Field Comparison of Containerized and Bareroot Tree Liners

Hannah M. Mathers, Luke T. Case, Alejandra Acuna, Michele Bigger

Significance to Industry: Retractable roof greenhouses (RRG's) have been found to increase growth (Stoven et al., 2006) reduce disease incidence, extend growing seasons (Stoven et al., 2006) and produce superior containerized tree liners (Mathers et al,. 2002; Stoven et al,. 2006). The RRG grown containerized liners offer a feasible alternative to field bareroot liner production based on price, availability and niche markets such as coarse-rooted, difficult-to-transplant and native taxa. Additionally, data indicates RRG grown tree liners have decreased mortality rates after planting into the field (Mathers et al., 2005) and accelerate tree field production in Midwestern states, when planted in October out of 3 gallon containers versus bareroot liners produced in the Pacific Northwest (PNW) or liners grown in a combination heated greenhouse-outdoor (CHGO) production environment. The RRG grown liners offer an initial advantage after planting into the field in increased caliper and height growth Mathers et al. (2005) that follows through production and becomes more significant after two and three years .

Materials and Methods: At Ohio State University (OSU) Waterman Farm, Columbus, OH four species of tree liners were out-planted from three environments. Tree were irrigated and fertilized as per Mathers et al. (2005). The three environments where liners had been produced were a peaked RRG (Cravo Equipment, Ltd., Brantford, ON, Canada) in 11.4 L classic Spinout® treated containers (Nursery Supplies, Inc., Fairless Hills, PA), a combination heated greenhouse-outdoor (CHGO) production environment also in 11.4 L containers at OSU, Columbus, OH and bareroot liners from Pacific Northwest (PNW) nursery fields, Canby, OR. The OSU liners had been produced according to the methods described by Stoven et al. (2005). The OSU liners were planted in the field in October 5, 2003 and bareroot liners were planted (when traditionally available for planting in Ohio) April 26, 2004. All plants were trained to 2 m tall bamboo stakes (A.M. Leonard, Inc., Piqua, OH) installed at planting. In August 2005, the bamboo stakes were replaced with TMO-PRO stakes (T-MATE-O, Charlestown, IN). The four species evaluated are, *Acer* x*freemanii* 'Jeffersred' (Autumn Blaze™ red maple), *Malus* 'Prairifire' (Prairifire crabapple), *Cercis canadensis* (Eastern redbud) and *Quercus rubra* (red oak). Growth measures of height and caliper (taken at 15.24 cm) were recorded at planting and June and September 2004, 2005 and June 2006, for a total of five measures to date. Measures will continue to be collected until June 2007. Average initial heights and calipers for redbud, maple, crabs and oaks out-planted from the RRG were as cited in Mathers et al., 2005. The redbud, maple, crabapple and oak PNW liners had (less height, greater caliper), (greater height, greater caliper), (less height, less caliper) and (greater height, greater caliper) at planting versus the RRG or CHGO production environment, respectively. In early November 2003, all the RRG and combination environment trees were pruned according to normal nursery practices. No pruning was done to bareroot liners at time of planting. Perennial ryegrass was seeded in the fall of 2003 between the rows and mowed as required. Row spacing between-rows is 12 ft and in-row 6ft. Height, caliper and change (Δ) in height and caliper from June to June 2006 data were subjected to ANOVA using the GLM procedure within SAS® (SAS Institute, Inc., Cary,

NC, 2000). Fisher's least significance difference test were used to compare means a $P \leq 0.05$ was used (SAS© Institute Inc.). The Type II Sum of Squares analyses was performed and graphs were produced in Excel from the analyses. All factors were considered fixed effects; therefore all terms were tested for significance against the error mean square.

Results and Discussion: The only tree mortality occurred in the oaks with five of 12 bareroot liners having died by September 2004 (42%). One of 12 oaks died out of the CHGO production environment (8%) and there were no deaths with RRG liners (0%). Two crabapples from the RRG snapped shortly after replacing the bamboo with the TMO-PRO stakes and a severe summer storm went through Columbus, OH. In June 2006, a maple snapped from the CHGO environment. Caliper differences were significant comparing June to September 2005 for the main effects of environment and species at P>0.0001. The RRG (Cravo) grown liners produced significantly greater caliper increases in the field from June to September 2005 versus the PNW bareroot liners, producing an average increase, across species of 7.5 mm (0.3 in) (Fig. 1). The caliper differences of the RRG liners were also significantly different than the liners obtained from the CHGO environment (Fig.1). The RRG grown liners produced significantly greater caliper increases in the field from September 2005 to June 2006 versus the PNW liners or liners obtained from the CHGO environment (Fig.2), producing an average increase, across species of 8 mm (0.31 in). The caliper differences of the CHGO liners were not significantly different than the PNW liners (Fig.2), for the first time in the three years of evaluation. The species accounting for the caliper differences due to environment from June to September 2005 were maple and oak (Fig. 3). These differences were even more significantly when considering the initial calipers of these species were significantly less than the PNW or the CHGO liners. The environments X species interaction effects for caliper measures for September 2005 to June 2006 were not significant. The main effects of species and environment were significant for June to September 2005 heights (P>0.001) (data not shown) and for environment X species interaction was also significant (Fig.4). With the exception of maples and crabapples, the RRG grown liners, had the largest heights in September 2005 versus the PNW bareroot liners; however, this differences were not significantly different than the liners obtained from the CHGO environment, again with the exception of oak (Fig.4). The PNW oak liners had less caliper and height growth by June 2006 and September 2005 (Fig.3 and 4, respectively), only 58% survival and were initial larger in both measures.

Literature Cited

Mathers, H.M. 2001. The future is in retractables: Nursery stock production in Retractable Roof Greenhouses. The Buckeye. August. Pp. 16-17, 19, 31.

Mathers, H.M. L.T. Case, E. Grosskurth, M. Bigger. 2005. Field Caliper Tree Production Using Retractable Roof GreenHouse Grown Liners. Southern Nurserymen Assoc. Res. Conf. 50:164-167.

Mathers, H., D. Struve and A. Stoven. 2002. Tree liner production in Ohio. The Buckeye. November. Pp. 14-17.

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

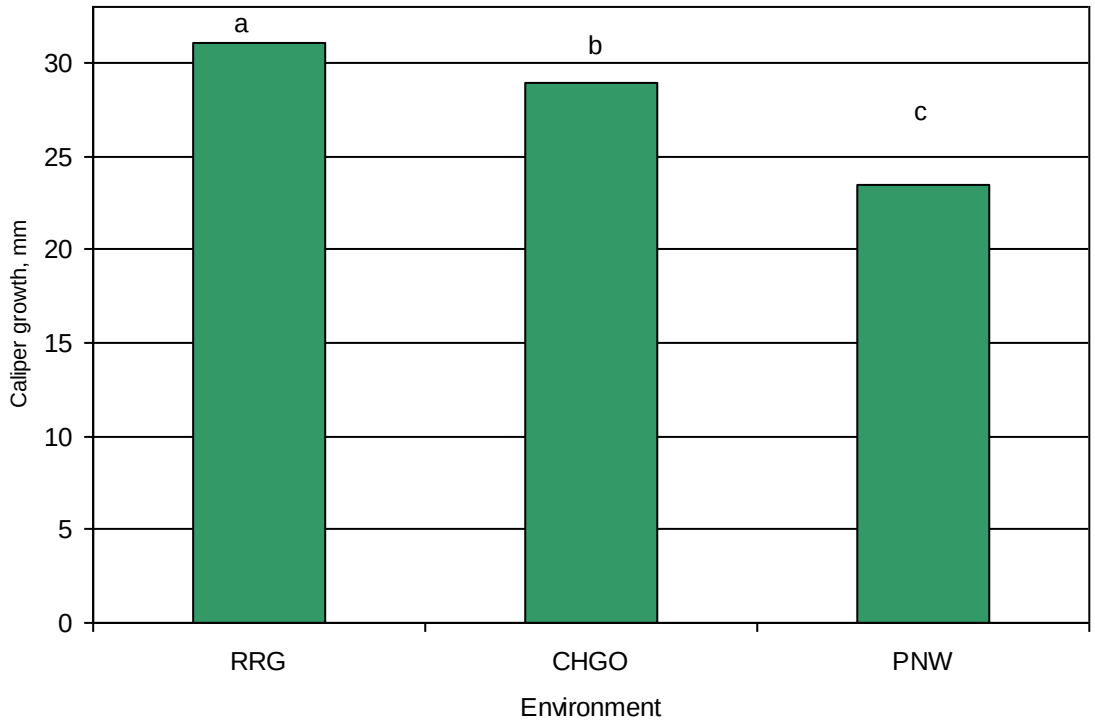

Fig. 1. Field caliper measures from September 2005 pooled over species for liners produced from three production environments. The abbreviations RRG, CHGO and PNW signify retractable roof greenhouse, combination heated greenhouse-outdoor, and bareroot liners from the Pacific Northwest, respectively. Different letters signify least significant difference (LSD) P = 0.05.

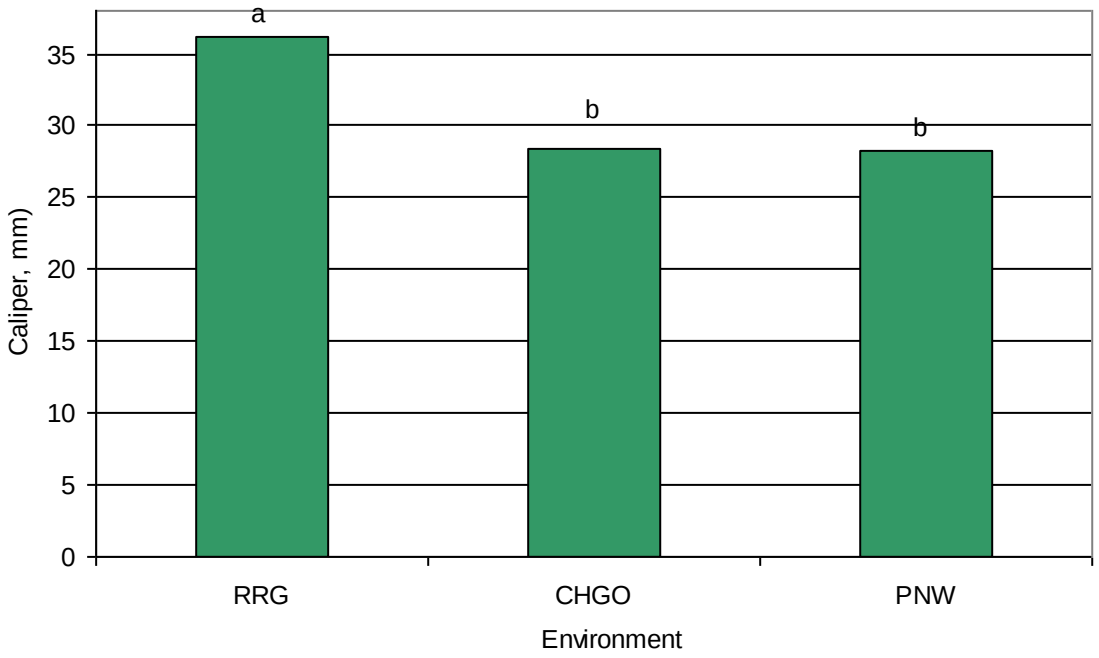

Fig. 2. Field caliper measures from June 2006 pooled over species for liners produced from three production environments. The abbreviations RRG, CHGO and PNW signify retractable roof greenhouse, combination heated greenhouse-outdoor, and bareroot liners from the Pacific Northwest, respectively. Different letters signify least significant difference (LSD) P = 0.05.

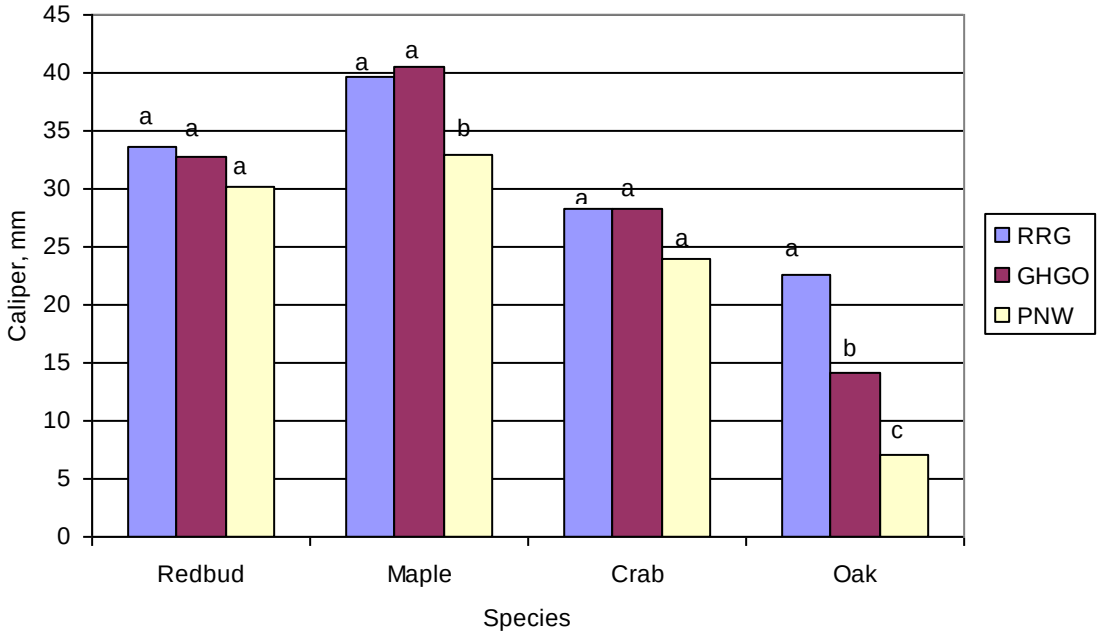

Fig. 3. Field caliper measures from September 2005 for four species of liners produced from three production environments. The abbreviations RRG and CHGO signify retractable roof greenhouse and combination heated greenhouse-outdoor, respectively. Different letters signify least significant difference within species (LSD) P = 0.05.

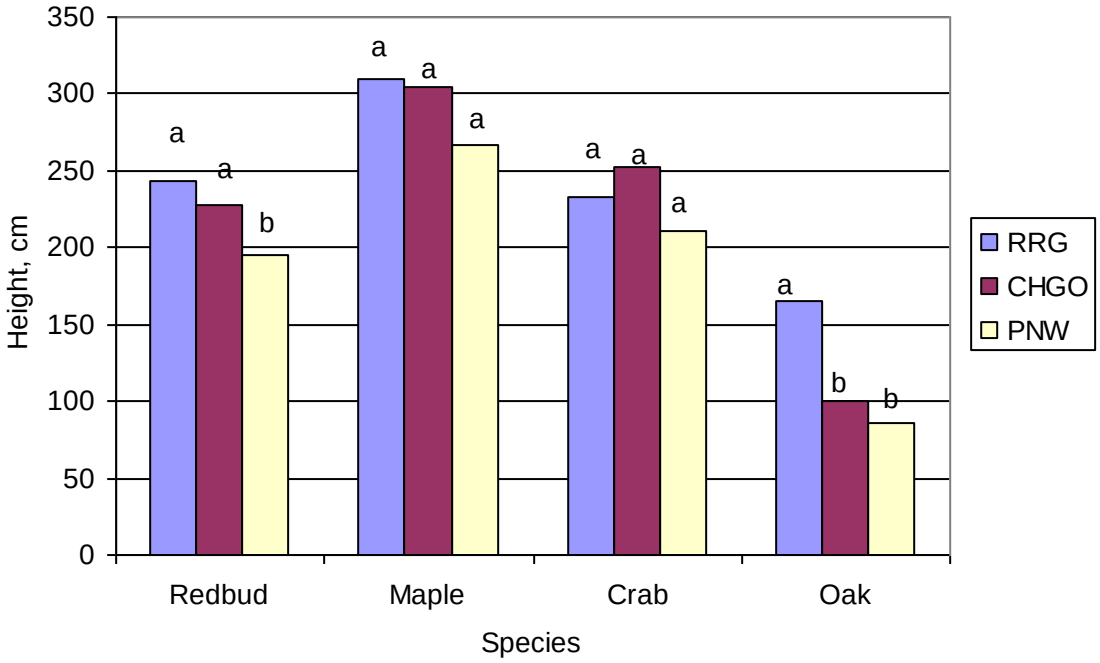

Fig. 4. Field height measures in September 2005 for four species of liners produced from three production environments. The abbreviations RRG and CHGO signify retractable roof greenhouse and combination heated greenhouse-outdoor, respectively. Different letters signify least significant difference (LSD) P = 0.05.