OPERATIONAL ROOTED CUTTINGS IN SOUTHERN PINES

JOE WEBER AND HANK STELZER

Joe Weber is with Boise Cascade Corp., DeRidder, Louisiana, 70634. Hank Stelzer is with the International Paper Co., Jay, Florida, 32565.

Joe_webber@bc.com

Weber, J.; Stelzer, H. 2002. Operational Rooted Cuttings in Southern Pines. In: Dumroese, R.K.; Riley, LE.; Landis, T.D., technical coordinators. National Proceedings: Forest and Conservation Nursery Associations-1999, 2000, and 2001. Proceedings RMRS-P-24. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station: 91-92. Available at: http://www.fcnanet.org/proceedings/2000/weber.pdf

Abstract

Use of rooted cuttings for planting of pine trees has become increasingly popular. Vegetative propagation can deliver planting stock of higher genetic quality, increasing productivity and shortening rotations. Clonal forestry can also provide stands of higher uniformity, which can reduce logging and processing cost and yield a much more uniform product. One of the largest disadvantages of rooted cuttings is keeping the cost low compared to bareroot nursery stock. Several large companies in the southeastern United States are in the initial stages of developing operational rooted cutting programs.

Key Words

Container nursery, loblolly pine, slash pine, transplants

There has been a worldwide increase in the use of rooted cuttings for planting of pine trees. Several pines are vegetatively propagated on operational levels in the following areas:

New Zealand-Pinus *radiata*
Southern Australia-Pinus *radiata* Northern Australia-Pinus *caribaea x elliottii* *Chile-Pinus radiata, Pinus taeda* Brazil-Pines *taeda*
Venezuela-Pinus *caribaea*
South Africa-Pious *patula, Pinus caribaea x elliottii*

Productivity is increased, rotations are shortened, and consistent genetic quality can be attained by using rooted cuttings. Logging and processing costs can be reduced and much more uniform stands and products will be produced.

A typical cutting is 3 to 4 inches (8 to 10 cm) long and has a basal diameter of around 1/8 inch (3 mm). It may be from a dormant or actively growing shoot. In the latter case, collection of the cutting may be delayed to allow some lignification of the shoot to make the cuttings more able to withstand rooting environments that are less than fully protected. Once the cutting is set, callus tissue is evident in 2 to 3 weeks and the emergence of adventitious roots from the basal region of the stem occurs within 5 to 6 weeks. Pine cuttings can be rooted in a field nursery, shadehouse, or greenhouse. Rooting directly in a field nursery bed has the advantages of reducing propagation costs (less labor-intensive handling of the rooted cuttings) and requiring no specialized structures for rooting. However, extreme variation in outdoor environmental conditions can result in a variable product and, in some cases, even loss of an entire crop. While a shadehouse does provide a more consistent rooting environment, in many climates one is prevented from utilizing the dormant winter cuttings because of low ambient temperatures. However, these dormant cuttings would not easily fit in with an operational program as they would be ready for outplanting in the summer. The rooting environment inside a greenhouse is the most controlled and has the additional advantage that,2 or 3 crops could be produced each year. However, the cost of the more specialized structure does increase production costs. In addition, containers and rooting substrate must be purchased for both the shadehouse and greenhouse rooting systems, and the added cost of handling containerized planting stock during tree planting needs to be considered. A containerized system in either a shadehouse or greenhouse will yield a higher percentage of acceptable cuttings over a system where cuttings are stuck directly into nursery beds. QFRI in Australia has moved totally to shadehouse systems. They have a 20% higher rate of acceptable cuttings with the shadehouses over sticking cuttings in nursery beds. There is considerable cost in collecting and sticking cuttings as it is all done manually at this time. The goal is to maximize the number of acceptable cuttings that can go to the field for reforestation. One possible solution is a transplant production system where the cuttings are rooted in small plugs inside a greenhouse or shadehouse and then transplanted to a conventional forest tree seedling nursery. The greenhouse provides optimal and uniform rooting conditions, and allows one to expand the time of year cuttings are set. Small plugs allow the grower to maximize expensive greenhouse space. Certain types of small plugs might be amenable to transplanting to a bareroot nursery to allow the rooted cutting to finish growing like a bareroot seedling. This system will be particularly attractive if a machine can be found or made to transplant the cuttings. The rooted cuttings can then be handled like its seedling counterpart, and the logistics of handling millions of containerized plants in large scale reforestation operations could be avoided. Producing root-cutting planting stock for forestry presents some problems not found with vegetative propagation for horticultural applications. Reforestation stock is a high-volume, low-cost product. Over 1.2 billion seedlings of loblolly pine *(Pinus taeda L.)* and slash pine *(P. elliottii* var. *elliottii* Engelm.) are produced in the United States each year at a cost of only a few cents per seedling. Most vegetatively propagated horticultural crops are produced as cultivars. A superior genotype is identified and then multiplied. This is a more difficult process for forest trees. One reason is that fairly extensive field-testing is required to identify the best trees to use for cloning. Another is that for most coniferous species, including the southern pines, donor plant maturation begins early and reduces propagation efficiency of the identified clones. This has led to 2 scenarios for pine rooted-cutting propagation and deployment.

In both scenarios, donor plants arise from controlled-pollinated crosses between genetically proven superior parents (a full-sib family). The first scenario involves a mass propagation of the entire family. This has the advantage of eliminating the field-testing requirement because the genetic values of the parents are already known from previous tests. It also minimizes the donor plant maturation problem because donor plants can be used for a short time and then new seeds can be germinated to replace them. This full-sib multiplication scenario, however, has the disadvantage that the genetic quality of the reforestation stock is only moderately improved relative to open-pollinated seedlings and falls far short of the quality that can be obtained with the second scenario, clonal forestry. Clonal forestry is analogous to the cultivar system in horticulture. A donor plant maturation problem can be approached in several ways. First, seedlings are rigorously pruned to produce "hedges" or "stool plants" that produce large numbers of cuttings and remain juvenile, at least for a few years. Hedging alone, however, may not be sufficient to retain seedlings at a juvenile stage for an adequate period of time. Two techniques are currently being evaluated that, hopefully, will maintain the juvenile, easy-to-root, phase of the hedge plants: 1) continuous hedging and serial rooting where the most vigorous rooted cuttings in a clonal line replace the older donor hedges; and 2) serial micropropagation or somatic embryogenesis accompanied by cryopreservation of tissue cultures. Rooted cuttings are increasingly becoming a viable option for increasing the genetic quality of forest planting stock in high wood-cost areas and on the most productive sites. Several large companies in the southeastern United States are in the initial stages of developing operational rooted cutting programs. As more expertise and technical knowledge is gained about growing rooted cuttings, we become more efficient and the price of cuttings should drop. This has occurred in bareroot nurseries. When the cost of seedlings from 40 to 60 years ago are put into today's dollars, we are presently paying much less for seedlings than we did in the past.