Seedlings, Service, and Insights[1]

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INTRODUCTION

Bed-grown tree seedlings have been produced for many years with variable performance at outplanting. Slowly, container-grown seedlings have gained in popularity in spite of their higher cost. But what about the future? Here is one practical research/practioner's outlook.

Over the years much of the variability among seedlings has been attributed to genetics. If 100 viable seeds of most species are planted in a seed bed, the resulting seedlings generally grow at different rates. Container-grown seedlings are generally somewhat less variable. This slight improvement in uniformity is mostly attributed to more precise control of cultural conditions.

In the fall of 1985 the opportunity arose to examine the roots of 720 trees, 180 each of four species: lacebark elm, *Ulmus parvifolia;* shumard oak, *Quercus shumardi;* loblolly pine, *Pinus taeda;* and Chinese pistache, *Pistacia chinensis*. They had been grown in bottomless milk carton containers for approximately three months, then transplanted into two-gallon poly bag containers for the remainder of the first growing season and planted into the field in October. There were approximately 500 seedlings of each species in the poly bags from which the most uniform 180 were selected to minimize genetic variability. After two growing seasons in a sandy clay loam soil of moderate fertility, some trees had grown very little, while others exceeded nine feet in height and two-inch stem diameter. Could all of this variation be due to genetics or was something else involved?

Three days were required to excavate the 720 trees with a backhoe. All of the larger trees had large root systems but was this a factor of genetics? Counts of roots 3/4-inch in diameter or larger were poorly correlated with tree size. Counts of roots at a point approximately 12 inches from the stem were also poorly correlated with tree size. However, when counts of roots approximately 1/8-inch in diameter or larger arising from the root/stem interface were taken, a striking correlation resulted (Figure 1). Only data and photo of the lacebark elm are included, since all four species responded similarly.

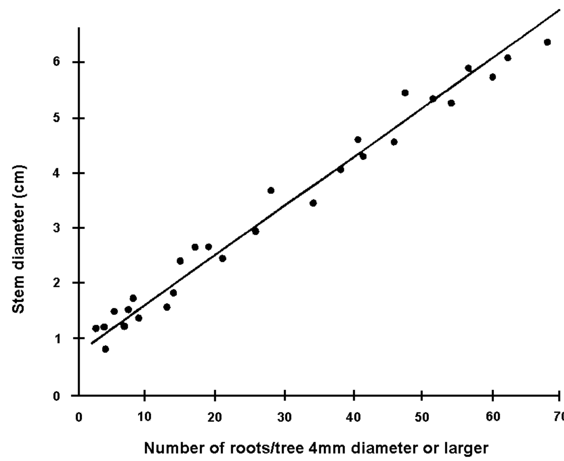

Figure 1. Relationship of number of roots arising from the root/stem interface and stem diameter of lacebark elm.

These data suggest that where the roots branch is very important and that this may be a major factor affecting the rate of tree growth. Thus, a genetically superior tree with a poor root system may only grow at a slow to moderate rate.

A NEW CONTAINER

To utilize this information, a unique new propagation container was designed. Called the Root Maker (U.S. and other patents pending), this container is 2.6 inches square and four inches deep and air-prunes the root system both at the bottom and on the sides (Figure 2). The bottom is shaped somewhat like a pyramid so that the taproot and any secondary roots that reach the bottom will be air-pruned at one of four drain holes. Secondary roots that grow outward are guided to air-pruning openings in the sides. The four-inch depth forces secondary root branching at, or near, the base of the stem. Individual containers lock into a frame for ease of filling and handling and to insure proper spacing, yet can be easily removed for shipping or planting.

This data also suggests that bed-grown seedlings should be root-pruned early and perhaps often. A wider spacing will also be necessary to accommodate more lateral roots.

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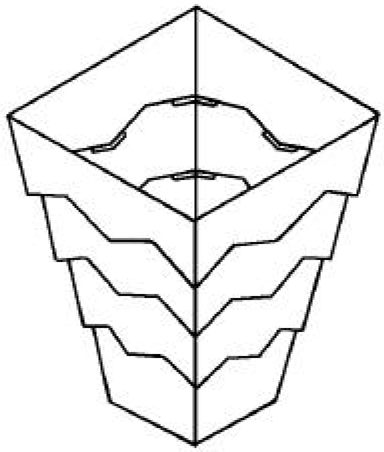

Figure 2. The Root Maker container air root-prunes tree seedlings on the sides as well as at the bottom. In addition, by controlling the depth, the root system is forced to branch at the root/stem interface to enhance tree growth.

NUTRITION

Proper nutrition can enhance plant growth and health and minimize other problems. The key is the synchronization of all of the essential elements. Studies with container-grown seedlings suggest that nitrate nitrogen, phosphorus, and the micronutrients are key factors.

Seedlings appear to have a limited capacity to utilize ammoniacal nitrogen, but do respond to nitrate. Phosphorus is very important. Potassium can vary considerably without affecting growth. The micronutrients play a key role in enhancing overall plant health and stem and root development. They can be added to the mix using research-formulated blends such as Micromax micronutrients that also provide sulfur.

The two major nutritional variables that are unique to each specific production site are calcium and magnesium. If pine bark or other wood product is used as a component of the .growth medium, it should be analyzed for calcium and magnesium. However, the analysis must be done using an ammonium acetate extract to determine the levels available to the plant. Water extracts show only what will readily leach out. Strong acid extracts give inflated values due to partial or complete destruction of the particles.

Water quality is a variable that must be considered in the production of both container and field production of seedlings. The levels of calcium and magnesium in the irrigation water play a key role in plant nutrition. In some cases, the irrigation water provides all of the calcium and magnesium needed. Other water provides only calcium, thus requiring a separate magnesium source. In the future, a water analysis plus growth medium analysis will be used to determine the levels of calcium and magnesium needed for optimum plant growth.

A related point is that the pH of the water gives little information regarding water quality. The pH gives only a measure of the acidity or alkalinity of the water, nothing more. A water may have a pH of 6 and contain considerable calcium or a pH of 9 and contain very little. A complete water analysis is the only way to know. Water with a high pH generally contains considerable bicarbonate which, if above about 200 ppm, must be considered in the nutritional program.

Bed-produced seedlings are affected by irrigation water quality as well. Due to the strong buffer of most soils, a longer time is generally required before the effects are noticed. Most soils labs suggest that a soil pH of 6 to 7 is ideal. This may be true for fast-growing annual crops such as corn, wheat, and soybeans, but it is not correct for trees. More precise management of this area as it affects nutrition will be required in the future.

Improved root systems in combinations with improvements in the entire water quality/nutrition complex and established good cultural practices will dramatically improve tree health, transplant success and subsequent growth. More precise production techniques will require more accurate monitoring by nursery managers. However, the payoff will be a superior product that requires fewer pesticides and is more uniform. The increased uniformity will allow further mechanization and labor savings. It all starts with the root system but the roots must be supplied with a precise nutritional program to maximize growth.

LITERATURE CITED

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