

ROOT CULTURING IN BARERoot NURSERIES¹

Tree seedlings are a unique crop. We spend most of our time and effort in the nursery producing a healthy, vigorous shoot; and, most cultural activities are scheduled according to shoot phenology and growth. This is understandable as the shoot is the part of the seedling that we can easily observe. Roots are the 'business end' of a seedling, however. Because the seedling root system is not readily accessible, it is much less understood. One of the sayings that I frequently use in training sessions is that '*tree seedlings are a root crop*'. While it may seem technically inaccurate to compare seedlings to carrots or potatoes, I think that the analogy is useful in getting growers to consider the culture of the lowly root.

**Roots are the 'business end' of a seedling.
There is no doubt that root culturing works -
the problem is using the right tool, in the
right way, and at the right time.**

You may have noticed that I have been using the term '*root culturing*' instead of '*root pruning*'. Because seedling roots can be trimmed in the seedbed or on the grading table, the following terms have been suggested to avoid confusion:

- **Root Culturing** - a general term for nursery cultural practices designed to modify root growth or morphology while the seedling is still in the nursery bed.
- **Undercutting** - severing seedling roots in the horizontal plane of the nursery bed, using a sharp blade drawn parallel to the soil surface at a regulated depth.
- **Sidecutting** - severing lateral seedling roots in the nursery bed by drawing sharp, vertical blades or colters between the rows.
- **Wrenching** - passing an angled horizontal blade beneath a nursery bed at a specified depth to cut newly penetrating roots and to loosen and aerate soil.
- **Root Pruning** - root trimming after the seedling has been removed from the soil.

Nursery managers have been culturing seedling roots for many years, but the published research on this subject has been mixed. The classic nursery manual, **Nursery Practice on the National Forests**, which was printed in 1917, has an entire section on root pruning. Although they endorse the practice, they also state that results of root culturing trials have been inconclusive. Things haven't changed much in the past 80 years. **The Forest Nursery Manual: Production of Bareroot Seedlings (1984)** states that the response of most species to root culturing practices has

been variable, and also discusses some of the reasons for this variation. Some of my thoughts on the subject:

- **1) Define Your Objectives**

Root culturing operations can have variable effects, and many nursery managers make the mistake of trying to achieve several different objectives with one operation. Root culturing can affect seedling morphology and physiology in several ways: control height growth, modify root-to-shoot ratio, increase root fibrosity, induce seedling moisture stress, etc. A root culturing treatment that is being applied to control shoot height may not increase root fibrosity at the same time. Exercise caution - don't apply root culturing treatments as a matter of general policy. Your objective will define what implement you use, how you use it and, most importantly, the timing of the operation.

If you don't know why you are doing an operation, then don't do it - any root culturing treatment induces some measure of stress, which can be harmful. Cultural operations that are applied for good measure' usually do more harm than good.

- **2) Properly Time Root Culturing Practices**

This is the tough one. Because of variations in weather from year to year and species/weather interactions, don't try to schedule cultural operations by the calendar. Get away from your desk and computer and go take a look at your seedlings. Yes, the root system is difficult to observe, but take a shovel with you and dig up some seedlings every few weeks during the growing season. Observations of phenology and measurements of relative shoot and root growth should be recorded and plotted to provide a permanent record. Shoot growth and root growth are often inversely related. So, after a few years of collecting these measurements, you should have enough personal experience and data to permit estimation of root activity based on shoot phenology.

- **3) Synchronize Root Culturing with Other Nursery Activities and Soil Conditions**

Root culturing should not be viewed as an independent operation. Irrigation, in particular, will affect the success of root culturing operations. Again, get out and check the soil profile with a shovel rather than assume that the soil is at the proper moisture content because the surface appears wet. The proper moisture content will also vary depending on your objectives: wrenching requires relatively dry soils for thorough fracturing, whereas undercutting and sidecutting are most efficient when relatively moist soils promote smooth movement of the blade.

- **4) Select the Right Implement for the Job**

In my mind, wrenching does not do a good job of cutting seedling roots in many situations. If the objective is to promote a more fibrous root system, I would consider undercutting rather than wrenching. Because of the thickness and angle of the blade, root wrenching equipment will often drag seedling roots instead of clearly cutting them. It is often necessary to undercut seedlings with a thin sharp blade before attempting a wrenching operation, particularly with tap-rooted

species or older seedlings. If the objective is to induce moisture stress to control top growth, I would try wrenching and pass the blade completely under the root zone to fracture the soil and break soil-root contact.

- **5) Follow Up and Evaluate the Operation**

Both undercutting and wrenching require follow-up irrigation to avoid damaging moisture stress. Wrenching, in particular, creates a severe moisture stress and heavy irrigation is normally required to repack the soil particles around the seedling root system. The timing and amount of irrigation will depend on cultural objectives, weather, soil type, and responses of each species.

Nurseries are busy places, and many times growers will go on to the next activity without ever checking back to see if the root culturing worked or not. It's hard to assess the effects of any cultural operation at the end of the growing season if you haven't taken the time to observe the physiological and morphological effects following the operation.

General references on root culturing:

Duryea, M. L. Nursery cultural practices: Impact on seedling quality. 1984. p. 143-164. In: Duryea, M. L. and Landis, T. D., eds. Forest nursery manual: Production of bareroot seedlings. Martinus Nijhoff/Dr. W. Junk Publishers, The Hague/Boston/Lancaster, for Forest Research Laboratory, Oregon State University, Corvallis.

Racey, J. E. and Racey, G. D. 1988. Undercutting and root wrenching of tree seedlings: An annotated bibliography. Forest Research Report No. 121. Maple, Ontario: Ontario Ministry of Natural Resources. 18

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