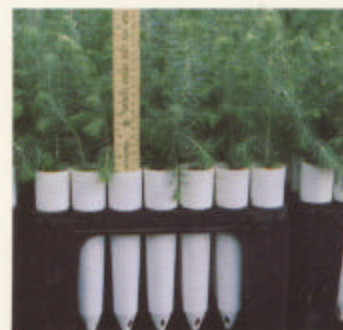
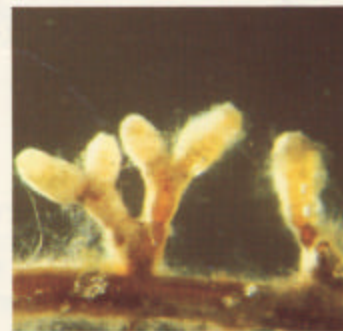




Atmospheric Environment



The Container Tree Nursery Manual

Volume One	Planning, Development, and Management
Volume Two	Containers and Growing Media (1990)
Volume Three	Atmospheric Environment (1992)
Volume Four	Seedling Nutrition and Irrigation (1989)
Volume Five	The Biological Component: Nursery Pests and Mycorrhizae (1990)
Volume Six	Seedling Propagation
Volume Seven	Seedling Processing, Storage, and Outplanting

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The Container Tree Nursery Manual

Volume Three Atmospheric Environment

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Preface

Work on the first comprehensive technical manual on the production of container tree seedlings, "How to grow tree seedlings in containers in greenhouses" by Richard W. Tinus and Stephen E. McDonald, was begun in June 1975 and it was published by the U.S. Department of Agriculture (USDA) Forest Service as a General Technical Report (GTR RM-60) in May 1979. This manual achieved worldwide acceptance as the primary reference on the culture of container tree seedlings. "How to grow tree seedlings" was originally intended as an interim publication and has been reprinted several times. However, it is currently out of print.

In 1982, planning began for writing a new container nursery manual based on "How to grow tree seedlings in containers in greenhouses," but adding several new chapters. The writing team consisted of four authors: Thomas D. Landis, Richard W. Tinus, Stephen E. McDonald, and James P. Barnett, with the assistance of Rebecca G. Nisley as managing editor. Guest authors were invited to write specific chapters and their contributions are acknowledged in the individual chapter title pages.

Realizing that container nursery management had changed considerably over the previous decade, the team surveyed container tree nursery practices in North America in 1984. To gain additional data for volume three on how nurseries regulated the nursery environment, nurseries were again surveyed in early 1991. Information from these surveys helped to determine writing priorities and emphasis and has been used to complement the published literature.

The Container Tree Nursery Manual consists of seven volumes; they are being published in the order they are written, all under the same series number-U.S. Department of Agriculture Agricultural Handbook 674. Each volume contains chapters on closely related subjects concerning the production of tree seedlings in containers. The volumes can be accumulated and used as a complete nursery manual or can be used separately by specialists needing information on a particular subject. Because several subjects must be discussed in more than one volume there will be some redundancy in the manual. Such repetition is justified, however, because most readers will be using the

manual as a technical reference and will not be reading the entire text.

The Container Tree Nursery Manual is structured around an outline of numerical organizational headings that allow the reader to locate a specific subject quickly, without referring to an index. The general outline of volume and chapter titles is as follows:

Volume One—Planning, Development, and Management

- Chapter 1 Initial Planning and Feasibility Assessment
- Chapter 2 Site Selection
- Chapter 3 Nursery Layout and Growing Facilities
- Chapter 4 Nonstructural Equipment and Controls
- Chapter 5 Auxiliary Equipment and Buildings
- Chapter 6 Shadehouses, Bedhouses, and Tunnels
- Chapter 7 Nursery Management
- Chapter 8 Troubleshooting Container Nursery Problems

Volume Two—Containers and Growing Media

- Chapter 1 Containers: Types and Functions
- Chapter 2 Growing Media

Volume Three—Atmospheric Environment

- Chapter 1 Temperature
- Chapter 2 Humidity
- Chapter 3 Light
- Chapter 4 Carbon Dioxide

Volume Four—Seedling Nutrition and Irrigation

- Chapter 1 Mineral Nutrients and Fertilization
- Chapter 2 Irrigation and Water Management

Volume Five—The Biological Component: Nursery Pests and Mycorrhizae

- Chapter 1 Disease and Pest Management
- Chapter 2 Mycorrhizae

Volume Six—Seedling Propagation

- Chapter 1 Stock Types and Growing Schedules
- Chapter 2 Seed Factors and Presowing Treatments

- Chapter 3 Sowing and Other Propagation Methods
- Chapter 4 Establishment Phase
- Chapter 5 Rapid Growth Phase
- Chapter 6 Hardening Phase

Volume Seven—Seedling Processing, Storage, and Outplanting

- Chapter 1 Processing and Storage
- Chapter 2 Handling and Transportation
- Chapter 3 Outplanting

The manual is based on the best current knowledge on container tree nursery management and should be used as a general reference. Recommendations were made using the best information available at the time and are, therefore, subject to revision as more knowledge becomes available. Much of the information in this manual was developed for western and southern conifer seedlings. Although the authors attempted to include information for species from other geographical areas, because of the wide variation in individual species responses, container nursery managers will need to adapt these principles and procedures to their own nursery situation. There is no substitute for individual experience, and recommended cultural practices should be tested before being implemented on an operational scale.

Trade names are used throughout the manual, but only to provide examples, and no endorsement of specific products, or exclusion of equally suitable products, is implied. The mention of specific pesticides is intended only for general information and should not be construed as an endorsement. Because of frequent changes in pesticide registration and labeling, the reader should check with local authorities to make sure that an intended use is both safe and legal. Remember that pesticides can be harmful to humans, domestic animals, desirable plants, and fish or other wildlife, if they are not handled or applied properly. Use all pesticides selectively and carefully, following the label directions. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

The Container Tree Nursery Manual was organized into separate volumes to allow for revisions and updating. The authors request that readers bring any errors in the text to their attention and also

offer suggestions for improvement. Submit any suggestions to Thomas D. Landis, USDA Forest Service, State and Private Forestry, PO Box 3623, Portland, OR 97208, USA. Many people have been instrumental in the preparation of the manual. Technical review of such a large publication involves considerable work, and the authors are extremely grateful to the following nursery professionals for reviewing various drafts of volume three:

Chapter 1—Temperature

- Dr. Eugene Shoulders, USDA Forest Service, Southern Station, Alexandria, LA
- Dr. William C. Carlson, Weyerhaeuser Technology Center, Federal Way, WA
- Mr. Eric van Steenis, British Columbia Ministry of Forests, Surrey, BC, Canada

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Chapter 3—Light

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Chapter 4—Carbon Dioxide

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- Dr. Leroy J. Heidmann, USDA Forest Service, Rocky Mountain Station, Flagstaff, AZ
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This publication reports research involving pesticides. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.



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