

Technical Notes

Periodic Updates on Current Technology
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Subject: Gravel Bed Tree Planting Series – Five-Year Growth Data

Executive Summary: Bare-root tree planting can be an effective low-cost alternative for municipal tree planting programs. Growing small trees in gravel beds for less than one year gives them abundant root systems, allowing them to establish quickly after being out-planted. These out-planted trees can also grow quickly. Average five-year diameter (caliper) of ‘Aeryn’ trident maple (*Acer buergerianum* ‘Aeryn’), eastern redbud (*Cercis canadensis*), ‘Princeton’ American elm (*Ulmus americana* ‘Princeton’), and ‘Bosque’ Chinese elm (*Ulmus parvifolia* ‘Bosque’) out-planted from gravel beds in Athens, GA, was 4.8", 3.5", 5.0", and 5.3", respectively, with 0.9" average initial diameter at time of planting. Average annual growth rate over the five-year period was 0.76", 0.52", 0.82", and 0.88" for trident maple, eastern redbud, American elm, and Chinese elm, respectively.

Brief Report: In January 2011, a 16'x24'x1.5' gravel bed was constructed in Athens, GA, and planted with 100 two-year-old field-grown trees (30 each ‘Princeton’ American elm and eastern redbud; 20 each trident maple and ‘Bosque’ Chinese elm) (fig. 1). Beginning in August 2011, trees were removed from the gravel bed and out-planted to various publicly-owned locations around Athens. Initial and annual diameter growth were recorded for five years for all out-planted trees (table 1).



Figure 1—Newly constructed gravel bed in Athens, GA, planted with 100 two-year-old trees.

Table 1—Average initial diameter (6" above ground line) and annual diameter for each species. Average annual diameter increment for each species and average diameter for all species is also shown.

Species	N	Initial diameter (in.)	Year 1 diameter (in.)	Year 2 diameter (in.)	Year 3 diameter (in.)	Year 5 diameter (in.)	Average annual increment (in.)
Trident maple	9	1.0	1.3	2.0	3.0	4.8	0.76
Eastern redbud	22	0.9	1.2	1.7	2.2	3.5	0.52
American elm	19	0.9	1.5	2.0	3.3	5.0	0.82
Chinese elm	18	0.9	1.6	2.6	3.9	5.3	0.88
Average for all		0.9	1.4	2.1	3.1	4.7	0.76



Eric A. Kuehler
Science Delivery/Technology Specialist
Urban Forestry South
320 Green St., Athens, GA 30602
706-559-4268
ekuehler@fs.fed.us



Figure 2—String trimmer damage on young bare-root tree.

Limitations: Bare-root trees are typically smaller than balled and burlapped (B&B) trees and as such are not appropriate for all planting sites. Trees planted in high-traffic areas of parks and along busy roads (high pedestrian and/or vehicular traffic) may experience an increased rate of vandalism or abuse that could reduce growth or vitality of smaller trees. Wildlife, especially deer, may also damage smaller trees by browsing on buds or rubbing on stems. Strategic placement of stakes around a newly planted tree may help to deter vandalism and abuse by people and animals. Keeping these stakes in place for several years may be needed until the tree is able to put on an adequate bark layer for protection.

String trimmer damage was also observed on many trees in the Athens, GA, planting (fig. 2), and may have adversely affected diameter growth of newly planted trees in the first several years. With age and bark development this observed damage subsided. Maintaining an adequate mulch bed around the tree as well as providing protection at the base of trees at planting by using 3-4" corrugated plastic pipes cut longitudinally may help reduce the need for string trimmers and protect the stem from damage.

The purpose of a gravel bed is to grow root systems for trees to be out-planted. Trees grown in a gravel bed for extended periods of time do not put on appreciable stem diameter growth. It is not recommended to keep trees in a gravel bed for more than one or two years.

Implications for Urban Forest Management: Many small municipalities have small budgets for planting trees that may not cover the expense of large balled and burlapped (B&B) tree stock or the equipment and personnel to plant them. Maintaining a small gravel bed for smaller trees is relatively inexpensive, takes up little space, is reusable, and can allow a city to plant more trees per year at current funding levels. Liner stock from a local nursery typically costs less than \$20 per tree as compared to a B&B tree that can cost between \$200 and \$400 per tree. Smaller and lighter, bare-root trees are easier to transport, handle, and plant, and require no special equipment for planting. Providing lighter trees to plant also encourages volunteer involvement with the planting process.

Because the roots of bare-root trees are exposed, it is easier to ensure that saplings are planted at the proper depth. Roots can be inspected before planting to correct any rooting issues and root systems can be manipulated to ensure proper belowground root distribution at time of planting. With adequate root systems, bare-root trees from the gravel bed can be out-planted any time of year as long as they are sufficiently watered after planting.



Figure 3—Bare-root tree grown in gravel bed and out-planted in June.

Conclusions: Bare-root tree planting can be an effective, cost-saving alternative for municipal tree planting programs. Planting small trees in gravel beds allows them to grow abundant root systems for out-planting. Because of the small size of bare-root trees, caution should be used when deciding where to plant. Avoid planting in high-traffic areas in parks, along sidewalks, or where large animals roam. Also, protect young trees from lawn maintenance equipment. When properly planted and maintained, bare-root trees started in gravel beds can grow quickly to the size of B&B trees in a few years, allowing a small city to plant more trees for less money.

Additional Resources: University of Minnesota, Department of Forest Resources. 2013. All you need to know about community gravel beds. 16. p. http://www.mntreesource.com/uploads/2/0/7/0/20706756/all_you_need_to_know_about_community_gravel_beds_2013_edition.pdf