Revegetation Techniques and Timelines

Peter White
(Nature Conservation Officer, Great Southern District)

and

Gavan Mullan
(Recovery Catchment Officer, Buntine-Marchagee),

Department of Environment and Conservation

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Fig. 1. Successful revegetation, Dongolocking area
Revegetation Techniques and Timelines

An introduction to site preparation techniques, choices of equipment and timing of works

Introduction

Revegetation of cleared farming land is a major component of nature conservation works. It can be achieved in three ways:

1. The use of seedlings
2. Direct seeding
3. Natural regeneration

Each technique can have its advantages, but are strongly influenced by soil types and available soil moisture. There is also a number of different ways each technique may be implemented, e.g. seedlings may be planted either by hand or by machine. Some techniques are more reliable than others, but require more time to get good results. It is important to consider the objective of the planting as well; if it has nature conservation or commercial outcome as its primary focus. At present, there is a reliance on the use of seedlings for revegetation works.

All revegetation has common requirements for success; these are:

a) Control of weeds
b) Control of vermin
c) Matching of species with soil type and landscape position.
d) Adequate levels of soil moisture
e) Preparation of a suitable seedbed
f) Quality seedlings and / or seed.
g) Minimum standards of quality for all aspects of revegetation
h) Correct timing of works

Be aware that even the most reliable technique will fail if poorly implemented.

Weed control

Weeds compete strongly with newly planted or emerging seedlings for both moisture and light. There are three stages where the success of weed control will have a bearing on seedling survival and subsequent growth. Firstly, a weed free area prior to planting will allow more soil moisture to be stored for the seedling and can assist with site preparation i.e. no weeds to clog ripping machinery. Secondly, all weeds present at the time of planting will be using moisture and may even smother the seedlings (common occurrence with Cape Weed). Thirdly, control of late germinating weeds will be necessary to prevent competition with the seedling in a crucial stage of its development.
Revegetation Techniques and Timelines

The two common methods employed for weed control are:

- **Chemical.** Herbicides are widely used to control weeds prior to planting. Knockdown herbicides e.g. glyphosate kills existing weeds, while residual herbicides e.g. simazine prevent the emergence of new weeds. A combination of these is recommended to achieve a suitable weed free period.

  Selective chemicals may be required for problem weeds. This may be as pre or post planting applications. Be aware that some pre planting herbicides can have residual affect on the planted seedlings. Care is also needed with the choice of herbicide and its application rate when overspraying young trees. In some cases, soil type can influence the efficacy of herbicides.

  Chemical weed control can give improved results if it also takes place in the years leading up to planting.

- **Mechanical.** Cultivation can give short-term weed control, while topsoil scalping removes the weed seeds.

**Feral animal control**

Grazing animals can easily wipe out any revegetation project and it is important that this problem be recognised before the planting takes place. Rabbits are a major source of concern and while there is a commonly expressed sentiment “there’s only a few rabbits”, in terms of revegetation, only a “few” can be catastrophic. Some textbooks advocate rabbit control if signs of damage are seen – however, the bitter experience is that by this time, it’s too late for effective control works and subsequent losses of seedlings will be high.

Rabbits can be prolific on sandy and light soils where they can easily dig burrows, but it’s important to remember that rabbits can (will) travel several hundred metres in an evening for a snack of tasty seedlings.

Kangaroos can be problematic in areas alongside bushland and may warrant special consideration, e.g. such as obtaining a damage licence from the DEC District Wildlife Officer to allow culling.

Though not considered “feral”, farm livestock can cause damage if the site is unfenced.

**Soil type and moisture retention**

Farmers also need to consider that, as soil moisture changes the timing for cropping, so it will for site preparation and tree planting. Soils which are too wet one week can be rock hard the next. Attempting to prepare a site where the soil type and available moisture are not compatible with the machinery used will be difficult; subsequent planting will be difficult, and seedling survival and growth compromised. Site preparation may take place in the same month as cropping so it is important that enough time and equipment is available to complete the task.
Revegetation Techniques and Timelines

Soil type and moisture retention will have a considerable bearing on the success of a chosen technique. For example, lighter sandier soils may lend themselves to be worked by a tree planting machine, gravely soils respond well to direct seeding and heavier soils can be better mounded and planted by hand. It is important to assess each site (and each section of each site) on its merits and be aware of the limitations of each technique.

Note that soil type will also influence planting time; that is, lighter soils have less water holding capacity than heavier soils and so, seedlings are more dependent on follow-up rainfall. In heavier soils where soil moisture holding capacity is good, seedlings require little follow-up rainfall after planting - as long as the soil moisture conditions are at or near their optimum at the time of planting.

Preparation of a suitable seedbed

Prior to either direct seeding or seedling planting, the soil will need some form of preparation. Depending on the technique used, this may be at the point of planting or several weeks in advance. Ripping with single or multiple tynes is a common approach, but the specific site requirements may need more consideration. One of the main purposes of ripping is to relieve soil compaction. This may not require excessively deep ripping or a large machine. A more comprehensive assessment of ripping and ripping equipment can be found at:


Similarly, mounding is an excellent technique for improving establishment on waterlogged and mildly saline sites, thought it does have wider application in other situations.

Seed / seedling availability and quality

Seed quality has a considerable influence on the success of both direct seeding and nursery work. Seed needs to be fresh, collected when properly ripe, then cleaned and stored under optimal conditions. Some seed will not be ready in time for the nursery season and will have to be collected 12 months before.

Seedling quality is strongly influenced by seed sowing times and viability rates. Good quality seed is needed and must be available to the nursery in plenty of time. Well grown seedlings are easier to handle, improving all aspects of planting.

Adequate control over planting or seeding quality

Seeds and seedlings have similar requirements; they need to be established when the soil moisture is adequate, when there is a sufficiently long growing period, they must be the correct depth below the soil and, in most cases, properly firmed in.

As an example, fine seeded species such as Melaleucas need to be direct sown on the surface; Acacias to about 10 mm deep. If seedlings are planted too deeply, there may be some losses through stem rot; too shallow and the exposed roots will dry out. Firming the plant in removes any air pockets from around the seedling.
Revegetation Techniques and Timelines

Seedlings must be kept moist prior to planting; and may dry out and die while sitting in the paddock waiting to be planted. Seedlings also need to be transported in a covered trailer or under a tarpaulin on the back of a utility. Seedlings will desiccate rapidly if exposed on the back of a moving utility.

**Correct timing of works**

Table 1 sets out a timeline for establishment works (primarily for seedlings) using either machine or hand planting.

Note that while every season is different, it’s important to keep the revegetation site bare from weeds from the beginning of the growing season. Pre-planting soil moisture conservation is a key element in seedling survival and performance.

![Good site preparation: rolled mounds over multi tyne ripping](image)

**Fig. 2.** Good site preparation: rolled mounds over multi tyne ripping

![Simazine damage](image)

**Fig. 3.** Simazine damage

![Excessive weed competition due to poor preparation and lack of post planting inspection](image)

**Fig. 4.** Excessive weed competition due to poor preparation and lack of post planting inspection

![Quality seedlings](image)

**Fig. 5.** Quality seedlings
1. **General prescription: Site preparation for establishing seedlings (based on using tube type hand planting tools)**
   see Fig. 6 & 7.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</table>
| Jan / Feb / March / April | • Control summer weeds. Note, some weeds, e.g. stinkwort and goosefoot are known to inhibit germination of winter crops via their allelopathic effect (they release chemical compounds into the soil to limit winter growth and so conserve moisture for the following generation of summer weeds). Seedling survival and growth may also be affected.  
  • Ensure site is clean – free from stubble, thick dry grass, summer weed residue, etc. |
| Feb / March / April | • An assessment of the soil types will help determine the equipment required for ripping. Heavy machinery is not necessary on light to medium textured soils; an agro plough or the DEC Multi tyned ripper is suitable. The main purpose of ripping is to break through any artificial hardpan; deeper than this can be counter productive.  
  On heavier soils e.g. breakaway slopes, contour ripping with a bulldozer will be necessary. The riplines will have to be run over with the dozer tracks to flatten off the large clods. |
| Feb / March / April | • Mound site if applicable. If salt affected, use ‘V’ notch press wheel. If fresh, use flat press wheel. Note: mounds are sufficient at 5 - 10 cm above ground level. |
| May / June | • After substantial germination of weeds, spray with a knockdown herbicide, e.g. Roundup® 450 g/l at 1 L per ha. |
| mid July | • Second spray application. Spray with a knockdown and a residual herbicide (mixed), e.g. Roundup® at 1 L per ha + Simazine® 500 flowable at 4 L per ha. This should give weed control extending into September. This is particularly important in southern areas that can receive substantial spring rainfall. |
| end July / early August | • Plant seedlings after two weeks with-holding and about 25 mm rain - post Simazine® application. Note, as the clay content of the soil increases, there is less risk of the Simazine® leaching through the profile and / or moving off-site. For example, with a valley floor clay soil, a with-holding period of 3-4 days has been used successfully; however, with a deep sandy soil, the maximum with-holding period is recommended |

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1 Though not always widely practised in the Wheatbelt, hand planting can be a very efficient way to establish seedlings in large numbers. Good control can be maintained over planting quality and the planting technique can adjust easily to soil moisture conditions. Short rows and rapid changes in species can be readily accommodated.
Revegetation Techniques and Timelines

2. **General prescription:** Site preparation for establishing seedlings (based on scalping of topsoil and using a tree planting machine) see Fig. 8.

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<thead>
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| Jan / Feb / March / April | • Control summer weeds. Note, some weeds, e.g. stinkwort and goosefoot are known to inhibit germination of winter crops via their allelopathic effect (they release chemical compounds into the soil to limit winter growth and so conserve moisture for the following generation of summer weeds). Seedling survival and growth may also be affected by this.  
• Ensure site is clean – free from stubble, thick dry grass, summer weed residue etc. Though the site will cleared by the scalping blade, weed residues can still clog the ripping tyne. |
| Feb / March / April | • If soil surface is very hard or clayey, pre-rip or cultivate the site (may require more than one pass if very hard). Prepare the site as soon as moisture softens the subsoil. Pre planting work such as this will increase the safety and efficiency of the tree-planting machine. |
| June to Aug        | • Set scalping blades, mounding discs and ripper depth to suit soil type and moisture levels. Consider spraying out the strips between the rows as these weeds will throw seed onto the scalped area. |

Note that while every season is different, it’s important to keep the revegetation site bare from weeds from the beginning of the growing season. Pre-planting soil moisture conservation is a key element in seedling survival and performance.

Machine planting can be an effective way to prepare and plant large areas. However, care needs to be taken with planting depth and quality. Machines may not be suited to all sites. Scalped areas may channel water and seedling performance may be reduced due to the removal of soil nutrients and growing media.
### Revegetation Techniques and Timelines

#### 3. General prescription: Site preparation for direct seeding (based on scalping the topsoil and sowing the seed with a direct seeding machine) see Fig. 9.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Jan / Feb / March / April</td>
<td>Control summer weeds. Ensure site is clean – free from stubble, thick dry grass, summer weed residue etc.</td>
</tr>
<tr>
<td>Feb / March / April</td>
<td><strong>•</strong> An assessment of the soil types will help determine the equipment required for ripping. Heavy machinery is not necessary on light to medium textured soils; an agro plough or the DEC Multi tyned ripper is suitable. The main purpose of ripping is to break through any artificial hardpan; deeper than this can be counter productive. Direct seeding is generally less successful on heavier soils.</td>
</tr>
<tr>
<td>May / June</td>
<td>After substantial germination of weeds, spray with a knockdown herbicide, e.g. Roundup® at 1 L per ha.</td>
</tr>
<tr>
<td>Late May – approx. late June ²</td>
<td><strong>•</strong> At any time after soil moisture has dampened the profile to depth (test by digging into the soil profile), machine sowing can start. Sculp to a depth of about 5 cm. <strong>•</strong> Sowing just before a rain event or during the rain is ideal. <strong>•</strong> Use vermiculite as a seed bulking agent. Dampened vermiculite carries the seed more effectively than dry vermiculite (use about 20 - 60 L per ha vermiculite). Mix seed and vermiculite in a cement mixer or similar. <strong>•</strong> Work on the contour.</td>
</tr>
<tr>
<td>Mid June (after direct seeding and before seed germination)</td>
<td><strong>•</strong> Spray whole site with insecticide for control of Red Legged Earth Mite. Use a ‘bare earth’ insecticide such as Talstar® at about 200 ml per ha.</td>
</tr>
</tbody>
</table>

**Notes:**

- Plan for a weed free perimeter buffer of about 2 m. Apply insecticide to this strip also.
- Use local direct seeding knowledge where possible.
- Sandy or clay surfaced soils are less suitable than loamy soils for direct seeding. Sandy soils dry out very quickly at the surface and clay can be hard setting.

² Earlier sowing is preferred if moisture is sufficient – warmth helps stimulate germination.
### Revegetation Techniques and Timelines

#### 4. General prescription: Site preparation for direct seeding

*based on scalping the topsoil with a grader and sowing the seed manually - with a hand spreader or sowing the seed with a conventional combine seeder* 

[see Fig. 10 & 11.]

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>Jan / Feb / March / April</td>
<td>• Control summer weeds. Ensure site is clean – free from stubble, thick dry grass, summer weed residue etc.</td>
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<tr>
<td>April / May</td>
<td>• Scalp topsoil with a grader.</td>
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<td>• Rip whole of scalped area with multi-tyned grader ripper.</td>
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<tr>
<td>Late May - late June(^3)</td>
<td>• At any time after soil moisture has dampened the profile to depth (test by digging into the soil profile), sowing can start. Sowing just before a rain event or during the rain is ideal.</td>
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<td>• If sowing seed manually, cultivate the scalped and ripped area immediately before sowing seed (this breaks the crusted surface that inhibits soil-seed contact).</td>
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<td>• If sowing with a conventional seeding machine, use the tynes to cultivate the soil surface and direct the seed delivery hoses to the rear of the cultivating tynes.</td>
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<td>• Sow seed on the surface. If there is a large percentage of large seeded species in the mix, e.g. Acacia species, drag a 2 m section of old carpet or similar. This will give the seed a slight soil covering.</td>
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<tr>
<td></td>
<td>• Work on the contour.</td>
</tr>
<tr>
<td>After direct seeding and before seed germination.</td>
<td>• Spray whole site with insecticide for control of Red Legged Earth Mite. Use a ‘bare earth’ insecticide such as Talstar® at about 200 ml per ha.</td>
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#### Notes

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\(^3\) Earlier sowing is preferred if moisture is sufficient – warmth helps stimulate germination.
Revegetation Techniques and Timelines

Fig. 6. Seedlings planted onto a low profile mound (about 5 cm above ground level). The flat and smooth surface of the mound is ideal for applying residual herbicide - gives a complete and even coverage. The flat surface also prevents concentration of herbicide, as occurs on irregular surfaces. Concentration of residual herbicide is often fatal to seedlings.


Fig. 7. Ripping with heavy machinery is sometimes necessary, but usually only for hard setting soils and steeper slopes. Ripping in this instance followed the contour.
Revegetation Techniques and Timelines

**Fig. 8.** Seedling establishment using a tree-planting machine for a one-pass operation. Weed control achieved by the removal of the topsoil i.e. scalping. Note: to optimise results, this method can be combined with herbicide weed control at the beginning of the growing season.

This method can have good success, especially where soils have a sandy texture and flow freely around the ripping tyne and seedling ‘niche’, and are easily firmed in by the press-wheels. Some difficulty may be found with changing species to accommodate differing soil types.

**Fig. 9.** Direct seeded site; scalped in narrow lines with a trailable direct seeding implement; very dense along the lines (about 4 m between scalped lines). A mixture of shrubs and trees: this method can have good success, but the density along the rows may compromise plant growth.
**Revegetation Techniques and Timelines**

**Fig. 10.** Direct seeded site, scalped with a grader. The mound is the spoil from two passes of the grader (soil stockpiled on site to reduce cost of scalping, i.e. removing off site). Manual seeding technique, resulting in very dense stocking – many thousands of stems per ha. Shrub layer mostly *Melaleuca* spp. Note scattered *Eucalyptus* spp. emerging above shrub layer. Part of the soil mound was planted with *Eucalyptus* seedlings - at rear of image.

Some good results, but a heavy use of seed. Not suited to lighter soils.

**STEP 1.**

**STEP 2.**

One grader blade

**STEP 3.**

**Fig. 11.** Recommended sequence of grader scalping minimises the risk of contaminating scalped area with weed seeds, i.e. topsoil isn’t graded over scalped soil

White and Mullan 2006
## Revegetation Techniques and Timelines

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<td>Site selection and inspection</td>
<td>Inspect sites while winter growth is still a good indicator of site conditions</td>
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<td>Seed collection</td>
<td>Collect and clean seed</td>
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<td>Bait trails, warren fumigation</td>
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<td>Planning</td>
<td>Mark out sites, plan fencing program, plan ripping</td>
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<td>Site preparation works, complete ripping and mound if necessary</td>
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<td>Weed control</td>
<td>Control summer weeds if necessary</td>
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<td>Pre planting control of winter weeds according to prescription</td>
<td>Post planting control if necessary</td>
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<td>Hand planting</td>
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<td>Sandy or gravelly upper slope areas first (June), mid slope. Then heavy soil, lower slope areas</td>
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<td>Machine planting</td>
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<td>Sandy or gravelly upper slope areas first (June), mid slope. Then heavy soil, lower slope areas</td>
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<td>Finish fencing after planting</td>
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<td>Insect control</td>
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<td>Check for insect pest damage.</td>
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### Table 1. Timeline for revegetation establishment works

4 Note that the seed collection indicated for this period is for a nursery program in 18 months time
5 Shades areas indicate farmer responsibilities (some may be shared)
6 Planting times may vary according to rainfall, planting times will also be slightly later than the herbicide application
7 Planting times may vary according to rainfall, planting times will also be slightly later than the herbicide application