1976 NURSERY PROGRAM

AT THE

MISSOULA EQUIPMENT DEVELOPMENT CENTER
USDA FOREST SERVICE

RICHARD HALLMAN and BEN LOMAN 1/

ABSTRACT

In recent years the Missoula Equipment Development Center, USDA, Forest Service, Missoula, Montana, has become more involved in trying to solve some of the equipment problems of forest tree nurserymen. At the present time the nursery program at Missoula is made up of eight projects that range from the development of cone and seed harvesting equipment to bedhouses and support equipment to improve growing conditions for bare root stock.

INTRODUCTION

The Missoula Equipment Development Center (MEDC) was organized about 20 years ago to solve some of the fire control equipment problems in the Northern Region of the Forest Service. In the 1960's the Center's responsibilities became Servicewide and MEDC began to work in other Forest Service activities such as pest management and forest roads and trails. The Center also began to do limited work in resource management in that period, but it has only been in recent years that a significant program has developed in that area at this Center.

The forest nursery program at MEDC is currently made up of eight development projects. This report briefly describes the problem to be solved, the project objective, the work accomplished to date, and the future work planned for each of the projects.

1/ Forester and Mechanical Engineer, Missoula Equipment Development Center

ED&T 1420 - TIMBER MANAGEMENT TECHNICAL SERVICES

Problem

The Missoula Equipment Development Center is frequently called on to review new equipment and to provide information concerning available equipment that can be used in timber management. The problem is to stay current with field problems and needs and to monitor the development of equipment that might help field units in their timber management activities. Work performed generally includes responding to requests for engineering assistance, acting on routine inquiries, writing reports and articles for publication, and attending selected meetings and workshops. Areas where the Center can work effectively are investigated to help solve problems through the use of equipment and technology. Project Proposals are then submitted for new projects resulting from these efforts.

Project Objective

The objective of this project is to provide prompt technical services on request and to coordinate the Center's activities in timber management.

Work Done to Date

In FY 76 the main effort in this project was to conduct a Servicewide survey at the Forest level, to identify problems in timber management that might be solved or at least alleviated through equipment development. A followup contact to each Region will begin to review the Forest responses and to put the problem areas identified in priority. A project record will present survey findings. Other activities funded under this program in FY 76 included: attending and presenting papers at the Intermountain Nurserymen's Meeting, August 1975, and the Servicewide Conference on Planting Stock Production, September 1975; semiannual trips to the Washington Office to review program status, preparing articles for Tree Planters Notes and an Equip Tips describing current timber management projects at the Center.

Future Work

In FY 76T we plan to finish the followup contacts with Regional Office Timber Management personnel to review the FY 76 timber management survey. In FY 77 the information gathered in the survey will be used to investigate priority problems and determine where equipment development efforts should be focused. Also in FY 77, it is planned to begin offering more engineering service to Federal nurserymen. Included in this effort will be personal visits to three or four Federal nurseries each year to help them with their equipment problems. The goals for FY 78 will be to continue the expanded nursery service effort and to explore timber management problems and provide technical services as needed.

ED&T 2522 - PRECISION NURSERY SEEDER

Problem

The present seeding equipment being used in the seedling nursery sows an erratic bed density. The number of seeds sown per square foot will vary from 20 to 100 when 40 per square foot is desired. A precision seeder is necessary to fully use the genetically improved tree seed. Genetically improved seed is now, and will be for some time, available in very limited quantities. Better utilization has to be made of the available seed. The present method produces 15 to 25 percent cull trees. Better control of bed density would probably shrink this to under 10 percent. This would reduce the time spent in sorting out cull trees while packing. Research has shown uniform bed densities can produce a better and more uniform tree. A better tree will increase outplanting survival, thereby reducing the number of trees needed to plant each acre and also reduce the amount of replanting. The nursery would be able to make a better estimate of area needed for sowing, reducing the cost of preparing beds that will not be sown.

Project Objective

The objective of this project is to help make available to the forest tree nurseryman a seeder that will permit precision sowing of tree seed in nursery beds.

Work Done to Date

This project began in July 1974. A survey was made of all Federal nurserymen to define the problem which was assumed to be representative of the entire industry. The survey provided answers to questions such as the average size of seed lot sown, species used, range of sowing densities and desired accuracy. In general the replies indicated a need for a sowing accuracy of ± 5 percent of density per sq ft and ± 30 percent on spacing. A market search was then conducted to attempt to find a seeder that could meet the requirements determined in step 1. Six seeders were selected for lab tests; Wind River (used for the control sample), Moden pneumatic (University of Idaho), Stanhay, Dahlman, Ventura, and the Oyjord (from Norway). A statistical analysis of the tests revealed that while most of the seeders had about the same sowing accuracy, the Oyjord was easier to operate and clean and was better suited for small lot sowing. Field testing of the Oyjord was conducted at five nurseries in the West last spring.

Future Work

Additional tests of the Oyjord are planned in 1977. Also, we plan to participate in an effort to get an American manufacturing firm to produce the Oyjord seeder in this Country to make purchasing and servicing easier for American nurserymen. Center personnel will also work with

ED&T 2547 - INTENSIVE NURSERY CULTURE

Problem

Two distinct methods of producing forest tree seedlings exist in the United States. Greenhouse production of containerized stock now accounts for approximately 5 percent of the industry's annual production. This percentage undoubtedly will increase as the system is perfected. However, bare root stock production from conventional nursery beds is likely to provide the bulk of planting stock used in this Country for the foreseeable future.

Project Objective

The objective of this project is to provide the engineering expertise necessary in the development of equipment and techniques to help nurserymen grow the type of seedling they want as economically and inexpensively as possible.

Work Done to Date

This project began August 1974. To gather background information MEDC personnel visited bedhouse operations at Weyerhaeuser's Mima Nursery, the Forest Service Nursery at Bend, and Washington State's Webster State Nursery at Olympia. Later MEDC personnel met with Coeur d'Alene Nursery and R-1 Timber Management personnel to set a course of action for the project. It was agreed that the first step would be to determine the biological response of seedlings to various levels of environmental control. To accomplish this, two aluminum bow poly covered bedhouses, 22'x96', were erected at Coeur d'Alene. One bedhouse (that had heat for frost protection) was sown in mid-March. The other bedhouse (without heat) was sown in early May, as was the uncovered control plot. Both houses and the control were sown with lodgepole pine, ponderosa pine, and western larch. Nursery personnel are tending the crop and measuring growth and environmental conditions. Instrumentation was also installed in a bedhouse at the Bend Nursery, Bend, Oregon, to measure similar parameters.

Future Work

The results of the bedhouse experiments will be analyzed at the end of this growing season to determine what type of growth tests should be conducted next year. If at the end of 2 years it appears that the method is basically economical, then an effort may be made toward improving the equipment and techniques of growing seedlings in a modified environment.

ED&T 2548 - EQUIPMENT FOR PROCESSING SMALL SEED LOTS

Problem

Because of rapidly expanding tree improvement programs many nurserymen must process a greater number of small seed lots each year. Most nurseries have equipment geared for handling large seed lots and have found this equipment unsuitable for the efficient processing of small lots. One problem is the difficulty of cleaning large equipment between batches. Another problem is that some large processing equipment such as brush dewingers may not work efficiently with small loads. As a result of these problems, most Federal nurserymen contacted in a recent questionnaire replied that there is a need for development work in this area.

Project Objective

The objective of this project is to help make available to nurserymen reliable equipment suitable for processing small seed lots in high output nursery operations.

Work Done to Date

Project began January 1974. The first **effort was** to survey all Federal **nurseries to** define the problems **associated** with processing small seed lots. In addition, seed testing laboratories and seed processors were visited to gather background information. A project record was written to cover the investigation. A catalog entitled *Equipment for Processing Small Seed Lots* was also published. The purpose of publication was to acquaint nurserymen with equipment that is commercially available from both domestic and foreign sources. The first year's investigation revealed that there was a need for a better dewinger for use in processing small seed lots. To meet that need, several prototype dewingers were built and tested. A model that uses a soft rubber flapper for dewinging appears to work best. Testing for damage is currently being done by the Eastern Tree Seed Lab. An analysis of damage and degree of dewinging will be done after the tests are completed.

Future Work

Field testing of this dewinger will be accomplished this winter. Drawings and specifications of the MEDC dewinger will be available in FY 77. At the first annual Equipment Meeting of Federal Nurserymen held in Portland, Oregon, in June 1976, the consensus of the group was that a small seed lot processing package be put together by the Center. The Center will investigate this need further and make recommendations to the nurserymen for assembling a complete processing package.

ED&T 2549 - MONITORING GREENHOUSE ENVIRONMENTS

Problem

In the past 5 years there has been a dramatic increase in the number of greenhouses built to produce forest seedlings. Many improvements have been made in structures, coverings, and accessory equipment. If there is one area that has been relatively neglected, however, it is the monitoring of the greenhouse environments. To date, most greenhouse operators have been too busy with the routine activities of their operation to concern themselves with optimizing environmental control. Researchers, especially those engaged in greenhouse production of horticultural crops, have demonstrated that the selection and maintenance of proper growing environments can markedly improve crop performance. The key to maintaining the optimum growing regime is good instrumentation. A properly instrumented greenhouse can permit a grower to produce the best crop possible for the money he has available for fuel, electricity and related expenses.

Project Objective

The objective of this project is to help make available to greenhouse growers of tree seedlings, equipment and techniques that will allow them to monitor all major aspects of the greenhouse environment.

Work Done to Date

This project began in August 1974. In October MEDC personnel met with representatives from PNW Forestry Sciences Laboratory, Corvallis, Oregon, Siuslaw National Forest, and Oregon State University (OSU) to discuss the project. It was decided to conduct the equipment tests at the Siuslaw National Forest greenhouse complex at Beaver Creek. The electrical engineering department at OSU was contracted to conduct a feasibility study to determine: (1) which parameters of a greenhouse environment should be measured, (2) how they should be measured (automatic or manual), (3) frequency and precision required, and (4) the best type or form of output data. The study was completed and the report received in August 1975. In January 1976 a contract was let to OSU to design and install an instrumentation system to the monitor greenhouse environment at Beaver Creek.

Future Work

The instrumentation system is scheduled for installation by December 1, 1976. After a suitable period of use, MEDC will either recommend to terminate the project with a report and drawings and specifications, or will recommend further work.

ED&T 2669 - NURSERY EQUIPMENT CATALOG

Problem

A prevalent problem forest nurserymen face is how to stay abreast of new equipment and techniques. Many instances can be cited where a nurseryman has spent time and money developing a piece of equipment when a similar version already existed elsewhere. Publications and annual nurserymen's meetings are helpful, but nurserymen need specific information on available equipment.

Project Objective

The objective of this project is to provide forest nurserymen with detailed information about available equipment suitable for use in their industry.

Work Done to Date

This project began in January 1975 at the time MEDC's survey of nurserymen's equipment problems was completed. The survey indicated that many nurserymen asked for the development of equipment that already existed. To help remedy the situation it was decided to assemble a general catalog of bare root nursery equipment. Approximately 150 manufacturers were contacted to gather information concerning commercially available equipment. In addition, about 25 nurserymen who listed custom-built equipment on the survey questionnaire were contacted. The material gathered was compiled in a rough draft format and reviewed by nurserymen and others throughout the Country.

Future Work

Comments made during the review are being incorporated into the catalog and we plan to have the document published by November 1, 1976. We anticipate that the catalog will have to be updated periodically to keep the information current. In addition, greenhouse equipment may be added depending on the Nursery Committee's recommendations.

ED&T 2670 - CONE AND SEED HARVESTING EQUIPMENT

Problem

In a recently completed survey of all Federal, State, and private nurserymen, the problem of harvesting cones and seed was listed as their third highest priority. In the South and Southeast this problem is one of harvesting seed from orchard grown southern pine species with persistent cones (principally loblolly pine). In other sections of the Country, where seed is harvested primarily from seed production areas or from wild stands, conventional cone shaking or similar equipment cannot be used, usually because of rough and uneven terrain. The problem therefore is diverse and widespread. Numerous tools and techniques will be needed to solve a problem of this nature.

Project Objective

The objective of this project is to provide those working in tree improvement with the necessary equipment to efficiently harvest seed from selected trees, be they in orchards, seed production areas, or in wild stands.

Work Done to Date

This project began in January 1975. MEDC personnel visited Forest Service and State forestry personnel in the Southeast to gather background material. From this initial contact it was learned that the North Carolina State-Industry Tree Improvement Cooperative was about to field test a prototype vacuum seed harvester. MEDC personnel attended the demonstration held in a loblolly seed orchard in Virginia. It was evident that the machine had good potential for successfully vacuuming loblolly seed from a groomed orchard floor. However, several modifications were needed. MEDC was invited to join the Coop in further testing and as a result the Center ordered a second prototype model for its own test program. The second prototype model was tested at three locations in October in the South by personnel from the Southern Region and MEDC. As a result of the fall testing, a meeting was held at Bowie, Texas, with the Company to suggest numerous changes in the machine to improve its performance. The improvements have been made and both the Coop's machine and MEDC's machine are scheduled for fall testing.

Future Work

We anticipate that the Bowie Harvester with its recent improvements will solve the problem of picking up tree seed from the orchard floor. In FY 77, MEDC will begin to look for equipment that can pick up cones from the orchard floor. Also, the Center will begin to look for ways to harvest seed and cones from individual trees in seed production areas and wild stands.