Trees, Water and Irrigation

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While the West is home to some of the most spectacular forests on earth, trees in urban settings often have a more stressful existence. Compacted soils, reflected heat and confined rooting areas usually require that even native trees receive supplemental irrigation. Although irrigation consultants devote their entire careers to landscape irrigation, arborists should have a working knowledge of irrigation concepts, systems and terminology to provide thorough tree care.

HOW MUCH WATER?

One of the first questions most clients have is ***"How much do I water?" As in most arboricultural responses, the answer is "It depends."*** There are many factors that are involved in determining the amount and frequency of tree irrigation.

First and perhaps foremost is the size of the tree. Obviously large old trees will use more water, but they may also have access to large soil profiles because of sinker roots. Large trees, even though they use more water than small trees, may be able to grow without irrigation in a normal rain year.

In drought years, even large trees may need irrigation. ***For large trees, a large volume of soil must be irrigated; slow, low precipitation rate sprinklers, drip or soak hoses will be necessary.***

Next most important is soil type. Soils in the West range from pure sand to pure clay. Sandy soils drain well, but hold little or no water. Clay soils are excellent at holding water, but can be difficult to irrigate because of potential runoff. The rate that water can be applied without running off is known as the infiltration rate. In addition, there can be less pore space (air pockets that surround the mineral particles in a soil) in a clay soil, so that roots may not be able to extract as much oxygen as they need.

Trees need more than two emitters for successful establishment and emitters should be added as the tree grows. Photo Courtesy: Russ Thompson

The species, size and age of the tree, the exposure and the tree, the time of year, and the amount of rainfall during a year all play into irrigation scheduling. In general, irrigation should wet at least half of the root zone surface and as deep as the rooting zone – at least 12 inches.

If you are evaluating an existing system, run the irrigation system and check the soil the next day. You should be able to insert a soil probe or a metal rod into the soil to the depth of at least 12 inches. You may have to repeat the process until you determine how long the system "run time" is, to thoroughly irrigate the rootball.

IRRIGATION SYSTEM BASICS

You will see many types of irrigation systems out in the field. A typical system consists of several components. ***To begin with, both drip and traditional irrigation systems usually require a back flow preventer.*** These are installed between the "point of connection" to the main line and the irrigation systems. Also known as cross-connection devices, these assemblies basically stop irrigation water (which once applied is considered contaminated with soil particles, fertilizers, pesticides, etc.) from being drawn back into the main water supply should there be a failure such as a line break or frozen pipe. There are many types, and they are required by law in most areas.

Next in line will be a valve. Valves control the flow of water into a system. Although there are manual valves, today they are generally operated by an irrigation controller (clock), which is programmed to turn the system on and off.

Traditional irrigation systems use PVC pipe from the valves to sprinklers, bubblers and spray heads. Sprays can be used beneath tree canopies, but they must not hit the trunk of the tree. Bubblers are often specified for tree irrigation and have several designs. If bubblers are used, care must be taken that they do not apply water too quickly and cause runoff.

The advantage to a traditional irrigation system is that breaks can easily be seen – often in the form of a "geyser." ***"Smart" controllers can sense the increased flow and shut the valve down until a repair is made.***

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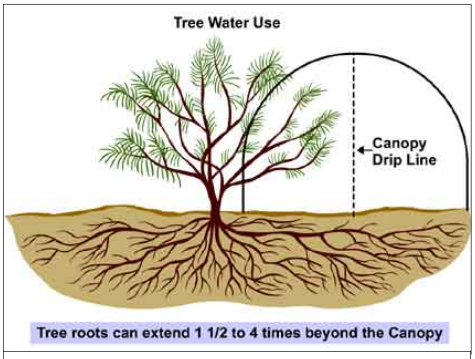
LOW VOLUME DELIVERY

Drip (or "low volume") irrigation systems are thought to be the most efficient way to irrigate. Drip systems pinpoint water where it is needed; there is no overspray and if the system is well-designed, there will be no runoff.

For any irrigation system to be efficient, it must have an even uniformity of application or distribution uniformity (DU). Just like sprinkler systems, the DU can be calculated for drip systems; if not designed correctly, they can be very inefficient. ***Drip systems should be designed to evenly wet the soil over a tree's root system.***

In a drip system, after the valve there is usually a filter and pressure regulator. While filters may not be required with clean urban water, since water is delivered through such small orifices, they can clog easily and filtration will add insurance that emitters keep flowing. They will also keep the pressure regulator from becoming contaminated. ***Even so, drip emitters should be periodically checked so ensure adequate and even flow.***



Tree roots grow beyond the canopy, but can only grow where there is water. Graphic courtesy: Elizabeth Davison

Since drip systems are designed to apply water slowly, they require lower pressure than found at residential or commercial properties, usually between 20-40 PSI. (45-60 PSI is recommended for plumbing systems.)

There are many different drip irrigation delivery devices. Standard emitters are probably the most familiar, but even they come in many shapes and sizes. Emitters that deliver 1-2 GPH (gallons per hour) are recommended to eliminate concerns about runoff. In addition micro-sprays and micro-bubblers are also available and can cover a larger area than pinpoint emitters.

Inline drip tubing simply has emitters installed in the poly pipe at uniform intervals. ***Inline tubing is often recommended for trees, as it can soak the entire root zone uniformly.***

Inline tubing can also eliminate the "sticker shock" that occurs when clients learn how many emitters are required to adequately water a tree. So many times, only two or three emitters are installed during landscape construction. At 1 or 2 GPH, it is obvious that trees need more than a couple of emitters running 20 minutes a day Also, drip systems rarely are upsized as trees grow larger and require more water.

MORE IS BETTER

In the 1990s, Dr. Jimmy L. Tipton of the University of Arizona published a chart with recommendations that raised eyebrows throughout the Southwest. ***For a tree with a 20-foot diameter canopy, the recommendation was between 28-450 emitters, depending on the delivery amount.***

One concept must be thoroughly understood: ***Tree roots will not grow in dry soil.*** This means tree roots do not "search" for water. Tree roots only grow where there is water. However, there may be more water in the soil than it appears, especially below the surface.

Use the method outlined above to determine how much water is needed to thoroughly wet the rootball. There are also formulas that can be used to deliver water with complete precision (see the first link below).

Keep in mind that irrigation systems designed to establish trees will not be adequate for growing trees or maturing trees. Plan to upgrade by adding more emitters as the tree grows larger.

Apply the same amount each time the tree is irrigated. During longer days, irrigate more often. When days are short, scale back the irrigation frequency. ***However, the irrigation duration should always be the same.*** Remember that day length or total sunlight is the driving force for transpiration and water use by trees.

The exception is that in times of low rainfall or multi-year droughts, salts may build up in the root zone. In this case, irrigate longer to wash the salts past the root zone.

In urban areas, trees are often overwatered as much as underwatered. It is important to determine a precise irrigation schedule for both water savings and optimum tree health.

Further Reading/Links:

Drip Irrigation for Trees
http://forestry.usu.edu/htm/city-and-town/tree-care/drip-irrigation/

Tree Irrigation: Water Where Roots Need It
http://landscapeonline.com/research/article/9308

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