

TREE SPADE VS. BARE ROOT PLANTING¹

by Robert A. Cool

Abstract: In 1973 the City of Lansing began a study to investigate the economical feasibility of using a Vermeer TS44T tree spade to plant street trees. A ten year average mortality rate for newly planted bare root street trees was found to be 41%. Tree spade planted trees had a mortality rate of less than 5%. Results of the study showed that 2.5 surviving tree spade trees could be planted for the same cost as one surviving bare root tree. A two year update of the 1973 study showed the basic premise to be valid. The new data showed that bare root mortality was 28% and the tree spade mortality was 1% resulting in 1.5 surviving tree spade trees being planted at the same cost as one surviving bare root tree.

Bare root planting of street trees has been the standard method utilized by the Lansing Forestry Division and most other cities. This premise was seemingly well founded on the concept of low cost, ease of handling, availability of trees, quantity planting in a short time and minimum personnel training.

In 1969 the City of Lansing purchased a Vermeer TS44A trailer mounted tree spade, one of the first in Michigan. This machine was successfully used for planting larger trees in parks, golf courses and cemeteries. Because the cost of the operation had not been determined, street trees were not planted by this method and it was believed that it would be an expensive luxury for a limited number of residents.

Trouble with the axle of this early model tree spade (since corrected) caused the City of Lansing in 1972 to trade-in the TS44A for a TS44T, a truck mounted model, utilizing the same four-wheel drive truck. The shorter over all length made street tree planting easier and an increased number of larger street trees were planted, but still restricted to replacements of auto, vandal, and gas caused tree losses or where the expenses were paid for the larger than normal size tree by the adjacent property owner.

Most of the trees planting during the first four years of operation originated from wholesale nursery block purchases of trees which had grown over salable size, had been wounded or scarred by nursery equipment, or were salvaged from road and building construction areas. A small per-

cent were taken from Lansing's bare root nurseries. Tree purchases were made for one dollar and later for two dollars per tree for both deciduous and coniferous trees. The most recent purchase in 1973 found the price per tree at \$7.46 for three inch average diameter trees. This increase in price was created by a large number of private landscapers operating Vermeer tree spades in the area. The "oversize" trees are now in great demand with most being planted privately in new multiple dwelling areas.

As a result of the low procurement cost, the success of operation of the tree spade, and the suspicion of high bare root mortality, Lansing began a study to examine the current cost of the bare root planting program and to determine the feasibility of converting from bare root to tree spade planting on the streets. Using data accumulated for the preceding nine years, the study showed a survival rate for bare root planted trees at only 59%. Of the 41% bare root mortality, vandalism and auto loss were less than 10%. While this figure caused a renewed effort to reduce the mortality of bare root planted trees, it presented a target cost to compare with the cost of the tree spade method which had a total mortality rate of less than 5%.

The total cost for each planting method was calculated to determine the "cost per surviving tree". The calculations included costs for tree procurement, equipment, supplies and labor for "all activities" necessary to obtain a surviving tree. These activities included the simple act of planting the tree in the ground, office and nursery preparation time, record keeping, wrapping, staking, watering and tree removal for non survivors.

The results of these calculations showed a shocking total cost of \$77.10 for "surviving" bare root trees and only \$30.45 for "surviving" tree spade trees. It was concluded that 2.53 surviving tree spade trees could be planted at the same cost as a single surviving bare root tree.

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This cost savings was attributed to:

- 1) the low cost of handling and preparing a tree spade tree for moving;
- 2) the high rate of survival achieved in tree spade planting vs. bare root method; and
- 3) the low maintenance costs after planting.

The 1973 study further concluded that the existing backlog of 4,500 street trees yet to plant in Lansing could be done at a cost savings of nearly \$210,000.00 by using the tree spade (\$137,025.00) instead of the bare root method (\$346,950.00).

As a result of this study the Lansing Forestry Division started major street tree planting with the Vermeer TS44T in September, 1973. During the following two years intensive cost accounting was performed on all planting operations to further refine unit costs.

It was immediately determined that not all sites could be planted with the tree spade. Underground utility locating was the first requirement. This activity performed at no direct cost by the local utility and now mandatory by state law has the purpose of avoiding utility breakage and subsequent repair costs, avoiding interruption of customer services, and most important, avoiding the hazard to workers and customers resulting from utility breakage. It is estimated that 10% of all sites had to be planted bare root due to unavoidable conflict. The City of Lansing found another important reason for having underground utilities located which applies to both planting methods. By knowing the utility locations the planting location can be moved as far away as possible from the utilities. Far too many trees are lost or injured by utility repairs within the root area. In addition,

the utility companies are very cooperative in this massive locating activity just so future encounters with tree roots can be minimized.

The lack of the right kind and size of trees growing in local nurseries also caused a large percent of the locations to be planted bare root.

The tree spade method itself limits the number of trees planted. Because it can plant only one tree at a time, there is a maximum number plantable in a normal work year. This is most dependent on the haul distance variable.

The cost accounting and work records maintained for the last two years has enabled Lansing to more closely look at the differences in the planting methods.

The first figure to stand out is bare root mortality which was reduced below 30%. At the same time tree spade mortality was only 1% for all reasons. During this period the tree spade planted 32% of the trees.

An intensive dead tree autopsy showed that for each cause of tree death, the bare root planted trees were lost at much higher rates than tree spade trees.

Table 1. Percentage of tree deaths from major causes by planting method.

Major cause of tree death	% Mortality	
	Bare root	Tree spade
Root failure-Good site	93%	7%
Borers	92%	8%
Canker	82%	18%
Lack of water	75%	25%
Vandalism	100%	0%
Other causes	88%	12%

Wrapping costs remained the same as the planting method is not the variable, while kind of tree planted does affect this cost.

The number of trees staked were found to be much less than the 20% estimated in 1973. Of the 1,523 trees planted in the fiscal year 1974-1975, 6% of the tree spade trees and 4% of the bare root trees needed to be staked as a planting aid.

Watering and other services given the newly planted trees are considered necessary to get the trees established, therefore is calculated as part of the overall planting cost. It was found that

the tree spade trees required at least 10% less of this activity than the bare root trees, a sizable cost savings at \$3.00 per year.

The 1973-1974 wage and equipment figures for bare root planting showed a cost of \$21.50 per tree and a tree spade cost of \$29.00 per tree before the 28% bare root and 1% tree spade mortality is considered. The actual planting operation cost corrected for mortality gives \$29.86 for a surviving bare root tree and \$29.29 for a surviving tree spade tree. This figure appears to contradict the 1973 prediction until the tree procurement cost for "surviving" trees is added to the bare root cost (\$17.50 corrected to \$24.30) and to the tree spade cost (\$17.50 corrected to \$17.68). Remaining costs for supplies, equipment and labor for watering and other miscellaneous items add \$18.05 to the bare root cost and \$6.82 to the tree spade cost. This gives a total cost for a surviving bare root tree of \$72.21 and a surviving tree spade tree of \$53.79. The 1973 projection of 2.5 surviving tree spade trees planted for each bare root surviving tree was substantiated only in principle. A corrected ratio is approximately 1.5 tree spade to 1 bare root tree. It is felt that this ratio will level out at approximately 2 to 1 for a normal year.

The last two years produced a number of factors which caused a loss of efficiency for the tree spade method. An early snowfall in November caused the addition of a tractor-loader to the tree spade operation which was used to remove snow from the planting sites and the nursery. This allowed the trees to be dug and planted at the proper depth. Muddy conditions for abnormally long periods in the nursery decreased production and increased towing charges. The total down time for bad weather came to 16% in 1973-1974 and 23% in 1974-1975. The tree spade truck (not the TS44T) broke down numerous times causing 26% lost time in 1973-1974 and 22% in 1974-1975. The 1973 projection was for 6 trees planted per work day. The 1973-1974 actual figures averaged 5.5 trees planted per work day and in 1974-1975 the average was 5.0 trees planted per work day. The tree spade operated approximately 50% of the total work days for both years.

A total of 689 tree spade trees were planted in 1973-1974 and 794 were planted in 1974-1975 in spite of the abnormal weather conditions and lengthy truck repair time. This quantity was in part due to the use of the tree spade in conjunction with wire baskets for balling trees where the haul distance was not economical. A number of trees were also planted with the use of "tree cans", a method using metal cans to transport tree spade dug trees. In both cases the total cost per tree planted goes up but a larger number of trees can be successfully planted in a short time.

The disadvantages of planting by the tree spade method can be summarized into four items:

1. abnormal weather (too wet, too much snow and too hot)
2. unplantable sites (utility conflicts and narrow parkways)
3. unavailable trees within an economical haul distance; and
4. lack of an equipment operator

It is the opinion of the Lansing Forestry Division that the advantages far outweigh the disadvantages for tree spade planting. Surviving tree spade trees are cheaper than bare root trees through greater survival, less special care and much less loss due to vandalism. The operation can take place twelve months of the year with one full time tree spade operator. This makes the activity routine and creates much less interruption of other work activities such as occurs when setting up for a bare root planting season.

Perhaps the biggest advantage is the ability to

plant up to a four inch diameter tree. The City of Lansing normally plants one and one-half to two inch diameter bare root stock and suffers much higher mortality whenever a tree over two inches is accidentally planted bare root in the heavy clay soils. The average tree spade tree planted during the last two years is two and one-half inches diameter with many coming from the city nurseries, from row purchases at wholesale nurseries, and from discounted overgrown stock. The gratitude of a property owner having a larger tree planted in front of his residence is overwhelming. The goal of the City of Lansing is to operate the tree spade primarily out of its own nurseries with three inch diameter stock being put on the streets. The operation of a city tree nursery is seen as the most economical method of procuring trees. The basic requirements include good available land within an economical haul distance of the center of the city (five miles for Lansing), a species mix to fill requirements, a maintenance program of band herbiciding tree rows and mowing the sod centers, and a tree spacing of paired rows with individual tree spade access to one side of each tree. An alternate procurement method to consider would be contract growing by a local private nurseryman.

One last advantage of having a tree spade is the capability to perform special planting jobs quickly and cheaply, whether it be for an instant mini-park or transplanting a donated specimen tree rose to a bicentennial rose bed.

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ABSTRACT

Burdekin, D.A. and H.M. Heybroek (eds.) 1975. **Dutch elm disease**. Proceedings IUFRO conference. USDA Forest Service, Northeastern Forest Experiment Station, Upper Darby, Pa. 94p.

In the 53-year-old history of research on Dutch elm disease, the conference reported on in this publication marks a junction of several interests. First, it has been shown that the causal fungus contains both aggressive and relatively nonaggressive strains, and that an aggressive strain recently started a fresh epidemic of staggering proportions in Europe. Second, the long-expected breakthrough in chemical control of the disease by application of internally active fungicides seems to have been attained at least experimentally. Third, the biological control of the fungus-carrying beetles has entered a new phase with the identification of pheromones which play such an important role in their social life. These developments made an interdisciplinary meeting most timely.