TRANSPLANTING LANDSCAPE TREES[1]

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Several types of tree spades are currently on the market. The manufacturers make various claims regarding transplanting success of various sizes of trees and the relative cost per tree moved. Few studies have been done to compare the rate of survival and the cost per amount of time for tree spades compared to conventional balled-in-burlap techniques.

A frequent criticism of the tree spade is that holes dug to receive the tree are not quite the same shape as the ball dug with the tree spade, thus, various gaps or voids exist between the two soil masses following transplanting. These air spaces probably restrict root development since roots seldom extend through large air spaces. An additional concern lies with the glazing of the sides of the tree spade dug hole and the face of the soil ball dug with the tree spade. Soil glazing may be sufficient to retard root penetration and development into the surrounding soil in some instances and restricts normal moisture movement in the soil following planting and watering. The shape and size of the tree spade dug ball is also frequently heard as a concern among landscape contractors. Balls of earth from tree spades are more narrow and deeper than conventional hand dug balls and probably contain a smaller proportion of the feeder roots.

An additional technique which contrasts with both the tree spade and hand digging is the procedure of pulling the tree from the ground using a pin and clevis through the trunk. At first, this technique seems very undesirable, however, with close inspection, it may have merit. Root tips which survive the transplanting procedure and those which develop quickly following transplanting probably play the greatest role in insuring survival of the tree. With either the tree spade or hand digging a sizable portion of the root tips are lost and the number and extent of larger roots which are probably most responsible for developing new root tips are greatly reduced. If the soil is moist when the tree is pulled, many of the small roots as well as most of the larger roots will be retained. It is important to prevent drying of the root mass once it is removed from the soil and replanting should be as soon as possible. With a pulled tree, the quantity of functioning roots and the potential for development of new roots at the new site appears greater than with the tree spade or conventional B&B.

In order to determine the merits of the various transplanting methods for trees, the following digging-planting treatments were compared:

1) Tree spade (TS) dug tree planted into tree spade dug hole.
2) Tree spade dug tree planted into holes partially dug by an auger and completed by hand (HD).
3) Hand dug balled-in-burlap (B&B) tree planted into auger and hand dug hole.
4) Trees pulled from moist soil via pin and clevis and planted into auger and hand dug hole.

Tree species used were *Ulmus parvifolia,* lacebark or true chinese elm, 2 years old, 5½ to 6′ tall with 2½ to 3½ inch stems near the soil line, *Pinus thunbergi,* Japanese black pine, 4 years old, 5 to 6 feet tall with 2 to 3 inch stems near the soil line. Both species had been grown in bottomless containers which destroys the tap root during the seedling establishment period and stimulates a very fibrous root system. *Fraxinus pennsylvanica* 'Summit', Summit green ash, were 2 years old and about 5 feet tall when obtained from a commercial nursery in 1977. These trees were 4 years old and 9 to 11 feet tall with 3 to 3½ inch stems near the soil line when this study began.

All trees were grown in a heavy clay loam soil and were transplanted to a site of similar soil type about ¼ mile away. All transplanting was done during late March, 1979, while all trees were dormant. Each treatment was replicated 6 times for each species. The tree spade used was a Vermeer T-20 mounted on the 3 point hitch assembly of a 40 horsepower tractor.

All trees were planted and watered in

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thoroughly the same day they were dug. Spring and summer rains provided good soil moisture until early August. Soils became very dry during late August and September and no supplemental watering was done.

Several assumptions were made in order to calculate transplant costs: 1) equipment cost was based on 1/10 of 1% of the value of the machine used in each operation. 2) labor cost was based on $5.00/hour/man, 3) overhead costs were calculated on multiplying the cost of labor per treatment by 30%.

Based on the assumptions made and time required, the following transplanting costs were determined:

Lifted/Hole preparation	*elm*	*pine*	*ash*	*average*
Tree spade/tree spade	$4.38	4.65	3.55	4.19
Tree spade/auger-hand	3.71	3.68	4.28	3.89
B&B/auger-hand	9.67	9.16	7.28	8.70
Pulled/auger-hand	4.85	5.52	did not work	5.18

Since all trees were transported only about ¼ mile, transport time did not become a major factor. However, in most landscape situations, transport time would become a very important consideration, especially if the tree spade was driven several miles between sites. Transport distance may also influence the performance of trees pulled from the soil with many exposed roots unless additional measures were taken to prevent root desiccation.

On September 23, a visual grade was taken for the lacebark elm and Japanese black pine (1=best appearance and 4=poorest appearance) and length of current seasons flush was measured on the Japanese black pine and Summit green ash. Visual grade of lacebark elm and Japanese black pine was highest (indicating more stressed appearance) when the trees had been transplanted by a tree spade and planted into a tree spade dug hole, treatment 1 (Table 1). Appearance of lacebark elm trees transplanted with treatment 2, tree spade into a hand dug hole; 3, B&B into a hand dug hole; or 4, pull method into a hand dug hole were similar and all were significantly better than treatment 1 (Figure 1).

Japanese black pine grew most when transplanted with treatments 2, 3 or 4 and the length of the current seasons flush was significantly shorter when trees were transplanted with treatment 1 (Table 1). In addition to a shorter flush of growth, Japanese black pine dug with a tree spade and planted into a tree spade dug hole also had an overall unthrifty appearance (Figure 2).

Table 1. Effects of transplanting method on visual grade or length of new growth of trees after one growing season.

Tree species	*(1) Tree spade Tree spade hole*	*(2) Tree spade Hand dug hole*	*(3) B & B Hand dug hole*	*(4) Pull method Hand dug hole*
		visual grade*		
Lacebark Elm	3.5[b]	2.2[a]	1.8[a]	2.4[a]
Japanese Blackpine	3.5[b]	2.0[a]	1.7[a]	2.0[a]
		new growth (in)		
Japanese Blackpine	6.0[a]	9.6[b]	11.0[b]	10.1[b]
'Summit' Green Ash	2.6[a]	2.3[a]	6.2[b]	—

*Visual grade based on 1-4 scale with 1 = best appearance and 4 = most stressed trees.

Summit green ash grew best when transplanted with treatment 3 (B&B) as compared to either tree spade treatment (Table 1). The difference in the Summit green ash appearance and length of new growth when compared to other test species, may be related to the manner in which the trees were grown prior to initial planting in the field. Air root pruning during the seedling stage greatly increases the quantity of fine fibrous roots as compared to trees grown in conventional ground beds. In the limited volume of soil in the tree spade ball, more roots were transferred to the new site on the elm and pine proportionate to the ash. Likewise, air root pruning probably increased the success of the pull method with the elm and pine.

It is interesting to contrast treatments 1 and 2. The success of treatment 2 suggests that glazing of the tree spade dug ball is not as serious as was originally thought at least when loose backfill can be placed in intimate contact with the face of the ball following transplanting. On the other hand, when a tree spade dug tree is placed in a tree spade dug hole, an airspace is likely to occur in numerous positions around the ball. In addition,

Figure 1. Lacebark elm foliage density and relative leaf size with tree spade dug tree in a tree spade dug hole (left) and typical response of other treatments, (right) in September after transplanting in March.

both the face of the ball and the face of the hole may be glazed, depending on soil type and moisture conditions. These findings suggest that digging out enough soil around the top of the tree spade dug hole to provide a loose backfill down as far as the major roots in the tree spade dug ball may increase survival and growth following transplanting.

The fact that the conventional balled-in-burlap technique was not superior to the tree spade and hand dug hole combination suggests that digging machines can be used with a similar degree of success as with B&B if the seedlings are air root pruned initially. The pull method deserves more attention, particularly when transplanting large trees. This may be a way to retain more roots capable of aiding reestablishment without the awesome weight encountered with very large soil balls.

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Figure 2. Japanese black pine foliage density and length of current seasons flush with tree spade dug tree in a tree spade dug hole (left) and typical response of other treatments (right) in September after transplanting in March.