

Nursery Equipment Development at the Missoula Equipment Development Center,

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Abstract.-- Discusses projects of the reforestation program done at the Missoula Equipment Development Center in Montana. Projects include: surveys of equipment problems, development of cone and seed harvesting equipment, investigation of seedling handling equipment, and work on several types of planting equipment.

The Missoula Equipment Development Center is one of two Development Centers in the Forest Service. The mission of Forest Service Equipment Development is the systematic application of scientific knowledge to create new or substantially improved equipment, systems, materials, processes, Techniques and procedures that will perform a useful function and be suitable to meet the objectives of advanced forest management and utilization.

The Missoula Center was established in the early 1950's to develop and test equipment for forest fire control. In recent years the emphasis has shifted to resource management and especially to Timber Management.

Today I would like to briefly tell you about some of the development projects in our Reforestation Program. Most of these projects are directly or indirectly tied to nursery production.

TIMBER MANAGEMENT TECHNICAL SERVICES

Under our Timber Management Technical Services project one of the things we do is make periodic surveys of field units to determine their equipment problems. In this case we contacted all Forest Service Ranger Districts in the United States. The problems are then reviewed at higher levels and then used to establish the Center's development schedule.

In a similar manner we contacted all Federal, State and Private Forest Tree Nurseries to determine what their equipment problems were. Again the results help us form a development

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schedule that will hopefully assure that Center engineers are working on current high priority problems.

Another task we have recently been working on in our Technical Services project is making construction drawings of equipment that has been built by nurserymen throughout the country. The idea is to help make it possible for others to build this custom equipment from our drawings. The drawings are available in a reduced size that permits them to be kept in the Nursery Equipment Catalog notebook that we distributed several years ago.

CONE AND SEED HARVESTING EQUIPMENT

Now to some of our development work. In the South there are about 13,000 acres of tree seed orchards. For species like slash pine, whose cones are easily dislodged, mechanical tree shakers work very well and the cone crop is easily harvested. But for a species with persistent cones like Loblolly Pine, shaking is not feasible because of excessive tree damage. Instead the cones are allowed to mature and open on the tree and the seed can be shaken out or allowed to fall naturally.

Then a machine like the Bowie Vacuum Harvester can be used to sweep up the seed from the orchard floor. The Center worked with the North Carolina Industrial Cooperative Association to evaluate the harvester. Although the machine does work well under ideal conditions, improvements must be made to make it more versatile.

Currently the Center is working with the Georgia Forestry Commission to improve their orchard netting system. Commission personnel spread plastic netting under their Loblolly Pine. The 16 foot wide material is stapled around the trees. To form a solid ground

cover. This netting is put in place before the seed release period begins. After several weeks the netting catches the fallen seed plus about everything else. At the end of the seed fall season, the netting is retrieved.

And the seed needles and branches are left in a windrow. A combine is then used to separate the seed from the windrow.

The Center is working with the Georgia Forestry Commission to improve the procedure by building a machine that will retrieve and separate the seed in one operation. The prototype was tested last November at the Commission's Arrowhead Orchard. Modifications are now being made to improve the seed separator and additional testing is planned for this fall.

INVESTIGATION OF SEEDLING HANDLING EQUIPMENT

Perhaps the most labor intensive part of the entire nursery operation is seedling handling in the packing shed. However, our investigation of the seedling handling problem shows that most nurserymen feel that sorting, grading, and packing will continue to be done manually for the foreseeable future because of the need for human judgment. Our goal therefore was to attempt to improve the packing table rather than try to automate the entire seedling handling procedure. The concept decided on is called the 3 belt seedling grading system.

The 3 belt system is designed to reduce the number of handlers needed to supply seedlings to graders. There are always boxes of seedlings available to the graders on the top belt and empty boxes and cull trees are moved away on the bottom belt. The 3 belt table will be evaluated at 3 Forest Service nurseries this fall. As part of this project various methods of root pruning will be evaluated next year in addition to this bandsaw method.

NURSERYBED HYDROMULCHER

One problem nurserymen face is protecting newly drilled seed from wind and bird damage. Eastern nurserymen have for sometime used hydromulch to cover seedbeds. For some reason this technique has not been used in the West, but the same need for seedbed covering exists.

The Center is currently working with Forest Service nurserymen in the West to evaluate hydromulching for their use. Improvements in nurserybed cultural techniques are beginning to dictate that nurserybed layout be controlled more precisely. Straight and level nurserybeds

will help nurserymen work toward precision seeding. Controlled root pruning likewise requires uniform bed layout. Straight and level seedbeds will make mechanical seedling lifting faster with less damage to the trees.

Center engineers are experimenting with commercially available laser units. . . That can guide nursery equipment to very close tolerances in a 1,000 foot range. The receiver is attached to the tractor. Which relays guidance directions by means of indicator lights to the driver. The driver simply has to follow the course direction displayed by the lights to keep his machine in perfect alignment. This evaluation work is just beginning and a progress report will be available later this year.

WILDLAND CONE HARVESTING EQUIPMENT

Perhaps the most serious problem in reforestation today is collecting cones from standing trees in natural stands. In much of the country the squirrel is still our primary source of coniferous tree seed. The Center was recently assigned the task of investigating the problem to see what can be done from the equipment standpoint, to help solve the collection problem in natural stands.

To begin the work we made a survey of seed workers in 19 countries to determine what techniques are currently being used and what new concepts should be explored. A committee has been formed within the Forest Service to guide our development work. We will meet in October to choose the most promising concepts and development work will begin.

In the meantime, we know that cone and seed collection in natural stands can be improved through training. Too many foresters and technicians have little or no knowledge of the basic requirements for conducting a successful collection effort. To help solve the problem we are preparing a three part slide/tape program. The first part will explain cone and seed development. The second part will cover cone inventory techniques to show how to predict the size of a cone crop. The third part will cover various collection techniques. We hope to have the slide/tape available within the year.

HAND PLANTING EQUIPMENT

Another serious problem in reforestation is hand planting of seedlings. In the West, planting is done pretty much as it was to reforestry the 1910 burn in Idaho. Techniques have changed very little primarily because of the limitations imposed by terrain and ground cover. However, new tools are available,

especially from European countries. We will soon publish a booklet that describes what kinds of planting tools are available and where they can be purchased. We may develop new tools if we find there is a need.

PLANTING AUGERS

One change that is occurring in hand planting is the use of augers to prepare the planting hole. Auger planting is becoming increasingly popular for planting larger seedlings on harsh sites. The problem is that many augers now in use are very heavy and difficult to operate.

Center engineers are evaluating new augers with lightweight components. We will recommend the best combinations of engines and gearboxes, together with augers for various sites. We found that there are sufficient components available commercially so that no development effort is needed.

DEWINGER FOR SMALL SEEDLOTS

A project we finished about a year ago was the development of a tree seed dewinger. We found in a survey of nurserymen that there was a need for a dewinger that could handle a wide variety of seed lot sizes. And one that is easy to clean and adjust. The machine features a soft rubber lined drum with rotating rubber flaps to minimize seed damage.

Flap rotation is easily controlled by setting the speed control. The dewinger is designed for easy disassembly and maintenance with common hand tools. The machine is now commercially available from a number of manufacturers and an operators manual and slide/tape is available at the Center. In the course of working on this project we also put together a catalog of equipment for processing small seed lots. This is also available at the Center.

INSTRUMENTATION TO MEASURE SEEDLING DORMANCY

As most of you know oscilloscopes have been used for sometime to give an indication of the physiological state of tree seedlings. The wave form can indicate if the seedling is dormant, active or dead. Many nurserymen and researchers use the square wave oscilloscope but the problem is the equipment can be bulky and expensive.

The Center was asked to design a solid state, field portable machine to duplicate

the readings obtained by the oscilloscope. The design chosen consists of a small box containing the instrumentation, readout dial and attached probe. Ten of the dormancy meters have been built and are being evaluated by plant physiologists and nurserymen throughout the country. If the evaluations prove positive, we will attempt to have the meter become available through commercial sources.

PRECISION SEEDER

For nursery stock to grow best, seedling density and spacing must be controlled. Control, of course, begins with sowing. Since many nurserymen are not satisfied with their present seeders, we were asked to see if any better seeders were on the market.

After evaluating several new seeders at various nurseries, the nurserymen expressed a lot of interest in a seeder made in Norway, called the oyjord. The oyjord's feeder mechanism is simple and places seed as accurately as any we evaluated. In addition the machine is easy to calibrate and use for small lot sowing.

After the evaluation we worked with a company in Washington to make the machine commercially available in this country. Production started last winter and about 15 machines are now in use. We have reports that describe the evaluation and a slide/tape that explains the machines operation available at the Center.

MECHANICAL SEEDBED THINNER - MYCORRHIZAE INOCULUM APPLICATOR

To conclude, I'd like to just mention a few other projects we are currently working on. One is the development of a mechanical seedbed thinner. We are also currently building a mycorrhizae inoculum applicator that will be used for testing in the Southeast.

CATALOGS AND REPORTS

By the end of the year we will have ready for distribution an equipment catalog for re-forestation and timber stand improvement.

A catalog of greenhouse equipment will also be ready for distribution in the near future.

The Equip Tips that is available here lists reports that cover many of the projects that were reviewed here. You can use the order sheet in this handout for sending for the information you want.