Extracts

Soil Moisture Monitors Help Save Water, Money

The cost of keeping a lawn green could get lower, thanks to soil moisture monitors that make automatic sprinkler systems more efficient, says a University of Florida researcher.

The devices can cut sprinkler system water usage by more than half, according to a recent UF study. The findings were presented at the annual meeting of the American Society of Agricultural Engineers in July.

Soil moisture monitors continuously check soil moisture levels and prevent sprinklers from operating when watering is not needed, said Michael Dukes, an assistant professor of agricultural engineering with UF's Institute of Food and Agricultural Sciences. The monitors are not widely used despite having been available for more than a decade.

On average, U.S. homeowners use almost 50 percent more water outdoors than indoors, according to a 2000 report by the American Water Works Association. Because lawn care accounts for most outdoor water use, homeowners who reduce unnecessary irrigation can save big on water bills, he said.

Sometimes, reduced watering can even improve a lawn's health — overwatering encourages shallow root growth, which makes turfgrass less resistant to stress and more susceptible to some diseases, he said.

The soil moisture monitors Dukes tested are marketed as accessories for automatic sprinkler systems that use timers to schedule irrigation. These systems are convenient to use but often wasteful, he said.

"We conducted a survey of Florida homeowners from 2002 to 2004 that showed mostly-grass landscapes are typically given two-and-a-half times the water they need," he said. "The monitors we studied, priced from $75 to $350, could pay for themselves within one year in areas where the cost of water is high."

Dukes' six-month study evaluated four commercially available soil moisture monitors, using them with timer-based sprinkler systems on UF turfgrass research plots. For comparison, he also tested timer-based systems with no water-saving devices as well as systems equipped with shutoff devices called rain sensors.

Rain sensors are popular water-saving options for automatic sprinkler systems, but because they measure rainfall rather than soil moisture, they may not accurately determine a lawn's water needs, Dukes said.

The UF study showed systems equipped with soil moisture monitors used 56 percent less water on average than systems with rain sensors when the timers were set to water twice a week. Systems with the monitors used 70 percent less water on average than systems without water-saving devices on a twice-weekly watering schedule.

Use of the soil moisture monitors did not produce visible differences in turf quality, Dukes said.

The monitors are particularly suitable for residential landscape irrigation because they require little effort from homeowners, he said.

"For a timer-based system to be water-efficient in a climate like Florida's, it has to be adjusted seasonally to account for heavy rains in the summer and reduced water requirements in the winter," Dukes said. "Homeowners can avoid that inconvenience if the sprinkler system adjusts to soil conditions on its own."

Soil moisture monitors are composed of two elements: sensors that track the soil's water content and an electronic controller that can override the sprinkler system's watering schedule if the sensors indicate the soil is sufficiently damp. The sensors, which detect moisture by measuring how well the soil conducts electricity, are buried three or four inches underground to monitor the region where turfgrass roots are densest, he said.

Soil moisture monitors have

Josh Wickham

improved in the 25 years since the technology was developed, said Brent Mecham, a landscape water management and conservation specialist with the Northern Colorado Water Conservancy District in Berthoud, Colorado.

The devices will have to overcome some skepticism to gain a foothold in the residential market, Mecham said. Some users have had bad experiences with soil moisture monitors, but he believes problems are often related to poorly planned or improperly maintained sprinkler systems.

"People who install one of these devices should understand it will take some time to fine-tune its performance," he said. "But we need to learn to trust this technology — we need better residential water management, and soil moisture monitors are a viable way to achieve that."

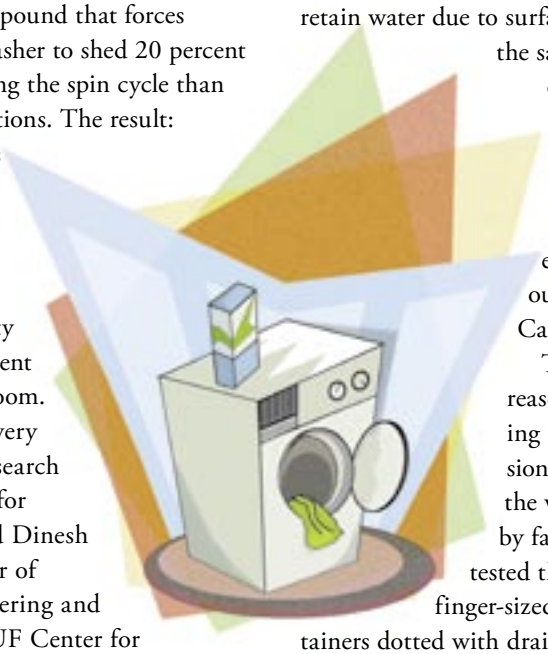
Michael Dukes, mddukes@ufl.edu

Julie Walters

"Rinse" For Washing Machines Dries Clothes

Think of it as a kind of chemical clothes wringer.

University of Florida engineers have developed a compound that forces clothes in the washer to shed 20 percent more water during the spin cycle than in normal conditions. The result: A load of clothes dries faster in the dryer, saving energy — and reducing homeowners' electricity bills and time spent in the laundry room.



"We feel it's very cost-effective research and convenient for consumers," said Dinesh Shah, a professor of chemical engineering and director of the UF Center for Surface Science and Engineering.

Shah and Daniel Carter, a doctoral student in chemical engineering, published their second article about their research in August in *Langmuir*, a surface science journal. UF has applied for a patent on the research, which was funded with $200,000 from Procter & Gamble, a major manufacturer of laundry detergent and related products.

More than 56 percent of Americans own electric dryers, with a typical dryer handling 300 loads per year, Carter said. With the average load requiring from 2.7 to 3 kilowatt hours of electricity, that means drying clothes equates to 5 percent of total residential electricity consumption, costing $2.6 billion annually, Carter said.

A conservative 10-percent reduction in drying times would save consumers $266 million annually. But Shah and Carter say they can do better than that.

Their invention: A water-shedding compound created from a mix of common detergents and fabric softeners.

Carter and Shah said their key insight was that the spaces between tiny fibers in the weave of fabrics comprise minute tubes, or capillaries, which retain water due to surface tension. It's the same phenomenon that causes a submerged straw to hold water when covered at the other end and lifted out of the surface, Carter said.

The researchers reasoned that reducing this surface tension would reduce the water retained by fabric. They first tested this idea using finger-sized copper containers dotted with drain holes. Filled with fabric and water and placed in a centrifuge, the containers mimicked the conditions of spin-cycling washing machines — except that the water loss and fabric retention could be easily measured.

When the researchers discovered that some compounds apparently increased water loss, they expanded their experiments to bigger fabrics and a real washer and dryer. The dryer sits in a crowded lab on a scale, allowing Carter to compare different wet loads by weight to their total drying times.

Their experiments revealed that one ratio of a common detergent and fabric softener — five parts detergent, one part fabric softener — added before the spin cycle forced the clothes to shed 20 percent more water than untreated clothes. The clothes then dried 20 percent faster.

Daniel Carter, carted2@ufl.edu

Aaron Hoover