Technote 3
Direct seeding Sandalwood systems in the N E wheatbelt

Introduction

Sandalwood is a root hemiparasite and its water and nutrients are extracted from the roots of host plants. For this reason, sandalwood plantations must include adequate numbers of host plants to sustain sandalwood growth for between 15–30 years. The method used to establish over 70 per cent of all plantations has been the planting of nursery raised host seedling followed by the sowing of sandalwood nuts one or two years later. This fact

sheet covers how to establish hosts and sandalwood via direct sowing seed. This approach has been used to cheaply establish about 5000ha in the wheatbelt of WA.

It is assumed that an appropriate site, layout and host (or mix of hosts) has been selected.

Before rushing into establishment one should be made aware that most long-term problems arise from poor planning and design and not from the process of establishment. There is often a lag time of up to 10 years between implementation of a poor establishment plan and the expression of the problem within the plantation. The author cannot emphasize enough the importance of site selection, host selection, density and layout.

It can take several seasons to establish a best practice sandalwood plantation, that is, a plantation that contains a uniform coverage of hosts and sandalwood at the desired densities. Indeed there are few "text book" plantations that have been established within one or two seasons. Most require some work beyond year two on all or part of the plantation to achieve uniformity and desired densities. It should also be noted that when considering establishment one should be aware that different approaches can produce an equally productive result, though often at a different cost.

Why direct sow hosts for sandalwood

Direct seeding can be a very cheap method to establish hosts plants. The technique of direct seeding hosts can readily establish hosts at densities of 800-1200 plants per hectare, which is ideal for sustained production of sandalwood over a period of 20 or more years.

A very simple host mix can be sown for a little as $150/ha.

Direct seeding requires minimal labour. A single operator can direct sow large areas in a day, whereas equivalent plantations established by nursery raised seedlings require hand planting teams (numerous people eg "backpackers") or two to several people for machine planting of seedlings.

It is much easier to establish a mix of species via direct seeding than it is via the planting of nursery raised seedlings.

The spines or prickles of some acacia species makes for difficult (or painfull) planting of nursery raised seedlings. This problem is overcome when such species are established from field sown seed.

The biodiversity benefits of direct sown plantings are superior to those established via the planting of nursery raised seedlings because the vegetation established has can have a greater structural and species diversity. This species and structural diversity is difficult to replicate with the planting of nursery raised seedlings alone.

Establishing hosts from direct sown seed can be as reliable (if not more reliable) than establishment via the planting of nursery raised seedlings. The author has spent a great deal of time developing improved equipment and better systems to direct sow legumes. Very robust systems and equipment have now been developed and the net result is that the direct sowing of legumes can now be reliably done in all agricultural regions of WA.

Excellent broad acre results (100–150 ha per year) have been achieved in regions of different climate; from the north eastern wheatbelt, (Koorda on Wodjil sands), Borden in the south, Esperance in the east and throughout the Great Southern region.

Challenges of direct sowing hosts for sandalwood.

While robust systems and improved equipment have been developed the main obstacle to reliable establishment is the fact that direct sowing of legume seed requires a much higher level of competency than that required to plant a nursery raised seedling. In summary, the important factors that determine the success of a direct sowing operation are:

- Practitioner competency
- Selecting the most appropriate sowing method
- Understanding species suitability to proposed site
- Moisture management
- Understanding site conditions (soils [pH, chemical history, fertility], climate, land use history, pests and diseases etc)
- Time of sowing: Optimum time differs according to climate - earlier in the more arid climates and later in wetter areas. Within a region optimum time of sowing can vary with soil type (dry soils sown earlier, moist sites sown later). Time of sowing is also species dependant.
- Niche requirements
- Germination characteristics of species
- Sowing depth
- Seeding rate
- Species mix
- Seed quality
- Seed preparation (breaking dormancy, inoculants).

If sowing a diverse mix of species, proponents should be aware that an inappropriate mix of species can retard sandalwood growth. Alternatively, a well balanced mix of species can deliver exceptional sandalwood growth.

How to direct sow host for sandalwood

Establishment of hosts from seed is most practically carried out using a direct seeding machine which is used to prepare the soil and sow seed in a one pass operation. A common tree planter that is fitted with a small seeds box can be used to direct sow sandalwood host seeds (eg a Chatfield's Tree Planter) that scalps 50 mm of topsoil (to remove weed seeds and harvest water), makes a shallow rip, and scatters seed on the freshly disturbed soil. It is advisable to drag a steel chain behind the machine to ensure shallow coverage of the seed. A seeding rate of about 0.5 kg per hectare will translate to 25 grams (approx1250 seeds) per 100 metre run if there

is 2km of sowing line per hectare. The seeder must be calibrated to deliver the desired amount of seed. This approach can be somewhat unreliable and delivers a non-uniform result. This approach can be dramatically improved by modifying the machine so that the seed is placed in a stable soil environment at a precise depth.

Modified agricultural seeders can also be used to sow sandalwood hosts. Proponents should however seek professional guidance as the sowing of acacias is somewhat different to cereal crops and pastures. While it might seem desirable to sow very quickly with a large modern airseeder, the techniques are usually not as reliable as that achieved with other machinery (modified tree planter or a purpose built native plant seeder eg a CommVeg Seeder). Agricultural machinery does a very poor job of sowing species such as Acacia resinimarginea. Higher seeding rates (double rates given in table 1) should be used when seeding with standard agricultural machinery as this partially offsets lower seed use efficiency. Species such as jam, A. lasiocalyx, A. ramulosa and A.saligna are amenable to sowing with large min-til air seeders. Practitioners should be aware that it can be difficult and costly to fix up failed or patchy host plantations.

The species used in host mixes have relatively large seeds which germinate readily and produce robust seedlings. Most host plants are leguminous and their seeds must be scarified (e.g. hot water treatment) before planting to ensure good germination rates. Hot water scarification can be optimised for each leguminous host species and the author routinely uses a 10–20 second immersion in boiling water with consistent good results. It is very important that each kilogram of seed is placed in an excess (usually five times the volume) of boiling water, that heat is removed via a rinse in cool tap water and the seed is then dried to its pre scarification moisture content or bulked up and sown immediately. Mechanical scarification is also suitable though under and over scarification can be a problem.

May to September is the ideal sowing period, but is dependent upon local climate, soil type and species requirements.

Just starting out?

If you have never direct sown before think about using a combination of direct seeded hosts (250g) and the planting of nursery raised seedlings (500 stem per hectare). As you become more proficient you can reduce your reliance on seedlings. It’s also important to seek professional advice from others who have local experience.

Sowing depth

On loamy soil seeds of *Acacia acuminata* and *Acacia saligna* should be sown at a depth of 10–20 mm. On sands the seed should be sown at 20–30 mm, though the two species are capable of emerging from depths of up to 60 mm. The optimum sowing depth for many other Acacias is not known, though a sowing depth of 10-30 mm is likely to be appropriate for these species.

Species mix and seed treatment.

The host mix depends on the aim of the project. Monoculture host plantations of for example Acacia acuminata can be established very simply via direct sowing good quality seed of this species at 250g/ha. Highly diverse mixes of suitable species can be carefully selected to achieve sandalwood production targets and other outcomes "biodiversity outcomes" forage for livestock etc. The species mix should be tailored to the project aims. Diverse mixes should contain a balance of short lived acacias and longer lived acacias. Seek professional assistance to guide the formation of a productive host mix, as an inappropriate mix will lead to poor sandalwood growth.

The species used in host mixes have relatively large seeds which germinate readily and produce robust seedlings. Most host plants are leguminous and their seeds must be scarified (e.g. hot water treatment) before planting to ensure good germination rates. Hot water scarification can be optimized for each leguminous host species and the author routinely uses a 10–20 second immersion in boiling water with consistent good results. It is very important that each kilogram of seed is placed in an excess (usually five times the volume) of boiling water, that heat is removed via a rinse in cool tap water and the seed is then dried to its pre scarification moisture content or bulked up and sown immediately. Mechanical scarification is also suitable though under and over scarification can be a problem.

Pest and diseases

Many agricultural insect pests and diseases can cause damage or kill germinating or recently germinated acacia seedlings, including RLEM, beetle larvae and rutherglen bugs. Red legged earth mites (RLEM) can cause extensive damage to, or kill, young seedlings. They may kill seedlings even before they emerge and a control program before or just after sowing is essential in most situations.

Nutrition

Acacias are legumes and they have the capacity to fix nitrogen. Selected inoculums are commercially available, though rarely used. In the wheat belt of WA host plants naturally inoculate and a lack of inoculation is rarely observed. The growth of recent Acacia germinants can be enhanced with an application of fertiliser at or after sowing.

Figure 1 Seeding with a precision seeder designed by Geoff Woodall (CommVeg seeder). As shown in this image, good weed control, precision sowing, and a stable soil environment are key to successful direct seeding.

Figure 2. Soil preparation achieved with the CommVeg precision seeder. The machine was travelling from left to right and the image shows the view behind the scalper, showing the ripper (spring tyne), small tillage disks and the floating seeder arm which places the seed

.

This project is supported by funding from Wheatbelt NRM under the Caring for our Country Program

wheatbelt
natural resource
management