

1993 Missoula Technology and Development Center Nursery and Reforestation Projects¹

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NURSERY TECHNICAL SERVICES

This continuing project allows MTDC to provide technical services to Forest Services nurseries and to respond to requests from State and Private personnel. New applicable technology is continually monitored under this project and Center personnel disseminate this information by presenting papers at professional meetings and symposiums. MTDC also answers inquiries from field personnel, does on-site visits to various Forest Service nurseries and provides drawings and publications on request.

Recent project accomplishments include:

1. Fabrication drawings for a new Mulch Spreader designed and built by the J. Herbert Stone Nursery.
2. Completions with the help of Tom Landis, Brenda Holland, and Ben Lowman, of the Bare Root Nursery Catalog.

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MACHINE VISION

Tree seedlings are grown in Forest Service Nurseries based on specifications tailored to specific Forest and District needs. After lifting, seedlings are delivered to packing sheds for grading and packing. Each nursery has developed its own quality control standards for the seedlings that they deliver to the field units for planting. The current quality control method is by having checkers sample graded seedlings and monitor the graders on the packing belt.

The machine vision equipment is otherwise known as a quality control module. The purpose of the equipment, initially, is do quality control inspection of seedlings that have been processed in the packing sheds.

This work is being done under contract with Dr. Glen Kranzler and Mike Rigney of Oklahoma State University. The object of the project was to develop a PC computer based system that would measure root mass, stem mass, measure length, caliper, sturdiness ratio, (which is a ratio of the length divided by the caliper), and other miscellaneous properties. Because it provides a

Abstract – The Missoula Technology and Development Center has provided improved equipment, techniques, and materials for Forest Service Nurseries and for Reforestation projects, for more than 20 years. The Center's work has improved efficiency and safety throughout the Forest Service. Our current work is summarized in this paper.

silhouette image to the camera, it cannot detect surface characteristics such as discoloration. With this information the nursery can evaluate if the seedlings are graded to specification and also determine the quality of seedlings in a seed lot.

The system will have an accuracy of one-tenth of an inch in measuring length and one-tenth of a millimeter in measuring caliper. The speed of the machine inspection rate is a function of the seedling length because the camera does a line scan of the seedling image. The machine will have an inspection rate of about 20 seedlings per second of 1-0 stock and about 10 seedlings per second of 2-0 stock.

The real challenge of the overall system will be the material handling of the seedling into and away from the machine vision system. It is estimated that it would take about 5 people to feed the machine vision belt at the 10 to 20 seedlings per second rate. An early working demonstration of the machine vision "Quality Control Nodule" is scheduled for next January and appears to be on schedule.

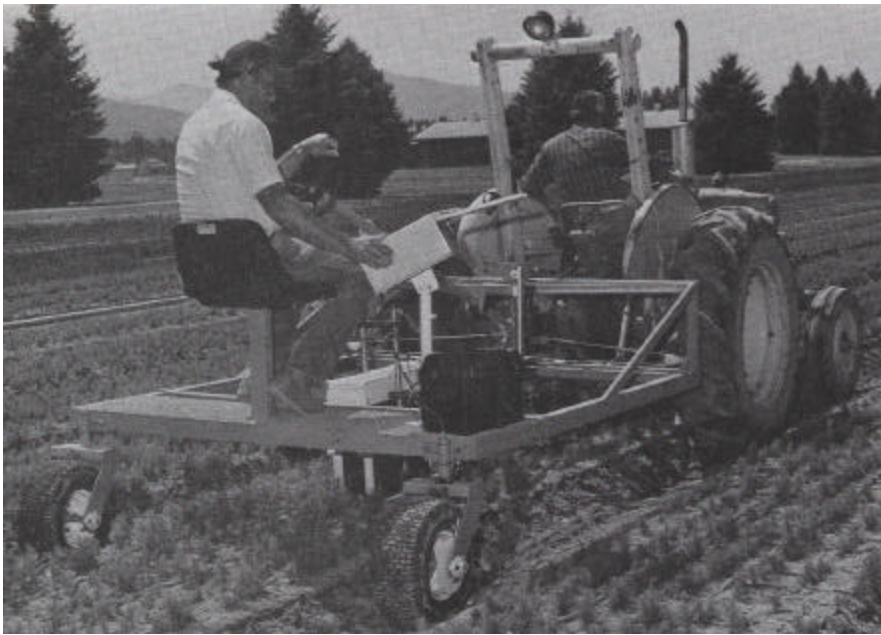


Figure 1 - MTDC Seedling Counter

SEEDLING COUNTER

A machine has been developed by NTDC to aid in taking inventory of seedlings that are being grown in nursery beds. The machine passes over a row of seedlings and a scanning device board computer counts the number of seedlings in that row.

Nine seedling counters have been delivered to the Federal nurseries that ordered them. New post processing software that incorporates pull-down menus will make it easier to evaluate the results obtained by the counter.

ROOT PRUNER

Existing root pruning methods used by nurseries in the packing shed were investigated. The most common method currently being used to prune roots to field specifications are modified and operated paper cutters. A number

of different cutters were tried.

Some concepts for an improved root pruner were developed. We started with rotating cutters, hedge trimmers, and pruning shears. The latest version uses a guillotine type blade operated by an air cylinder. This version currently does not have the capacity to replace all that paper cutters now present at the end of the packing belt. A cylinder capable of higher cutting forces is being added to the machine as well as more loading positions to increase the machine's capacity. Further testing is scheduled for the fall of 1993.

SEED SEPARATOR

Forest Service nurseries are currently reporting difficulties in obtaining separation of pitch from tree seed. This is especially true with white pine and western larch seed. Many seed separation

devices are used in the agricultural area that are not presently being used in tree seed cleaning operations. This project started in FY 1992. Initial testing and consultation with Bob Karfault, Director of the National Tree Seed Laboratory in Macon, Georgia, revealed that a vibratory separator was the most promising for separating pitch from seed. NTDC has purchased a small vibratory separator to do further tests and field demonstrations in. Commercial products are available for removing pitch from seed, but a technique or learning curve needs to be developed to find the ideal settings of the vibratory shakers. Four commercial machines were tested and one shows promise.

SMART TOOLBAR

Nursery equipment operators have experienced problems in maintaining toolbar height at a consistent level above the seedbed while doing various cultural operations. This capability is essential for such tasks as root wrenching, root culturing, and top pruning. With current technology, it is possible to design a system that can automatically sense toolbar height above the seedbed and simultaneously adjust a toolbar to maintain whatever level is desired. Essentially, this project will test various distance sensing devices, determine the most applicable device, and design a toolbar system for automatic height control. This idea originated at the J. Herbert Stone Nursery and NTDC will be working with them on this project. The project began in

October 1991. Testing of ultrasonic measuring devices to determine distance is underway.

Sensor

The original ultrasonic sensor to determine vertical height came with a custom program that was specified by NTDC that averages a number of readings from the ultrasonic sensor. This should reduce and possibly eliminate false readings of ground surface echoed by the growing vegetation. Test show that the sensor still confuses vegetation with the ground surfaces. Three other manufacturer's sensors will be evaluated in the near future.

Hitch

A hitch that maintains lateral alignment has been obtained from H & R Manufacturing Inc. This "Navigator" should provide lateral alignment of the 3-point hitch. The attachment will be modified to incorporate a height adjustable plate, which will then be controlled by the height sensor discussed above.

HARDWOODS CUTTINGS PLANTER

A planter was developed by the PFRA Shelter Centre, at Indian Head, Saskatchewan, Canada, that would plant cuttings from hardwood whips. These whips would be cut into 6- to 8-inch lengths with 3/8- to 3/4-inch diameters. These cuttings would then be dropped into a chute or guide, picked up by a pair of rubber-coated rollers, and propelled into a furrow that was just opened ahead of this device. The

cutting would then be pushed the remaining distance into the ground by a wheel immediately following the planting device that also packs the dirt around the cutting.

The Lincoln-Oakes Nursery, Bismarck, North Dakota, looked at the Saskatchewan cuttings planter and decide that it would work for their applications. They built a 4-row unit and operated it at their nursery. After their field experience more improvements were made and incorporated into their planter and into a set of drawings that they provided to MTDC.

This spring a 3-row unit was built by MTDC for the Bessey Nursery located at Halsey, Nebraska. This planter has all the latest changes from the Lincoln-Oakes Planter along with other suggested improvements that they recommended for future versions. The machine was used for this spring's planting. Lincoln-Oakes estimated that the produc-

tion rate of the cuttings planter would be about 125 cuttings per row per minute under ideal conditions. The spacing of the cuttings are about 8 per foot row

SCARIFICATION FOR NATURAL REGENERATION OF HARDWOODS

Natural regeneration of White Birch and other hardwoods is enhanced in shelterwoods and partial cuts if some site preparation or soil disturbance can be accomplished without damage to the residual stands. This dictated a need for some smaller more maneuverable tools and equipment to perform this task. MTDC has produced some small anchor chain implements that can be pulled through these stands with small crawlers or skidders to provide the desired scarification. The original blade of a small crawler can be replaced with a scaled down version of the "Salmon Blade" to perform the

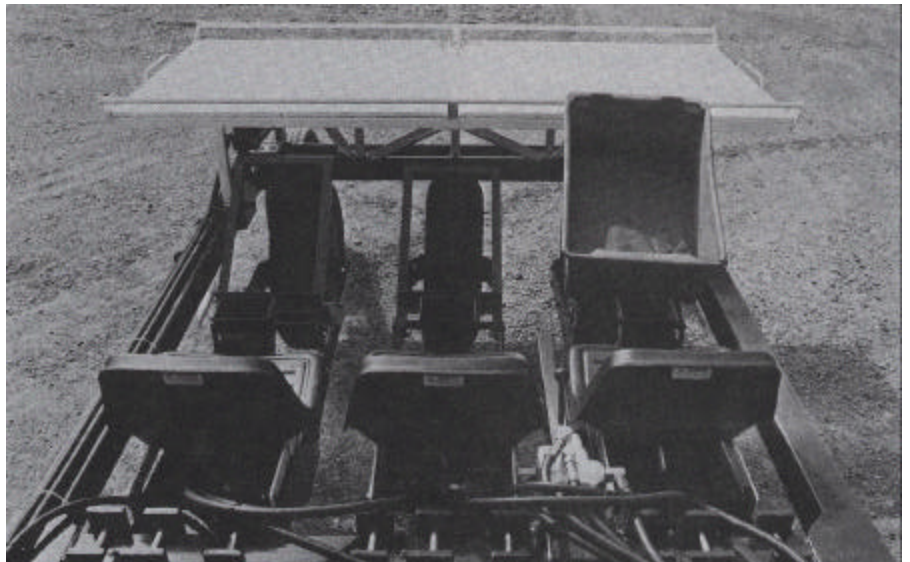


Figure 2 - Hardwoods Cuffing Planter: three-row cuttings planter for planting six eight inch long hardwood cuttings in a nursery bed

desired scarification and maneuver around the standing trees. The Salmon Blade produces more scarification than the chains. Either implement can be used in areas with a large amounts of slash and debris.

STEEP SLOPE SITE PREPARATION EQUIPMENT

The current trend is to leave more material on the ground after logging for soil protection, wildlife habitat, and seedling protection. Leaving heavy amounts of slash and logging debris on the ground greatly complicates site preparation for natural and artificial regeneration, especially if steep slopes are involved. The guidance group for this project determined what desired conditions should be present on the site for regeneration, and with that criteria what equipment would be available to do that job, with the emphasis on steep slopes.

A literature search was done to see what equipment would be available to operate on the various slopes. Although some of the machines were not currently used for site preparation work, only minor modifications or additions would be required to make them suitable for site preparation on steep slopes.

A report was prepared, *Site Preparation Equipment for Steep Slopes*. 9324-2804-MTDC, that discuss site preparation considerations and contains some of the commercial brochures of the equipment that would be suitable for work on steep slopes. The British Columbia Ministry of Forests also has published a Site



Figure 3 – Mulch for Seedlings: typical plastic mulch used to reduce vegetative competition for seedling

Preparation Manual and has produced a videotape on excavators and related attachments that are being used for site preparation work on steep ground in British Columbia, Canada.

SEEDLING PROTECTION

MTDC has been working with the Southern Region Timber Management to evaluate and improve, if possible, commercially available devices that can be used to protect seedlings from animal damage and promote growth. Europe has used these seedling protectors for years to improve survival of hardwood seedlings. Keith Windell, MTDC, and Dan Sims, R-8 Cooperative Forestry, recently traveled to England to observe first hand the long term effects of using tree shelters. For high value hard-

woods it may have some potential. Various field test sites are in place and these protectors will be studied as to the durability of the shelters and how effective they are at protecting the seedlings.

MULCH FOR SEEDLINGS

Ground mulch is commonly used in the ornamental and landscape business to reduce vegetative competition and improve soil moisture around newly planted trees and shrubs. A preliminary investigation by Forest Service researchers indicate that ground mulch also can significantly improve survival and promote early growth of seedlings on National Forest lands. Data is being obtained on various types of mulch material and the techniques and equipment that is required to install

and maintain the material that are being evaluated.

POLLEN EQUIPMENT

There was a need for pollen gathering and application equipment for both research and also in the seed tree orchards. The method previously used was labor intensive and time consuming. Applicators have been made to apply pollen to individual flowers and also to mass apply pollen in the seed tree orchards. Pollen gathering equipment can harvest large quantities of pollen with a cyclone separator in short periods of time. Individual pollen collectors can also selectively gather pollen from individual trees if desired.

The current mass applicator uses air to deliver the pollen to

the trees. This result in more drift and more pollen is required to insure that the tree is properly pollinated. A wet pollen applicator would have the potential to deliver more pollen to the tree with less drift and quantity required, but it is unknown how viable the pollen would be if it has been wetted and dried a number of times. Preliminary work is under way to develop a wet applicator.

PORTABLE POWER PLATFORM

A machine is desired to perform silvicultural operations such as thinning or creating planting spots that is small enough of to be maneuverable in forested areas without causing damage to residual trees. The machine

would be somewhere in size between a hand operated machine and a small crawler tractor. The Iron Horse is a 25 HP tracked vehicle that can be used to skid small trees, with a special attachment can operate hydraulic equipment such as hydraulic thinning shears, provide planting spots, etc. In trials with the machine it appears that a larger unit would be desirable, but the current machine would be very versatile.

REFERENCES

Recent Publications Produced by MTDC Include:

1. *MTDC Seedling Counter Tests*, Gasvoda and Herzberg, Tree Planters
2. *Mobile Tree Seedling Coolers*, Herzberg, Tech Tips, 9324-2302-MTDC
3. *Automated Seedling Height Measurement*, Gasvoda, Sponsor Report, 9324-2810-MTDC
4. *Mobile Tree Seedling Coolers*, Herzberg, Tree Planters Notes 44 (1): 16-18,1993
5. *Proqeny Seeder Operator's Manual*, Herzberg, 9224-2806-MTDC
6. *MTDC Nurseries Program*, Lowman, 9224-2818-MTDC
7. *Bareroot Nursery Equipment Catalog*, Lowman, 9224-2839-MTDC.
8. *Portable Power Platform*, Windell, Tech Tips, 9224-2301-MTDC

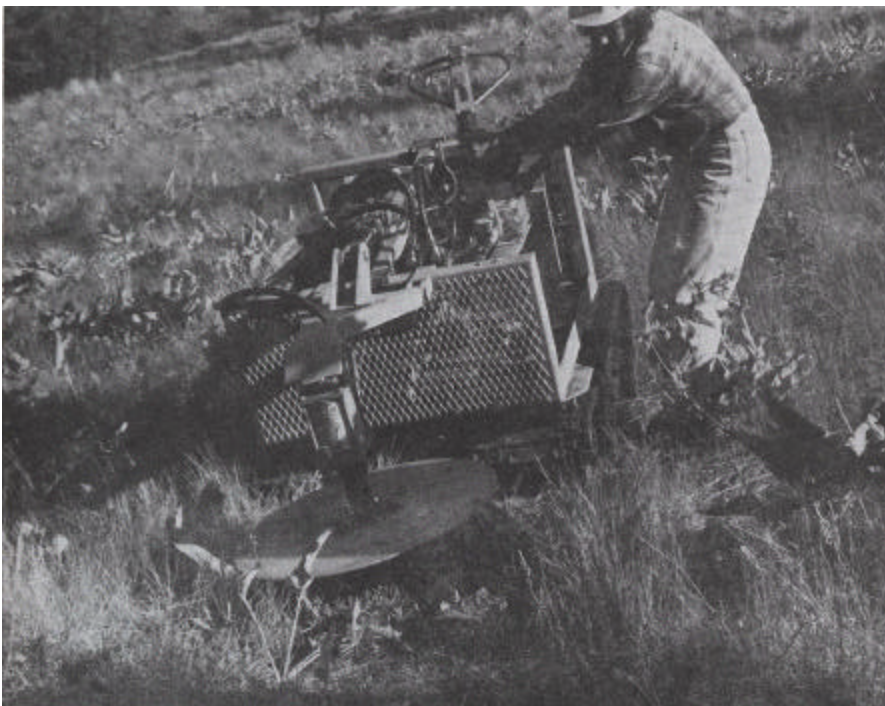


Figure 4 – Portable Power Platform: equipped with site preparation scarifier head

9. *Sudan Reforestation and Anti-Desertification Project*, Jasumback, 9224-2804-MTDC
10. *MTDC Reforestation Program*. Hallman, 9224-2819-MTDC
11. *Tree Shelter for Seedling Protection*, Windell, 9224-2834-MTDC
12. *Scarifiers for Shelterwoods*, Karsky, Tech Tips, 9224-2343-MTDC
13. *Site Preparation Equipment for Steep Slopes*, Karsky, 9324-2315-MTDC
14. *Tree Shelters for Seedling Survival and Growth*, Windell, Tech Tips, 9324-2315-MTDC
14. *Mulches for Increased Seedling Survival and Growth*. Windell, Programs Report, 9324-2321-MTDC
16. *Net Retrieval Tree Seed Collection System*, Hallman, Tech Tips, 9324-2325-MTDC
17. *Reforestation Equipment Catalog*. Hallman, 9324-2343-MTDC
18. *Mulch Evaluation Project*, Windell, Tech Tips, 9324-2343-MTDC

Single copies of publications and drawings are available from MTDC.