The use of *Acacia dealbata* as a plantation species in Tasmania: a summary of recent research

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Abstract

A research programme was undertaken between 1990 and 1993 to evaluate the potential of Acacia dealbata *(silver wattle) as a plantation species in Tasmania. Information was obtained on the establishment, management and yield of this species. Results have shown that it can be established satisfactorily in plantations using standard techniques. However, potential problems are poor survival, extreme growth variability, and poor form. Its establishment is more difficult than for the commonly used eucalypt species, but browsing pressure from native mammals appears less than that on* A. melanoxylon *and eucalypt species. Growth rates of* A. dealbata *were variable and often very poor in the small number of older plots that have been measured. The best growth rates recorded were 23 m^3/ha/yr (age 10 years) but, on some sites with excellent growth potential, they were less than 1 m^3/ha/yr. The exact reasons for poor growth are unknown. On poor sites, the growth of* A. dealbata *was no better than that of commonly used plantation species.*

Conclusive recommendations about the potential of A. dealbata *plantations in Tasmania cannot be made on the basis of research completed so far. Assessments from the main long-term trial established as part of this project should supply information on growth, tree form, wood properties and the impact of insects over the next three to ten years. There should be no major plantings of* A. dealbata *until these data are obtained.*

Introduction

The potential of *Acacia dealbata* (silver wattle) for commercial plantations in Tasmania is indicated by the rapid growth and good form of this species in native forests. Interest in *A. dealbata* has been increased by its promising pulping characters (e.g. Phillips *et al.* 1991; Sibly *et al.* 1976) and occasional use as a furniture or feature timber. However, there has been little documented knowledge about the silvicultural characteristics of *A. dealbata*.

A research programme commenced in 1990 using funding from the Forests and Forest Industry Council, under the Intensive Forest Management Special Purpose Native Species Project. The overall aim of the programme was to provide information on the establishment, management and yield of a range of species, enabling decisions to be made about the development of plantation hardwoods to supplement accessible native forest resources. As part of that programme, the present project was initiated to investigate the plantation potential of *A. dealbata*. Specifically, the aims were to:

(a) Determine the optimum methods of establishment on various sites, including appropriate seedling stocktypes;

(b) Determine productivity on a series of sites, and the site limitations for economic production; and

(c) Collect seeds from a wide range of native provenances, establish a series of trial plots, and test for genetic variation in economically important traits.

Plantation establishment techniques

Little is known about basic establishment details of *A. dealbata*. Although its growth

potential is well known, mainly as a weed competing with pines and eucalypts, growth rates in plantations have often been very poor. Therefore, trials were established to evaluate some of the basic establishment requirements of this species. There were four major aims of these trials:

- Determine whether normal plantation establishment practices are suitable for establishing this species;
- Define the seedling type which gives the most successful establishment (i.e. bare-root seedlings that are grown in open nursery beds, or container-grown seedlings in small pots);
- Evaluate survival and early growth rates across a wide range of sites; and
- Determine the effects of browsing animals on establishment success.

Trials

Basic establishment requirements were evaluated in a series of trials at four sites. These trials represented the range of potential plantation sites throughout Tasmania, and establishment details and site descriptions are given in Kube and Brooks (1996). The trials also evaluated the field performance of different nursery stocktypes. These were bare-root seedlings (raised in open nursery beds, and grown to about 35 cm tall) and container seedlings (raised in small pots and grown to about 10 cm tall). This set of trials was established in July and August 1991.

The effects of animal browsing on *A. dealbata* were evaluated in plots established in July and August 1992. Plots were located at two sites in northern Tasmania in areas expected to receive high browsing pressure from native mammals. Full details of this trial are given in Kube and Brooks (1996).

All trials were monitored and measured in the 18 months following planting. They were designed as short-term trials and have all been completed and documented (Kube and Brooks 1996).

Summary of results

Acacia dealbata can be grown satisfactorily in Tasmania using the standard plantation establishment techniques. However, potential problems are poor survival, extreme growth variability (Photo 1), and poor form (Photo 2). Many of these problems appear to arise from the foliage loss that occurs at transplanting, which is presumed to be due to desiccation. Establishment of *A. dealbata* was found to be more difficult than for the commonly used eucalypt species (*E. nitens* and *E. globulus*).

Large bare-root seedlings had better early growth and survival than smaller container seedlings. Container-grown seedlings often had very poor survival under conditions that caused no problems to eucalypt seedlings of a similar size. A good seedling size appears to be about 30 cm tall, with a collar diameter of at least 7 mm. In future, serious consideration should be given to using large container seedlings in order to capture the benefits of a larger seedling, and possibly avoiding problems with foliage loss after transplanting.

Initial stocking should be reasonably high to minimise the potential impact of poor survival and variable growth. It could be assumed that, even under good conditions, at least 33% of seedlings will suffer major growth loss due to foliage loss after transplanting. These seedlings are unlikely to produce merchantable stems.

It appears that form pruning is required when trees are 2–3 m tall (one or two years after planting). This is particularly important if substantial foliage loss has occurred after planting because, after foliage loss, seedlings produce numerous shoots from the stem or base of the seedling. These shoots often persist and, without form pruning, are likely to produce multi-leadered trees which will probably be unmerchantable (Photo 2).

Browsing pressure on *A. dealbata* is much less than that on *A. melanoxylon* (blackwood), and possibly less than that on *Eucalyptus nitens*. It is likely that *A. dealbata* can be established without the need for secure fences as required

Photo 1. Form and growth of Acacia dealbata *can be good in plantations but variability remains a problem.*

for *A. melanoxylon*. However, *A. dealbata* appears to receive more browsing pressure than *Pinus radiata*.

Evaluation of growth rates

Trials

Acacia dealbata was included in a number of species trials and small plots planted during the late 1970s and early 1980s. Information was collated from three of these early plantings. The first was a series of four trials established on poor quality sites in north-eastern Tasmania. These trials had been previously measured and results reported by Orme *et al.* (1992). The second was a species trial established on a good quality site in north-western Tasmania. The trial had been measured and the results were collated as part of this study. The third was two small plots of *A. dealbata* established in far north-western Tasmania. These plots had not been measured previously, and were assessed as part of this study.

Trials were established during this project to allow assessments of growth rates in the longer term. The most useful and comprehensive long-term growth information will be provided by the provenance trials in north-western Tasmania and southern Tasmania. These trials are described in the next section. The establishment trials described in the previous section will also provide growth information for *A. dealbata*, and will allow accurate comparisons to be made with other species.

Summary of results

Growth rates of *A. dealbata* in the small number of plots measured so far are variable and often very poor. The best growth rates recorded were 23 m^3/ha/yr at age 10 years (near Smithton in north-western Tasmania) but, on some sites with excellent growth potential, growth rates were less than 1 m^3/ha/yr at age eight years. On poor sites, the growth rate of *A. dealbata* was no better than that of other commonly used plantation species. The

cause of poor growth cannot be stated with certainty but probable reasons are poor plantation establishment, severe transplant shock and defoliation by the fireblight beetle (*Acacicola orphana*).

Early results from more recent plantings indicate that good early growth can be obtained through good establishment practices. However, growth rates of *A. dealbata* 18 months after planting were generally less than those of *Eucalyptus nitens* and *E. globulus*, and it remains unclear whether the long-term growth of *A. dealbata* will be comparable to these species.

Information on the fireblight beetle was not obtained during the course of this study. Attacks by the beetle are sporadic, and no major outbreaks occurred during the course of this project. Fireblight beetle is known to have a high impact on the growth of natural stands in Tasmania (Elliott 1978) and, before any major plantation programme can be considered, more information on the management, control and impact of this insect is essential.

Photo 2. Trees with multi-leaders are common and form pruning will be required in most plantations.

Seed collections and provenance trial establishment

Acacia dealbata has a wide natural distribution throughout Tasmania, Victoria and New South Wales. Therefore, it is likely that genetic variation will exist for economically important traits. Studies to determine the importance of genetic variation between provenances and within provenances commenced as part of this project. It is expected that important traits will be growth rate, stem form, branch habit, wood quality, wood colour, frost tolerance and insect resistance. Eventually, it will be possible to select outstanding genotypes from these trials for use in plantations.

Seed provenances

Seeds from Tasmanian provenances were collected in 1991 as part of this project. Seeds from the Victorian and New South Wales provenances were obtained by exchanging seeds with the Australian Tree Seed Centre (Canberra). Collections from individual trees were kept separate so that variation between provenances and within provenances could be assessed.

Trials

Provenance trials were established on three sites. The main trial is located in the Florentine Valley (Westfield) in southern Tasmania and is 10 ha in area (Forestry Commission 1993a). It had very good survival and good growth. A second trial is located at Meunna in north-western Tasmania (Forestry Commission 1992). It had moderate survival and slow early growth, but is expected to provide useful information. The third trial was located at Virginstow in north-western Tasmania. It had very low survival, and has now been

abandoned. Low spring rainfall and late planting of bare-rooted seedlings is thought to have caused the failure of the Virginstow trial.

Assessments were made of early growth at the Westfield and Meunna trials, and frost damage at the Meunna trial, and the results have been presented in Kube and Brooks (1996). Assessments of growth rates, tree form, insect resistance and wood properties between about 1998 and 2000 will provide a thorough evaluation of the potential of *A. dealbata*, and the importance of genetic variation in the utilisation of this species.

Summary of results

Trials examining the genetic variation in *A. dealbata* are still in their early stages, and the only information available is from early height growth and field frost damage. Although no conclusions can be drawn on the importance of genetic variation at this stage, the early results suggest there will be important variation between provenances and also within provenances for growth rates and frost tolerance (see Kube and Brooks 1996 for details). The heritability of height growth at age 16 months was 0.21, with a standard error of 0.03. This indicates moderate genetic control over growth. In other studies, heritabilities at about age one year usually increase as trees mature. Therefore, it seems likely that tree breeding could make economic gains for this trait.

Important genetic information will be collected at about age five years. The plantation potential of this species in Tasmania will be greatly enhanced if selections can be made to avoid problems of defoliation by the fireblight beetle. Selections for improved growth rates, and wood properties and tree form will also increase the plantation potential of this species.

Management and control of fireblight beetle

An important pest on *A. dealbata* is the fire-blight beetle (*Acacicola orphana*). The biology of this insect and its effects are detailed in Elliott (1978). The larvae can cause complete defoliation in winter and spring, and growth rates are significantly lowered with repeated defoliation. Defoliation may also encourage attacks by wood borers which can cause major stem damage and tree death (Bashford 1991).

The damage caused by the fireblight beetle is seen as a major barrier to establishing plantations of *A. dealbata* in Tasmania, and management prescriptions to control the insect are essential if *A. dealbata* is to be used as a plantation species. A trial was established at Westfield, in southern Tasmania, to investigate the impact and methods of control of the fireblight beetle on selected provenances of *A. dealbata* (Forestry Commission 1993b). However, no outbreaks of the beetle have occurred since the trial was established.

Conclusion

Acacia dealbata has often been considered a potentially important species for producing feature timber or pulpwood for Tasmania's forest industries. Although some small trials had been established over the last 15 years, there had been no major effort to properly evaluate the potential of this species. The present project has provided some basic knowledge about establishment requirements and potential problems during establishment. It has also allowed well-designed field trials to be planted which will provide a sound evaluation of this species in the longer term.

It is not possible to make conclusive recommendations about the potential of *A. dealbata* plantations in Tasmania based on the research completed so far. Although the potential of this species is apparent, more information is needed before *A. dealbata* can be used with confidence. Therefore, no major plantings of *A. dealbata* should be undertaken until this information is obtained.

There are three main priorities for future research. Firstly, productivity from well-established plantations needs to be

determined. Reliable and long-term measurements of growth rates, tree form and wood properties are needed. Secondly, information on the control and impact of the fireblight beetle is essential if *A. dealbata* is to have any commercial potential. Thirdly, an assessment of the importance of genetic variation in overcoming problems of variable growth rates, poor tree form, and defoliation by the fireblisht beetle is required. The trials established at Westfield (Florentine Valley) will provide information in all these areas.

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