



Direct seeding of trees and shrubs for the northern hill country of Victoria

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This note explains how to direct-seed trees and shrubs in the hilly terrain north of the Dividing Range (average rainfall 450- 700 mm and elevation 200-400 metres). Revegetation is vital for this part of Victoria to control land degradation.

Direct seeding (where a seed bed is prepared and seed is sown directly onto the ground), has two main advantages over tube-stock planting:

- the cost of 'planting' is less
- the trees have a stronger root system

Selecting the site

If you haven't undertaken direct seeding on your property before, choose a site with the following points in mind:

- Access will be required in mid winter for pre-sowing weed control. The site must be able to be driven on with a tractor if direct seeding machinery is to be used.
- Aspect can play an important part in the success of direct seeding. North-facing (and often western slopes) are far drier and less likely to be successful.
- Consider the soil type at the site. Soil type will influence the amount of moisture available for germination. Allow for soil types in the timing of sowing. Coarse-textured sands for example dry out much quicker than clay soils. Some soil types will also be difficult to work in late winter when very wet (e.g. the soft plastic clays) and a good tilth in the seed bed will be difficult to achieve.
- The depth of topsoil is very important. Seed should be sown onto topsoil where possible because the subsoil usually has inferior chemical and physical characteristics for direct seeding. This is important if a scalping technique is used.
- Weed control is probably the most important aspect of direct seeding. Where possible choose a site with less weeds. The types of weeds are important. Avoid areas with perennial weeds, especially those that are winter dormant and/or regrow from underground parts, e.g. couch grass, sorrel. Areas with these weeds may require an extra year of presowing weed control.

- The competition from mature trees and shrubs makes establishment close to them difficult.
- Grazing animals, particularly rabbits, hares and stock, must be excluded from the direct seeding sites.

Species selection

Local species

In general the species of trees most likely to grow successfully, provide the most benefit to the environment and regenerate naturally will be those indigenous to the site. At some sites however, the local species may no longer be able to survive due to salting, waterlogging, exposure or pests. Use of non-local species, for this or other reasons e.g. commercial tree growing, will require careful selection of species, provenance, and even individual parent tree in order to maximise tree growth.

Local provenance

When using local species, the seed should ideally be collected locally from similar situations to the proposed site wherever possible. This means using hill top species seed for hill tops, and so on.

What types of trees?

When direct tree seeding, a mixture of *Eucalyptus* (eucalypt), *Acacia* (wattle) and *Casuarina* (sheoak) is the best choice because these species establish and grow well, and are the dominant vegetation in most areas.

Large-seeded species such as wattles and sheoaks generally germinate better in harsh conditions e.g. dry and/or poor soils. Eucalypts and other species with small seeds such as *Leptospermum* (tea-tree) and *Melaleuca* (paperbark) are more dependant on moisture for good germination.

Other useful tree and shrub genera to include are:

Dodonaea, *Callitris*, *Daviesia*, *Indigofera*, *Hakea*, *Banksia*, *Cassinia* and *Helichrysum*.

Seed quality

Seed quality is generally described in terms of viability, the number of seeds per unit weight expected to germinate. The viability of seed can -vary enormously and depends on many factors including the ripeness of the seed at time of

picking, processing or extraction techniques, storage conditions and age of the seed. Generally the fresher the seed the better.

Most wattles due to their hard seed coat can retain viability for decades but sheoak seed stored at room temperature will begin to lose viability after one year (store sheoak and most other seed dry at 4°C i.e. under refrigeration).

Eucalypt seed stored at room temperature is unlikely to remain viable after four years.

If using seed (other than wattles) older than one year or if a large project is planned, find out the seed viability by germinating a small amount.

Simple viability tests can be done by germinating measured seed amounts in a clear plastic container with moist blotting paper, cotton wool or vermiculite in the bottom. Sprinkle a known quantity of seed, say half a gram (less for tiny seed) on top, replace the lid to seal in the moisture and Put it in a warm, light room away from direct sun.

As seedlings germinate, remove them from the container and keep a tally. After one or two months the viability can be calculated by dividing the total number of seedlings by the seed mass originally weighed out. Your local nursery may be able to help you with a similar test.

When collecting tree and shrub seed ensure the genetic 'health' of your seed by collecting from at least ten healthy trees over a wide area. Avoid collecting from isolated trees as lack of cross-pollination produces inferior and/or nonviable seed. If you are interested in seed collection, local nurseries can be very helpful or ask at your local office of the Department of Natural Resources and Environment(NRE) for the seed collection note in this series.

Seed quantity

To calculate how much seed of each species is required, you need to know;

- How many plants you want established.
- How many viable seeds your seed lot contains. The establishment rate you can expect i.e. the percentage of viable seeds expected to become established seedlings. In wattles (large seeds), for example, establishment rates can be as high as 30%. Rates with eucalypts (very small seeds) can be as low as 0.5%.

To calculate how much seed is required.

$$Q = \frac{P}{E \times V}$$

where Q= Seed quantity in kilograms
P= number of plants desired
E= establishment rate
V= viability of seed (number of living seeds in a kilogram of seed).

If, for example, you wish to establish 4,000 trees of a species that has 120,000 viable seeds per kilogram and an expected establishment rate of 5%, then the number of kilograms of seed required is:

$$\frac{4000}{5/100 \times 120,000} = 0.66 \text{ kg (or 660 g)}$$

Often this information is not available, so the general rule of a total of 300 grams of seed mix a kilometre of sowing line can be used. Seed is often the cheapest part of direct seeding and in difficult sites the rates can be increased and the seedlings thinned later if necessary

Seed pre-treatment

Overcoming dormancy

The seed of wattles and other legumes (plants that bear pods like a bean) usually has a hard seed coat which prevents germination.

Overcoming seed dormancy in wattles is easily done by pouring boiling water onto small quantities of the seed. For larger amounts, seed should be immersed in a large volume of boiling water for around one minute. It is often said that the seed has to swell to germinate but this is not true.

Other species may also require some form of treatment before they germinate. Some seed, for example, *Eucalyptus pauciflora* (Snow gum), may require cold, moist stratification (storage of moist seed at 4°C for one month) before germination will occur. Callitris (cypress-pine) seed germination is improved by freezing dry for about one week. Generally however, most seed can be sown without treatment. Direct detailed questions to local nurseries or NRE staff.

Protective seed treatments

The harvesting of seed by ants can be a problem in the drier areas. Treatments are available (e.g. Permethrin, Bendiocarb) for dressing the seed before sowing. The success of these treatments for tree seed has yet to be fully tested. Red-legged earth mite is a problem in some areas; use the normal agricultural means of control.

Timing of sowing

On the northern slopes of the divide, sowings later than August risk failure from a dry spring. Generally, the drier an area the earlier it should be sown. For example, areas with 450 mm rainfall should be sown around July and 700 mm around late August. Always sow seed onto freshly disturbed soil without delay before rain seals the surface and reduces seed-soil contact.

Weed control

Weeds prevent seedling establishment by competition, primarily for moisture but also light and nutrients. Thorough, early weed control creates a 'soil moisture bank' over winter. By tapping into this bank, seedlings can germinate and establish even if rainfall is low (see diagram next page.) Even in a wet year, good weed control will prevent shading and smothering of seedlings.

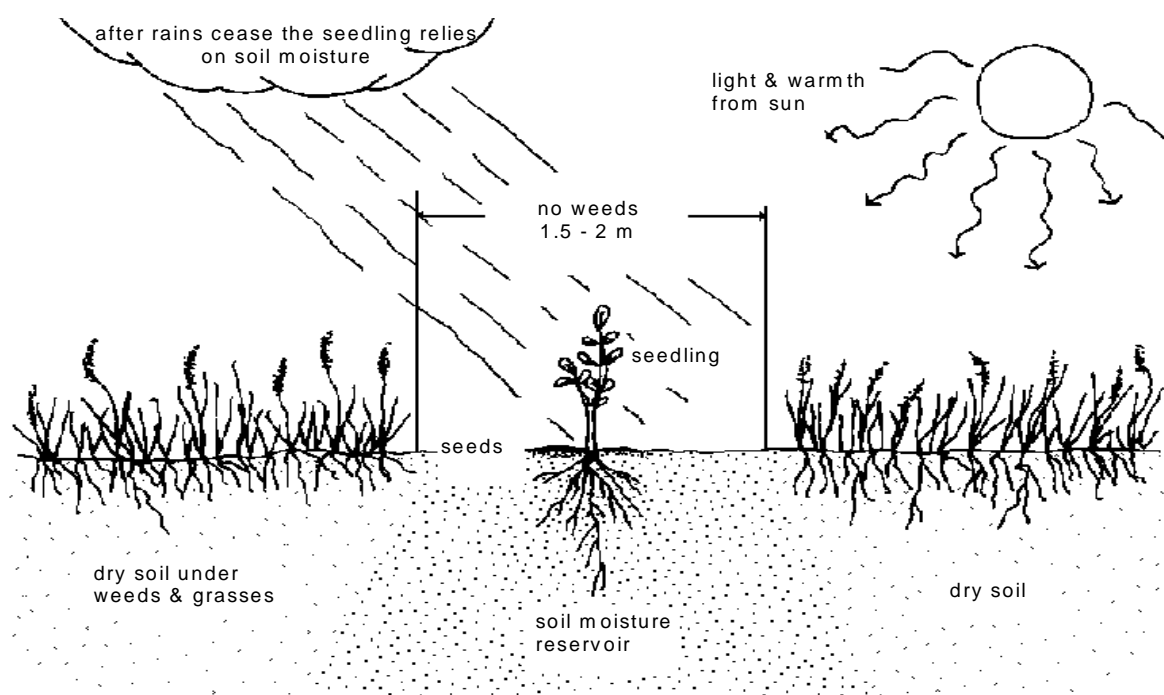


Figure 1: Good weed control and therefore a good supply of soil moisture is essential for the seedlings to establish and continue to survive after the end of the spring rains

Mechanical

Standard broadacre cultivation techniques have not proven very successful in direct seeding because weed control is only short-term. In contrast, mouldboard ploughing and grading give the tree and shrub seed an advantage over weeds through longer weed control.

Mouldboard ploughing turns the soil upside down, burying weeds and their seed. Tree seed is broadcast across the ploughed strips which can be any width (usually the pasture is first killed with herbicide).

Grading the topsoil (and weeds and weed seed) to one side prepares a seed bed with long-term weed control. Some cultivation may be needed to loosen the soil. Tree seed is then broadcast across the strip.

While these techniques are proven in other districts they are only of very limited application in the northern hill country, due to very shallow soils and the steep and rocky terrain.

Presowing herbicides

For thorough weed control, two applications of knockdown herbicide are necessary, spaced at least a month apart. The second spray kills any weeds missed in the first spray; apply it immediately before sowing. Winter-dormant weeds will have to be controlled during the previous summer.

Spray out strips 1.2-2.0 metres wide. The sowing line will be in the centre of the strip and this will provide a weed-free area for germination. Most knockdown herbicides

require six hours after spraying without rain to be most effective. This can be difficult in mid winter.

Read the product label carefully before using any herbicide and follow all label instructions when using that herbicide

Rates need to be chosen according to the weeds present. Where annual weeds are mixed with remnant native ground-cover (which is not very competitive), low rates of some knockdown herbicides applied in mid winter will control the annual weeds but often allow the native vegetation to survive. See advice on the label.

Pre-emergent residual herbicides can also be applied along with the second spray. In the soil these act as a 'chemical blanket' preventing seeds from germinating. Used prior to scalping (which removes the poison 'blanket' from the seed bed), they extend the weed control period into spring and summer.

If there is a known weed problem with prolific regrowth of either summer annuals (eg. heliotrope, wireweed, nightshade) or perennial weeds (eg. horehound, gorse, broom), residual herbicides can provide control (consult the label for species controlled). Residuals may increase the first-season growth of seedlings, *but will not produce more seedlings.*

Be careful with residual herbicides. In sandy soils some residuals such as the triazines (eg. atrazine and simazine) can be washed into the sowing line by rain and kill the seedlings. This can also occur regardless of soil type, if water floods across the surface, for instance in a

downpour. Ask your local NRE treegrowing officer for advice for your area.

Seed bed preparation and sowing

Scalping

'Scalping' by vehicle-drawn disc blade or manually with a rakehoe is widely used and can be employed in rocky ground. At least three commercial direct seeding machines use the technique of removing the weed seed and herbicide affected soil to provide a suitable weed free seed bed.

In most soils the scalping disc should be followed by a soil loosening tyne to allow seed burial, good soil-seed contact (and therefore contact with the soil moisture) and easy root penetration. The tyne should penetrate to around 50 mm. If large, hard clods result, break them up. Ripping before scalping has no benefit.

Do not scalp too deeply. If clay subsoil is exposed seed germination is much poorer. The fertile, moisture-holding and good textured topsoil is vital for the establishment of young seedlings. This may not be such a problem in lighter soils.

Shallow ripping

Shallow ripping (to a depth no more than 150 mm) is also successful especially in less fertile soils and it can be done the day before sowing. Using a bulldozer allows steeper slopes to be treated. As with scalping, contour ripping minimises erosion and loss of seed in runoff. Mechanical weed control is less effective than scalping, so weed control must be thorough.

'Wings' added to ripper tynes throw the sod sideways improving weed control. (See diagram below).

Rip deep enough to break the topsoil; you should not bring up large clods or subsoil.

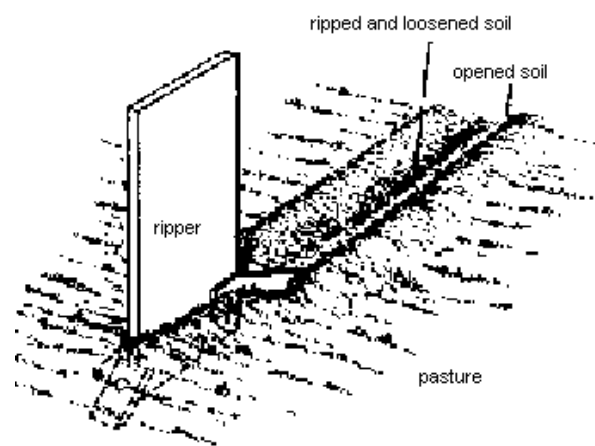


Figure 2: Modification of a ripper by adding 'wings'.

Sowing

If machinery is used, calibrate it so that you know how much of your seed mix will be applied per linear metre or square metre.

Commercial machines

Commercial machines available include the Hamilton direct seeder, the Eco tree seeder, the Shelterbelter and the Rodden III. Your local regional office of NRE will provide further information. For most machines the seed must be bulked up for sowing. Suitable materials include sand, sawdust, gravel, bran or chick pellets.

Sowing by hand

Manual sowing is ideal for many areas being quick, easy and cheap. For larger areas split the seed into portions to ensure there is sufficient for the whole area. Seed can blow away on a windy day.

Manual spot scalp-sowing

Direct seeding of native trees and shrubs using hand tools is a simple and low-cost technique developed by the Woods and Forests Department of South Australia.

Scalp with a rakehoe (available from hardware stores or local fire brigades) and use a knockdown herbicide to control weeds. You will need 200-300 grams of fine seed (such as eucalypt) or 300-500 grams of large seed (e.g. wattle) a hectare, or for each 1000 seeding sites.

As usual, thorough weed control is essential.

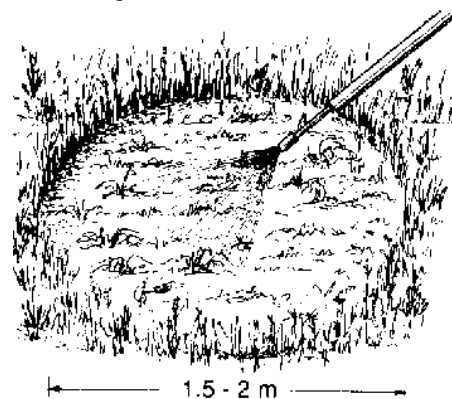


Figure 3: Chemical weed control: Control weeds for a circle of 1.5-2.0 metres



Figure 4: Manual weed control: Remove all weeds but leave litter trash to protect the soil.

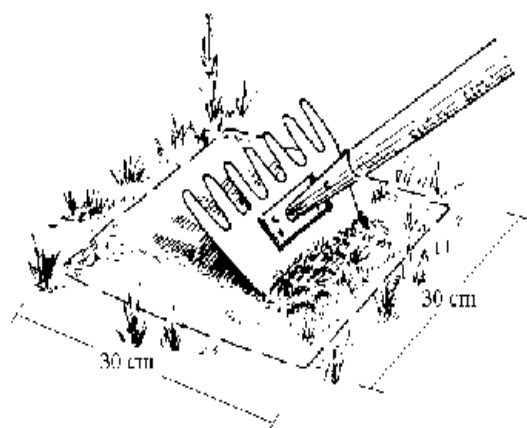


Figure 5: Preparation of the sowing site can be done about one to three weeks after spraying. Scrape to remove dead weeds and trash (30cm x 30cm area)

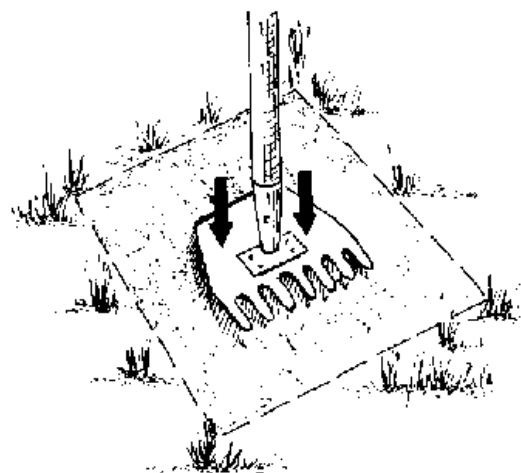


Figure 8: Tamp the surface when using fine seed.. Ideally, bury the seed to a depth of once or twice its size

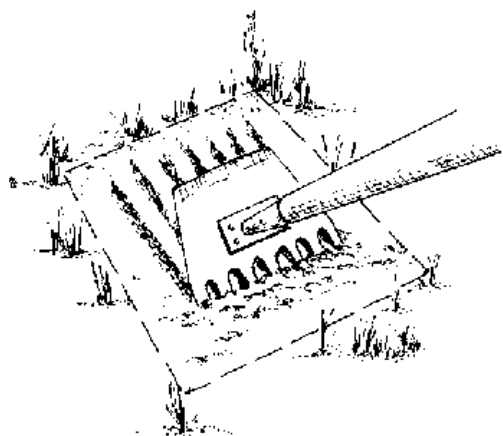


Figure 6: Rake to prepare seed bed

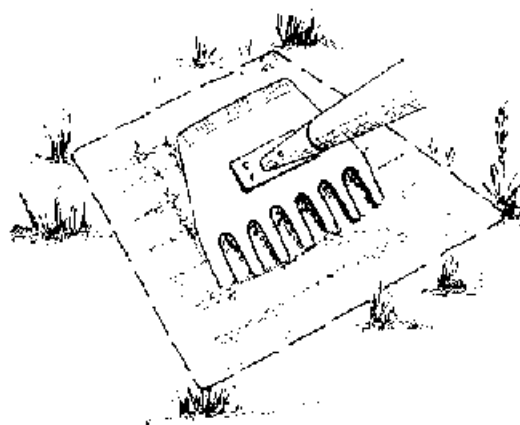


Figure 9: Rake, then tamp for large seed, for example, wattle and sheoak

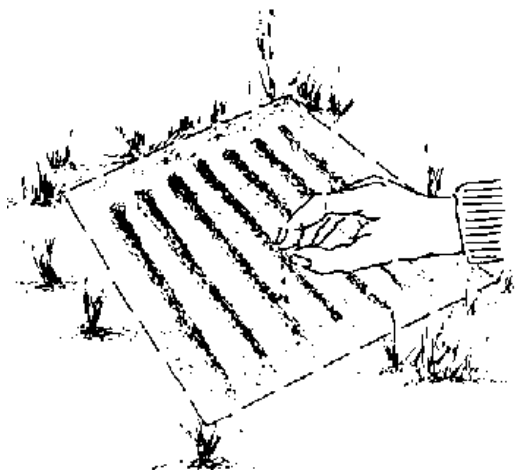


Figure 7: Sowing the seed. A pinch is plenty (10 to 20 seeds). Sow only one species at each site

Sowing depth

Ideally sow seed about the same depth as the diameter. Therefore sow fine seed, such as *Eucalyptus*, *Melaleuca* or *Leptospermum*, onto the surface of the seedbed. Bury larger seed (wattle and sheoak) at the appropriate depth. Some direct seeding machines allow for the different sowing depths and sow fine seed separately, however it is extremely difficult to place the seed precisely in rough rocky terrain.

Reasonable results occur by sowing and rolling down all seed on a rough cultivated seed bed; some seed is buried and some remains on the surface.

Post-sowing weed control

Some weeds always regrow and may require further control. Selective may be used to kill grass without harming seedlings. Boomspray broad-leaf weeds with knockdown herbicides using a shield to protect the seedlings. Rope-wick wipers mean no spray drift; careful spot spraying with knapsacks is also suitable. Hand-hoe small areas.

Read the product label carefully before using any herbicide and follow all label instructions when using that herbicide

An 2 metre-wide spray of seedlings in autumn with residual pre-emergent herbicides (such as simazine, atrazine etc.) can provide weed control until spring. In fertile areas with vigorous pasture or weeds, this can improve survival and growth. Soil-active herbicides are not greatly absorbed by leaves and will not harm seedlings; apply before the major germination of weeds in late autumn. Application to moist soil is most effective.

If weeds have already germinated, it may be appropriate to include a knockdown herbicide to cope with small weeds; trees and shrubs should not be harmed.

Pest monitoring

Grasshoppers may destroy seedlings, although their presence does not always mean significant damage. While direct-seeded trees recover better than tube-stock, local experience may show control is still required.

Further information

Contact your local regional office of the Department of Natural Resources and Environment.

References

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Acknowledgments

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