

EFFECTS OF NURSERY PRODUCTION METHOD ON GROWTH AND SURVIVAL OF BUR OAK

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Abstract.

This study compared the transplanting and survival of balled in burlap (B&B) vs. Knit Fabric Container grown bur oaks. It also compared trees that were spring planted vs. August planted. All trees were spring dug. Trees planted in August were held in RootBuilder® containers after digging. Survival rates and height were significantly better in August transplanted trees. Nine of 16 B&B spring planted trees died. Of 16 trees in each treatment losses in fabric bag spring planted, B&B August planted, and fabric bag August planted were 2, 2 and 1 respectively. The purpose of August planting was to bypass the oviposition period of the Two-Lined Chestnut Borer (TLCB). Although the trees were planted in a turf landscape among mature oaks, none of the trees were attacked by the TLCB during the study.

Résumé.

Key Words: Summer Planting, Transplanting, B&B, RootBuilder® Container, Knit Fabric Container, air root pruning container

INTRODUCTION

Oaks are an important tree group in Illinois with bur, white and red being the most common species. The trees in many of the state's oak forests are mature and overmature. Their natural regeneration is not taking place due to the absence of period prairie fires. Mature specimens of these oak species also dominate the urban landscape in parks, golf courses, cemeteries, school campuses, and community neighborhoods. Turf maintenance prevents their natural regeneration. Therefore, in order to preserve and perpetuate the native oak species they must be planted.

The transplanting of young oaks involves cutting roots when digging, causing tree stress and making the newly transplanted trees attractive to attack by borers and canker fungi. When landscape managers replant young oaks within or near mature and declining oak stands, these stressed trees may be so severely attacked that high mortality rates result.

The greatest root loss occurs when landscape-sized oak trees are dug balled-in-burlap (B&B). Digging the root ball with a tree spade, then setting the ball in wire baskets lined with burlap is now a common nursery production practice. Regardless of whether trees are dug by hand or a mechanical tree spade, root loss can exceed 90% (Watson 82).

Some nurseries are now producing landscape-sized trees in in-ground fabric containers (Figure 1). The most important advantage of fabric containers is that a much higher proportion of the root system is retained with the root ball. Other advantages include: less effort in digging, reduced weight, and usefulness in sandy soils (Harris & Gillman 91; Whitcomb 85).

Carl Whitcomb (2001) has developed a method of holding harvested field stock for later planting using a container, called RootBuilder®, made from polyethylene plastic formed with a series of inward and outward projections and holes (air root-pruning container). A RootBuilder® container is placed around a harvested tree increasing the radius by a minimum of 6 in (15 cm) and filled with potting mix. After 6 weeks, the roots from the original root ball have filled the potting mix, and the tree is ready for planting anytime thereafter.

In this study comparisons were made by planting 1.75 in (4.5 cm) caliper bur oaks, half B&B and half fabric bag, within a stand of mature oaks at Olympia Fields Country Club, Will County, Illinois. Half of the B&B trees were spring (May) planted and half were held in RootBuilder® containers and planted in August. Of the fabric bag trees half were spring planted and half were held in RootBuilder® containers and planted in August.

The August planting is past the oviposition period of the Two-Lined Chestnut Borer (TLCB), *Agrilus bilineatus* (Weber). By waiting until August to plant it was believed it would reduce or eliminate TLCB infestation. Traditional methods to prevent TLCB attack include spraying a protective insecticide on the trunks during the period of adult beetle activity. This usually requires three insecticide applications per growing season.

Oaks are generally spring transplanted because of increased survival in spring planting vs. late summer planting. However, there may be new methods for growing oaks so that they can be planted in late summer, *i.e.* post borer, without decreasing transplant shock loss of

transplanted trees. The scientific literature is lacking about summer or fall planting of oaks in northern areas.

OBJECTIVE

The objective of this study is to compare two methods of tree production in the nursery and two holding/planting dates relative to transplant survival and susceptibility to attack by the TwoLined Chestnut Borer (TLCB). This study compared:

- a. Trees balled-in-burlap (B&B) transplanted in the spring vs. trees grown in Knit Fabric Container transplanted in the spring;
- b. Spring dug trees grown in Knit Fabric Containers shifted into RootBuilder® Containers and transplanted in August vs. spring dug B&B trees shifted into RootBuilder® Containers and transplanted in August.

MATERIALS & METHODS

The experiment is designed as a 2 X 2 factorial comparing B&B vs. Knit Fabric Containers and trees planted in the spring vs. planted in August after spring dug and held in RootBuilder® Containers.

Sixtyfour uniformly grown Bur Oak trees, 1.75" (4.5 cm) caliper were used in this study. There were four treatments:

1. **BBSP** (B&BSpringPlant): Sixteen trees were spring dug (before leaf emergence), balled-in-burlap (B&B) and transplanted in May 1998.
2. **FBSP** (FabricBagSpringPlant): Sixteen trees were grown in InGround Knit Fabric Containers. They were dug and transplanted in May 1998
3. **BBAP** (B&BAugustPlant): Sixteen trees were dug B&B in the spring and transferred into RootBuilder® Containers. The trees were transplanted in August 1998
4. **FBAP** (FabricBagAugustPlant): Sixteen trees were grown in In-Ground Knit Fabric Containers and were transferred into RootBuilder® Containers. The trees were transplanted in August 1998.

The trees were planted with open spacing, on upland soils, in the vicinity of mature oaks, and outside of irrigation systems at Olympia Fields Country Club, Will County, Illinois. Each tree was surrounded by mowed turf typical of golf course rough areas. Trees were protected from lawnmower injury with 2-3 in. (5-7.5 cm) of mulch applied on a 3 ft (1 m) radius. Trees were watered at the time of planting but not watered other than by rainfall thereafter.

Half of the trees in each treatment (8) were randomly selected and received three preventative insecticide (Dursban) treatments during the first year to prevent borer infestation.

Caliper and height measurements were made on all the trees starting in June 1999 (base measurements), November 1999 (first season growth) and August 2000.

Statistical Analysis: Statistical analysis of the data on height and caliper was done with Minitab version 13.

RESULTS

Survival

Holding trees until August in RootBuilder® containers improved bur oak survival in B&B trees and reduced top dieback in B&B and fabric bag trees (Fig 2)

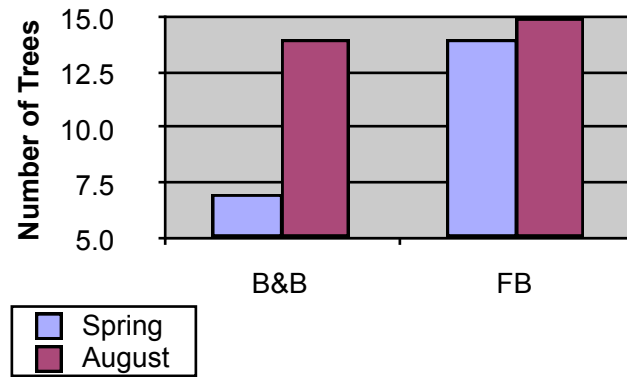


Figure 2. Bur Oak Tree Survival

Of the B&B spring planted trees (**BBSP**) one was dead at the first measurement period (6/99). Eight of the remaining 15 died by the final measurement period (8/00). Of the remaining 6, two had lost their top and coppice sprouted resulting in a tree that was shorter than what was originally planted.

Of the fabric bag spring planted trees (**FBSP**) two died by the final measurement. Nine of the remaining 14 had top dieback with coppice re-growth resulting in shorter trees than their original planting height.

Of the B&B August planted trees (**BBAP**) one died before the first measurement (in the RootBuilder® container) and one died by final measurement. Of the remaining 14 trees none had top dieback or negative growth measurements.

Of the fabric bag August planted trees (**FBAP**) one died by final measurement and one had slight top dieback resulting in the loss of 1 in. (2.5 cm) in height.

Height

Initial (baseline) measurements were made in June 1999, 13 months following spring planted trees and 10 months following August planted trees. A T-test comparison of height measurements for the baseline data showed no significant difference in height.

Increase in height was significantly greater for August planting [\bar{x}] = 19.13" (47.8 cm) vs. spring planting [\bar{x}] = 6.97" (17.4 cm)]. Fabric bag height averages [\bar{x}] = 14.28" (35.7 cm)] were slightly greater than B&B height averages [\bar{x}] = 11.81" (29.5 cm)]. (Table 1.)

Table 1. Average Tree Height Differences

	SPRING	AUGUST	AVE
B&B	5.56 \pm 0.3	18.06	11.81
FB	8.38 \pm 0.3	20.19	14.28
AVE	6.97 \pm 0.3	19.13	

Diameter

Measurement of diameter growth of the surviving trees shows similar results as the height measurements. Increase in diameter was significantly greater for August planting [\bar{x}] = .54" (1.35 cm) vs. spring planting [\bar{x}] = .21" (0.53 cm)]. Fabric bag diameter averages [\bar{x}] = .453" (1.13 cm)] were slightly greater than B&B diameter averages [\bar{x}] = .297" (0.74 cm)]. (Table 2.) In many instances the top dieback was above the 6" (15 cm) location of caliper measurement. For these trees top measurements were negative but caliper was the same as the base measurement or greater.

Table 2. Average Tree Diameter Differences

	SPRING	AUGUST	AVE
B&B	0.14	0.45	0.30
FB	0.28	0.63	0.45
AVE	0.21	0.54	

DISCUSSION

None of the dead trees had insect borer infestation. Therefore, this study did not succeed in determining whether August planted oaks bypass the oviposition period of the Two-Lined Chestnut Borer. This study does demonstrate that bur oaks survive better and have less dieback if grown for 6 weeks or longer in RootBuilder® containers whether dug B&B or grown in fabric bags. This should apply to other tree species. This RootBuilder® container system also should help nurseries provide trees for successful planting during months (August-October) that are traditionally slow for tree planting.

Trees held in RootBuilder® containers have greater root volume than the spring planted trees. Spring planted trees grow their root systems after planting at a time when conditions become adverse, *i.e.* hot and dry. Also, spring planted trees allocate energy into leaf and shoot growth, thereby delaying root growth. RootBuilder® container grown trees have regenerated roots that have been grown under favorable conditions during the hot and dry part of the year. They have the remainder of the growing season to establish roots into the surrounding soil. This is past the time for shoot and leaf growth so energy can go toward root growth. With proper irrigation and mulching following planting RootBuilder® container trees will retain most of their root system during their dormant period and are ready for growth the following spring without having been stressed. If a spring planted tree is stressed during the summer, it may not fully recover by the following spring. If stressed during the following spring, the plant becomes susceptible to attack by insect borers and canker fungi.

It is believed that survival rates and growth rates would have been better and top dieback would have been less if the trees would have been irrigated during dry periods following planting (Gillman 2001, Gilman et al. 1998). Trees coming from RootBuilder® containers need to be irrigated regularly following planting. They have been grown with 7-days per week irrigation and are being planted at a time where rainfall rates are usually at their lowest. The tree's new roots are in potting soil which when planted creates a soil discontinuity with the surrounding soil. Frequent, regular irrigation is recommended until the tree's roots can colonize the surrounding soil.

Advantages to Urban Landscape Managers

1. In the northern half of the United States the oviposition period of Buprestid insects is during the spring to early summer. If trees can be planted in late summer and early fall they will avoid infestation until the following year.
2. Planting in late summer and early fall with a 100% root system can help avoid stress by missing the hot and dry part of the year. However, proper irrigation following planting, at anytime, is considered mandatory.
3. Late summer and fall planting gives the tree good opportunity to allocate its energy growing roots rather than shoots and leaves. With roots established in the fall and protected from cold temperatures there is less chance for stress at the time of growth in the spring and during hot, dry summer weather. If not stressed, the tree is more resistant to attack by Buprestid insects.
4. Nurseries often provide discounts for trees purchased during an off-season period.

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