Effective Irrigation Scheduling

Second in a series | by Robert Bodi

Any irrigator wants the best performance out of his or her sprinkler system. If you are blessed with a good system it is easier to achieve an effective schedule for the area you are trying to water. If you are less fortunate with a below average system it will be a slightly harder task. No matter the condition of your system it is worth the effort to learn more on how you can effectively water your irrigated areas.

Each and every project has different watering needs. You can have different watering needs within one project. More than likely there will be a seasonal adjustment that will need to be made as the watering requirements increase or decrease.

For us to determine how to water our areas in the most effective way, we must do some homework. In generic terms we must determine:

1. The rate at which we are able to put our water down
2. How much water actually goes into the soil and how fast
3. How much time it takes for the soil to retain an adequate supply of water

Soil is no more than a water holding tank for the plants that reside in it. The water is put in the tank, the plant uses it and rain or irrigation must refill it again and again. It is up to us as the irrigator to determine the best time to water and the right amount.

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Precipitation Rate

The rate that we can put water down is referred to as the precipitation rate (PR), and is expressed in inches per hour. There are several ways to determine the PR of your system. First and easiest is to refer to the manufacturer's literature for the equipment that is sprinkling your area. Usually it will give you the PR. You will need to know the PSI of your system to be able to read the chart correctly and determine the PR. There is also a formula that you can use to find out your PR. It is 96.3 x gpm (flow) divided by the amount of square footage of the area covered.

Example

Let's say that you have a zone that has six heads in it. The heads deliver 4 gpm each. The zone covers 600 square feet. The formula would work in this manner: 96.3 x gpm / Area or 96.3 x 24 / 2000 or 2311 / 2000 or 1.15 inches per hour. What that means is that you would be able to put out 1.15 inches of water per hour of run time for that zone. The best way to determine the PR of your system is to do a "catch can" test. This is where you actually put out several cans and run the system. You will need to time the watering cycle to be able to determine the PR. Place the cans in the middle of the heads if possible. Next, turn on the zone for, say, 10 minutes. If there is not enough water to measure after 10 minutes, then leave it on longer. Be sure to keep up with the time. Measure the water in each can. If you used multiple cans you would need to pour the contents of each can into one can. Measure the total water in the can. Divide it by the number of cans. This will give you the average amount of water in the cans. Let's say that you came up with a 0.25-inch average in the cans and it took 20 minutes run time. If it took you 20 minutes to achieve 0.25 inches it would be safe to say that you would have 0.75 inches in the can if you ran it for an hour (0.25" x 3 = 0.75 inches per hour).

Soils

Now that we have determined how much water we can put into our soil with our system we need to determine how our soil or "holding tank" will let the water in, hold it, and how much water the plant can safely use before our next watering cycle.

We must first determine the type of soil that we have to be able to know how the water will be absorbed and held. Generally soils are divided into three types (see Table 1).

Use Table 1 to determine the type of soil that you have. The inches column refers to the amount of water that is known as the water holding capacity of a soil given in inches of water per inch of soil thickness. If you have Bermuda turf with roots 6 inches deep in loamy soil, then you will have a water holding capacity of 0.75 inches for your turf (6 x 0.125 = 0.75). As the water is used out of the soil, it must be replenished before the turf gets to what is called the wilting point. The term used for the difference between the field capacity and the wilting point is available water holding capacity

(AWHC). To be sure that you do not get to the wilting point you need to know the amount of water that you can afford to take out of the soil. This is referred to as the Management allowable depletion (MAD). For turf grasses it is 50 percent of the AWHC. Therefore if you have the same 6 inches of roots in loamy soil you would have a MAD of 0.37 inches (0.75 x 50 percent = 0.37). This is the highest amount of water that you should take out of the soil before irrigating again.

Now that we understand how much water our system can put down and how much we can afford to use before we irrigate again, we need to know how fast we can water our soil without it running off. This is called the infiltration rate of soil. Table 2 shows how many inches of water can be taken in for our different types of soil with turf grass cover.

With our example from above we still have loamy soil with Bermuda grass with 6 inches of roots. We have determined that we need to water after we loose 0.37 inches of water in our soil. So that means we need to put 0.37 inches back into it to fill up our holding tank again.

Water Usage By Plants

So we now know how to figure out our PR, AWHC and MAD. (Sounds like the way you talk to your spouse with little ones around when you don't want them to know why you are saying, doesn't it?) Well, we need to be able to know how to find out just how much water is being taken out to find out how much water we need to put back in.

The major factor in water usage by plants is evapotranspiration rate. And yes, there is another abbreviation for this, too. it is referred to as the ET rate. You can usually find out historical ET rates for your area from government extension offices or sometimes a radio or television farm report. However you find it out, it is a vital tool for understanding how to water your plants. The ET rate is usually given as a monthly average. This means that you need to divide it by the number of days in that month to determine the daily ET rate. If you have a monthly ET rate of 6 inches with 30 days in the month, you would have a daily ET rate of 0.2 inches (ET rate of 6 inches divided by 30 = 0.2). Now one more little factor to use. It is called the crop coefficient. And guess what, there is no abbreviation for this one. We'll keep it uniform and refer to it as the CC. The CC is the fractional amount for different plants because they have different transpiration qualities. You need to know the CC of what you are growing to be able to adjust the ET rate for figuring out the watering requirements of the plants. If we have an ET rate of 0.2 and a CC of 0.9 then our adjusted ET rate would be 0.18 (0.2 x 0.9 = 0.18). This is referred to as our adjusted ET rate or ETA.

So we have learned many abbreviations. They are all important in determining how to schedule our irrigation systems for our most efficient watering. Here is an example and summary of everything and how it ties all we have talked about together:

Example

We have our Bermuda grass with 6 inches of roots in loamy soil. We know that our intake rate is 0.30 for this soil. It is on the high side because it has been aerofied properly. The MAD is 0.37 inches. We have an irrigation system that can deliver 1 inch per hour. Our daily ETA is 0.18. How de we determine our scheduling times?

If our ETA is 0.18 that means that we are basically using 0.18 inches of water per day. We can only afford to take out 0.37 (MAD) total before watering again. So if we divide the MAD by the ETA we will come up with our frequency of watering two days (0.37 divided by 0.18 = 2.05 days).

So every two days we need to put back into the soil 0.37 inches. We have a given of an intake rate of 0.30 inches. Remember that means that we cannot exceed 0.30 inches per hour in any given watering or it will be a waste. Our system has a PR rate of 1 inch per hour. That means our system will deliver 0.016 inches per minute (1 inch divided by 60 minutes). Therefore we cannot exceed 18 minutes per cycle (intake rate of 0.30 divided by 0.016 equals 18.07 minutes). But we can only water 18 minutes per cycle maximum. Therefore we need to water only for 12 minutes and wait approximately 30 to 45 minutes and water for 11 minutes to fill up our tank again and not have any runoff.

This is the best way to have successful water management for your project. There are several steps to go through, but in the long run you will have healthier turf while preserving as much water as possible.

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Table 1

Soil Type	Appearance
Sandy Soils	Dry—loose, non-moldable Wet—forms ball, crumbles
Loamy Soils	Dry—slightly moldable Wet—moldable
Clay Soils	Dry—cracks in surface Wet—sticky

Texture	Inches
Coarse	0.083
Medium	0.125
Fine	0.167

Table 2

Soil Type	Soil Intake Rate
Sandy soils	0.3-0.5 inches per hour
Loamy soils	0.15-0.3 inches per hour
Clay soils	0.05-0.15 inches per hour