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# Irrigation audits save water

by Julie Newman

Adoption of water conservation practices has become a priority for many greenhouse growers due to escalating water use fees. In many states, conservation measures are required to comply with mandates that restrict the amount of water growers can use.

To save water, it is important to perform audits to ensure that your irrigation system is performing efficiently, to conduct system maintenance and to make necessary improvements. Ideally, such audits should be performed before a crop is in place, on a yearly basis or whenever any major irrigation system changes are made.

## Improve irrigation uniformity

An important component of the audit is measuring irrigation system uniformity to quantify how evenly water is applied to a crop. Irrigation uniformity is important because most growers water to the driest plant or container.

For example, if one side of an irrigation system is applying half the amount of water that the other side is applying, the system will have to run twice as long to ensure that the plants on the low application side are adequately watered. Improving uniformity minimizes the number of plants receiving excessive water when all plants are adequately irrigated.

Irrigation uniformity is especially important in containers because the roots of these crops are confined and have access to only a limited volume of growing medium. Therefore the irrigation system for container plants must be capable of irrigating each individual plant in a uniform manner.

## Determine irrigation uniformity

To evaluate irrigation uniformity, a stop watch, catch cans (such as empty cat food cans) and a little time is all that is needed. Sprinkler system distribution uniformity can be determined by placing the catch cans in a uniform grid pattern in an irrigated area, operating the sprinkler system, and then measuring the amount of water collected in the containers.

The average volume or depth is calculated by adding the measured amounts and dividing by the number of measurements. One of the most common methods to determine distribution uniformity is to calculate the "low quarter distribution uniformity." If 20 measurements were used, the low quarter distribution uniformity consists of the five smallest measurements. Quantifying irrigation uniformity in an irrigation zone is done by comparing the average of the low quarter to the average applied amount, and then converting to a percent. The distribution uniformity value is calculated as:

$$\text{Distribution uniformity (\%)} = \frac{\text{Average of the low 25\% of catch cans}}{\text{Average of all catch cans}} \times 100$$

For example, after measuring the depth of water in 20 catch cans placed uniformly in a zone that was irrigated for one hour, the average depth of all the cans was 0.8 inches and the average depth from the five cans with the lowest depth was 0.6 inches. The calculated distribution uniformity is 75 percent (0.6 divided by 0.8 times 100).

## Improve distribution uniformity

Although no irrigation system applies water perfectly uniform, the more you can improve the distribution uniformity of your system, the more water you will save. A low distribution uniformity (below 60 percent) indicates that application rates are very different, while a high distribution uniformity (80 percent or higher) indicates that application rates over the area are similar in value and the water is distributed evenly to all plants.

## Determine emission uniformity

Micro-irrigation system uniformity or emission uniformity is determined by collecting an irrigation sample, usually from 20 or more emission devices in an irrigation zone, and quantifying how much water is delivered by each sampled emitter in a given time, usually 15 to 30 seconds. Emitter flow rates can be expressed as gallons per hour. Another method is to quantify the time it takes each emitter to deliver a certain volume.

Thirty-five millimeter film canisters (provided by Kodak, Fuji, etc.) are easy to use for this purpose because they contain nearly 35 milliliters of water when full. A film canister will capture the approximate equivalent of a 1-gallon-per-hour emitter in 30 seconds.

29(2):48-49.

The emission uniformity of a drip system can be determined by dividing the average discharge of the low quarter emitters by the average flow rates of all emitters:

$$\text{Emission uniformity (\%)} = \frac{\text{Average of the low 25\% emitter discharges (volume or time)}}{\text{Average of all emitter discharges}} \times 100$$

For example, after measuring the flow of 20 emitters, the average flow rate of all emitters was 1 gallon per hour; whereas, the average flow rate from the five emitters with the lowest discharge was 0.9 gallons per hour. The calculated emission uniformity is 90 percent (0.9 divided by 1 times 100).

An irrigation system with an emission uniformity of 90 percent or greater is operating efficiently, 80–89 percent is good, 70-79 percent is fair, and less than 70 percent is poor.

## Take pressure measurements

In addition to determining uniformity, an irrigation audit consists of pressure measurements taken at key locations in pipelines and tubing to characterize the system pressure distribution. Measuring pressure is important since it controls the discharge rate of most sprinklers and many micro-irrigation emission devices.

Irrigation components, such as valves, gauges and filters, should also be checked. Audits are particularly important in micro-irrigation systems since they may detect clogging problems at early production stages when they can be more easily resolved.

Audits also provide information on any irrigation system changes that occur over time. A decrease in drip emitter discharge from one year to the next may require a change in irrigation times, but it may also indicate a drop in system pressure or a clogged emitter.

Additional irrigation audit information should be gathered to explain an emitter discharge decrease and to point to steps to correct the problem.

## Correct irrigation problems

Besides conducting regularly scheduled audits, employees should be trained to continuously check for leaks, clogs and missing emitters and tubing to ensure efficient irrigation system performance. Replace leaky pipes, washers and hoses and clean spray heads.

Leaks are commonly found in irrigation connections or at the ends of drip tape and feeder lines. Fixing these leaks removes a constant source of water runoff and reduces friction loss and pressure differentials in lines.

Missing emitters and spaghetti tubing allow water to erupt from unplugged holes in the feeder line during each irrigation event resulting in significant water losses. If spaghetti tubing is inserted too far into lateral poly lines, the portion of the spaghetti tube inside the lateral line increases friction loss and reduces flow capability. The solution to these problems is proper installation of components, regular inspection of irrigation lines and plugging any holes in the lines.

If lines are clogged with mineral calcification or algae, distribution uniformity may be dramatically reduced. Use filters to help prevent clogging and clean the system with approved algaecides to remove algae buildup.

Follow the manufacturer's directions for cleaning and maintenance. Removal of calcification requires an acid treatment and should only be done when no plants are present.

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