Using Technology to Enhance Irrigation Efficiency

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As urbanization is projected to increase, so does the demand for freshwater resources. As a result, water used for irrigating turfgrass lawns and golf courses becomes heavily scrutinized by the general public to the point where, in some instances, turfgrasses are removed from the landscape, and golf courses are labeled as resource-wasting. To help mitigate the negative opinions and misunderstandings about turfgrass water requirements, it is important to utilize new and/or improved tools and technologies that have demonstrated to effectively improve irrigation efficiency in these turfgrass systems. Using these improved technologies can help homeowners and turfgrass managers make smart, site-specific decisions in terms of improving their irrigation scheduling and managing their watering programs.

Irrigation technologies for lawns

Over the last 10 to 15 years improvements have been made for automatic irrigation systems in efforts towards increasing water-use efficiency in residential and commercial lawns. A majority of these improvements have come by the way of rain sensors, smart controllers, and / or soil moisture sensors. In 2003, the state of Minnesota enacted statute 103G.298, requiring all automatic irrigation systems to have technology installed which bypasses or interrupts operation of an irrigation system during periods of sufficient moisture. Rain sensors are the most widely utilized device used to meet compliance with this statute. However, since that time smart controllers and soil moisture sensors have become more user-friendly for residential and commercial purposes in terms of their affordability and adaptability to existing automatic irrigation systems. Smart-controllers (i.e., weather- or ET-based), obtain climatological data from a local weather station and utilize the information to adjust scheduled irrigation run-times; some popular models include: Hunter Hydrawise, Rain Bird ESP-ME, or Toro Evolution controllers. Some manufacturers have also developed mini-weather stations (such as the Toro Wireless ET Weather Sensor), which can be utilized as an add-on device to the smart controller, allowing for site-specific runtime adjustments to be made. Soil moisture sensors (Figure 1) continuously monitor the moisture content in the soil rootzone, where water is actively absorbed by the turfgrass roots. These sensors bypass scheduled irrigation when the soil moisture content is above a default-calibrated or user-adjusted threshold, therein preventing unnecessary watering. Some popular models include the Hunter Soil-Clik, the Rain Bird SMRT-Y, and the Toro Precision Soil Sensor.

Figure 1. Soil moisture sensors

Soil moisture sensors have been demonstrated to reduce water usage by upwards of 70%, while still maintaining turfgrasses at an acceptable quality. Implementing technologies such as smart controllers or soil moisture sensors can effectively reduce water use without compromising the quality and aesthetics of the turf. Furthermore, investing in these devices can result in a significant return on investment and in some cases, a payback period in as little as one growing season. A study investigating the use of these technologies will be installed at the Minnesota Landscape Arboretum this upcoming fall.

Site-specific irrigation technologies for golf courses

Site-specific management involves the application of management inputs (e.g., water) only where, when, and in the amount needed. GPS-equipped sampling devices to measure plant and soil properties can aid in creating maps to identify variations within a turfgrass area. These maps are used to classify units for site-specific management (Figure 2), which can be employed by managing each unit independently. A 3-year study is in progress in Minnesota to encourage the adoption of site-specific irrigation technology through on-site application and demonstration of water savings. Using golf as an example, we are utilizing a GPS-equipped mobile multi-sensor sampling device and unmanned aerial vehicle, as well as in-ground soil moisture sensors, to demonstrate a practical approach for creating irrigation management units, defining thresholds to trigger irrigation within each unit, and programming an irrigation system to irrigate site-specifically by unit. Water consumption from this site-specific irrigation technique will be compared to traditional (irrigating when the golf course superintendent believes it is necessary) and evapotranspiration-based (using weather data) irrigation practices.

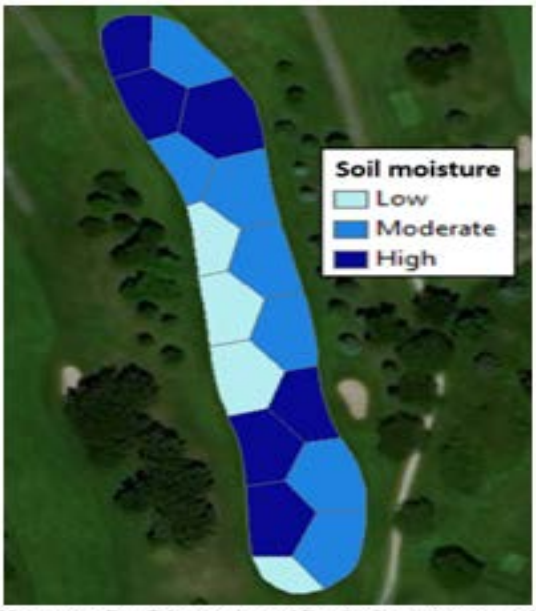

Figure 2. Site-specific irrigation units

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In this session we will discuss several new and/or improved irrigation technologies and their applications for residential lawns and golf courses. Current and future research projects concerning these technologies will also be discussed.

Note: Reference to products in this discussion is intended to express objective information, and not a specific endorsement of the product(s) over other similar products with similar results. The use of brand names and any mention or listing of commercial products or services does not imply endorsement by the University of Minnesota or discrimination again similar products not mentioned.