Evapotranspiration Offers Superintendents More Irrigation Control

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The Problem

The old way of setting irrigation system run times is outdated and inefficient, leading to increased water and electricity costs.

The Solution

Using evapotranspiration (ET) rates and a computerized central control system will give superintendents much more control over their water budgets.

For more than 25 years, state-of-the-art central irrigation control systems have been computerized and have simplified how superintendents set run times for sprinklers. Whether the central system is programming a field satellite, paging a superintendent or activating a decoder, it still tells that sprinkler station to run for a certain amount of time.

Today, we have the capability of setting specific run times for individual sprinkler heads depending on how we choose to water: deep watering, frequent/short run times or repetitive cycles or repeats. But despite using these precise computers, superintendents must still answer the vital question: How should we determine how long those run times should be?

Superintendents have two options to set run times for today's irrigation central-control systems. One method is to set specific run times in minutes and budget for each of those times from one day to the next depending on weather conditions. The other, more scientific option is to let a weather station calculate evapotranspiration (ET) rate and let the central-control system set the run time itself. To understand how using ET values to set your run times can help your irrigation system run more efficiently, it's important first to understand exactly what ET stands for and why it's important.

ET rates are calculated by combining two separate plant processes - evaporation and transpiration. Evaporation is how water moves from the soil to the air, and transpiration is how water moves from the soil through the plant to the air. When the water loss of the two processes are combined (an ET rate), superintendents have a calculation that will tell them the precise amount of water needed to replace what the turf lost because of ET that day.

Many on-site weather stations can calculate ET rates automatically after collecting data from five sensors over a 24-hour period. The sensors measure the minimum and maximum temperatures, relative humidity, wind speed, sunlight and rainfall amounts. The weather station averages the data and calculates an ET value based on a modified Penman equation. That rate is transmitted to the central-control system, which uses it, combined with the precipitation rates of the sprinklers to calculate the run time for each station, to set proper run times.

So why is using the ET method a better way to set run times than more traditional, time-based systems? ET maximizes water-distribution efficiency because of its precision. Superintendents avoid over- or underwatering certain areas of the golf course because they are replacing exactly the amount of water the plant lost during the day, meaning the plant can use the irrigation water immediately. That limits runoff and water waste.

It's difficult, of course, for superintendents to notice the difference between a day with .16 ET and a day of .15 on their own, but an ET-enhanced control system can save thousands of gallons of water because it does recognize the difference. This can reduce water costs and result in electrical savings because the pump station does not have to run as long.

Since golf courses are often made up of multiple microclimates, however, superintendents are often skeptical of how calculating ET rates off of one weather station

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can possibly control the irrigation system for the whole course. One option is to position multiple weather stations throughout the golf course, which allows for accurate determination of proper ET values for the different microclimates so the central-control system can calculate precise run times for the area.

Another option is to assign a different percentage value for each sprinkler station in the central control. This percentage would adjust the run time of any sprinkler based off of one weather station. Superintendents could tweak these percentages manually, allowing for shady areas, extra dry stations, slopes or even different turf types and heights. Once these percentage values are adjusted, they will rarely need to be changed because the ratio between the ET value generated by the weather station and each sprinkler station's microclimate always remains consistent.

Another factor affecting how the user incorporates ET into his irrigation system is how rainfall is measured. Most irrigation systems only use rainfall measurements to cancel the current or next irrigation cycle because rainfall affects ET for the 24 hours when the value was calculated. Some systems, however, use the value of rainfall for up to seven days to calculate ET. This depletes from ET the amount of rainfall from one day to the next, giving a net ET value in which to set the irrigation times for that night.

> ***"Calculating ET can ensure a golf course is more consistently playable and more efficient with its water use, saving your course money and producing a better golf course."***

Another important factor in calculating ET is rainfall intensity. Occasional cloudbursts produce rain of such intensity that most of the water runs off before it can soak in. If the system counted all the rain from such an event as an aggregate, it would assume there is adequate soil moisture when there really isn't because so much is lost to runoff. To avoid this problem, the weather station should monitor rainfall frequently (perhaps as frequently as every hour) and then disregard any rainfall over a preset limit determined by the superintendent. Only the amount of rainfall below the limit, which should correspond to the infiltration rate of the site's soil, would be used to calculate an ET value.

Superintendents have more control of their irrigation systems at their fingertips than ever before with today's computerized central control systems. The new systems give superintendents the ability to use scientific calculations like ET rates to run times instead of using generic run times of 10, 15 and 20 minutes. In addition, today's ET-enhanced control systems operate based on climatic data derived from on-site weather stations using the system's ET calculator. With that, no single sprinkler station should overwater or underwater the turf.

Calculating ET can ensure a golf course is more consistently playable and more efficient with its water use, saving your course money and producing a better golf course for your customers.

(Editor's Note: Alan Clark is the Great Lakes region golf manager for Rain Bird Golf.)