SUBIRRIGATION AND LONG-LASTING POINSETTIAS CAN GO HAND-IN-HAND

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Reduction of pesticide and fertilizer runoff from greenhouses has been a repeated theme in the argument for a sound and protected environment. Many North American growers have taken the cue from their European counterparts and have started implement irrigation systems that can decrease or virtually eliminate the chemical runoff from their operations. It seems like a logical move if the future of increasing environmental concerns and protection laws is faced. But how do you deal with these pressures and continue to satisfy your customers who flock by the millions demanding a high-quality long-lasting poinsettias for the holiday celebrations? After all, it's no secret that a poinsettia crop requires an intensive fertilization program.

How Does Subirrigation Work

Research at the University of Georgia has shown that ebb-and-flow irrigation is a viable method of producing high-quality poinsettias. Here's how subirrigation works: benches (trays, really) or whole greenhouse sections, are flooded with a fertilizer solution, which is pumped from a holding tank. After a certain time period (about 15 to 20 minutes), the potting medium picks up this solution by wicking action and becomes saturated. The fertilizer solution remaining on the bench or the flooded floor is drained back into the holding tank where it is stored until the next fertigation (usually the next day). No runoff is allowed with this irrigation system. As an added benefit, these subirrigation systems can be automated easily, thus saving greatly on labor requirements. With the current job market, that is a big advantage over many other irrigation systems. So far, so good.

Fertilizer Salts Accumulate in the Top Layer of the Growing Medium

As loss of water from the soil and the plant occurs, fertilizer salts from the bottom layer of the growing medium are brought up to the top and middle layers, where they accumulate. In fact, soluble salt levels (measured as electrical conductivity, EC) in the top soil layer of subirrigated plants can be up to ten times higher than those in the middle and bottom layers. When salts reach prohibitively high concentrations, root growth stops and some roots may get damaged in the affected soil layer. This may make the plants more susceptible to disease. Research with New Guinea impatiens, peace lily, and poinsettia, has shown that most of the root growth in subirrigated plants is concentrated in the bottom and middle layers of the growing medium. So what if the roots are at the bottom? High soluble salt levels in the top soil layer won't have any effect on these roots. It is all well for poinsettias while they are in production. But what happens once they reach the garden center or the florist shop and eventually the customer's home? To start with, the method of irrigation will probably change from subirrigation to top-watering. Then, the water applied from above will pick up the fertilizer salts concentrated in the top layer and carry them to the middle and bottom layers on its way to the drainage holes. Exactly where the roots are! And this may spell salt stress and trouble!

Top-Watering Carries Fertilizer Salts to the Bottom Layer of the Growing Medium

Research has shown that ebb-and-flow irrigated plants drop more of their leaves than top-watered plants in the first three weeks after production. What can be done to remedy the problem? Accumulated salts can be removed by top-watering the medium at the end of the production cycle. Top-watering can leach the fertilizer salts from the pots, but its efficiency depends on the volume of water applied. A small volume of water may simply wash the salts from the top into the bottom layer, where they are most likely to cause damage. Thus, sufficient water must be applied to leach the salts from the bottom of the pots. The question is how much water to apply.

The Remedy to Salt Accumulation is Leaching

To answer this question, researchers at The University of Georgia grew poinsettia plants in six inch pots with soilless medium on ebb-and-flow benches. Plants were fertigated daily with 210 ppm nitrogen (the recommended rate, EC = 1.5 mS/cm). To simulate a worst-case scenario, we even fertilized the plants until the end of the production cycle. Then, poinsettias were top-watered with different amounts of water, half (0.5x), one (1x), and double (2x) the volume of the growing medium. No matter how much water was used, leaching reduced the EC in the top and middle soil layers (Figure 1). However, applications of half the volume (0.5x) and the full volume (1x) increased the EC in the bottom of the pots, where most of the root growth occurred. This shows that using 0.5x or 1x the volume of the potting soil simply washes the salts from the top into the bottom layer of the pot. Nonetheless, the EC of the bottom layer remained well within the recommended range (2 to 3 mS/cm, measured with the SME method). Applying a larger volume of water (2x) decreased EC in the bottom soil layer, indicating that the volume applied in top-watering must be larger than the volume of the growing medium to reduce the EC of the bottom layer.

Top-Watering Has No Detrimental Effects on Photosynthesis

Researchers have found various ways to determine if a treatment (whether light or fertilizer levels, or salt accumulation in this case) has a detrimental effect on the plants. One of these ways is to measure photosynthesis (sugar production in plants), which provides energy and food to the plants. Just like people need to eat, plants need food to remain healthy and photosynthesis is known to be very sensitive to salt stress. So, how did top-watering affect the poinsettias? Surprisingly, leaching with different volumes of water had no effect at all on photosynthesis, indicating that all was well with the plants as far as food production was concerned. Even though leaching with 0.5x and 1x the volume of water did increase EC of the root-containing bottom layer, it had no detrimental effect on the poinsettias. Watering with 2x the medium volume resulted in a decrease in the EC of all soil layers. Since short-term effects of increased EC of the bottom soil layer did not negatively impact photosynthesis, the performance of subirrigated poinsettias is not likely to be affected by top-watering the plants in the post-production environment.

Leaching Is Not Necessary at the End of Poinsettia Production Cycle

What does all this mean to the grower? A high-quality poinsettia crop can be produced with subirrigation without the practice of applying water (leaching) at the end of the production cycle to remove salts that have accumulated on top of the potting soil. Top-watering in the post-production environment is not likely to cause any damage to the plants because the level of fertilizer salts remains well within the recommended range. Leaching salts from subirrigated poinsettias does not appear to be necessary to maintain high plant quality and is therefore not recommended. The only exception to this may be for plants that were over-fertilized during the production period. In that case, soluble salt levels may become too high and adversely affect the keeping-quality of the plants. Leaching may provide some benefits, but keep in mind that over-fertilizing will almost always result in poor-quality plants and leaching cannot fix this.

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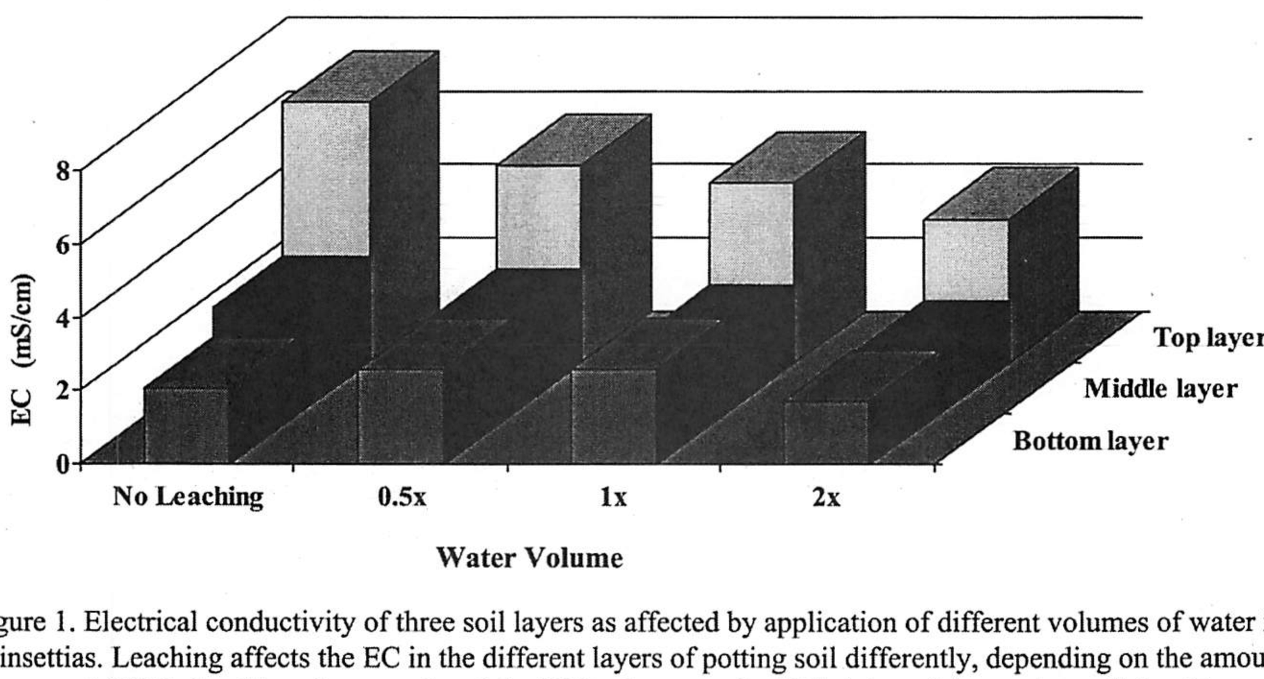

Figure 1. Electrical conductivity of three soil layers as affected by application of different volumes of water in poinsettias. Leaching affects the EC in the different layers of potting soil differently, depending on the amount of water used. While leaching always reduced the EC in the top and middle layer of the potting soil, leaching with a relatively low volume of water (half the volume (0.5x) or 1x the volume of the potting soil) increases the EC in the bottom part of the pots, where most of the roots grow. However, our research indicates that this increase in soluble salts in the bottom of the pot is not large enough to have a detrimental effect on the plants. Using an amount of water equal to twice the volume of the potting soil (2x) reduces the EC throughout the entire pot.