PLANTING TECHNIQUES FOR TREE SPADE DUG TREES[1]

by Robert Birdel, Carl Whitcomb, and B.L. Appleton

Abstract. New growth on Japanese black pines and Hopa flowering crabapples was greater on tree-spade-dug trees transplanted into back-hoe dug holes than on tree-spade-dug trees transplanted into holes dug and modified in other ways. This study suggests that a large volume of well-aerated backfill will reduce transplanting stress.

Digging and planting landscape trees with tree spades is likely to increase in the future due to demand for an immediate landscape effect at a reasonable installation cost. Despite disadvantages such as the need for a special equipment operator and the inability to use tree spades in abnormal weather or where underground utilities exist, or where buildings, paving or vegetation reduce mobility (1), many advantages encourage their use. Tree-spade dug and planted trees have been promoted for year-round planting (1) and can reduce manpower and save time under some conditions (5). In other instances tree spades allow use of larger trees that can better withstand mechanical abuse and vandalism along streets (7), and may be less expensive in the long run (1,5).

When tree transplanting fails, profits decrease, from the grower to the landscape contractor (2). All production and preplanting efficiencies then are in vain. In tree digging and planting, the arborist must consider many factors (5,7): time of year, climate, exposure, production site, landscape site, soil types, digging-to-planting time span, post planting care, and tree species.

Watson & Himelick (8) stated that up to 98% of the root system can be lost when a tree is dug with a tree spade. Such injury also permits pathogen entry. Therefore, efforts to minimize the loss of roots, and shock and recovery period should be made (4). Although more roots may be retained by a properly dug bare root tree than with balled in burlap or tree-spade-dug trees (2, 6) they sustain more damage to the important small, shallow feeder roots and with large trees show less growth one year after transplanting than with tree-spade-dug trees (7).

When many roots are damaged during any digging, new roots develop from the point where the older roots were severed. These new roots grow and branch (3). Soil characteristics important for new root development include soil aeration (8). Whether a tree is bare root, balled in burlap or tree-spade-dug, a hand dug hole in the landscape site — where the backfill soil mass is broken up and therefore aeration improved, has been found better than a tree-spade-dug hole (6).

Because it is expensive to dig large tree planting holes by hand, improvements in tree-spade-dug holes are being sought. Tree spades compact and glaze the hole walls by their pressure as the blades are inserted into the soil. It is impractical to manually roughen or disturb the face of the tree-spade-hole. Even if the soil is roughened to break any glaze of the face of the tree-spade-dug hole, new roots would still be forced to grow into undisturbed soil which is relatively low in oxygen in most situations. One proposed improvement is to hand dig a tree-spade-dug hole at least two feet larger in diameter to provide well aerated backfill (5).

Procedures and Results

A transplanting study was begun on March 10, 1981, using Japanese black pine, *Pinus thunbergi,* and Hopa flowering crabapples, *Malus* X 'Hopa'. A randomized block design using the following four treatments was replicated six times for each plant species:

1) Tree-spade-dug tree planted into a tree-spade-dug hole. Normal efforts to water-in soil around the root ball were made.
2) Tree-spade-dug tree planted into a tree-spade-dug hole *with* approximately one cu.

1. Journal Series #4276 of the Oklahoma Agricultural Experiment Station.

ft. of soil added to the bottom of the hole and made into a mud slurry. The volume of the mud slurry was enough to fill the air spaces around the root-ball from the bottom of the hole to the soil surface, thus preventing any air pockets.

3) Tree-spade-dug tree planted into a tree-spade-dug hole *with* a ring of soil approximately 8" deep and 8" wide removed from around the top of the tree-spade-dug hole. This soil was then used to backfill and water-in around the tree, thereby reducing or eliminating the air space in the upper 8" of soil and any glazing in the surface 8" of soil where the tree roots are most concentrated and active.
4) Tree-spade-dug tree planted into a hole approximately 4'X4'X30" deep, dug with a back-hoe. The tree-spade-dug tree was held in the hole by the blades as the soil was backfilled. When all backfill soil was in place, the blades were removed and the tree was watered-in.

The tree spade used was a 30 in. Vermeer. The crabapples were 12 feet tall and 2 inch diameter; the Japanese black pine were 6 feet tall and 2 inch diameter. Both tree species had been grown on a clay loam soil. The planting site was unproductive; very heavy clay with shallow topsoil. All trees were watered well following transplanting and numerous rains occurred until mid-June. No further watering was done. Trees were evaluated by measuring 10 new shoots per tree in May, 1982. For both species shoot growth was best for treatment 4, the tree-spade-dug tree in the back-hoe dug hole (Table 1).

In mid-August, 1981, the flowering crabapples were visually evaluated for summer heat and drought tolerance using 1-10 rating where 1 = small leaves and much stress while 10 = large leaves and little if any stress. Again treatment 4 was best (Figure 1, Table 1).

Little benefit was seen from treatments 2 and 3, mud slurry and loosened top ring of soil, compared to treatment 4, back-hoe dug hole. It appears that loosening the soil surrounding the transplanting root mass is the most practical means to reducing the stress of transplanting

Table 1. Average length of 10 new shoots of Japanese black pine and Hopa flowering crabapples, for each of 4 transplanting treatments.

	Treatment			
	Tree-spade-dug hole (1)	*Tree-spade-dug hole with mud slurry (2)*	*Tree-spade-dug hole with loose soil rim (3)*	*Back-hoe dug hole (4)*
Crabapple — Avg. shoot length	11.8 cm_b (4.6 in)	8.6 cm_a (3.4 in)	13.5 cm_b (5.3 in)	20.3 cm$^*{}_c$ (8 in)
Crabapple Visual Rating**	2.6_a	3.5_a	3.7_a	9.4_b
Pine — Avg. shoot length	1.5 cm_a (0.6 in)	3.1 cm_{ab} (1.2 in)	5.4 cm_b (2.1 in)	11.7 cm_c (4.6 in)

* Averages in horizontal line followed by the same letter are not significantly different at the 5% level.

** Visual ratings from 1-10 where 1 = very poor appearance and 10 = excellent appearance.

trees. This benefit is probably due to improving soil aeration. The reduced soil density may have allowed more rapid root growth from the root ball into the surrounding soil.

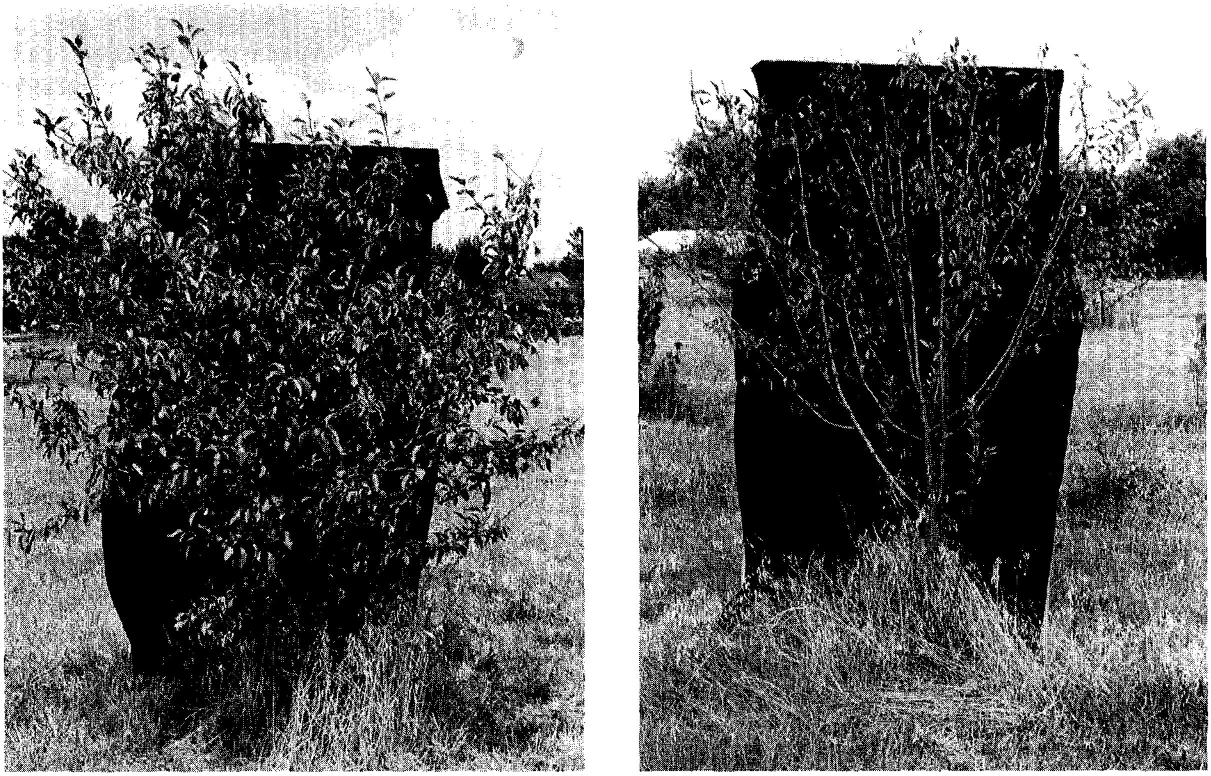

Figure 1. The tree on the left was typical of the crabapples transplanted into the large hole dug by the back-hoe. Even though the trees were not given any supplementary water during the summer of '82, foliage was dense, dark green and no internal leaves were yellowing or dropping as of August 28, 1982. No measurable rain had occurred for 7 weeks prior to these photos. The tree on the right was typical of plant response to the other treatments. Of the 18 trees in the 3 poorer treatments only two had died, however, all were unthrifty in appearance and with very small leaves. These findings emphasize the importance of loosening a large volume of soil when planting to reduce transplanting stress.

Literature Cited

1. Cool, R.A. 1976. *Tree spade vs. bare root planting.* J. Arboric. 2: 92-95.
2. Flemer, W. 1982. *Successful transplanting is easy.* J. Arboric. 8: 234-235.
3. Furuta, T. 1982. *Influences on root determine transplanting success.* Am. Nurseryman 156(7): 65-69.
4. Hamilton, D.F. and S.D. Verkade. 1982. *The development and care of a healthy root system.* Am. Nurseryman 156(6): 73-80.
5. Himelick, E.B. 1981. Mechanical tree digging and planting with a tree spade. In: Tree and shrub transplanting manual. pp. 29-32.
6. Preaus, K.B. and Carl E. Whitcomb. 1980. *Transplanting landscape trees.* J. Arboric. 6: 221-223.
7. Vanstone, D.E. and W.G. Ronald. 1981. *Comparison of bare-root versus tree spade transplanting of boulevard trees.* J. Arboric. 7: 271-274.
8. Watson, G.W. and E.B. Himelick. 1982. *Root distribution of nursery trees and its relationship to transplanting success.* J. Arboric. 8: 225-229.

Department of Horticulture and Landscape Architecture
360 Ag Hall
Oklahoma State University
Stillwater, OK 74078