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Irrigation Systems

South Carolina has an abundant amount of annual rainfall – 48 to 52 inches per year in some areas, which is an average of almost an inch per week. While 1 inch per week is adequate for many plants and ground covers grown in the state, we cannot always depend on receiving the correct amount of rainfall at the right time. Irrigation provides a way to ensure that plants receive the appropriate amount of water in a timely fashion.

IRRIGATION AMOUNTS

The amount of water needed by a plant depends on the plant type, plant size and the weather conditions. Plant water requirements can vary tremendously – small, newly-sprouted potted plants may only require a few ounces of water twice a week, while a fully grown pecan tree requires up to 90 gallons of water per day or more!

A good rule of thumb to begin with is to plan to irrigate 1 inch of water per week. This 1 inch is the net irrigation amount, or the amount of water that actually enters the soil. If the water requirements of the plant or crop are known, then plan to apply the known amount of water each week. For instance, sweet corn may require up to 2½ inches of water per week, while many lawn grasses require only 1 to 1¼ inches per week. Be sure to include rainfall in this net amount of water – the plant certainly receives a benefit from rain!

If you are unsure about the amount of water needed, begin by applying a set amount (say an inch or so) for a few weeks. After two or three weeks, try adjusting the amount of water as needed – if the ground stays very wet, lower the irrigation amount. If the plants appear stressed regularly, try applying a little more water. Remember that new, young plants do not require as much water as older, fruit-bearing plants. This is especially true in a home garden. The proper water amount is a dynamic number – it changes with plant growth and weather conditions. Plan to adjust your irrigation throughout the season.

Tensiometers and other devices are available to help you determine when to water. These devices measure either the tension of the soil water (how tightly it is held by the soil) or the electrical conductivity of the soil (drier soil conducts less electricity).

How much water is 1 inch? One inch of water on 1 acre of land is 27,154 gallons (3630 cubic feet). So, if you plan to apply 1½ inches of water on 0.7 acres of land, you will actually use 27,154 x 1.5 x 0.7 = 28,511 gallons.

EVAPORATIVE LOSSES

As mentioned previously, net irrigation is the amount of water that actually enters the soil. Gross irrigation, then, is the total amount of water pumped or sprinkled. The difference between these two numbers is the water lost due to runoff and evaporation.

Evaporative losses can be quite severe. A typical sprinkler system operated at noon on a hot, windy, dry day in midsummer can lose 30 percent or more of the water to evaporation. The same system operated in the late evening when wind speed is low and humidity is high may only lose 15 percent of the water applied to evaporation. The most important factor for irrigation, then, is the time of application.

Many are afraid to irrigate in the evening, citing increased disease problems. Irrigating at night and in the early morning will not cause increased disease problems unless the wetness period of the

plant leaves is increased. That is, plant leaves are wetted overnight by dew and dry in the morning as the sun rises. If irrigation is scheduled so that the plants are wet for a longer period in the morning, additional disease problems can occur. Plan your irrigation cycles so that the plant leaves dry in the normal time frame – possibly by ending your irrigation cycles by 4:00 or 5:00 in the morning.

The best way to check your net irrigation amount is to place a rain gauge or straight-sided can in a representative area of the irrigation system. The depth of water in the gauge or can is the net irrigation amount after evaporative losses. It does not, however, include runoff losses.

RUNOFF LOSSES

Runoff occurs when water is applied more quickly than the soil can absorb it. Sandy soils accept water more quickly than clayey soils, and dry soils accept water more readily than moist soils. Each soil type has a distinct water infiltration curve that describes how quickly water will move into the soil. Obviously, we do not want to apply water too quickly – if it runs off, we receive no benefit from that water, even though we paid to apply it.

The first step, then, is to design an irrigation system that applies water based on your soil's infiltration capacity. If the system is already in place, a second option is to split the irrigation time in half. If you notice runoff as you apply the correct amount of water, adjust your system to water twice with half the total amount needed each time. This will give the water more time to soak into the soil, preventing runoff. If there is a sprinkler in the system that is irrigating pavement, adjust the sprinkler so that it applies water only to the lawn or plants. This is runoff water too!

IRRIGATION FREQUENCY

Exactly how many times a week should you irrigate? The answer is as seldom as possible! It is always better to irrigate once deeply than to irrigate twice or three times shallowly. The only exception to this rule is possibly during lawn establishment by seeding or sprigging.

Irrigating deeply allows the irrigation water to sink more deeply into the soil, which in turn promotes deeper plant root growth. This deep root growth then allows the plant to access nutrients in the soil that would not be available to a shallow-rooted plant. Not only will you have a healthier, hardier plant, you will also have a plant that has a longer time period to retrieve nutrients as they move down through the soil after fertilization. Irrigating less often pays dividends in more ways than one.

If you must irrigate in two separate cycles due to runoff problems, try to finish both cycles on the same day. This will allow you to irrigate without runoff and will provide the benefits of deep irrigation.

Clayey soils hold more water per inch than sandy soils and are not as easily drained. If you have a clayey soil you should be able to irrigate once per week (possibly in split cycles to prevent runoff). If you have a very coarse, sandy soil you may have to water more often with a smaller amount of water. The low water-holding capacity in combination with the good drainage characteristics of sandy soils means the soil will not hold as much water for the plant and will not hold it as long. Also, over-watering sandy soils (which are not very prone to runoff) can cause leaching of the nutrients in the soil down past the root zone in short order.

IRRIGATION WATER SOURCES

Wells, ponds and municipal water sources are all good sources of water for the landscape. Some coastal wells may not be suitable for extended irrigation due to salt content. This salt will build up in the soil over a period of time. Many of these wells can be utilized if managed properly, especially since rainfall helps leach the salts out of the soil profile.

Other upstate wells may have high concentrations of iron. Iron stays in solution until it is contacted by air, then it oxidizes into a solid form. This is no problem for sprinkler systems generally (except for the reddish-brown stains from high-iron wells), but can cause major blockage difficulties with drip systems and soaker hoses due to their small outlets.

Municipal water systems are usually excellent sources of water. Their major drawback is the cost of the water. If you plan to use a municipal

water source, plan on installing an irrigation water meter. The water charge is usually the same as the household meter, but there are no sewer charges on the irrigation water since this water is not returned to the municipal sewer system. This simple sewer cost savings will usually pay for the meter placement cost in a few years (or less). Some type of backflow prevention device at the meter to protect the water supply will be required by the municipality.

Ponds also work quite well as irrigation sources. There is one caution: If the pond has no spring or water supply it can be pumped down quickly. For instance, if a half-acre pond is used to irrigate a 1-acre lawn, the pond will drop 2 inches for every inch of water pumped on the lawn. If we irrigate 1 inch per week for 10 weeks, we will lower the pond some 20 inches (over 1½ feet). Rainfall will help replenish the pond – just make sure the pond has adequate capacity for your plans.

Also, if you plan to use drip irrigation, you will need to provide good filtration for the pond water. Drip systems have extremely small openings and usually require filters of 150 mesh opening size (150 openings per linear inch).

SPRINKLER PLACEMENT AND UNIFORMITY

Sprinklers and spray heads spray water in a circular pattern. Just as a race car driver on the outside corner has more ground to cover than a driver on the inside corner, a sprinkler's stream has to cover more ground as it gets farther away from the sprinkler head. This means that more water is applied near the sprinkler, with less applied as the distance from the sprinkler increases. Obviously, if we place one sprinkler on the ground alone and operate it, we will have a green area right around the sprinkler with plenty of water and then progressively lighter shades of green as we move away from the sprinkler until we get to the brown area near the edge of the sprinkler's throw.

To overcome this problem and obtain a good, uniform coverage, sprinklers and spray heads should be placed so that their stream of water actually touches the next sprinkler (or is within 1 or 2 feet of touching). This complete overlap will ensure good uniform coverage and no "brown spots" in the lawn or garden. On first glance this sprinkler-to-sprinkler placement looks like needless excess, until you see an improperly designed system with brown areas between the sprinklers! Proper initial design will certainly prevent many later problems and headaches.

IRRIGATION EQUIPMENT

There are many different types of irrigation equipment. The following list provides some general ideas of the capacities and uses of the various types.

Sprinklers: Sprinklers can be pop-up or stand-up and can operate by impulse (the oldest type), gear drive or rotor drive. Sprinklers shoot a single stream of water and rotate that stream in a circle. They can be set to cover a full circle or a portion of a circle. Typical sprinklers cover an approximately 80-foot circle and have flows of from 2 to 8 (or more) gallons per minute. Application rates of sprinklers can be 1 inch per hour or more depending on nozzle size and pressure. Sprinklers are typically used for large lawn or shrubbery areas.

Spray Heads: Spray heads can also be pop-up or stand-up. These heads come in pre-set patterns of throw (90 degrees, 180 degrees, etc.) and spray water over the entire coverage area at the same time, hence the term spray head. Typical spray heads cover an approximately 30-foot circle and have flows of from 0.3 to 3.7 gallons per minute depending on size and pattern. Application rates of spray heads can exceed 1½ inches per hour. Spray heads and sprinklers cannot be placed on the same irrigation sections because spray heads, while covering a smaller area, apply water to that area at a much higher rate. Spray heads are typically used on shrubbery and small lawn areas.

Timers: Timers (or controllers) are used to operate a sprinkler system automatically. Timers can be electronic or electro-mechanical and have various features and numbers of operating zones or stations. All timers use a 24-volt AC power source to operate electric valves in the system, which is virtually harmless (a shock cannot be felt with your fingers). Current is carried to valves in wires buried in the ground with the irrigation pipe. Timers can be programmed to turn a system on at any given time and irrigate separate sections (or

zones) of the system for differing time lengths on varied days. The options are almost endless – and can get quite expensive.

Electric Valve: This is an irrigation valve that is turned on by applying a 24-volt AC power source. The valve turns off when the power is removed. Most electric valves may also be operated manually. These valves are buried in the irrigation area in a valve box, which is a plastic pail with a lid that permits access to the valve in the ground.

Backflow Preventer: This device is a fail-safe check valve that is used to prevent water from moving from the irrigation system back into the water supply. It is usually required on municipal systems.

Drip Irrigation: Drip irrigation is characterized by small (½ inch) polyethylene tubing with "emitters" located at various points. Drip irrigation applies water much more slowly than sprinkler systems and therefore must be operated longer. Flow rates are typically 1 or 2 gallons per hour per emitter. Drip systems are usually 95 percent efficient (compare this to 70 to 85 percent for sprinklers) and suffer almost no losses due to evaporation or runoff. It is primarily used for shrubbery areas and some home gardens. Most drip products do not wet leaves or foliage, so they can be used at any time. Drip irrigation requires filtration and should always be placed on top of soil but under any mulch used in the landscape.

Prepared by W. Bryan Smith, Area Extension Agent, Irrigation/ Water Quality and Bob Polomski, Extension Consumer Horticulturist, Clemson University.
