

THE NURSERY TECHNOLOGY COOPERATIVE;
A COORDINATED EFFORT TO IMPROVE SEEDLING QUALITY

Mary L. Duryea and Steven K. Omi

ABSTRACT: The Nursery Technology Cooperative (NTC) was established July 1, 1982 to improve the productivity of the Pacific Northwest's forest tree nursery industry. The NTC and the two other cooperatives (tree improvement and vegetation management) in the Department of Forest Science are aimed at helping to solve reforestation problems beginning with seed and ending with a free-to-grow forest stand. Membership categories in the NTC include (1) nurseries, (2) seedling users, and (3) specialist organizations. Problem areas for Cooperative study are identified and prioritized by Cooperative members. Our first study, investigating the effects of top pruning on seedling morphology and field growth and survival, has been installed at six nurseries. Planning is in progress for a long-term Cooperative study examining the effects of selected herbicides on weeds and seedlings. Other activities in the Cooperative include (1) a nursery pathology research project, (2) a tissue culture/vegetative propagation project, (3) continuing education (production of a nursery manual), (4) technical assistance (compilation of lists of specialists available to help members), (5) information gathering (collection of state-of-the-art information on compaction, tilth, and drainage), and (6) a seedling evaluation program.

INTRODUCTION

Origin Of The Nursery Technology Cooperative

Because of the importance of the forest nursery industry, a task force was appointed by the Oregon State Forester and the Dean of the School of Forestry, Oregon State University (OSU), to study and report on the status of forest nursery management technology in the Pacific Northwest. The task force found that the forest nursery industry wanted more research and educational assistance, and proposed that a Nursery Technology Center be established at OSU to address these needs. The Nursery Technology Cooperative (NTC) was officially established July 1, 1982.

Mary L. Duryea is Assistant Professor and Leader, Nursery Technology Cooperative, Department of Forest Science, Oregon State University, Corvallis.

Steven K. Omi is Research Assistant, Nursery Technology Cooperative, Department of Forest Science, Oregon State University, Corvallis.

Objective

The objective of the Cooperative is to improve the productivity of the Pacific Northwest's forest tree nursery industry through an integrated program of coordinated studies, information sharing, and technical assistance.

Examples of specific needs to be met through cooperative action are:

1. Better nursery-specific cultural prescriptions for the improvement of seedling physiological quality.
2. Improved soil management guidelines for the maintenance of long-term nursery productivity.
3. More effective coordination of nursery and outplanting techniques.
4. Better information sharing among nurseries, and between nurseries and related groups such as reforestation foresters and researchers.

Why Cooperatives?

The three cooperatives in the Department of Forest Science at OSU have been established to help solve reforestation problems beginning with seed and ending with a free-to-grow forest stand. The Tree Improvement Research Cooperative, headed by Thomas Adams, coordinates genetics and breeding research on Pacific Northwest tree species to enhance tree improvement efforts in the region. The Nursery Technology Cooperative, by helping to increase nursery productivity, will aid in the better utilization of improved seed and the matching of high quality seedlings to planting sites. At the outplanting stage the CRAFTS Cooperative, headed by Steven Radosevich, helps to coordinate research on methods of controlling competing vegetation in commercial forests of the Pacific Northwest.

Cooperatives enable us to:

1. Define and study useful problems.
2. Reduce fixed costs per cooperator to study these problems.
3. Investigate treatment x site interactions.

4. Rapidly use results.
5. More effectively share information by using OSU as a clearinghouse.

Organization

Fifteen members from state and federal agencies and industry participated in the Cooperative in its first year (Appendix 1). A Technical Committee and a Policy Committee assist the NTC leadership. The Policy Committee advises the Cooperative Leader on decisions concerning program strategy, size, and support. The Technical Committee helps to identify and prioritize problems, and assists in planning, installing, and measuring Cooperative studies. Together, the Policy and Technical Committees guide the activities of the Cooperative, insuring that efforts are focused on real problems.

The NTC membership categories (and annual membership fees) are: (1) nurseries (large--\$6,000 and small--\$3,000), (2) seedling users (full--\$4,000 and monitoring--\$2,000), and (3) specialist organizations (\$2,000 to \$4,000). All members (except for the seedling user monitoring members) have representation on the Technical and Policy Committees, and are directly involved in nursery and outplanting studies. Seedling user monitoring members receive study results only, and do not participate in guidance.

ACTIVITIES

Cooperative Studies

Problem areas for study are identified and prioritized by Cooperative members. Top pruning and weed control will be investigated in our first short-term and long-term studies, respectively.

Top pruning.--This study was installed in May, 1983, to examine the effects of top pruning on 2+0 Douglas-fir seedling morphology, survival, and growth. Top pruning is a common practice in western nurseries (fig. 1); however, there is little available information about the effects of top pruning. Treatments for the experiment include two different pruning heights, two different times of application, and one multiple pruning. The entire experiment, with one seed zone was replicated at three nurseries; a smaller version, involving fewer treatments, was included so that more seed sources could be tested. In total, six nurseries (fig. 2) and nine seed zones are involved in the study. Test seedlings from each seed zone will be planted on sites located within their respective zones. In addition, a common garden study, including seedlings from all seed zones, will be established at the OSU McDonald Forest. The growth and survival of outplanted seedlings will be monitored for up to three years.



Figure 1.--Top pruning with a rotary mower at the D.L. Phipps Forest Nursery (Oregon State Department of Forestry).

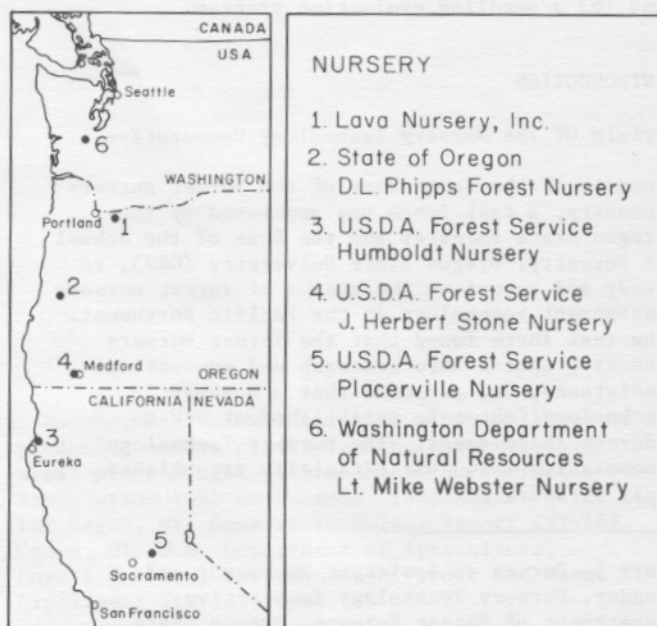


Figure 2.--Map showing the location of the six nurseries where the top pruning study has been installed.

Weed control.--Planning is in progress for a long-term Cooperative study that will examine the effect of selected herbicides on weeds and seedlings. Presently used methods of weed control (e.g., handweeding, fumigation) are costly and may be detrimental to tree seedlings and soil microorganisms. The objective of this study will be to screen new and currently available herbicides for their effectiveness in controlling weeds without injuring conifer seedlings. Additionally, we want to determine the residual effect of herbicides on weeds and crop species.

Other Cooperative Projects

Two other OSU projects are connected with the NTC: the Nursery Pathology Research Project, headed by Everett Hansen, and the Tissue Culture/Vegetative Propagation Project, headed by Joe Zaerr. Both projects are meeting Cooperative objectives, although both are funded by sources other than Cooperative annual fees.

Nursery pathology research project.--The broad goal is to provide the biological information necessary to predict and prevent disease outbreaks in nurseries. The initial focus of the project will be on the various top blight diseases that have caused substantial loss in recent years. In preliminary work, systematic isolations have been made from blighted seedlings at a Pacific Northwest nursery to identify suspected pathogens. These isolates, plus those from three other participating nurseries, will be tested for pathogenicity. Timing, environmental, and predisposing factors that influence infection will be determined for the identified pathogens.

Tissue culture/vegetative propagation project.--The objective of this project is to develop techniques for producing large quantities of superior forest trees by means of tissue culture. The approach has been to measure growth hormones in cultures and to determine which hormones produce the desired results. Work to date has resulted in the development of techniques to isolate and detect plant hormones in extremely small quantities. These techniques have been used to measure auxin in callus cultures and in cultured buds. Cytokinins, another class of growth hormones, were measured in suspension cultures of Douglas-fir. The results of these studies indicate that the growth hormone requirements for embryogenesis (producing whole plants from cell cultures) probably are very specific, and that the growth hormones that have been used in previous attempts to produce embryogenesis are probably not the ones that should be used.

Future work will include a broadening of the objective to include other methods of propagation, such as the rooting of cuttings, and the problems associated with those techniques.

The Forest Nursery Manual: Production of Bareroot Seedlings includes 30 chapters covering specific topics such as nursery site selection, fertility management, and seedling storage (fig. 3). A comprehensive survey of Northwest nurseries provided the authors of each chapter with information on current cultural practices. In addition, each chapter contains a state-of-the-art review of nursery research. A workshop held at OSU in October, 1982 previewed the manual for over 250 people. The manual will be published this summer, 1983. Both the Manual and the workshop have been co-sponsored with the USDA Forest Service, State and Private Forestry, Region 6.

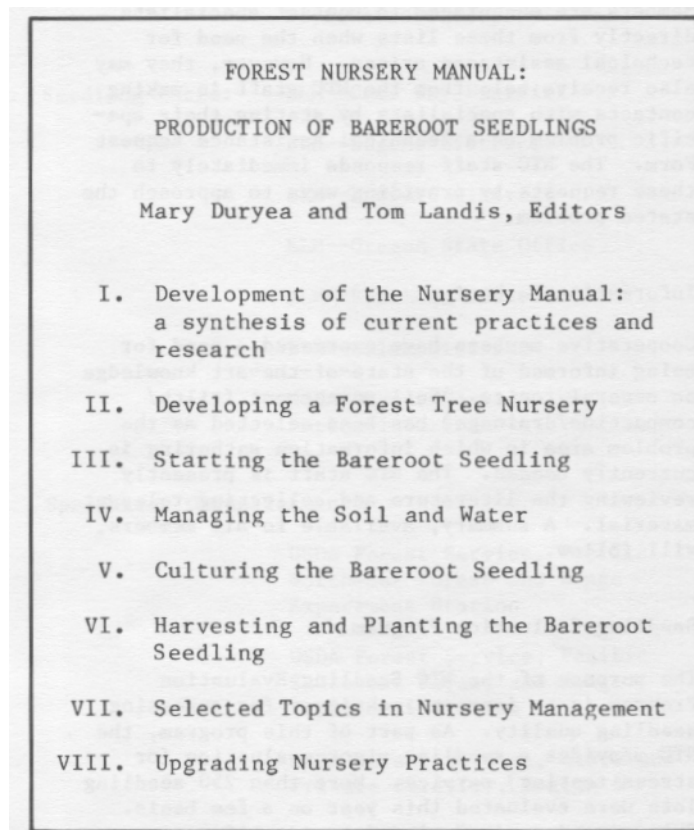


Figure 3.--Major Sections in the 30-chapter Forest Nursery Manual.

Seedling Physiology and Reforestation Success will be the title of the Physiology Working Group Technical Session to be held at the Society of American Foresters (SAF) National Convention in Portland this October, 1983. The one-day session will include both overview and specific research reports concerning the effects of seedling physiology on reforestation success, with major emphasis on stock quality and planting site manipulation. The proceedings of the session will be published in 1984.

Technical Assistance

As part of our commitment to improve information flow and technical assistance, we are compiling lists of specialists who would like to help nurseries and reforestation people. Questionnaires (fig. 4) have already been sent to insect/ disease, soils, weed control, and irrigation specialists, seedling physiologists, and silviculturists. A very positive response has been received--many have expressed a strong desire to be involved in workshops, Cooperative studies, and problem solving. Other specialists who will be contacted include agricultural and industrial engineers, seed physiologists, crop scientists, and horticulturists. The list of specialists for insect and disease, soil, and irrigation problems have been sent to Cooperative members.

Members are encouraged to contact specialists directly from these lists when the need for technical assistance arises. However, they may also receive help from the NTC staff in making contacts with specialists by stating their specific problem on a Technical Assistance Request Form. The NTC staff responds immediately to these requests by providing ways to approach the stated problem.

Information Gathering

Cooperative members have expressed a need for being informed of the state-of-the-art knowledge on several topics. Soil management (tilth/ compaction/drainage) has been selected as the problem area in which information gathering is currently needed. The NTC staff is presently reviewing the literature and collecting relevant material. A summary, available to all members, will follow.

Seedling Evaluation Program

The purpose of the NTC Seedling Evaluation Program is to improve techniques for assessing seedling quality. As part of this program, the NTC provides a seedling vigor evaluation (or stress testing) service. More than 250 seedling lots were evaluated this year on a fee basis. This procedure is designed to identify poor quality lots by monitoring the growth and survival of potted seedlings placed in a growth room after exposure to hot-dry conditions. Although this procedure has been very useful, work continues to refine the test. A study is being conducted to determine the effectiveness of the current procedure in predicting field survival under uniform planting conditions. We are also examining the relationship between the vigor evaluation results and standard measurements of root growth capacity. This investigation will indicate whether these two assessment procedures are consistent in predicting field survival or, perhaps, are complementary and could be used together to improve prediction accuracy. The study began in March, 1983.

SPECIALIST QUESTIONNAIRE
Nursery Technology Cooperative

Name _____ Affiliation _____

Address _____

Phone Number _____

IN THIS QUESTIONNAIRE WE ARE SEEKING INDICATIONS OF INTEREST AND NOT NECESSARILY A FIRM COMMITMENT TO PARTICIPATE.

1. a. Would you be interested in being involved in the Nursery Technology Cooperative? (check yes or no)

Yes _____ No _____

b. In what cooperative efforts might you be willing to participate? (check yes or no for each starred (*) area below)

| | <u>Yes</u> | <u>No</u> |
|---|------------|-----------|
| (1) *Workshop teaching? | | |
| (2) Studies: | | |
| *Review of study plans? | | |
| *Active involvement in experiments? | | |
| (3) *Team problem solving and providing technical assistance through the Cooperative? | | |
| (4) *Individual direct consulting? | | |
| (5) *Others? (please specify below) | | |

Figure 4.--Page one of the questionnaire being sent to specialists in the West.

Another recently completed study in the NTC Seedling Evaluation Program was aimed at developing a specific procedure for detecting damage to seedlings which have been unintentionally frozen during cold storage. In this study, we found that a pressure chamber could be effectively used to identify this type of injury. Results indicate that the change in plant mois-

ture stress (PMS) of potted seedlings during the first week after freezing can generally predict whether or not they will survive. The PMS of damaged seedlings tends to increase much more rapidly than that of non-injured seedlings. A more complete description of this study is reported by Douglas McCreary in this proceedings.

LOOKING AHEAD

In its second year the NTC staff is (1) coordinating the NTC studies (top pruning, weed control), (2) providing continuing education programs (Physiology Workshop at the SAF National Convention, publication of the Forest Nursery Manual), (3) updating the Seedling Evaluation Program, (4) supporting other projects within the NTC (Nursery Pathology, Tissue Culture/Vegetative Propagation), (5) providing technical assistance (compilation of specialists lists), and (6) gathering information on soil management, and, given continued Technical Committee interest, a soil management study plan will be prepared.

APPENDIX I

Members of the Nursery Technology Cooperative.

Nurseries: Lava Nursery, Inc.

Oregon State Department of Forestry, D. L. Phipps Forest Nursery

USDA Forest Service, Rogue River National Forest, J. Herbert Stone Nursery

Washington State Department of Natural Resources, Lt. Mike Webster Nursery

Weyerhaeuser Company

Seedling Users: BLM--Coos Bay District

BLM--Eugene District BLM--

Medford District BLM--

Oregon State Office BLM--

Roseburg District BLM--

Salem District

USDA Forest Service, Umpqua National Forest

Specialist Organizations.

USDA Forest Service, Pacific Northwest Forest and Range Experiment Station

USDA Forest Service, Pacific Southwest Forest and Range Experiment Station

USDA Forest Service, State and Private Forestry, Region 6

In: Murphy, Patrick M., compiler. The challenge of producing native plants for the Intermountain area: proceedings: Intermountain Nurseryman's Association 1983 conference; 1983 August 8-11; Las Vegas, NV. General Technical Report TNT-168. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1984. 96 p.