Field growth of three tree liners planted from containers from three environments

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Significance to the industry: Most tree liners in Ohio are not initially grown in Ohio, but are derived from the West Coast. There are a few reasons for this including low production from Ohio and the increase in season length of the West coast versus Ohio. Because of the shorter seasons in Ohio, traditionally, growers believe Ohio produced tree liners are inferior compared to those that come from the West Coast. However, it has been shown that liners can be grown in Ohio (Stoven et al., 2006). The liners from Stoven et al. were outplanted to the field and growth was compared to liners shipped bareroot from the West Coast. Growth from the liners grown in Ohio was actually higher than those that were coming from the West coast (Mathers et al., 2006). In this study, liners outplanted to the field were all from Ohio; however, they were grown in containers from three different environments. The objective of this trial is to determine growth differences of five species in the field initially grown in a polyhouse, flat-roof retractable roof greenhouse (RRG) and peak-roof RRG.

Materials and Methods:
Initial Growth. Seedlings (6" to 12") of yellowwood (*Cladrastis kentuckea*), red oak (*Quercus rubra*), stewartia (*Stewartia pseudocamellia*), Japanese tree lilac (*Syringa reticulata* 'Ivory silk') were upshifted to copper treated 3 gal. (11.4 l) containers in October, 2004. Littleleaf linden (*Tilia cordata* 'Greenspire'), because of their size, were potted into 250-XL containers. All of the plants were then put into a peak-roof RRG (Cravo Equipment Ltd., Brantford, ON, Canada). The roof on the RRG was set to open at 38 °F (3 °C). Temperatures were kept above 25 °F (-4 °C) in the RRG by a forced air heater. Plants were watered twice monthly during the cold season. On March 15, 2005, all of the plants were fertilized with 3 tablespoons 19-5-8 Osmocote® (Scott's Co., Marysville, OH) slow release fertilizer. They were then moved to their respective environments: one-third of the plants were kept in the peak-roof RRG, one-third were moved to the flat-roof RRG, and one-third were moved to a polyhouse covered with 6-mil, milky poly. Also on March 15, 2005, settings in the peak-roof and flat-roof RRG were changed. The sidewalls were set to open at 55 °F (13 °C) in both environments. The roofs remained closed unless temperatures exceeded 75 °F (24 °C) through the remainder of the growing season. On April 1, 2005, the sidewalls and roof were reset to open at 65 °F (18 °C), and on April 15, 2005, sidewalls were set to open at 75 °F (24 °C) and kept that way for the remainder of the season. However, if temperatures exceeded 85 °F (29 °C) during the day, then the roof was set to close for shading, and the sidewalls remained open for air circulation. On May 15 (frost free day for Columbus, OH), poly was removed from the polyhouse.
Field methods. On October 25, 2005, plants were brought to the field and planted in a completely randomized design with three subsamples per four replications. There was five feet between trees in the row and rows were spaced nine feet apart. In April of 2006 and 2007, a preemergence herbicide treatment of SureGuard (flumioxazin) at 0.25 lb ai/ac and Surflan (oryzalin) at 2.0 lb ai/ac was applied in the rows. The same treatment

was also applied in October of 2006. Fourteen grams 34-0-0 ammonium nitrate was applied on April 26, 2006 and then 28 grams were applied on June 1, 2006 and August 23, 2006. Growth was measured by taking caliper and height in June and September of 2006 and 2007. Data was analyzed using ANOVA in Proc Mixed in SAS software. Treatment means were separated using LSMeans.

Results and Discussion: All of the stewartia died during the summer of 2006. It was speculated that there was not enough irrigation for these plants. Many (over half) of the yellowwood, which were small at planting died over the span of both years of growth, so they are also not discussed here. Littleleaf linden showed no differences between environments for any of the dates for caliper or height (Figures 1 and 4). Red oak only showed differences in caliper in September 2007. Caliper from trees grown in the flat-roof RRG had a significantly higher caliper than those coming from the peak-roof RRG at $\alpha = 0.10$ (Figure 2). Japanese tree lilac showed the most interesting results. By September, 2006, those originating from the polyhouse had significantly lower heights and calipers than those originating from the flat-roof RRG (Figures 3 and 6). In the spring of 2007, the month of March was warm, and so the Japanese tree lilac broke bud. In mid April of 2007, Ohio received some unusually cold weather (with snow). Many of the Japanese tree lilacs suffered enormously. However, the amount of injury and subsequent growth seems to be attributed to where the trees were originally grown. Both height and caliper growth from September 2006 to September 2007 from those that originated from the polyhouse were significantly lower than those that were originally grown in the peak- or flat-roof RRG (Figures 3 and 6). From this trial, it looks as if field growth from different production environments is species dependent. More studies should be done that looks at different species growth from the peak- and flat-roof RRG's and polyhouse and how these species perform in the field after grown initially in each production environment.

References:

Mathers, H. M, L. Case, A. Acuna, M. Bigger, D. Struve. 2006. Sense and Sensibility: Tree liner prodcution. American Nurseryman. 204(11):26-28, 30-31.

Stoven, A.A., H.M. Mathers, D.K. Struve. 2006. Fertilizer application method affects growth, nutrient and water use efficiency of container-grown shade tree whips. HortScience 41:1-7.

Figure 1. Caliper of *Tilia cordata* 'Greenspire' by environment from June 2006 to September 2007

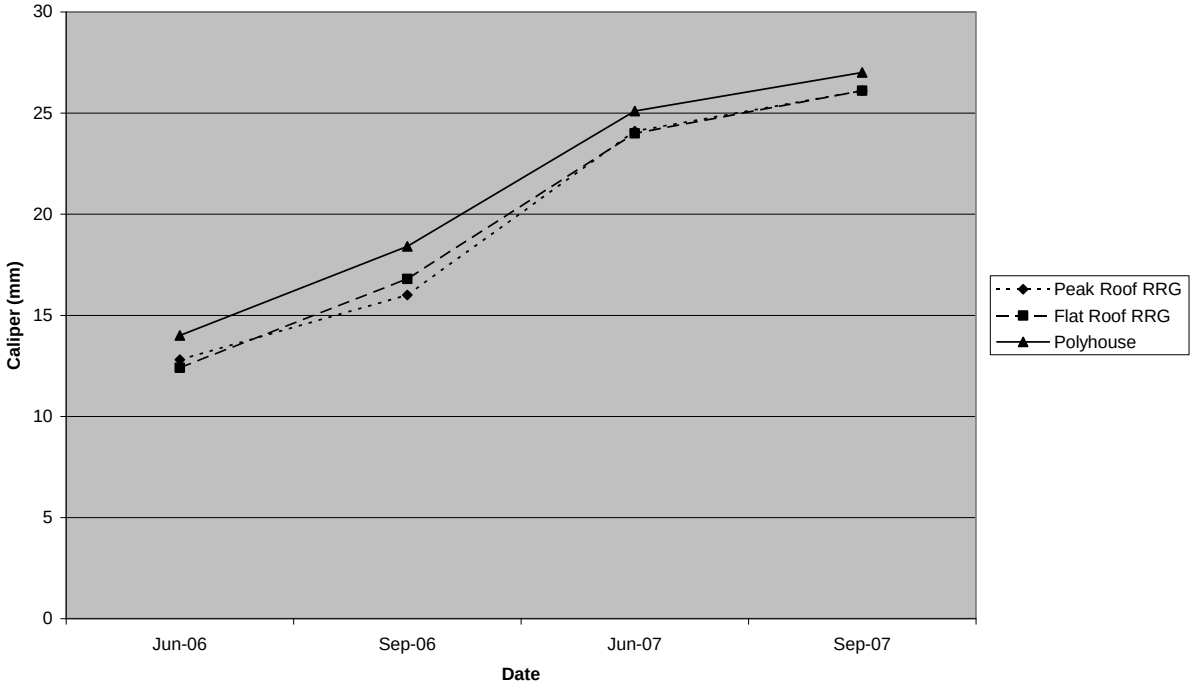
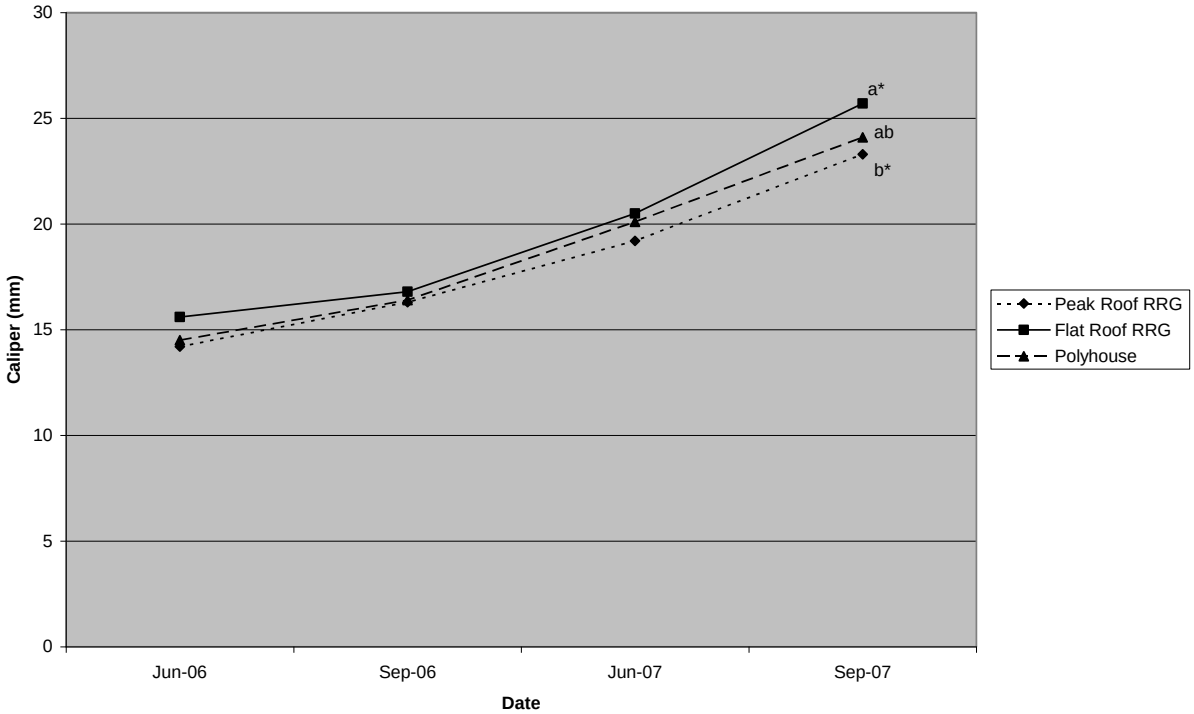


Figure 2. Caliper of *Quercus rubra* by environment from June 2006 to September 2007



Different letters indicate significance at that date at α=0.05, * indicates significance at the 0.10 level between those with a *.

Figure 3. Caliper of *Syringa reticulata* 'Ivory silk' by environment from June 2006 to September 2007

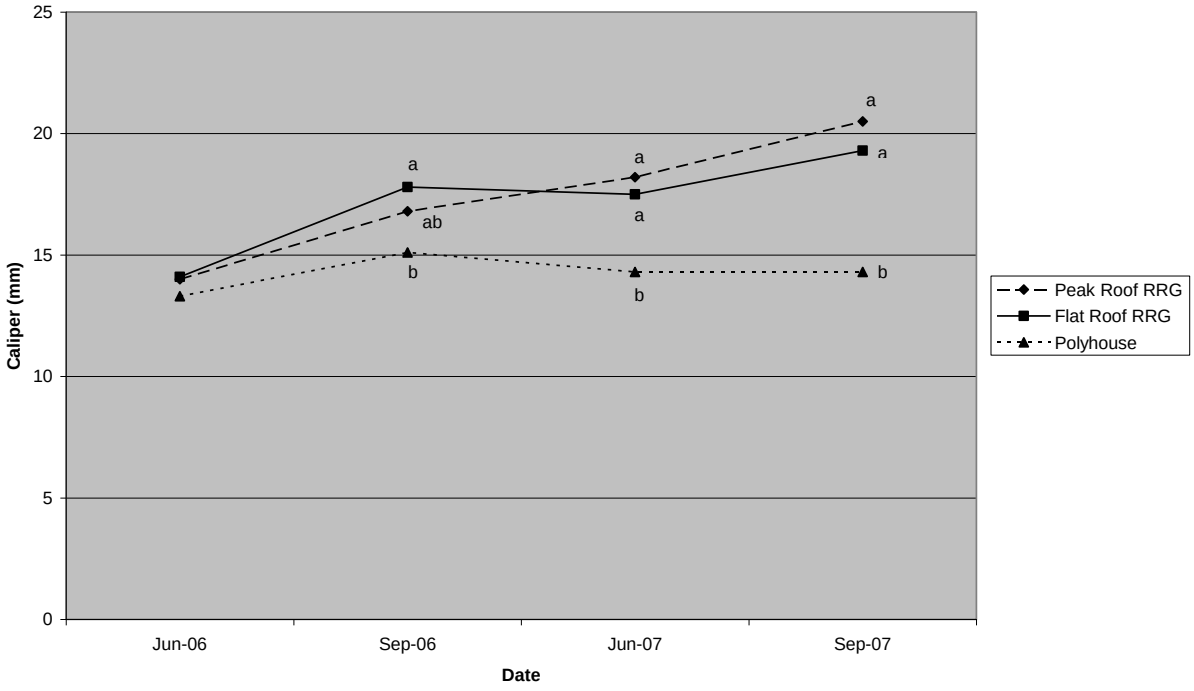
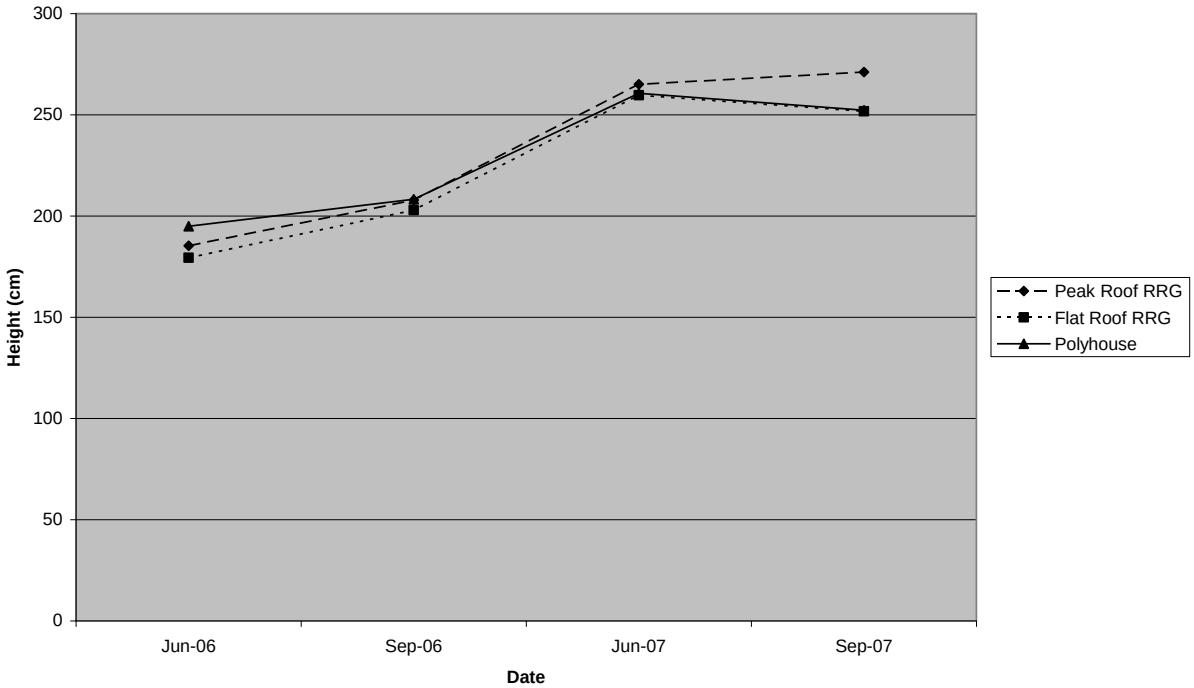


Figure 4. Height of *Tilia cordata* 'Greenspire' by environment from June 2006 to September 2007



Different letters indicate significance at that date at α=0.05, * indicates significance at the 0.10 level between those with a *.

Figure 5. Height of *Quercus rubra* by environment from June 2006 to September 2007

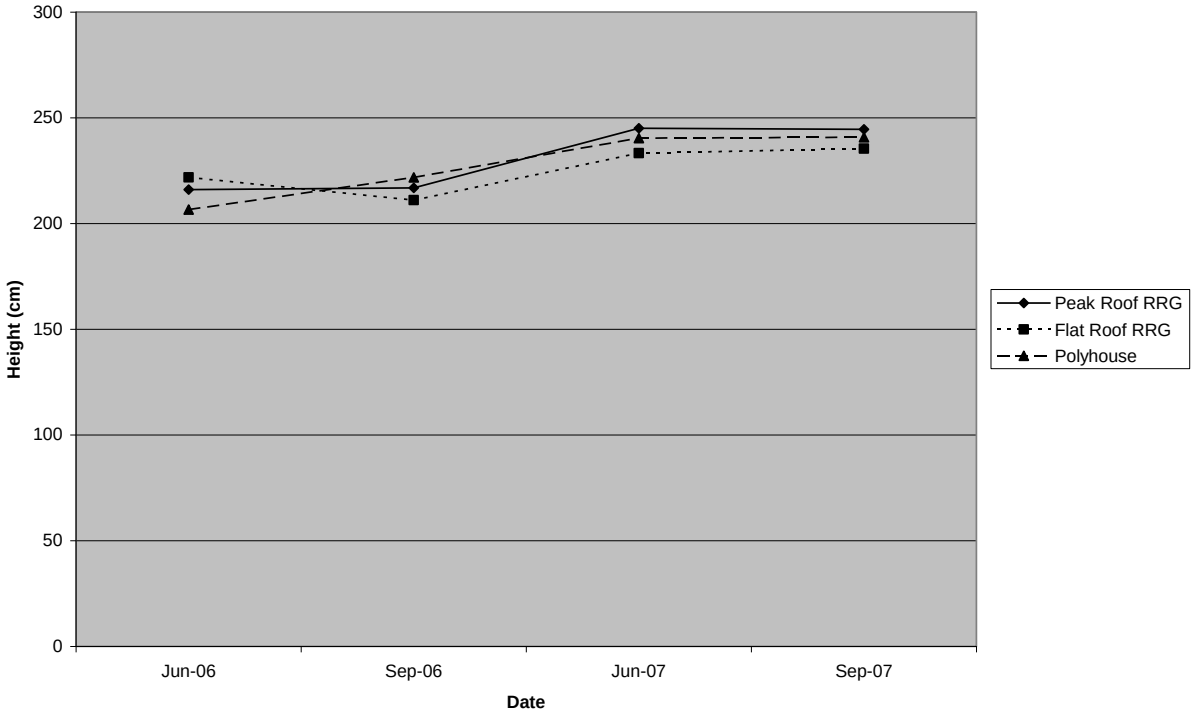
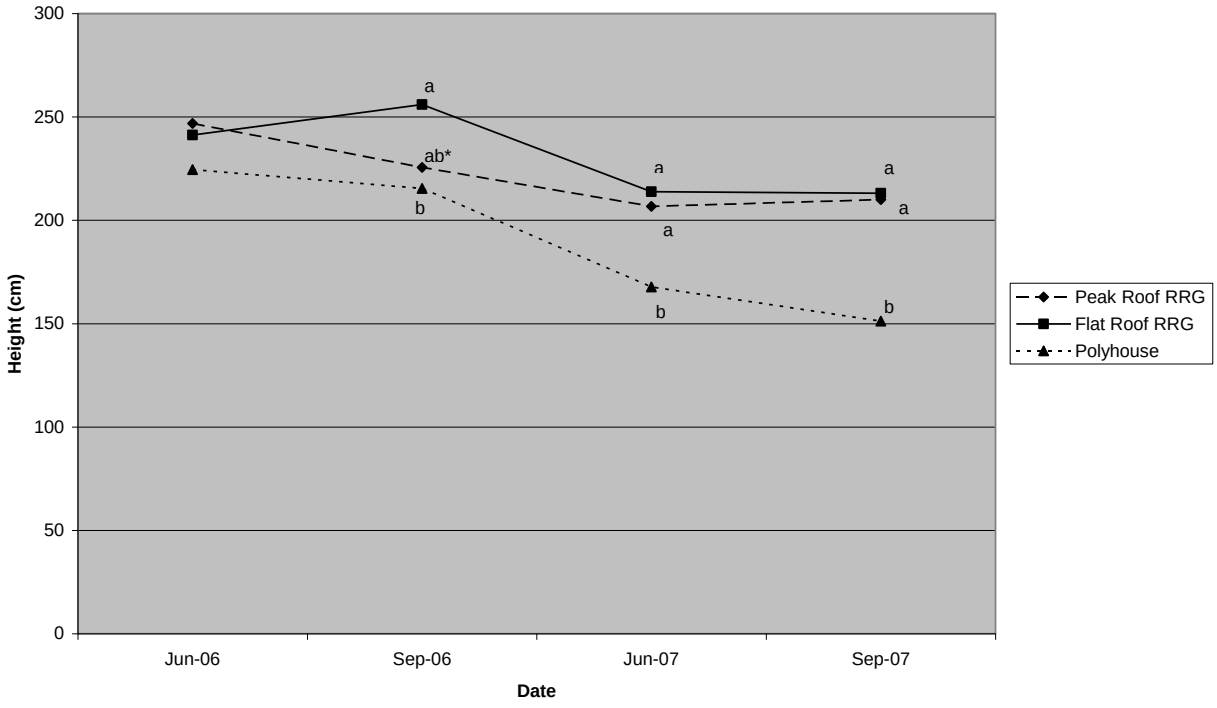


Figure 6. Height of *Syringa reticulata* 'Ivory silk' by environment from June 2006 to September 2007



Different letters indicate significance at that date at α=0.05, * indicates significance at the 0.10 level between those with a *.