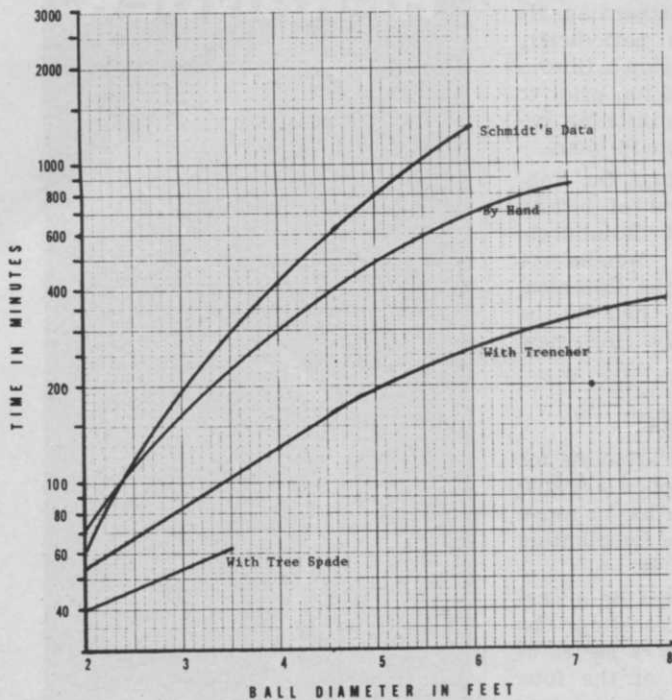
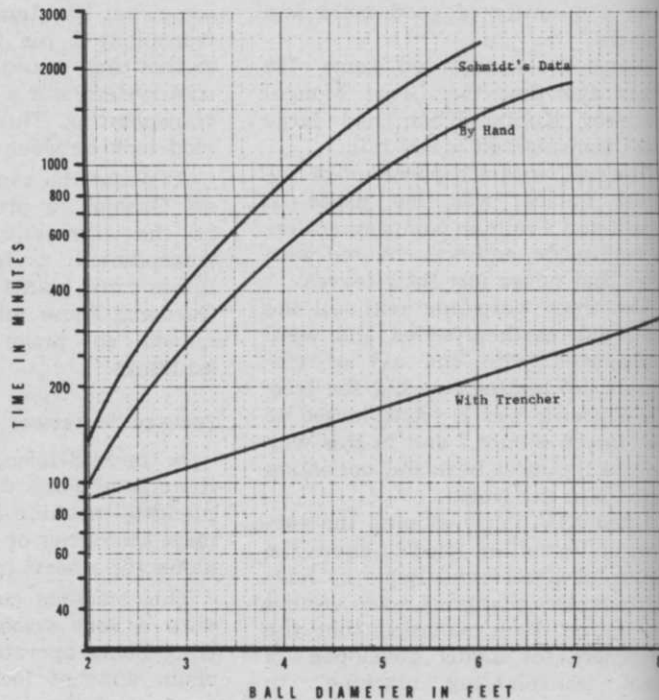


AVERAGE TIME FOR DIGGING



AVERAGE TIME FOR PLANTING



Time Study for Planting Trees

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TRANSPLANTING of large trees has interested man since the dawn of history.

The Hanging Gardens of Babylon, built centuries ago by King Nebuchadnezzar, undoubtedly had many trees transplanted from great distances, as the garden was created to provide a mountain environment in the midst of a great plain. Kublai Khan also built a "Green Mountain" and had beautiful trees transplanted from great distances with the aid of elephants.

Louis XIV ordered thousands of trees to be transplanted from the forests of Europe to create a pleasant park-like environment about the Palace at Versailles. And today, man continues in his ceaseless efforts to improve the environment in which he lives by planting and transplanting trees.

Although trees have been transplanted for centuries, little published information is available on the time required to perform the various operations associated with the process.

Some years ago, Surties* and

Schmidt** compiled and published the results of their studies on digging and planting large trees. However, little has been done to up-date these studies with information that could be used by modern nurserymen and arborists to base estimates for transplanting of trees. Data published by Surties and Schmidt were based on hand labor using the techniques of their period; whereas, the plantsman of today needs data based on machines—used to dig and lift—supplemented with hand labor to complete the details of the job.

A series of motion and time studies was conducted in cooperation with a group of nurserymen and arborists in order to obtain the raw data from which time-sequence curves were calculated for the digging and the planting phases of the transplanting operation.

The digging phase was subdivided into three subphases: preparation, digging, and burllapping to include tying.

The planting phase was subdivided into four subphases: excavating, setting and facing, backfilling, and guying which also included clean-up.

In addition, data were collected on: species, soil type, weather conditions, and other special conditions.

Equipment Triples Work Speed

As might be expected, digging time and planting time were found to be functions of ball size. (Fig. 1). However, the average times were found to be considerably below those reported by Schmidt (Schmidt's data were averaged and plotted for comparative purposes); evidently, the combination of men and machines is more efficient than man alone.

Where it took 800 minutes (13 hours, 20 minutes) to dig and process a tree with a 5-foot ball, according to Schmidt; it took only 190 minutes (3 hours, 10 minutes) with the aid of a trencher.

In general, it took three times as long to dig and prepare the ball by hand as it did with the aid of a trenching machine or a backhoe. However, in each case, the skill of the men was the limiting factor; skilled men can do three times the work of less skilled employees.

The time required to prepare the tree varied considerably with size and with the type of tree. Small-sized trees required only a few minutes of preparation time, whereas for larger trees, it took 30 minutes and in a few cases up to two man-hours to prepare a large tree (8-foot ball) for digging.

It took about twice as long to

prepare evergreen trees for digging as it did to prepare deciduous trees with the same size root-ball.

Unfortunately, data on the digging of trees with the tree-spade were limited to trees with relatively small root-balls, but the data showed that there was a consider-

Where it took 20 to 30 minutes to dig a two-foot ball by hand, the same job was accomplished with the aid of a mechanical "power-spade" in 8 to 10 minutes. The maneuverability of the machine, either in the nursery or in the landscape, was the limiting factor.

Undoubtedly, the digging machines of the future will possess increased maneuverability, but it also appears that trees in the nursery will have to be spaced further apart to accommodate digging machines, as they were adjusted years ago when mules were replaced by tractors for cultivating in the nursery.

Planting Time Varies Most

Time required to plant trees varied with the size of the root ball and the method employed (Fig. 2). Digging holes for transplanting was most effectively done with the aid of a backhoe.

The time requirement was reduced to one-sixth of that required for hand labor. Where it took 30 minutes to dig a hole for a 2x2.5-foot ball by hand, the same job was accomplished in about 5 to 6 minutes with the machine.

The greatest time variable, encountered in the planting operation, was the time required to place and set (face) the tree. Small-sized trees were generally positioned in a few minutes (10-15), whereas it required about an hour to position a tree with a 4-foot ball, and in some cases, as long as 4 hours to position a large specimen tree.

It would pay arborists to know how large trees are to be positioned prior to setting in order to minimize "facing" time.

Backfilling about the tree-ball was greatly facilitated with the aid of a "blade" but most nurserymen seemed to prefer handwork for this operation; apparently, they feel that this part of the transplanting operation should still be done by hand.

Guying and Pruning

Guying, wrapping, and pruning of transplanted trees was found to be a variable practice. Although most nurserymen pruned the trees, they were divided in how and when the pruning was done.

Some pruned the tree when it was in the horizontal position, still attached to the tree mover. However, others waited and pruned the tree after it was planted. In most cases, the pruning consisted of thinning out, although a few arborists did prune rather heavily.

The standard triangular system of guying was used by almost all of the arborists; however, a few did not guy. They indicated that the weight of the root ball was sufficient to hold the tree in an upright position without the aid of guy wires.

It is interesting to note that such a practice was recommended by Boutcher in 1775; in fact, he went so far as to state that "staking (guying) was only necessary to support the defect of good culture." Nevertheless, it took, on the average, 20 to 30 minutes to stake and clean up following the planting of a small tree, and from 2 to 3 man-hours or more to guy and clean up following the planting of a large tree.

Effects of Soil Type

Insufficient data preclude drawing any firm conclusions on the effect of the weather, soil type, or other special conditions, such as slope, obstacles, etc., on the transplanting operation. But it would appear that sandy or clay type soil slows the hand digging phase. Whereas soil type plays only a minimal roll when a "power-spade" is employed. Also, the "power-spade" can very effectively penetrate six inches of frozen ground. Its primary limitation was maneuverability within the nursery.

The average time curves for digging and planting, as presented in Figs. 1 and 2, are suggested for use only when more pertinent data are not available. Also, to these average times must be added time to transport the plant from site to site plus a time margin of some 30% to 40% for labor efficiency.

* Surties, John, 1940. Master Units of Landscaping, Series No. 2 and 3.

** Schmidt, Owen B. 1953 (Cited by H. S. Conover, Grounds Maintenance Handbook, F. W. Dodge Corp., N. Y.)

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