



Weed control for farm forestry plantations

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This Agriculture Note provides an overview of the weed control required for successful establishment of farm forestry plantations. It includes information complementary to the Agriculture Notes AGO770: Site preparation for farm forestry, and AGO788: The use of fertiliser in farm forestry.

Weed control in farm plantations and woodlots is crucial during the first 2 growing seasons. Without adequate weed control, competition for water, nutrients and light can lead to high early mortality of trees. Slow growth of surviving trees is inevitable if weeds are not controlled.

Good weed control leads to fast early growth, and trees more rapidly dominate the site, providing their own measure of weed control by shading out weeds, particularly along the cultivated rows (ripped, mounded or both) or seeded rows. Good weed control also ensures that nutrient and water is available to the trees. Grasses in particular are very competitive along with some of the deeper rooted broadleaved weeds such as Flatweed-dandelion, Docks, Sorrel, and numerous others. Tall, deep rooted grasses such as *Phalaris* spp. can shade out trees as well as out-competing trees for water. Another example is Bracken fern - a severe competitor for phosphorus.

Weed control should be continued until the trees are dominating the site. For example, slower growing *Pinus radiata* (Radiata pine) requires 2 years of weed control. Generally the mean height of the faster growing *Eucalyptus globulus* (Blue gum), should be at least 2 m after 1 year. It is usually necessary to apply a second herbicide application in the autumn - early winter of the year after planting (**second season weed control**). Advantages often include better trafficability for machinery (sites can be too wet in winter – early spring) and minimal weed competition during the following spring

Classification of herbicides

Herbicides used in plantation establishment are usually systemic, that is, the chemical is translocated throughout the weed. These herbicides can then be described in terms of other properties as follows.

Foliar knockdown herbicides

These may be either broad spectrum ie. control a wide range of weeds, or specific to particular weed types eg. grasses, or classes of broadleaved weeds. These herbicides act only through foliar uptake by existing weeds.

Soil residual herbicides

Similarly, these may be either broad spectrum or weed class specific. They can act through:

- root uptake by existing weeds
- by pre-emergence or early post-emergence activity, such as contact by the emerging weed with chemical on the soil surface or close to the surface
- uptake by the developing roots
- some herbicides can be taken up by both foliage and roots

Application of soil residual herbicides provides ongoing weed control for several months, particularly during the high growth seasons of spring and autumn. These herbicides require adequate soil moisture for activation.

Mode of Action

Herbicides are further classified as to their 'Mode of Action'. There are 14 Mode of Action groups with a letter code of A to N (found on the label). The Mode of Action designation indicates the point at which the chemical disrupts the plant growth chemistry. Examples of these disruptors include:

- photosynthesis inhibitors
- disruptors of cell growth
- inhibitors of protein synthesis.

Types of herbicide products

These may be liquids or solids. Liquids include flowables (which are very finely divided suspensions) and chemicals dissolved in solvents such as water, alcohol, or oils. Oil based products form emulsions when mixed with water.

Solids include dry flowables and wettable powders (which form suspensions when mixed with water) and water soluble granules (which are usually a high concentrate product).

A recent development is that of soluble packs of pre-mixed high concentration solids containing 2 or more residual herbicides. The herbicide mix is packaged so that a single pack is the correct quantity to broadcast spray a given area, usually one hectare. Another type is soil-dispersible granules, which contain only soil residual chemicals. These are best applied to bare soil and require soil moisture for activation (breakdown of the granule and release of chemical).

Site assessment

Before any site preparation is carried out, the site should be assessed 9-12 months before planting for both weed cover and soil type.

The weeds present may determine that immediate treatment is required. For example, Bracken fern is very difficult to treat after trees are planted. This woody weed requires pre-conditioning for successful control, either by slashing or an initial herbicide application in the winter - spring to stimulate new growth. This should be followed by a further treatment in mid to late summer before site preparation.

Other woody weeds may require treatment at a specific time of year eg. the appropriate time to treat Blackberry is December-January (at the early flowering stage).

Summer active grasses such as *Phalaris*, Couch, Paspalum or Kikuyu will also require treatment at an early stage, utilising the principle that weeds are best treated when small. Seed set control (see below) is also an option.

The type of soil is important when considering the rates at which some residual herbicides are applied either pre- or post-planting. In general, the lighter textured soils (sands) should be treated with lower rates of certain residual herbicides. However, a broadcast treatment is usually applied to sandy or light textured soils which are less water retentive, whereas a strip application may be appropriate for heavier textured loams and clay loams.

Non-chemical weed control

There are several mechanical and other non-chemical methods of weed control to consider prior to planting.

Pre-cropping

One approach is to grow a crop (excluding grass or grass cereal) on the site during the previous spring/summer. This eliminates annual weed seed set and improves tilth during site preparation, due to the initial cultivation. Hay cropping also removes seed and improves subsequent site preparation.

Scalping

Scalping is used in some circumstances for plantation establishment, for example, *Pinus pinaster* (Maritime pine) plantations in Western Australia. Scalping involves removing the weed and topsoil with a blade (tractor or bulldozer), and is usually only carried out on flat sites. Disadvantages include cost and possible tree nutrition problems resulting from the removal of topsoil. Further, on any land previously cropped, the soil seed bank will be present at depth, thus requiring deeper scalping.

Grazing

The weed mass can be substantially reduced by grazing prior to site preparation. Grazing can also be used to remove inter-row growth when the trees have attained a sufficient height eg. in the second spring and later when eucalypts have developed mature foliage and are in excess of 2 m tall, or later still in slower growing *Radiata* pine.

Other non-chemical methods

These are largely still experimental, and include heat kill of weeds with gas burner equipment set close to the ground (called flaming), or steam, which sterilises the surface soil, destroying near-surface seed. Weed mats are effective but add to cost.

Seed set control

The main agricultural weeds are grasses (annuals and bi-annuals) and broadleaves. These exist in high densities, up to thousands per square metre, and are severely competitive if not controlled. The survival of annual weeds is primarily dependent on massive seed sets every year, since the seed has a low dormancy period.

Seed set control involves 'freezing' the site before the weeds can set seed. 'Freezing' means the application of herbicides to prevent annual grass and broadleaved weed seed set at the growth stage just prior to elongation and formation of seed heads. It involves a broadcast kill of all weeds present, and differs from spray topping in agriculture where low rates of herbicides are used to prevent seed set without killing the grass.

Apart from reducing the quantities of all weeds in the following year, it selects weeds that have a greater reliance on seed dormancy. This means that there is a severe reduction or elimination of grass species, but an increased proportion of Clover, Flat Weed, Plantain and others. The result is a broadleaf dominant pasture, with a much lower overall weed cover. Ploughing before seed set is also effective.

Grasses controlled early have a low lignin content, and residue breakdown and soil root release occurs far more quickly. The formation of large grass root clumps is prevented, so that cloddiness is reduced and tilth improved when ripping and mounding is carried out.

Timing of herbicide applications

It is important to maximise any accrued benefit from chemical weed control. Weeds are best controlled when small. Control at an early stage requires minimum label rates of chemicals, reducing costs and minimising the potential for harmful effects such as movement off-site.

A pre-planting application is usually used in eucalypt establishment, because there is no suitable immediate post-planting prescription. This also applies to most other non-*Pinus* sp. plantings and direct seeding. If ripping and mounding is carried out before the autumn break in the weather, and planting is in mid-late winter, there is normally a period of about 2-3 months between site preparation and planting which allow mounds to settle (and eliminate air pockets), during which weeds can

germinate. However, ripping and/or mounding is not always necessary - see AGO770: *Site preparation for farm forestry*.

Pre-planting applications of herbicide are carried out within a period of a month to about 10 days before planting.

Where there is existing weed cover on the planting rows prior to planting, tank mixes of a broad spectrum foliar knockdown herbicide with one or more soil residual herbicides are commonly used. Such tank mixes provide knockdown of the existing weed cover with the foliar knockdown herbicide, and maximise the soil residual period of the residual herbicides. For bare soils, the foliar knockdown component is not required.

Soil applied granular herbicides are not used for the initial establishment of eucalypts, but may be used in establishing Radiata pine.

For various reasons, weed control may not be sufficiently effective and a treatment in the late spring may need to be applied to control, for example, an emerging summer active grass. Suitable herbicides are available but are more expensive, and in some cases risky, because higher temperatures and good soil moisture may predispose actively growing trees to be more susceptible to phytotoxic (herbicide) damage.

For Radiata pine, there are suitable spray and granular herbicides which allow treatment to be delayed until up to 2 months or more after planting. Pre-planting treatment may be preferred, and is usually cheaper.

Table 1 provides an establishment sequence.

Table 1. Plantation establishment sequence

Time of year	Action required
October-November	Inspect weeds and determine soil type. List weeds, including annual/perennial grasses, Sorrel, Dock, Thistles, Ragwort, Blackberry, Bracken.
Before grasses flower, late October-November	Boomspray with appropriate tank mix to kill as much of the weed cover as possible.
December-February	Spray Blackberry during early flowering. Respray problem areas, areas of initial poor control, and re-emergent Bracken. Grasses should break down rapidly due to low lignin levels.
February-April	Ripping and mounding.
May-June	Following the autumn break, assess weeds on mounds, and spray with tank mix of foliar knockdown and residual herbicides.
July-August	Plant trees. Regularly inspect thereafter for weeds.

The above sequence is more suited to large plantations. As soil type, climatic conditions, locality and the type and size of plantations vary from one site to another, each site may require a different sequence. Spring planting or seeding is preferable on sites which are water logged in winter eg. basaltic soils in south-west Victoria, or duplex soils in

Gippsland. The sequence then requires pre-planting application of herbicides in late winter or early spring. A broad spectrum foliar knockdown herbicide combined with soil residual herbicides kills existing or emerging weed and provides longer term control, preferably through to the following autumn. However, rates of application of herbicides are usually less than in the sequence in Table 1. This is because the period required for extended weed control (to the following autumn) is shorter, and because rates at which residual herbicides are applied are seasonally dependent. There is more risk of phytotoxic damage to actively growing seedlings if residual herbicides are applied late in spring or into early summer. Late winter to early spring applications prior to spring plantings, and use of lower rates for spring plantings and direct seeding, usually need to be considered in order to avoid phytotoxic effects.

Second season weed control

Second season weed control is usually carried out in the autumn to early winter period of the year after planting, but may be delayed until spring if the initial first season weed control has given an effective weed free year.

Spray applications for eucalypt plantations are usually directed ie. half of each mound is sprayed using directed (sideways) nozzles on either side of a low boom. The herbicide prescriptions again usually include a foliar knockdown component which if sprayed over the top of the trees can cause unsightly short term scorch.

It may be necessary to also control inter-row weeds, either by slashing or by a herbicide application. Certain herbicides used for this purpose need to be applied by shrouded boom to protect the trees. Shrouds for boom sprays are usually heavy skirts on a frame over the boom, and can be of heavy plastic or 'straw broom' construction. Their purpose is to prevent spray drift of chemicals which will scorch the trees.

In the second season, Radiata pine can be oversprayed with appropriate products. For spring plantings or direct seeded species, early autumn overspraying after rain with minimum rates of residual herbicides is usually sufficient to provide weed control until the following spring.

For both eucalypts and Radiata pine, granular herbicide products can be accurately applied in the second season. Spot treatments of diameter 1-2 m are applied around a tree by the hand-held 'Weed-A-Metre'. Strip (band) treatments also use specialised granule applicators, which include a powered back-pack applicator and a tractor applicator (3 point linkage).

For strip applications, either spray or granular, the width should be at least 2 m, and on sandy sites, broadcast application may be preferred.

Dr Rod Bird and associates have carried out considerable work, regarding the establishment of direct seeded trees on farms, at the DPI's Pastoral and Veterinary Institute at Hamilton. Research has shown that overspraying of mixed species with many different herbicides in many cases increased survival. Although this is potentially harmful to

the trees, the effects were not severe enough to cause significant damage (Bird et al 2002).

Readers are also referred to Dr Bird's book (Bird, 2000).

Application volumes for spraying

To some extent, application volumes for spraying depend on the terrain (speed of tractor, etc.). However, on pasture sites volume is usually in the range 100-150 L of spray mix per hectare.

Costs

Chemical cost of pre-planting treatment in the establishment of eucalypts, is less than \$100 per hectare on a broadcast basis. Costs may be less than \$50 for a strip application, depending on the proportion of the area treated (which in turn depends on the inter-row spacing).

Costs are further reduced for applications for direct seeding or spring plantings, where lower rates are used.

Chemical costs for establishing Radiata pine are higher if certain standard prescriptions are used. These 'standard' prescriptions are of long standing and may be spray or granular, but specific rates of one or both of two particular chemicals are usually applied.

The costs of granules for both eucalypts and pine, are about \$200 per hectare or greater, on a broadcast basis.

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