Specifying irrigation needs for container-grown plants

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A study at the University of Florida's Institute of Food and Agricultural Sciences examined the efficiency of irrigation schedules used for container-grown plants to determine if they could be improved with specific daily adjustments.

Jeff Million and Tom Yeager conducted two experiments to monitor the effect of irrigation schedules on plant growth and water usage.

The researchers present their findings in their article "Periodic Versus Real-time Adjustment of a Leaching Fraction-based Microirrigation Schedule for Container-grown Plants" published in the open-access journal *HortScience*, published by the American Society for Horticultural Science.

The goal of efficient irrigation is to supply enough water for profitable production, but not so much that unnecessary leaching occurs. Million and Yeager determined that one method for monitoring irrigation efficiency under a wide range of production conditions is to note the amount of container drainage and then divide that by the amount of irrigation water applied to the container. The result is called the leaching fraction.

The leaching fraction is defined as the degree of extra irrigation water that must be applied above the amount required by the crop in order to maintain acceptable substrate water content.

Open-field production of 524,000 irrigated acres of horticultural plants in the United States used 205 billion gallons of water in a recent year. Fifty percent of this water was pumped from groundwater sources. These figures are concerning because water resources for irrigation are becoming increasingly limited—technologies to conserve water are needed.

Million and Yeager devised two experiments to determine if a leaching fraction-guided irrigation practice with fixed irrigation run times could be improved by using an evapotranspiration-based scheduling program to make additional adjustments to irrigation run times based on real-time weather information, including rain.

Evapotranspiration is the process by which water is transferred from the land to the atmosphere by evaporation from the soil and by transpiration from plants.

Although sprinkler irrigation is used to produce plants in small containers in high densities, direct application of water using spray-stake irrigation is used to produce plants in larger containers that are placed in low densities. Compared with in-ground production, container production of plants with sprinkler irrigation is inherently inefficient, as containers occupy only a fraction of the production area even when closely spaced.

Direct application of water to the container with spray-stake irrigation can also be inefficient. Typical water delivery rates for spray-stakes are much higher than for typical sprinkler systems so that small changes in irrigation run times can equate to large changes in application volumes and higher chances of overwatering.

Efficiency of spray-stake irrigation can be improved by using a cyclic irrigation system that applies water multiple times per day rather than

relying on a single application.

A tested irrigation system with pressure-compensating emitters applied irrigation uniformly and consistently, whereas in a nursery with large irrigated areas, irrigation water may be distributed less uniformly, and irrigation applications may be unpredictably skipped for a host of reasons.

Million and Yeager used a medium-flow, down-spray emitter in a container that represented the smaller size of the range of containers that are typically in nurseries and production facilities. This likely resulted in a more efficient retention of water than would have occurred using the same spray-stake in a larger container.

The researchers found that small daily adjustments to the amount of water applied based on evapotranspiration were not beneficial for saving water compared to adjustments made every 1 to 3 weeks, based on leaching fraction tests. The fact that plant growth was similar for all plants indicates, as Yeager adds, "the leaching fraction test provides a way to justify the amount of irrigation applied and the test is easy to conduct in the nursery."

More information: Jeff B. Million et al, Periodic Versus Real-time Adjustment of a Leaching Fraction-based Microirrigation Schedule for Container-grown Plants, *HortScience* (2019). DOI: 10.21273/HORTSCI14402-19

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