, enough water needs to be supplied to satisfy evapotranspiration, ET, the combined evaporation and transpiration losses. Below is the 'reference' ET for the Sacramento Valley. (It is for 4" tall cool-season turfgrass with an abundant water supply.)

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .04 | .06 | .10 | .15 | .19 | .24 | .26 | .22 | .17 | .11 | .06 | .03 | inches/day |

Actual water use varies by type of plant and weather. For example, dense planting of shrubs or trees may use 10 or 20% more water. (1 inch of water over 1 sq ft = 0.6 gal.) A large apple tree may use about 50 gal of water on a hot summer day; that's about 1 inch of water over 80 sq ft.

**4. Effective Lawn Watering**

a. Determine what type of lawn you have
   1) warm-season: bermudagrass, zoysiagrass, St. Augustinegrass vs.
   2) cool-season: tall fescue, Kentucky bluegrass, perennial ryegrass.

b. Determine the output of your sprinklers.

   1) Set six or more straight-sided cans of the same type (e.g., tuna or cat food cans) on the lawn between sprinkler heads. Run sprinklers 20 minutes and measure the water in each can with a ruler. Determine the average depth in each can. Multiply by 3 to get inches per hour.
   2) If more than a 15 –20% difference occurs between cans, check sprinklers.

c. Determine how long to water your lawn each week. See charts below for <u>number of minutes to water each week for different sprinkler rates</u>.

**ZONE 4. SACRAMENTO VALLEY**
**Cool-season turf**

| | Hourly sprinkler output (inches) | | | |
|---|---|---|---|---|
| Month | 0.5 | 1.0 | 1.5 | 2.0 |
| Jan | 25 | 13 | 8 | 6 |
| Feb | 59 | 29 | 20 | 15 |
| Mar | 92 | 46 | 31 | 23 |
| Apr | 134 | 67 | 45 | 34 |
| May | 168 | 84 | 56 | 42 |
| Jun | 210 | 105 | 70 | 53 |
| Jul | 218 | 109 | 73 | 55 |
| Aug | 193 | 97 | 67 | 78 |
| Sep | 151 | 76 | 50 | 38 |
| Oct | 109 | 55 | 36 | 27 |
| Nov | 50 | 25 | 17 | 13 |
| Dec | 25 | 13 | 8 | 6 |

min/wk

**ZONE 4. SACRAMENTO VALLEY**
**Warm-season turf**

| | Hourly sprinkler output (inches) | | | |
|---|---|---|---|---|
| Month | 0.5 | 1.0 | 1.5 | 2.0 |
| Jan | 19 | 9 | 6 | 5 |
| Feb | 44 | 22 | 15 | 11 |
| Mar | 69 | 35 | 23 | 17 |
| Apr | 101 | 50 | 34 | 25 |
| May | 126 | 63 | 42 | 32 |
| Jun | 158 | 79 | 53 | 39 |
| Jul | 164 | 82 | 55 | 41 |
| Aug | 145 | 72 | 48 | 36 |
| Sep | 113 | 57 | 38 | 28 |
| Oct | 82 | 41 | 27 | 20 |
| Nov | 38 | 19 | 13 | 9 |
| Dec | 19 | 9 | 6 | 5 |

min/wk

**5. Design of irrigation systems**

Cost vs. time (automatic vs. hand; fixed piping vs. drag-around)

<u>Minimal</u> $
Soaker hose
Portable sprinkler on hose

High-end $$$
Dedicated valves/piping/lines for different watering needs (e.g., lawn, pots, garden, trees) with appropriate sprinklers/emitters for each use and each line operated by an automatic timer. See 'Components of a drip system' below.

**6. Lawn watering systems**

Many sprinklers are available at garden/hardware stores. Selection will depend on the size and shape of the area and adjacent plants/buildings/cars.

Design sprinkler layout and types of sprinkler heads to maximize infiltration and minimize runoff.

Water early in the day to minimize evaporation losses. Check your irrigation system for too much runoff or malfunctioning sprinklers. If excess runoff occurs, divide the watering time into more frequent and shorter intervals leaving time in between intervals for the water to infiltrate.

**7. Drip irrigation for the home landscape/garden**

Drip irrigation is the slow application of water by drip or spray emission devices to specific local areas of the landscape. A drip system has significant advantages over traditional spray, flood, or furrow irrigation in the home landscape.

a. Advantages

1) Efficient water use applies water where needed. There is less evaporation loss and less runoff.
2) Promotes good soil/water environment because correct amount of water can be applied when needed.
3) Fewer weeds - wets soil only where plants are.
4) Flexible application: Different emitters for different needs; can be moved easily as needed; can be buried for even less evaporation and to avoid the lines being damaged..

b. Disadvantages

1) Emitters may clog due to dirty water, water chemistry, or bugs.
2) Not as easy to see when not working properly (clogged emitters or broken lines).
3) Can be damaged by animals, insects, and humans.
4) Difficult for some applications like turf grasses.
5) Doesn't wash off dust/pests from plant surfaces.
6) Takes some learning and experience for best use.

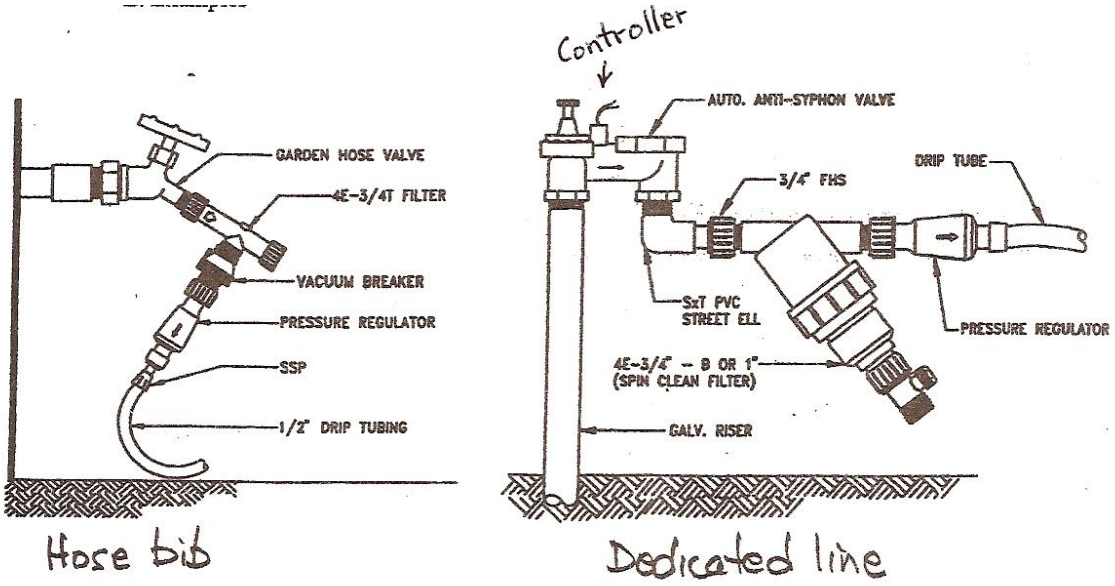
c. Components of a drip system

1) Water source: hose bib or dedicated valve, see figure below.
2) Valves: shutoff, anti-siphon, automatic, and manual.
3) Controller: automatic timers (manual or electric) to open/close valves.
4) Filters: clean water to reduce emitter clogging.
5) Distribution pipe: PVC plus polyethylene or just polyethylene. Be sure to match color coded plastic pipe and connector fittings, e.g., blue-stripe pipe with blue-stripe fittings.
6) Pressure regulator: keeps fittings/emitters from blowing out. Pressure regulator is the last item before the drip tubing, see figure below.
7) Emitters: inline tubes and tapes, heads on tube or lateral lines, and micro-sprinklers.

d. Getting started: 'Starter Kits' (Landscape Kits and Vegetable Garden Kits) have all the basics to get you started. Improve/adjust/expand parts in kit as you gain experience.

Controllers are usually separate from kits. Simple battery-operated, single valve, single start-time controllers are inexpensive. The price goes up with multiple valves and start times functionality. Be sure the controller is approved for the valve being used.

e. Examples of water-source connections.




**8. Maintenance of irrigation systems**

a. Watch landscape: wet areas, dry areas, plant problems, etc.
b. Be able to clean/adjust sprinkler heads and dripper emitters.
c. Choose emitters that can be easily cleaned. Our water and bugs will clog things up! 'Flagged' drippers and bubblers can be cleaned easily.

**9. Resources/references**

Local hardware/nursery stores and irrigation supply dealers have literature, parts, starter kits, and expertise. Much information is available on-line. Many of these websites have free catalogs with good illustrations and design information.

www.irrigationtutorials.com www.harmonyfarm.com www.sprinklerwarehouse.com
www.agproducts.com www.raindrip.com www.rainbird.com
www.dripworksusa.com www.toro.com www.ewing1.com
www.netafimusa.com

Regional Water Authority. 'Rules of Thumb for Water-Wise Gardening,' Sacramento, CA, (916) 406-5117, www.rwah2o.org.

Sunset Books. 'Sprinklers & Drip Systems,' January 2006.

University of California, Davis, Division of Agriculture and Natural Resources, Publication #3382: California Master Gardener Handbook, 2002.

Check with your local city to see if they offer water conservation information, brochures, and/or devices.

By Arlen Feldman

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