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Landscape Transplant Success of Nursery-Grown Chanticleer® Pear and Evaporative Water Loss from Three Container Types: Black Plastic, Root Pouch®, and Smart Pot®

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The most common container type for nursery tree production is black plastic (BP). Root injury sustained during production may negatively affect tree health when planted in the landscape. Research at Colorado State University using *Pyrus calleryana* Decene. 'Glen's Form' (Chanticleer®), is comparing trees grown in BP to two fabric containers: Root Pouch® (RP) (Averna & Associates, Hillsboro, Ore.) and Smart Pot® (SP) (High Caliper Growing-Root Control, Inc., Oklahoma City, Okla.). Trees were planted into the landscape after being grown in a nursery production setting (summer 2010) in fall 2010; trees are fully excavated and harvested (after one, two and three growing seasons) to compare transplant success based on growth measurements (e.g. root and shoot re-growth, leaf area, height, caliper and branching measurements). Post-transplant success of trees was determined during the growing season using pre-dawn leaf water potential and infrared leaf canopy temperature. In 2011 and 2012, there were no significant container effects on height, caliper, root:shoot ratio and dry leaf, shoot and root weight. In addition, there were no container effects on pre-dawn leaf water potential and infrared canopy temperature. However, in 2012, there was a significant difference for average root re-growth beyond the original root ball: BP had 17.5% root re-growth compared to 30.2% and 29.4% for RP and SP, respectively. There were no significant differences for root re-growth in 2011 (8.4% BP, 10.6% RP and 10.2% SP). Though there were no significant differences in above-ground growth, nor dry root weight, root re-growth and visual root architecture differed among the three container types. We are currently measuring fine (<2mm diameter) and coarse (>2.1 mm diameter) roots to determine the potential for water and nutrient uptake by each root system. One preliminary conclusion from this study is that you cannot predict below-ground establishment potential based on above-ground growth. Another conclusion is that planting to BMP standards is unlikely to correct problems caused by container type in the nursery. Another component of this research, examining overwintering effects by container type will be on-going through 2015. However, it appears that overwintering treatment (lined out versus consolidated) in the nursery has an effect on tree biomass; plants overwintered as a consolidated group had greater shoot and root growth when harvested. We will attempt to determine whether these effects continue through transplant establishment.

Another component of this research is investigating evaporative loss from the three container types to determine if RP and SP containers have a greater irrigation requirement than BP. Other studies have alluded to the fact that fabric containers do lose water more quickly until plants become established in the containers, then have similar water requirements to black plastic. From January to March 2013, we conducted two greenhouse studies to measure evaporative loss from the three container types. The first study examined evaporative water loss among the three container types during a single dry-down from field capacity. In the second study, we wrapped RP and SP containers in plastic to prevent evaporative loss from the outside container surface, and compared this to unwrapped RP, SP and BP. Containers were weighed to determine daily water loss, and volumetric water potential was measured using frequency domain reflectometry.

In the study with just the three container types, it was not surprising to see that RP and SP containers lost significantly more water each day compared to BP, based on both weight and volumetric water potential. Over the 28-day study, RP and SP lost water at a significantly greater rate compared to black plastic for the first 15 days, as well as a greater total amount of water by the end of the study. As measured volumetrically, RP and SP contained significantly less water than BP at the beginning of the study. Volumetric water loss for all containers occurred at a linear rate throughout the study; RP and SP did not significantly differ from each other, but were significantly drier at all dates than BP. Of the three containers, RP was the first to reach unreadable volumetric moisture levels.

Results from the study where fabric containers were wrapped with plastic demonstrated that all containers, regardless of material or wrapping, lost water at roughly the same rate. The wrapped SP and RP containers had significantly greater gravimetric water content than BP for the first 15 days of the study. For the first five days, the unwrapped RP and SP had significantly greater gravimetric water content than BP, but less than the wrapped RP and SP. After day 10, the unwrapped RP and SP containers rapidly lost gravimetric water and were significantly drier than both the wrapped RP and SP containers and BP. Also following day 10 of the study, the volumetric water content of fabric containers, wrapped or unwrapped, was significantly lower compared to BP. On all dates of the study, the volumetric water content of wrapped containers was significantly greater than that of their unwrapped counterparts.

What we conclude from this study is that fabric containers (without plants) lose water differently (as measured by gravimetric and volumetric water content) than BP containers. This lead us to conduct another study during summer of 2013 using plant material. The study, conducted outdoors with *Viburnum trilobum* L. 'Compactum' (compact American cranberrybush viburnum), compared water use rates of fabric containers with black plastic when transpirational losses are factored in. We hope these studies will answer questions regarding irrigation requirements for nursery producers if they choose to grow using alternative container types.

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