The Smart Controller is You

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Last month, we discussed how "smart" controllers still needed proper hardware (i.e. a sound irrigation delivery system with an even distribution uniformity) and accurate environmental information, including plant type. After you understand the above principals you will know how much water you need and how you can deliver that volume.

But wait! There are complications beyond poor uniformities. If the hydro-zone ("zone") in question is in full sun or shade the evapotranspiration (ET) rate will differ dramatically. You can assume a lower plant ET coefficient for most shady areas. Windy areas may require greater run times both because of elevated ET and poor uniformities resulting from watering during windy conditions.

Another major issue affecting the watering schedule is the area's soil. Clay soils are tight. They hold water well, but don't readily allow irrigation or precipitation water to infiltrate. Clay soils may allow as little as 0.1 inches of water per hour to soak in. On the other extreme, sandy soils may take in as much as an inch of water in an hour.

Obviously if the sprinklers apply nearly two inches per hour, a perfectly acceptable rate for spray sprinklers, the run times must be shortened drastically with repeat operations.

If the zone is on a slope, watering time must be further curtailed. When water begins to run off the zone's surface, it is time to turn off the water. In cases where high applications are occurring on slopes, you may need to substitute alternative sprinkler types.

PUTTING IT TOGETHER

How much water do you need to deliver? More to the point, how many minutes do you need to schedule per hydro-zone?

Referring to the 1,000-square foot zone example in which it was assumed a 0.20" per day ET rate, you know that the planting will demand about 0.8 times the peak season ET, or about 0.16 inches of water per day. If the zone contains highly efficiently designed and installed small rotors, the daily demand might be close to the ET rate (0.20 inches x 0.8). But if the equipment watering this 1,000-square foot area consists of spray sprinklers applying only 10 GPM, you know without conducting an irrigation audit that distribution uniformity (DU) is poor. It is reasonable to conclude that uniformity will be less than 50 percent. (With the audit you will have highly accurate DU information.)

EXAMPLE SITE

Peak Season ET = 0.25 In/day

Zone	**Inf. Rate**	**Root Depth**	**Area**	**GPM**	**ET K**	**Application Rate**
(sta.)	In/hr	inch	Sq. ft			In/hr
1	0.75	8	1000	10	0.8	0.96
2	0.15	6	1000	18	0.6	1.73
3	0.75	14	1000	5	0.5	0.48
4	0.15	22	1000	8	0.6	0.77

Divide daily turf water demand by 50 percent (0.20 inches x 0.8 turf coefficient / 0.5 DU) to determine your water demand, or 0.32 inches per day. You know you are using 10GPM and the application rate is 0.96 inches per hour.

Divide the required 0.32 inches of moisture per day by 0.96 inches per hour of application rate (0.32 / 0.96) to get 0.33 hours (20 minutes) watering time per day. But do you need to water every day? How often do you water?

The short answer is as infrequently as possible. But rather than guess, look at the water holding capacity of the soil. The greater that capacity the less often you need to water.

As mentioned earlier, clay soils allow water to infiltrate only slowly, but hold water well once the water is stored. On the other hand, sand does not hold water well. Water holding capacity for clay is about 0.16 inches of water per inch of soil. In other words, turf with a root depth of eight inches will have access to about 1.3 inches of available soil water.

Most irrigation managers allow only about 50 percent of the soil water to be used before replenishing a turf grass root zone reservoir. Therefore if the zone requires 0.32 inches water per day, you might need to apply 0.65 inches every other day. If you can afford more than 50 percent root zone water depletion, water perhaps every third day.

A tree with a two-foot root depth can use a soil water reservoir of about 3.8 inches. In the case of the tree, the deeper root zone allows for the possibility of greater water depletion between irrigations. Once every 20 days might do.

Turf rooted in eight inches of sand with a water-holding capacity of 0.08 inches of water per inch of soil may need to be watered every day. On the other hand, sand may afford the opportunity of cultivating a deeper root zone.

Putting the stated principals together the watering schedule will look something like the one below. You will notice that the example site oddly contains extreme soil differences and coincidentally all the zones are exactly the same size. This example is instructive as to how soil type and application uniformity greatly influence as efficient watering schedule.

In this example plant types, soil types and zone size are known. Zone one (or station one) is cool season turf in sand; zone two is warm season turf in clay; zone three is shrubs in sand; zone four is trees in clay.

Also you know the DU (you've conducted an irrigation audit) and you know the application rate in inches per hour. Based on plant type you know the water use coefficient (ET k), and the root zone depth. From the soil type you know the infiltration rate and soil water available.

Compute hours per day as outlined above. Convert hours to minutes by multiplying by 60.

Divide application rate by infiltration rate and round up to compute number of start times per watering to avoid runoff waste.

To find irrigation frequency in days per week, compute the following:

7 days / Soil water available
Peak daily water need / DU

Remember: soil water available = root depth x soil water holding capacity.

And peak daily water need = plant coefficient x peak ET.

DU	**Soil Water Avail.**	**Min/Day**	**Start Times**	**Minutes**	**Days Week**
	In/in		/day	/start	
40%	0.08	39	2	19	7
65%	0.16	31	12	3	3
90%	0.08	121	1	121	2
90%	0.16	152	6	25	1

The irrigation schedule matches the peak season water demand. Early in the season and late in the season demand will be lower. Weather-based controllers should be able to change the watering schedule every day. Similarly, use your controller's seasonal adjustment feature to easily change schedules at no less frequently than once a week.

Normally, run times can be trimmed. Lateral water movement in the soil helps to mitigate a poor uniformity. Besides, visual plant quality seldom needs to be perfect. Some hydro-zones can be trimmed more than others. Even with a "smart" controller, this type of calibration must take place.

After that, change the program and check the operation of every station weekly at a minimum.

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