



MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #267

Watering Efficiently

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Of the seven principles of water-wise gardening, attention to irrigation efficiency has the greatest potential for water conservation for most residents. In the typical home yard, extra attention to irrigation system design, maintenance and management could reduce water use by 20 to 70%, or 40% on average.

Irrigation Zones Reflect Water Need

Unfortunately, in the design of many home irrigation systems, little attention is given to zoning by water need.

- **Zone by irrigation demand** – The following examples have different water requirements and should be independent irrigation zones.
 - Lawns—Routine irrigation
 - Lawns—Reduced irrigation
 - Lawns—Limited irrigation or non-irrigated
 - Mixed flower and shrub beds—Routine irrigation
 - Mixed flower and shrub beds—Reduced irrigation
 - Mixed flower and shrub beds—Limited irrigation
 - Vegetables – routine irrigation
 - Tree fruits – reduced irrigation
 - Small fruits – routine to reduced irrigation depending on the fruit

- **Zone by exposure** – Because exposure to sun, heat, and wind also plays a significant role in water requirements, irrigation zones should reflect exposure levels. For example, lawn on an open, windy, southwest-facing slope will have considerably higher water requirements than the average lawn. Design this southwest slope as an independent irrigation zone.

Areas in full or partial shade may have lower irrigation needs than areas in full sun. As a rule of thumb, if a shady area is outside of the rooting zone of large trees, water use may be 30 to 50% lower. If the shady area is in the

rooting zone of large trees, water use will be similar to full sun (the tree pulling water from the soil is not in the shade.) Irrigation zones should reflect site needs.

- **Drip irrigation** in flower and shrub beds, small fruit gardens, and vegetable gardens can reduce water usage by 50% when coupled with organic mulch. For details on drip irrigation, refer to *CMG GardenNotes #263, Irrigation Equipment*.

Sprinkler Design Criteria for Uniform Water Distribution

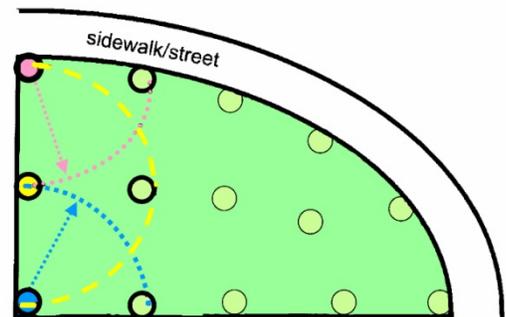
Unfortunately, in the design of many home (and commercial) sprinkler systems, little attention is given to design criteria for water conservation.

Sprinklers do not deliver a uniform quantity of water over their distribution area. Thus to keep the dryer spots (i.e., spots that receive less water) green the rest of the area receives more water than needed. Designing sprinkler layouts to provide a more uniform water delivery can reduce water use by 25 to 50%. Most home lawn sprinkler systems have a 30 to 40% efficiency rating, whereas a 70 to 80% rating is very achievable with attention to design and management.

Sprinkler design criteria for uniform water distribution include the following:

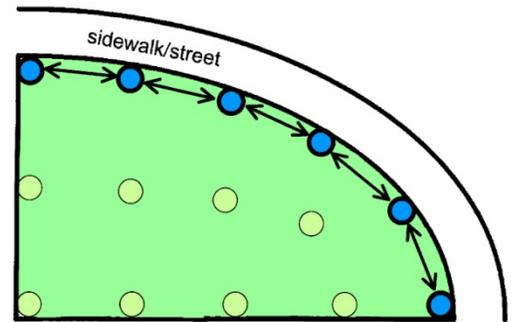
1. **Head-to-head coverage** – Designs with head-to-head coverage (i.e., the water from a sprinkler head reaches the neighboring sprinkler heads) generally give the most uniform delivery. A 10 to 20% overlap may actually give the best uniformity. In other words, space heads at 90% of their radius of throw. For example if the radius of a pop-up spray head is 15 feet, the ideal spacing would be 13.5 feet (15' x 90%); and maximum spacing would be 15 feet. Wider spacing could increase water use by 25 to 50%. [Figure 1]

Figure 1. A standard in sprinkler design is head-to-head coverage. Ten to 15% overlap may give even better uniformity.



2. **Line out the edge** – In the design process, start by *lining out* the edges (i.e., run a line of sprinkler heads down the edge of the lawn or irrigated area), spraying onto the lawn but not onto the sidewalk, street or non-irrigated area. [Figure 2]

Figure 2. Start the layout by lining out the edge, running a row of sprinkler heads along the edge of the irrigated/non-irrigated areas.



In sprinkler design, avoid layouts where sprinkler heads spray from the center of the lawn area out onto the sidewalk. It either wastes 20% of the water as it over-sprays onto the sidewalk or creates a dry lawn area along the edge. [Figure 3]

If our society is going to deal with limited water supplies, it has to become unacceptable for the homeowner, private and commercial property manager or government entity to apply irrigation water onto roads, sidewalks and parking lots.

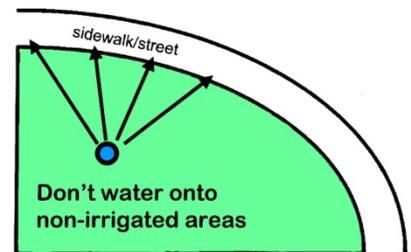
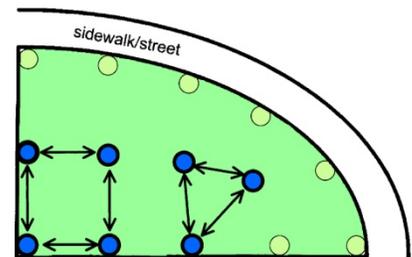


Figure 3. Spraying from the center out onto a sidewalk or non-irrigated area is unacceptable in water-wise landscaping.

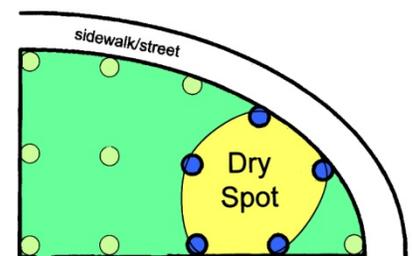
3. **Arrange heads in square or triangular patterns** – In the next step of the irrigation design process, fill in larger areas with sprinkler heads in square or triangular patterns. Square and triangular head patterns give the most uniform water delivery. [Figure 4]

Figure 4. For uniform water delivery, fill in heads in square and triangular patterns.



In irregularly shaped areas, heads easily fall into pentagon (five-sided) patterns. Avoid these as it creates an area that receives less water than other parts of the lawn. [Figure 5]

Figure 5. Avoid pentagon-shaped head layout. The area receives less water, creating a dry spot.



4. **Avoid irrigating small, irregularly shaped areas** – It is impractical to sprinkle irrigate small areas (less than eight feet wide) and irregularly shaped patches without applying water where it is not needed. In small or irregularly shaped areas, consider replacing lawns with plantings that can be watered with

drip irrigation, or consider non-irrigated options. For example, in the narrow side yards around urban homes, consider a low-water-requiring ground cover or a non-irrigated mulch area.

5. **Use recommended water pressure** – Water distribution patterns change with pressure. Use the pressure recommended for the specific sprinkler head in use. Most sprinklers in the home garden trade are designed to operate at 30 to 40 psi. Commercial heads typically operate at 40 to 100 psi, and some heads have built-in pressure regulators.

New homes typically have a pressure regulator where the water line enters the home. In older homes, adding a pressure regulator may significantly reduce landscape water use.

Sprinkler Maintenance Criteria for Uniform Water Distribution

We have all noticed that blown sprinkler head down the street that goes unfixed for weeks. A problem with automatic sprinkler systems is that the gardener may not be aware of a system malfunction. Check the irrigation system's operations frequently.

As water-wise gardening concepts spread in our community, we need to adapt the practice of alerting neighbors to popped sprinkler heads and other system malfunctions. With an automated sprinkler system, many residents or landscape managers may be unaware of the mechanical failure.

Maintenance issues for uniform water distribution include the following:

- **Arc adjustment** – Sprinkler heads (particularly rotor-type heads) frequently require adjustment of delivery angle to keep water on the irrigated areas and off non-irrigated areas. [Figure 6]

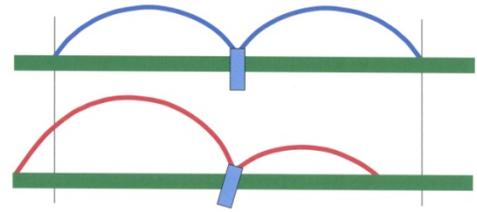
Figure 6. Heads frequently shift their delivery arc. Frequent adjustment is required.



- **Adjust radius of throw** – As discussed in design, water from one sprinkler head needs to reach adjacent heads for uniform delivery. A 10 to 20% overlap is preferred where it does not spray a non-irrigated area. Occasional adjustment on the radius of throw may be needed. This is done with a screw adjustment on the nozzle or changing out the nozzle to one with a different radius.
- **Adjust sprinkler heads to vertical** – Distribution patterns change when the head tilts off vertical alignment. To correct it, remove a donut shape of sod around the head with a shovel. Carefully loosen the soil around the head.

Realign the head to vertical, and then firmly pack soil around the base of the head before replacing the sod. [Figure 7]

Figure 7. Heads require frequent adjustment back to vertical. Tilted heads change the distribution pattern.



- **Adjust head height** – When water flow does not clear the grass height, the distribution pattern can be distorted. Raise heads to release water above grass height. On the other hand, sprinkler heads set excessively high can be a trip hazard and can interfere with mowing. [Figure 8]

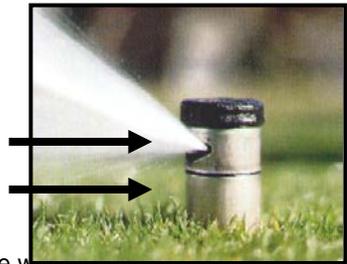


Figure 8. Raise height of head to a point where water is released well above the grass height.

To correct this, remove a donut shape of sod around the head with a shovel. Carefully loosen the soil around the head. Adjust head to the correct height, and then firmly pack soil around the base of the head before replacing the sod.

- **Replace worn nozzles** – As sprinkler nozzles wear, distribution patterns change, giving a less uniform water delivery. Periodically replace old, worn nozzles. [Figure 9]

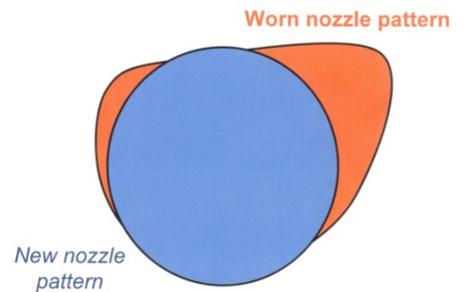


Figure 9. Worn nozzles distort the delivery pattern.

- **Adjust pressure** – A mist cloud around a sprinkler head indicates that the water pressure is too high for the head. Reduce pressure to avoid wasting water. A pressure regulator can be added to the main supply line. When adjusting pressure, slowly drop the pressure until you see water flow just start to drop, then up the pressure just a touch.
- **Replace leaky valves** – In an irrigation valve, the rubber diaphragm that actually turns water on and off ages over time. Valves that do not shut off completely need the diaphragm or entire valve replaced. Values often fail to shut off if the pressure is above 80 psi.

Sprinkler Management Criteria for Water-Wise Irrigation

Sprinkler management addresses two primary questions, how much and how often. Irrigation scheduling is discussed in more detail in *CMG GardenNotes #265, Methods to Schedule Home Lawn Irrigation*.

- **Know the precipitation rate for each irrigation zone, and adjust run time to match water need of each zone.** – The first step in irrigation management is to calculate the precipitation rate for each zone. Once the precipitation rate is known, the controller can be set to deliver the desired amount of water. Because distribution patterns and precipitation rates generally vary from zone to zone, run times should be set for each irrigation zone based on precipitation rates.

Most irrigation controllers are set with all zones receiving the same run time. This results in zones that need less water being over-watered.

- **Adjust irrigation controller for the season** – As summer temperatures increase, water use goes up; as cooler fall weather moves in, water use goes down. Unfortunately, most gardeners have their controllers set for the summer, and never adjust the controllers for the season. Most lawns and gardens are over-watered by 40% in the spring and fall. Iron chlorosis is a common symptom of springtime over-watering. Several methods can be used for irrigation scheduling. For details, refer to *CMG GardenNotes #265, Methods to Schedule Home Lawn Irrigation*.
- **Water bluegrass at 80% ET** – When water is available, Kentucky bluegrass uses significantly more water than what it actually needs to remain green. Bluegrass also slows its water use and growth rate as soil moisture decreases. Watered at 80% ET, a home bluegrass lawn will remain thick and green. Watered at 60% ET, a home bluegrass lawn will remain green, but not as thick.
- **Summer-dormant Kentucky bluegrass** – Where appropriate for the use of the site, summer-dormant Kentucky bluegrass has a very low seasonal water use. It requires only 14 inches of rain and irrigation per year (applied in the spring and fall). For additional details, refer to *CMG GardenNotes #412, Water-Wise Landscape Design: Selecting Turf Options*.
- **Turn off sprinklers in rainy weather** – Manually shutting off the sprinkler system during rainy weather is another effective management tool. An inexpensive investment (around \$25) to help manage the irrigation system is a rain shut-off sensor. In many parts of the country, but not Colorado at this time, local ordinances require rain shut-off sensors.
- **Soak and cycle** – On slopes and on compacted or clayey soils water can be applied much faster than it can infiltrate into the soil, leading to surface run-off. To deal with this, use multiple short-run cycles that allow the water to soak in between cycles. Most controllers readily accommodate this with multiple start times.

On clayey soil with pop-up spray heads, apply about quarter-inch per cycle (about eight to ten minutes) with two or three cycles to apply one-half-inch to three-quarters-inch of water per irrigation. Runs are typically spaced an hour apart or, more commonly, after all the zones have run it cycles again.

- **Dry spots** – The common approach for managing dry spots is to increase the amount of water applied. Although it may green up the dry spots, it also overwaters the rest of the lawn, wasting water.

To evaluate a dry spot, first place some identical, straight-sided, flat bottomed cans (like soup or vegetable cans) out to measure the water applied. Compare the amount of water received in the dry spot to the amount of water received in green areas. If the dry spot receives significantly less water, it is a water delivery problem (like a malfunctioning head or design problem). If similar amounts of water are being received, the problem is soil/plant related (like compaction, thatch and root damage).

Note: as the gardener fine-tunes the management of his/her irrigation system, dry spots will show up in hot weather. This indicates that he/she is successfully walking the edge on ideal irrigation management.

- **Aeration** is a primary tool to increase water infiltration. Aeration may be useful spring and fall on lawns with a lot of traffic (children and dogs), compacted, clayey soils and slopes. Refer to lawn care information for details.
- **Water deeply and infrequently** to develop a deep root system that gives the plants more resilience in hot, dry weather.
- **Water at night or early morning hours** – To reduce water loss from evaporation, water between 9:00 in the evening and 9:00 in the morning. In many areas, wind drift is less in the early morning hours. (Note: Some cities experience peak water use from 4 to 6 in the morning as automatic sprinkler systems come on. To help the community avoid spikes in water demand, remember the suggested watering window is 9 in the evening to 9 in the morning, not just 4 to 6.)

Additional Information – *CMG GardenNotes* on Irrigation Management

#260	Irrigation Management: References and Review Questions
#261	Colorado's Water Situation
#262	Water Movement Through the Landscape
#263	Understanding Irrigation Management Factors
#264	Irrigation Equipment
#265	Methods to Schedule Home Lawn Irrigation
#266	Converting Inches to Minutes
#267	Watering Efficiently
#268	Home Lawn Irrigation Check-Up

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