WHAT'S YOUR LEACHING FRACTION?

A SIMPLE TEST CAN REDUCE IRRIGATION INEFFICIENCIES

Story and Photos by Jim Owen

Irrigation management of nursery crops grown in containers can be difficult to assess because of the numerous factors that are challenging to account for on a day-to-day basis. These factors include weather, substrate, crop water use, crop canopy architecture, irrigation type, precipitation rate, irrigation distribution and irrigation efficiency. Therefore, many growers are likely to make an educated guess based on the current wetness of their substrate, current weather conditions and the weather forecast.

Other nursery managers are likely to choose a coarse substrate that will allow them to excessively irrigate to ensure that the crop will not undergo water stress or suffer reduced growth. These are both suitable approaches when one has profits sitting in containers that depend on water. However, over-irrigation affects the cost to produce a containerized nursery crop. Excessive or unneeded irrigation leaches water and applied nutrients from the container, preventing uptake by the plant. In addition, over-application of water results in longer pumping time (electricity cost and pump wear), decreased access time for workers and increased disease pressure. Measuring **leaching fraction** is an easy and proven method to help reduce these inefficiencies and determine the amount of water actually being used by a crop.

Measuring leaching fraction

Leaching fraction is the volume of water leached from the container divided by the volume of water applied to a container (leaching fraction = water leached ÷ water applied). For example, if you apply 1000 mL of

42 ▶

Six steps to determining a leaching fraction

1. Randomly place plants in trays, buckets or plastic bag-lined containers.
2. Place an empty set of containers in buckets or plastic bag-lined containers adjacent to containers used in Step 1. If using micro-irrigation, place emitter in a milk jug or bleach bottle to capture all water applied.
3. Irrigate as normal.
4. Collect and measure water leached from container with plants
5. Collect and measure water that ran through the empty containers and was collected in bucket, plastic-lined container or bottle.
6. Calculate leaching fraction by dividing water leached (from Step 4) by the amount of water applied (from Step 5).

MICROIRRIGATION

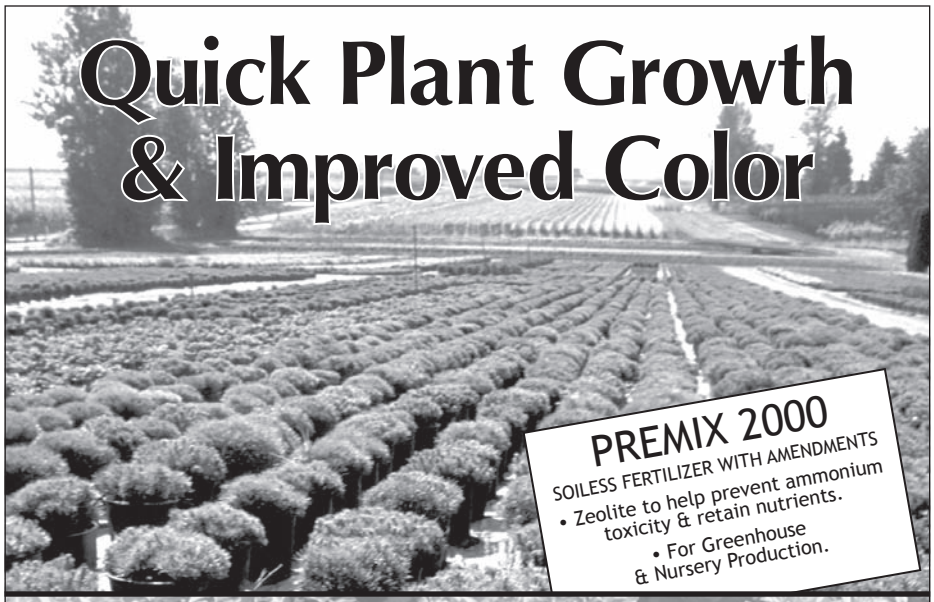
LARGE CONTAINER

SMALL CONTAINER

OVERHEAD IRRIGATION

LARGE CONTAINER

SMALL CONTAINER



water via irrigation and 250 mL was leached from the bottom of the container, you have a leaching fraction of 0.25. In other words, 25 percent of the total water applied was leached. One can use this number to determine the amount of water captured and used by the plant by subtracting leaching fraction from 1.0. Therefore, 75 percent of the water applied in the above example was captured by the plant and retained in the substrate.

It is also important to note that when using overhead irrigation, the crop canopy architecture can greatly affect leaching fraction. Plants can act as funnels to increase the percentage of water captured beyond the edge of the container, resulting in greater water capture. Consequently, you can have a leaching fraction greater than 1.0, which is equivalent to capturing more than 100 percent of the water applied. The opposite effect is a reduced leaching fraction due to umbrella-shaped canopies that can reflect water and decrease the percentage of water captured by the canopy. Therefore, leaching fraction can be used to determine if you are accurately grouping taxa, properly considering canopy architecture and grouping high- versus low-water-use plants. Placing containers with varying taxa and substrate in the sample block will allow the nursery manager to determine the difference in water interception, water retention and water use.

Leaching fraction is used to make an inference on the efficiency of irrigation application volume. Measurements should be taken on clear, sunny days with average or above-average temperatures. This will ensure results that show maximum water use.

It is recommended that leaching fraction be measured on at least five containers per taxa or growing block to ensure that you do not under- or over-estimate needed water. This will also allow you to make inference on irrigation uniformity within a block of plants. If a large amount of variability

occurs within a growing block, then a nursery manager should be conscious of container placement used to measure leaching fraction.

When initially using leaching fraction for irrigation management, a grower should ideally maintain a high leaching fraction (approximately 0.5) and evaluate two to four crops with varying canopy architecture and water requirements. In the beginning, measure leaching fraction more frequently (every two weeks) until you better understand how water use of a specific crop increases as the plant grows, becoming larger throughout the season.

Once you are comfortable with managing irrigation based on this method, you can maintain a much lower leaching fraction (approximately 0.25) as suggested by some nursery best management practices. The nursery manager will have to monitor more frequently when maintaining a low leaching fraction to ensure that plants are adequately watered. It is my observation that it is difficult to maintain a suitable leaching fraction when large weather changes occur quickly. A good example of this is spring in the Pacific Northwest, when the rain stops, the sun comes out, and temperatures rise suddenly.

Leaching fraction is a simple and inexpensive method that requires little materials cost. This practice allows nursery managers to gain insight on current irrigation practices that account for the container system (container, substrate, plant) and production facility (irrigation type, application time). This method can be used effectively to manage irrigation, minimize runoff of nutrients and water, and consequently decrease the bottom line cost of operating a nursery.

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