

# Comparison of Irrigation, Leachate and Tree Growth between Soilless and Coal Ash Based Media

In nursery production, knowledge of water quality and quantity is needed to improve irrigation and fertilizer application efficiency as it relates to potential for soil and groundwater contamination. Common nursery practice is to irrigate every 20-30 minutes daily if rainfall is not substantial enough to wet the medium. Research has shown that a large amount of water is lost through drainage in pot-in-pot systems by over-applying water to container-grown plants during a short period of time. The water either moves down the side of the container due to medium shrinkage or moves through large pores without ample time to absorb into small pores.

To obtain optimal growing conditions for plants, water should be applied at the time when plants need water. A water and fertilizer monitoring system was designed to control irrigation based on the moisture content of the medium. When the medium moisture level reached 30%, the irrigation system triggered to water in short 5 to 10 second bursts until the moisture content reached 40%. Irrigation amounts, leachate, and tree growth were evaluated over two growing seasons to determine if the designed irrigation system could produce a quality tree while reducing water and fertilizer waste.

Red maple trees were bare-root transplanted to #15 containers filled with one of three mixes, a bio-solid medium composted with coal ash (Mix#1), a soilless media with a lower rate of  $\text{NH}_3\text{-N}$  and  $\text{NO}_3\text{-N}$  (Mix #2), and a soilless media with a higher rate of  $\text{NH}_3\text{-N}$  and  $\text{NO}_3\text{-N}$  (Mix #3). Trees with Mix #1 were not fertilized the first growing season, while Mix #2 and #3 were; however, all treatments were fertilized equally in the second growing season.

Mix #3 produced the largest tree caliper growth, while Mix #1 produced the smallest (Figure 1). During the second growing season, the growth rate of trees in Mix #3 was slower than in Mix #1 and Mix #2. During the first growing season, trees with Mix #3 used the highest amount of water while trees with Mix #1 used the least amount of water among the three treatments (Figure 2). Changes in tree growth during the second growing season caused the amounts of water applied and subsequently lost through drainage to differ from the first growing season. Mix #1 used the least amount of water and produced the lowest drainage among the

three mixes. During the two-year tests, the amount of water (including irrigation and rainfall) applied to each tree with Mix #1, #2, and #3 was 741, 910, and 950 L, respectively; while, the amount of water loss through drainage for each tree with Mix #1, #2, and #3 was 107, 147, and 112 L, respectively.

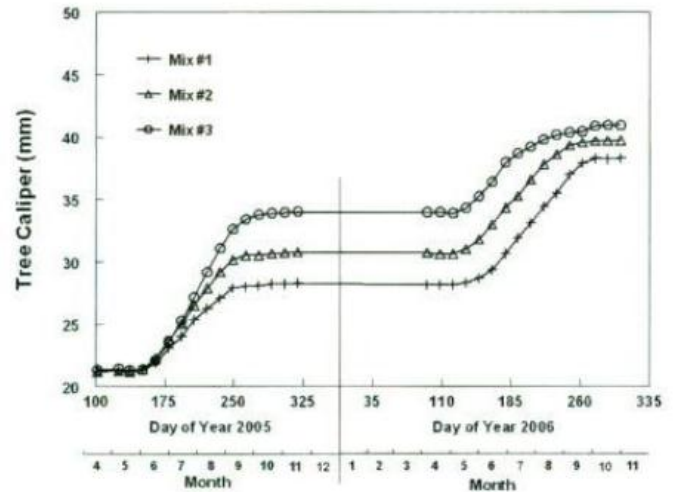


Figure 1. Comparison of red maple tree calipers among three different potting media.

Using the medium moisture content trigger, irrigation time was reduced from 20 to 30 min. daily to 6 min. daily. Higher initial nutrition resulted in higher tree caliper; however, this also resulted in higher amounts of leaching in water and fertilizer. The amounts of  $\text{NO}_3\text{-N}$ , P, and K lost in the first growing season were higher than the second growing season for Mix #2 and #3. Mix #3 had higher  $\text{NO}_3\text{-N}$  leachate in the second growing season than the first due to a difference in fertilizer application practices.

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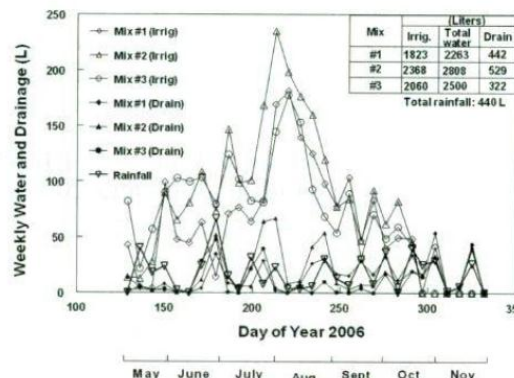
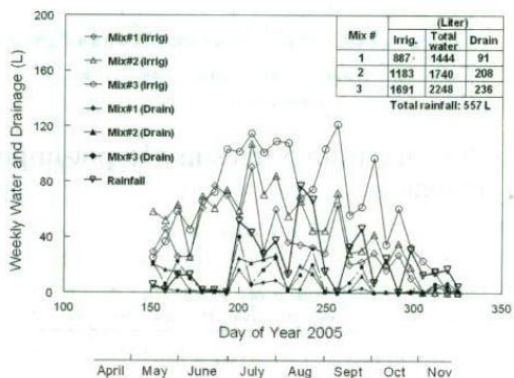


Figure 2. Amounts of weekly water (irrigation = rainfall) applied and drainage loss from five maple trees with three different mixes during 2005 and 2006 growing seasons.