Xeriscape Irrigation Recommendations

State of Knowledge

Summary

- **Very little definitive information on xeriscape irrigation requirements exists**
- **Xeriscapes can need supplemental irrigation to maintain desired appearance in the landscape**
- **Many climate-adapted (xeriscape) species will use whatever water is made available**
- **Irrigation of climate-adapted species is best viewed as applying minimum water demand**
- **Soil water deficits keep the plant in a state of drought adaptation, limiting growth and irrigation requirements**
- **Recommended average landscape coefficient (K_L) is 0.3 (30% of tall canopy (alfalfa) reference evapotranspiration, ETrs, equivalent to 0.35-0.38 ETos)**

Xeriscaping is promoted as a set of landscape water conservation practices. The seven principles include efficient irrigation systems, separate irrigation zones, and appropriate plant selections, among other principles.

Xeriscape plantings in semi-arid and arid regions are frequently touted as 'climate-friendly' or 'climate-adapted'. That usually means these plants can survive on the natural rainfall of the location, but may require supplemental irrigation for best appearance in the landscape. However, little information is put forth about how much supplemental irrigation is needed and when it should be applied.

Northern Water
Irrigation Management

Inexperience with climate-friendly plants and improper irrigation zoning or management can lead to overwatering, excess growth, and higher water demand by the plants, plus potentially a loss of capacity to tolerate drought conditions that may develop or be imposed by watering restrictions.

The vast number of plant species available in any given region makes it very difficult to develop hard information on species-specific water requirements. However, it is important to quantify appropriate irrigation amount and frequency because many xeriscape plants have the capacity to use whatever water is applied. Others are injured with overwatering. For many plants, there is a spectrum of growth across the applied irrigation scale from no irrigation to 75-100% of reference evapotranspiration. Appearance and suitability for the landscape vary along this spectrum. Because of this appearance factor, as opposed to simply a survival factor, there is subjectivity in the irrigation management for xeric plant selections.

Irrigating xeriscapes is best viewed as applying 'minimum water demand', which is not the same as applying to meet full evapotranspiration (ET) needs, as in turf irrigation of sports fields or in irrigation for

optimum crop production. The ability of the 'climate-friendly' plants to adjust to limiting water conditions and tolerate water deficits allows these plants to survive and maintain acceptable appearance during drought conditions when supplemental irrigation is limited or prohibited.

Properly irrigating xeriscape plants for water conservation and drought tolerance means following some basic guidelines common to all plants in the landscape: irrigate deeply and irrigate as infrequently as possible. Too frequent and light irrigation after establishment leads to shallow root systems that are trained to need more frequent irrigation. Deeper root zones provide a large soil moisture buffer when rainfall or irrigation are limited or restricted, allowing plants to survive longer without precipitation or supplemental irrigation.

'Climate-friendly' plants in semi-arid and arid climates have many physiological mechanisms that allow them to survive with low and often sporadic precipitation. This makes climate-adapted plants ideal choices for landscapes in semi-arid and arid climates when managed for low supplemental irrigation. The landscape water management must, however, irrigate the plants to supply the minimum water demand for survival or desired appearance in the landscape.

It is important to limit irrigation after establishment. Irrigating to replenish moisture deeper in the root zone is important, but maintaining a soil water deficit allows the plants to adjust through the various physiological mechanisms the species employs for adaption. Physiologically adjusted plants are well-prepared to tolerate drought and continued water deficits, but overwatered plants may have lost their drought adaptation and are therefore more vulnerable to irrigation limitations or prohibitions. Actively growing plants cannot adapt quickly to sudden water deficits and will suffer compared to landscape plants maintained in a water-deficit condition. Overwatered plants also have more biomass to support, another point of vulnerability to drought.

There are almost no explicit recommendations on how much to irrigate, or when. Many xeriscape websites indicate that plants require little or no water after establishment. What does that mean? Others list plants by water category: Very Low (0-25%), Low (25-50%), Medium (50-75%), and High (75-100%) of grass reference ET.

Smeal et al (2010) recommend an average landscape coefficient (K_L) of 0.3 for tall canopy reference ET (ETrs, ASCE-EWRI, 2005), based on a study in northwestern New Mexico. This is equivalent to 0.35-0.38 of ETos (grass reference ET). Many of the species in the study are grown throughout the Intermountain West, so this K_L is a reasonable value for irrigators to start with. Most plants in Northern Water's Xeriscape Plaza fall into the Low water use category (25-50% of grass reference ET), with the exception of the Southwest landscape and some individual plants that have slightly higher water demands. An irrigation recommendation of 30% ETrs (35-38% of ETos) is a good starting point for irrigation scheduling in the Xeriscape Plaza. Note, however, that most landscape irrigation schedules are based on grass reference ET (Eto, ETos) instead of alfalfa reference ET (ETr, ETrs). At some point, a correlation should be verified between an ETrs and ETos based K_L.

How much irrigation is needed and when to apply? As an example, Northern Water's Berthoud weather

station measured 7.75 inches of ETrs in August, 2011. At 30% ETrs, that would be 2.3 inches of irrigation required for the month (with no rainfall). Best practices indicate watering deeply and infrequently, preferably when changes in plant condition indicate need for water. Knowing how much water to replace in the soil profile is then necessary.

How often to apply? Instead of irrigation at 0.57 inches per irrigation once per week (the maximum time interval allowed by nearly all irrigation controllers is once per week), irrigation would occur every 2 weeks at a rate of a little over an inch per irrigation. Irrigations applied at higher levels will penetrate deeper into the soil profile. Irrigations are reduced, eliminated, or delayed depending on rainfall during the period. Irrigating to reach maximum depth in the root zone promotes deeper root development.

Colorado's Front Range climate can make xeriscape irrigation scheduling challenging. Rainfall can be sufficient in late spring and early summer to void the need for supplemental irrigation. Historically, however, as summer continues, supplemental irrigation is needed to maintain plants at an acceptable appearance.

The recommendation of irrigation at 30% ETrs (35-38% ETos) is currently a uniform rate from May through October. It makes sense, however, that as plants break dormancy, their ET will ramp up from near 0% to a soil-moisture and climate controlled rate. However, these post-dormancy ET ramp-ups are not documented at this point, so checking soil moisture before irrigating is highly recommended. Similarly, it makes sense that xeriscape plants will start preparing for winter dormancy and follow a decreasing plant irrigation coefficient.

The best approach at any time, but especially during early and late seasons, is to check soil moisture and not irrigate if soil moisture levels remain adequate.

Northern Water is following the irrigation schedule suggested by Smeal et al (2010). Four-foot long soil moisture probes have been installed in each Plaza landscape. Soil moisture is read weekly at 6" and 12" depth intervals in the four-foot soil profile. After applying the 30% ETrs (35-38% ETos) irrigation rates, we periodically check soil moisture and plant condition and ascertain whether this irrigation rate is working with our climate-adapted plant selections. Soil moisture in each plant grouping will be evaluated for plant evapotranspiration during periods with no rainfall or irrigation. While not species specific, insight into irrigation requirements of the Conservation Gardens Xeriscape Plaza is anticipated.

References

Smeal, Daniel, Michael K. O'Neill, Kevin A. Lombard, Richard N. Arnold. 2010. Climate-Based Coefficients for Scheduling Irrigations in Urban Xeriscapes. An ASABE Conference presentation. Paper Number: IRR10-10038. 5th National Decennial Irrigation CD-ROM Proceedings. Phoenix Convention Center, 5 - 8 December 2010, Phoenix, AZ USA. M. Dukes ed. St Joseph Mich: ASABE. ASABE Publication Number 711P0810cd

ASCE-EWRI, 2005. The ASCE Standardized Reference Evapotranspiration Equation. Technical Committee report to the Environmental and Water Resources Institute of the American Society of Civil Engineers from the Task Committee on Standardization of Reference Evapotranspiration. ASCE-EWRI, 1801 Alexander Bell Drive, Reston, VA 20191-4400, 173 pp. http://www.kimberly.uidaho.edu/water/asceewri/ascestzdetmain2005.pdf

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