

SEEDLING PHYSIOLOGY AND REFORESTATION SUCCESS

Edited by Mary L. Duryea and Gregory N. Brown

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This book reports the proceedings of a Physiology Working Group Technical Session of the Society of American Foresters National Convention, held in Portland, Oregon, in October 1983. The 14 chapters are divided into two main sections – Stock Quality, and Planting Site and Stock Response. Stock Quality is further subdivided into Propagation Method, covering vegetative propagation and seed, and Stock Type, which covers bare-rooted and container-grown seedlings. The section on Planting Site and Stock Type is divided into Matching Species and Stock Type to Site, and Accelerating Growth in Plantations, covering vegetation and nutritional management. An overview chapter is presented on each topic, followed by a chapter covering a specific related problem. An excellent introduction by G. N. Brown explains the rationale for the book and stresses the importance of an understanding of seedling physiology in improving reforestation success.

In the first chapter, D. G. Thompson reviews clonal reforestation, covering both macropropagation methods including cuttings and grafts, and micropropagation methods or tissue culture. He foresees clonal forestry becoming increasingly important for the establishment of future forests, bulking up superior clones. Although problems of maturation during clonal testing and selection are recognised, current options and problems of rejuvenating tested clones or holding micropropagated clones juvenile in cool storage while clonal tests are done are not discussed. However, this chapter is a good introduction to present and future propagation methods. The practical research chapter, by D. F. Karnosky and R. A. Mickler, is a brief (8 p.) discussion of tissue culture methods, using elms as an example.

A review of seed technology by F. T. Bonner reminds us that, although clonal forestry may be coming, current practices do not yet include genetically superior seed for all reforestation. The chapter reviews seed collection, testing, storage and germination. Vigour of germination, as well as seed viability, is stressed. J. R. Dunlap and J. P. Barnett then demonstrate the importance of stratification time, germination temperature, and moisture stress in the germination of loblolly pine.

The Stock Quality section opens with a paper by M. L. Duryea and K. M. McClain, discussing bare-rooted seedling physiology. The importance of both morphological and physiological characteristics in defining planting stock quality is emphasised. Rather than review all aspects of seedling physiology, the authors have selected frost hardiness, mineral nutrition, and carbohydrate reserves, and the effects of nursery cultural practices on these three characteristics are discussed. The topic of water relations is surprisingly omitted, although other chapters in the book stress the importance of this subject. Frost hardiness is well covered, discussing the effects irrigation and fertiliser may have on dormancy and frost hardiness development. The section on mineral nutrition stresses the importance of nitrogen fertiliser for altering morphological characteristics and improving field performance, but the importance of balance between nutrients for

optimum stock quality receives scant attention. Cold storage is often necessary between lifting and planting, and the effect of depletion of carbohydrate reserves during storage is emphasised.

The companion chapter by J. L. Jenkinson discusses the importance of lifting season, or lifting window. This is a very detailed chapter showing how Douglas fir seed sources vary in their optimum lifting window, particularly when the lifting window commences in winter, and this has obvious relevance for other species.

Container-grown seedling technology is given a brief overview by R. W. Tinus and P. W. Owston, listing the important considerations rather than discussing in detail the cultural practices for producing quality seedlings. J. P. Barnett then gives results of a trial with Southern pines, comparing morphological and physiological characteristics with later field performance. Plant size was the best indicator of final field height.

An ecophysical approach to matching species and stock type to site is reviewed by S. D. Hobbs. The key environmental factors discussed are heat, soil oxygen, water, and animals, and examples of these are given with the effects of drought, flooding, high temperature, light, nutrient deficiencies, and animal damage. Selecting the right stock type of the right species can have a major effect on successful plantation establishment. Manipulating the environment by site preparation methods is not discussed. The practical example is development of target seedlings for target sites. T. C. Hennessy and P. . Dougherty demonstrate how the influence of timing and amount of irrigation can affect seedling characteristics. Cycles of drought stress in the nursery resulted in improved seedling water relations and better seedling morphology.

The section on accelerating early growth in plantations is opened by D. H. Gjerstad *et al.* reviewing the importance of weed control. Weed competition affects water and nutrient availability. This brief chapter discusses only moisture, and not the effects of nutrition or shading. The companion chapter by S. R. Radosevich demonstrates the importance of moisture in competition between ponderosa pine and the shrub, manzanita.

J. T. Fisher and J. G. Mexal provide an excellent overview of nutritional management, covering both nursery and forest fertiliser use. Balanced nutrition is stressed to improve seedling growth after outplanting, and to enhance seedling drought-resistance and cold-hardiness. The final chapter by R. K. Dixon *et al.* demonstrates how inoculation with the mycorrhizal fungus *Pisolithus tinctorius* benefited establishment of oak.

It is probably inevitable that conference proceedings give an uneven coverage of the field when structured into a text, and the editors have had obvious difficulties trying to maintain a balance. Some of the review papers are very brief and incomplete, and presenting an overview paper with an example paper under a common heading can produce unrelated pairs.

There are also problems in keeping terms consistent between chapters. For instance, in water relations, where the accepted term is plant water potential, a wide range of terms is used, from DPD (never defined as Diffusion Pressure Deficit, but last used

in the 1960s), percent moisture content, relative water content, water deficit, and plant moisture stress. The relationships between these terms are not explained. A range of units is also used, including atmosphere, bars, kPa and MPa. Uniform terminology would help the non-physiological reader to more easily understand the topics being discussed in related chapters.

Repetition also occurs, and this can produce inconsistencies. Mineral nutrition is reviewed in Chapters 5 and 13. The impression from Chapter 5 is that nitrogen is the only important element to be considered, but in Chapter 13 the importance of balanced nutrition for improved growth and drought and frost hardiness is stressed. There is also loose use of terminology. Wrenching is used as a general term, synonymous with undercutting and wrenching (p. 93), rather than as an operation following undercutting. There are some typographical errors, including mis-spellings, incorrectly labelled graphs (Fig. 2, p. 67), odd scale on graphs (Fig. 5, p. 173), and incompletely labelled graphs (Fig. 6 and 7, p. 281). The papers have been reproduced as camera-ready, with different typescripts, and the binding on the review copy has already failed. The book is advertised at £30.50 (approx. NZ\$78), and better presentation could be expected for this price.

However, for all these faults, the book does have some excellent chapters on establishment problems and how a knowledge of physiological processes can solve or minimise these problems. Selective reading provides an informative background useful to those both in general forestry and those specialising in establishment.

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