Arid Zone Trees

Irrigation Practices for Desert Trees

Effective irrigation begins when the landscape is designed. Most horticultural literature on irrigation of desert trees deals primarily with irrigation scheduling. Vigorous long-term tree growth requires appropriate distribution of applied water and its ability to penetrate to a soil depth where is can be absorbed by anchoring and feeder roots. It must also wet a profile of soil outside the rootball to encourage exploration and development of new roots. Consequently, irrigating desert trees requires distributing water over a wide area beneath and beyond the tree, water penetration through the depth of the rootball and application an frequency that is appropriate to the soil composition and the water demands of maturing and established trees.

SOILS

Soils in the desert southwest vary enormously from location to location and even within a single landscape site. The ability of water to penetrate soil is fundamental to successful irrigation. It is nearly impossible to significantly change the water penetration of soils by the application of products to the surface of the soil. Methods that can be used typically involve excavation and are best done while grading or at the time of installation. The "Tipton Method" of planting recommends tilling an area three to five times the diameters of the rootball, then excavate the center area of the planting hole to the same depth as the box/rootball and slightly wider. These practices create a post installation soil environment around tree roots that is conducive to proper water penetration and successful root growth and establishment. In locations where this additional radial soil fracturing cannot be accomplished (narrow landscape and streetscape planting areas or parking lot medians) fracturing the soil within the margins of the planting area will help increase downward lateral water movement.

Further improvements in water penetration can be accomplished by amending the backfill soil with sand. The amount of sand used varies with the type of native soil being modified. Heavy clay soils would require the most and sandier soils require little if any. Thoroughly mix amendments into the backfill before adding amended soil to the planting hole. This will prevent layering of different soil types in the backfill. Using a backfill with characteristics and composition similar to the surrounding native soil is by far your best formula. Organic matter should not be added to the backfill soil when planting desert-adapted species as they may slow water penetration and contribute to the development of root diseases. In tree grate cutouts or around tight parking lot medians, a Cornell University studies reported that using the CU-Soil profile will increase the viability of trees around pavement from 7 to 10 years to expectations over 40 years.

Hard pans or caliche layers are all too common in southwestern soils. Their ability to impede or completely eliminate the downward movement of water makes them a hazard for trees and some larger shrubs. These layers must be physically fractured or at least punctured to allow water to pass through. If water cannot pass through these layers, it accumulates below the surface of the soil and can promote a number of root diseases. Some planting details recommend digging or drilling a drain hole through the hard pan and filling the drain with rock so water can escape. Some golf course construction projects have used small explosive charges, placed where trees will later be installed, in an effort to fracture the hard pan. In any event, conditions that favor the movement of water downward and laterally will promote a broader and more dispersed root system, lessening the likelihood of root disease and wind-throw.

DISTRIBUTION

The depth and distribution of irrigation water will dictate the depth and distribution of plant roots. Roots only grow into moist soils. If the distribution area of irrigation water is limited, even in the most ideal soils, the root system will be similarly limited. A single, point source of water, like that delivered by a drip emitter, produces a cone-shaped profile of wet soil with the point of the cone (or smallest part of the profile) being directly beneath the emitter. The distribution of emitters then will dictate the distribution of water and directly influence rooting. The design and installation of traditional irrigation systems has favored economics over horticultural considerations. All too often irrigation systems are either designed or installed as if the tree is established and at its mature size when installed with emitters placed near the trunk or towards the outer edge of the original rootball. In these situations adequate growth can be achieved by simply running such a system for long periods of time. The long-term consequence will be trees that have large canopies, stout trunks and very small root systems. These trees are highly prone to wind throw or vulnerable to root rotting diseases.

Ideally the irrigation system is designed in such a way as to allow it to expand outwards as the canopy and root system grow and mature. Tree roots can extend from one and a half to four times the diameter of the tree canopy. It is obvious that as the tree grows the irrigation system should be expanded to deliver water over the ever-expanding root zone. Juan Barba, a Tucson area Certified Arborist, has proposed alternative designs for tree irrigation systems that better accommodate tree and root growth. One method is to install concentric rings (see diagram) of emitters that extend out to the drip line of the tree. Such an arrangement would distribute water over a much larger area and result in a more highly dispersed root system. A second alternative would be to arrange numerous emitters to an X pattern (see diagram) rather than the rings. Both options increase the initial cost of installation but could pay long-term dividends as trees mature.

In either configuration, the emitter(s) nearest the trunk act to help settle, compact and firm the soil around the freshly transplanted root-ball. These emitters also promote the first stages of root growth beyond the original rootball by wetting the soil and promoting the earliest exploration and colonization of the surrounding soil by new roots. Shortly after transplanting these emitters should be closed or capped and those near the drip line, if not already open, should be opened. The capping of these emitters allows the soil nearest the trunk to dry out and will help decrease the likelihood of wind throw. The emitters watering the soil near and beyond the drip line will be irrigating the newly developing feeder and anchoring roots. This management approach, if continued as the tree matures, encourages greater root distribution and a larger total root mass.

Not all planting locations can accommodate some of the alternative planting methods discussed. Nor are all these methods currently cost effective. Desert adapted plants and arid landscape designs present new and unique challenges to conventional horticultural methods. Regardless of the limitation of a given site, the irrigation system should be designed so it can respond to and encourage the long-term growth of the tree and the development of a dispersed and well-distributed root system.

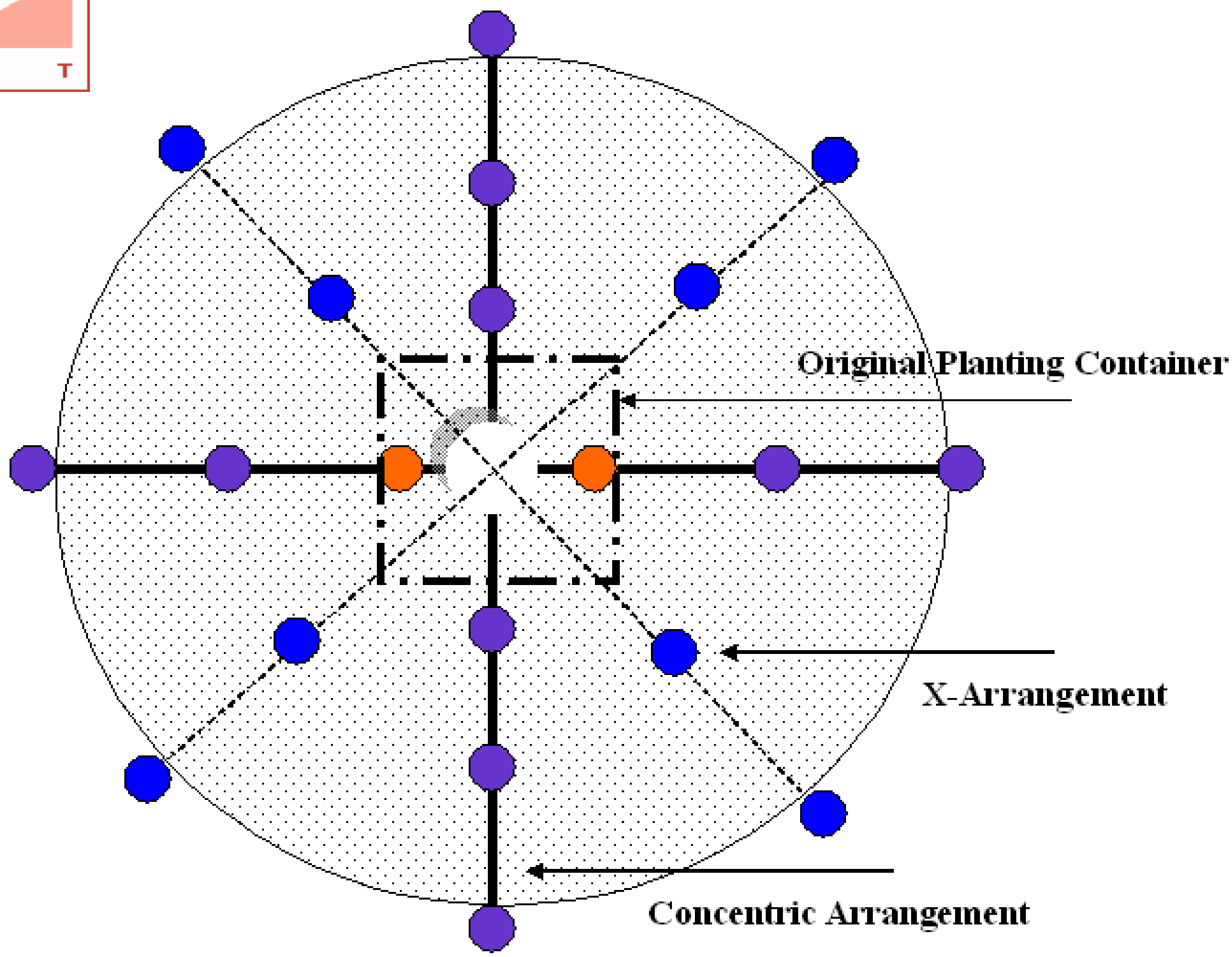
IRRIGATION SCHEDULING

Water applied to soil will follow one of three fates. Gravity and other physical forces in the soil eventually pull some water to depths out of the reach of plant roots. Another portion evaporates from the surface and just slightly below the surface of the soil. The third and most important fraction is for water to be absorbed by plant roots.

Irrigation schedules must be responsive to the water needs of the plant as influenced by the plant's stage of development, air and soil temperature and relative humidity, other available sources of water (rainfall, site drainage, subsurface water) and the nature and structure of the soil. Another consideration is surrounding hardscape elements such as walls, planter boxes, parking lots and sidewalks that can shade or store and reflect the suns intense rays. With these factors in mind its clear that irrigation scheduling is a site specific and in many instances a plant specie specific tack. It is unlikely that even the most sophisticated irrigation system can precisely meet the exact need of all the plants in a typical desert landscape. A reasonable goal when scheduling should be to replenish lost or absorbed water at a frequency that allows the root profile to proceed through a cycle from saturated (immediately following the application of water) to slightly dry soil (when most soil moisture has either drained through or been taken up by the plant). The length of this cycle, or the interval between irrigations, will be determined by the plant species present, their stage of maturity and the water retention characteristics of the soil.

Soils with high clay content hold water tightly causing them to remain saturated or nearly saturated for long periods. Sandy soils are quite porous and may drain very quickly, significantly shortening the intervals needed between irrigations.

Some general guidelines are available like those offered by the Desert Botanical Gardens and the University of Arizona College of Agriculture Any schedule recommendations made in publications should be weighed against knowledge of the plant material, surrounding hardscape and the soil type at the location being irrigated.



Irrigation Emitter Arrangement Options

Emitter watering original rootball (plug emitter 30 to 90 days after planting)

Concentric watering pattern (3 foot spacing)

X watering pattern with additional emitters for more water demanding trees i.e.: Chilopsis linearis or Acacia smallii

Trunk of tree

Arid Zone Trees, P. O. Box 167, Queen Creek, AZ 85242, Phone 480-987-9094 e-mail: aridzonetrees@msn.com
www.aridzonetrees.com