



Preparing Grass Sites for Planting Natives ~ use of herbicides

INTRODUCTION

Many planting sites, perhaps most, will be long or short grass and weed cover, such as found on recently retired or abandoned farmland. There are two major reasons why it is imperative that effective control of the grass is obtained at planting and then maintained for at least two years after planting. Firstly grasses are especially damaging to early growth of native species because of overtopping and smothering. Secondly, and less obviously, grasses produce a fine root mat that is much more effective in nutrient and water uptake than the planted tree, and can easily compete with the tree for these essentials.

Herbicide is the preferred method of grass and weed control at planting and in later management. It is the poor management of competing vegetation cover, especially grass, that most often compromises survival

and growth of planted native trees and shrubs. Site preparation methods and outcomes are influenced by a range of factors including the scale of the proposed planting programme, resources available to undertake the planting and a wide range of environmental and site factors such as degree of exposure, presence of problem weed and animal pests, and local climate characteristics.

The focus of this article is on preparing open grass sites using herbicides to allow planting of native trees and shrub species. Preparing sites for planting into woody weed infested sites or into native shrubland are covered in other articles within Section 7 of this Handbook, as is the management of animal pests and fencing of livestock.

SITE PREPARATION USING HERBICIDES

Herbicide alone has proven to be adequate in preparing most grass sites for planting. Cultivation, while useful perhaps on compacted soils, is not normally considered necessary.

Planting into short or rank grass

A grass sward may be heavily grazed or even mowed prior to herbicide treatment or it may be left rank. The merits of planting into a dense sward of rank grass or into a short grass sward are presented in the side box.

Choice of planting rank or short exotic grass and weed covered sites will be dependent on site factors, resources available and scale of proposed planting programmes. There are likely to be advantages, especially in low rainfall areas, of planting into herbicide-treated rank grass sites where the mulch of dead grass will suppress weed seed germination and growth and will help retain moisture. In high rainfall sites, this may not be critical, but the bare ground left where short grass has been sprayed will be havens for germination of weeds when a germination-inhibiting chemical is not used.

For planting natives into a short sward of grass such as on farm sites, stock can be used to hard-graze to remove top growth before the site is permanently fenced to exclude stock and the site sprayed with herbicide and planted. Alternatively, mowing or mulching by tractor machinery may be practical on accessible sites or by motorised weed and scrub cutters.



Where practical stock can be used to graze pasture to a low height to allow spraying with herbicide before planting with natives.

Rank grass vs low grass sward

There are advantages and disadvantages in preparing rank grass and short grass for the planting of native trees and shrubs.

Rank grass sward

Advantages include:

- No mechanical removal or grazing is required to reduce the rank grass cover;
- After spraying, dead grass can act as a mulch which aids moisture retention and suppresses weed establishment;

Tall grass may deter rabbits.

Disadvantages include:

- Rank grass, especially if it comprises a high proportion of dried leaves and stalks, is less efficient in uptake of herbicide; follow-up applications of herbicide may be required to ensure a complete grass kill;
- May be difficult to identify sprayed spots amongst dry rank grass; blanket spraying for rank grass may be more practical;
- More difficult to plant seedlings amongst a dense thatch of sprayed rank grass.

Low grass cover

Advantages include:

- Short, actively growing green grass cover is highly receptive to uptake of herbicide from a single application;
- Easy to identify planting spots by presence of dead or dying grass or marker dye (if applied);
- Easy planting of seedlings into short dead grass cover.

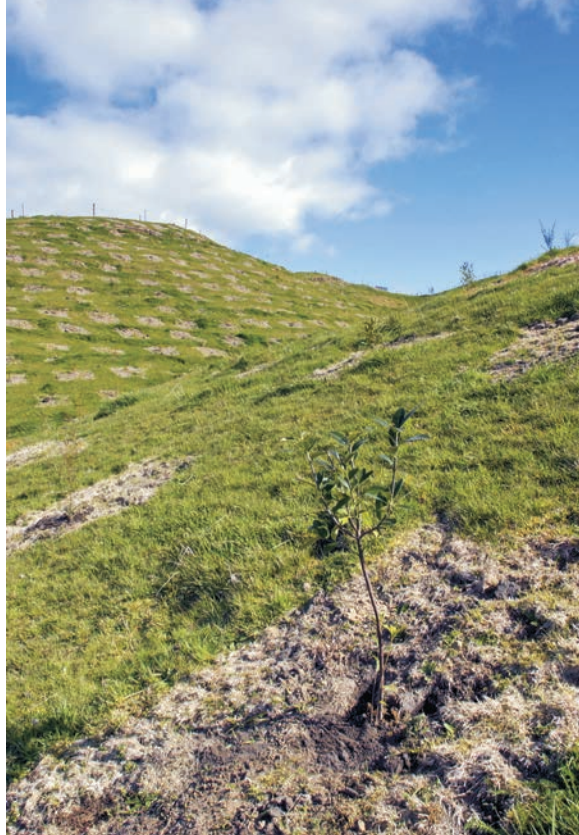
Disadvantages include:

- Depending on the site, a low grass cover will need to be achieved by grazing or mowing prior to planting;
- Grazing will require fencing and stock;
- Mowing will require machinery for which access and cost may limit use;
- Herbicide sprayed short grass can create bare ground receptive to weed germination; and
- Lack of ground cover (mulch) leaves bare planting sites vulnerable to moisture loss.

When to spray

Depending on the grass sward and the herbicide chemical used, spraying should be carried out at least a month before planting (Ledgard and Henley 2009). This will allow time for the herbicide to be taken up by the vegetation and for sprayed areas to show up. In cooler areas, some herbicides may take several weeks to be visible and marker dyes may be needed to aid detection of spots (refer to later section).

As most herbicide formulations operate by uptake of chemical through green leaves and stems, it is best to spray herbicide when there is a high level of actively growing foliage. Uptake of chemical by recently cut vegetation, by plants that have frosted or salt-burnt foliage or by plants that are dormant is likely to be less effective than healthy growing plants with plenty of leaf surface area. This applies equally to grass as it does to woody plants. In addition, for improved foliar uptake, herbicides are likely to be more effective if sprayed early in the day, but after dew on leaves has dried.



Large-scale site preparation of a recently retired farmland involving pre-plant spot-spraying with herbicide.

SPRAY METHODS

There are two options for the application of herbicide to prepare grass sites for the planting of natives - spot-spraying or blanket-spraying. Choice largely depends on the density of planting.

Spot-spraying

Most large-scale planting programmes on grassland involve the use of knapsack sprayers to spray spots at the intended plant density. Spot spraying is efficient from a minimum plant spacing of about 1.5 m between seedlings (approximately 4500 stems per hectare). The advantage of spot spraying is the use of significantly less quantities of chemical for the lower density plantings and the shelter provided by the surrounding vegetation. The relatively lower-pressure spray application from knapsacks compared to high-pressure spray application from motorised equipment may reduce any associated risks of spray drift in confined sensitive areas.

Ideally, a sprayed spot of up to 1.2 m wide is required for each seedling to ensure rank grass does not overtop plants within the first year. Pre-plant spot-spraying of grass is best undertaken using a fan nozzle and applying the spray with up to 3 parallel strokes to give an even coverage of herbicide (Davis and Meurk 2001). Circular spraying tends to result in greater overlap and consequently more herbicide applied than is necessary (Figure 1).

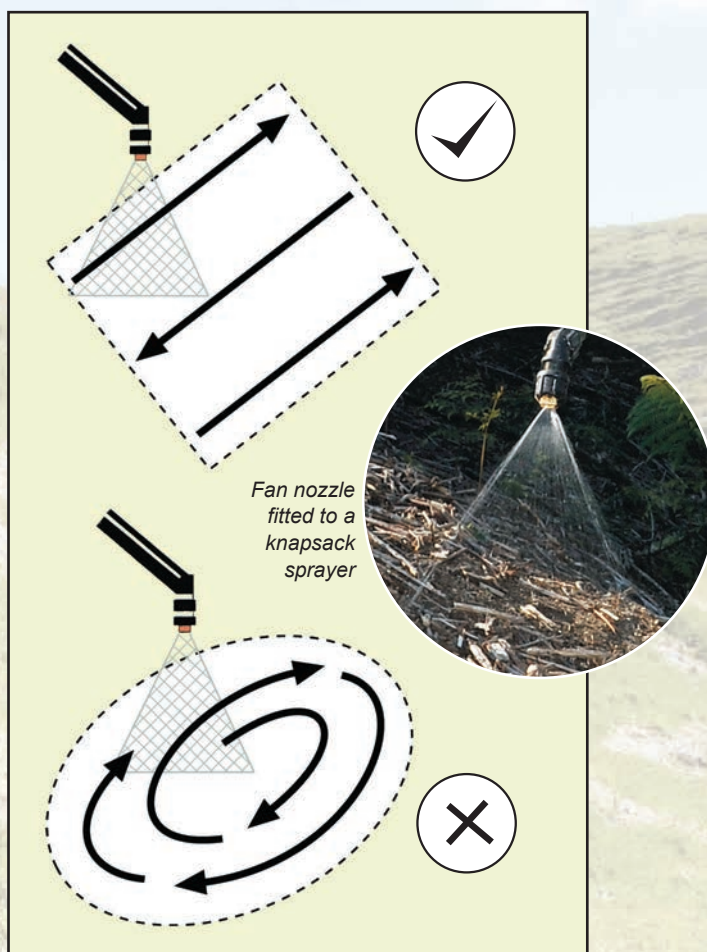


Figure 1: Recommended spray pattern (above) for spot spraying herbicide on grassed open sites using a fan jet attached to a knapsack sprayer for the planting of native seedlings. Circular spraying tends to result in greater overlaps (modified from Davis and Meurk 2001).



Area of grass and herbaceous weeds blanket-sprayed with herbicide to allow dense planting of natives.

Where particularly aggressive grass species such as kikuyu (*Pennisetum clandestinum*) occur it will be wise to blanket spray localised areas within a spot-sprayed area. However, blanket-spraying large areas of aggressive grass species is not practical at lower planting densities so extra vigilance is essential to maintain planting spots free of regrowth.

Blanket-spraying

Spraying the whole planting site (sometimes referred to as blanket-spraying) is required for high-density planting where seedlings will be planted less than 1.5 m apart (approximately 4500 or more stems per hectare). Small areas can be blanket-sprayed effectively by knapsacks, taking care to cover the area adequately and not overspray already treated areas.

Blanket spraying by helicopter or machine may be an economical alternative for large-scale planting operations compared to hand-spraying methods. Skilled and experienced operators will be required in the use of pressurised spray or boom equipment mounted on vehicles or for aerial application.

HERBICIDE OPTIONS FOR GRASS SITES

There are a number of commonly used chemicals in the control of grass and herbaceous weed sites, all sold under various trade names. Herbicides should be selected according to the grass and weed cover to be controlled and always following the manufacturer's instructions for use and at the label rate.

A selection of common herbicides used for most grass and herbaceous weed control are listed in Table 1, modified from recommendations from several sources including Davis and Meurk (2001), Ledgard and Henley (2009) and information from Regional Council websites (e.g., <http://www.aucklandcouncil.govt.nz/environment/biosecurity/pest-plants/herbicides>). This includes details on weeds controlled and use of each herbicide, rate for application using a knapsack, plus the care required in their use.

Four of the herbicides listed are applied to weed foliage and are combinations of foliar or root absorption chemicals with some systemic capacity - where the absorbed chemical is translocated to other parts of targeted plants. The fifth herbicide listed, Simazine, is a pre-emergent inhibitor generally applied to the soil or short grass sward where it is absorbed through the roots of germinating plants, thereby preventing their emergence. Pre-emergent inhibitors are generally mixed with other foliar active herbicides to provide both the benefit of knock-down of the existing cover as well as long term control by preventing emergence of new weed growth.

All herbicides have their limitations, both for weeds controlled and for their effect on the environment. All users must ensure they obtain all the necessary information on the appropriateness of herbicides they intend to use, including local council restrictions, risks to the environment and safety requirements. For some herbicides care will be required to ensure that sprayed soil does not come into contact with roots of planted seedlings. For example, soil sprayed with the pre-emergent herbicide simazine should not come into contact with roots if seedlings are planted after spraying.

Table 1: Common herbicides used to prepare sites, with a cover of grass and/or herbaceous weeds, for planting of native trees and shrubs (based on information from several sources).

Herbicide - active ingredient (Selected products*)	Mode of action	Weeds controlled	Use for preparing grass sites for planting natives	Rate for knapsack application (based on 10 L tank)	Warnings/comments
Glyphosate (Roundup® G2, Renew, Glyphosate 360, Trounce®, Zero, Touchdown)	Absorbed through foliage and translocated to all parts of plant including roots	Non-selective; controls most annual and perennial grasses and broadleaved weeds; useful for vines and some shrubs	Used as a pre-planting or a release spray; can be short term control; useful for stem/stump treatment	100 ml/10 L water	Low toxicity; non-volatile; spray drift must not contact foliage or green bark of desirable trees; non residual – site can be planted immediately; some formulations permissible over water but need to check local Regional Council rules for any restrictions
Haloxifop (Gallant® NF, Ignite)	Emulsifiable concentrate; foliar active with minimal soil activity	Selectively controls grasses; can damage other monocots (cabbage trees, flax, rushes, etc.); doesn't kill broadleaf plants, ferns, etc	Can be mixed with Versatil, Gardoprin or Simazine for controlling clovers and broadleaved weeds	12.5-60 ml/10 L water depending on grass species (refer manufacturers specifications)	Harmful substance; low volatility; flush all equipment several times immediately after use; short soil residue; rainfall one hour after application
Terbuthylazine (Gardoprin, Agpro Terbuthylazine 500)	Suspension concentrate; absorbed through roots with some through the leaves; works by inhibiting photosynthesis	Selective herbicide; controls a wide range of annual and perennial grasses and broadleaved weeds	Apply pre-planting or as a release; some annual broadleaf weed may be resistant; can be mixed with some herbicides such as glyphosate	550 ml/10 L water	Hazardous substance; avoid using near desirable plants were the chemical can be leached into the root zone; spray drift may cause serious damage to other desirable plants; prevent material entering waterways
Clopyralid (Versatil®, Tango, Cloralid 300, Vivendi® 300, Archer, Contest)	Acts systemically; absorbed by leaves, stems and roots and spreads through entire plant	Kills only a narrow band of broadleaf spp. in Fabaceae (legume) and Compositae (daisy) families and a few other species; doesn't kill grasses or other monocots	Can be mixed with other herbicides for control of additional weeds	25 ml/10 L water	Harmful substance; non-volatile; not for use in home gardens; do not use near planted native legumes (e.g. kowhai) or native compositae (daisy) or native podocarps; long-term soil residue to species controlled
Simazine (Agpro Simazine 500, Simanex™ SC)	Suspension concentrate; absorbed only through roots of germinating plants	Prevents the emergence of a wide range of annual and perennial grasses and broadleaved weeds; provides long-term control of weeds and grasses	Effectiveness depends on rainfall after application to move it down into weed root zone; duration and effectiveness of control depends on amount of chemical applied, soil type, rainfall and weed species	16 ml/10 L water; Can be applied with other herbicides such as glyphosate	Poisonous; toxic to aquatic organisms and in soil environment; spray drift may cause serious harm to other plants; do not use in channels or drains or where roots of desirable plants likely to extend including newly planted shrubs and trees; screef (remove) small area of sprayed soil before planting

* Note – List of trade/product names is not necessarily complete or endorsing any particular brand, supplier or manufacturer. Consult suppliers and/or manufacturers for the range of products that are available including their appropriate specifications and use. Information on herbicide use is readily accessed from websites and Fact Sheets from manufacturers and local councils.

ADDITIVES TO HERBICIDES

Marker dye

A marker dye can be added to the herbicide to clearly indicate the areas sprayed and to reduce missed areas or over-spraying already treated sites (“skips or overlaps”). They are a non-toxic coloured indicator for use in many agricultural applications including mixing with herbicide spray operations. Marker dyes come in several colours. Red and blue show up particularly well on grass sites. Areas sprayed with dyed herbicide remain visible for 2-3 week after spraying, thereby allowing identification of sprayed spots for planting before grass shows signs of dying. Marker dye also aids in detecting any spray drift.

Marker dye is particularly useful in spot-spraying operations where the time between herbicide application is too short to allow dead grass to show. Dye can also help identify sprayed spots in rank grass dominated by tall seedheads.

Manufacturers provide instructions on the use of marker dyes for a wide range of applications. The dosing rate depends on the type of terrain, vegetation cover being treated, intensity of colour required and the period the marker is to remain visible. Higher dosing rates will give a darker spray pattern. A suggested starting rate is 3-5ml/10L. It is recommended that the dye is added half way during filling of the tank to allow adequate mixing. Care in its use is advisable to reduce colouring of equipment, clothing and skin.

Wetting agent

The effective spread and uptake of any spray is greatly enhanced by the addition of a wetting agents (also known as surfactants or penetrants). Wetting agents are essentially detergents that break down the surface tension of water and allow water-based herbicides to more evenly wet a surface and assist in penetration of the leaf. Advantages of different formulations of wetting agents are usually

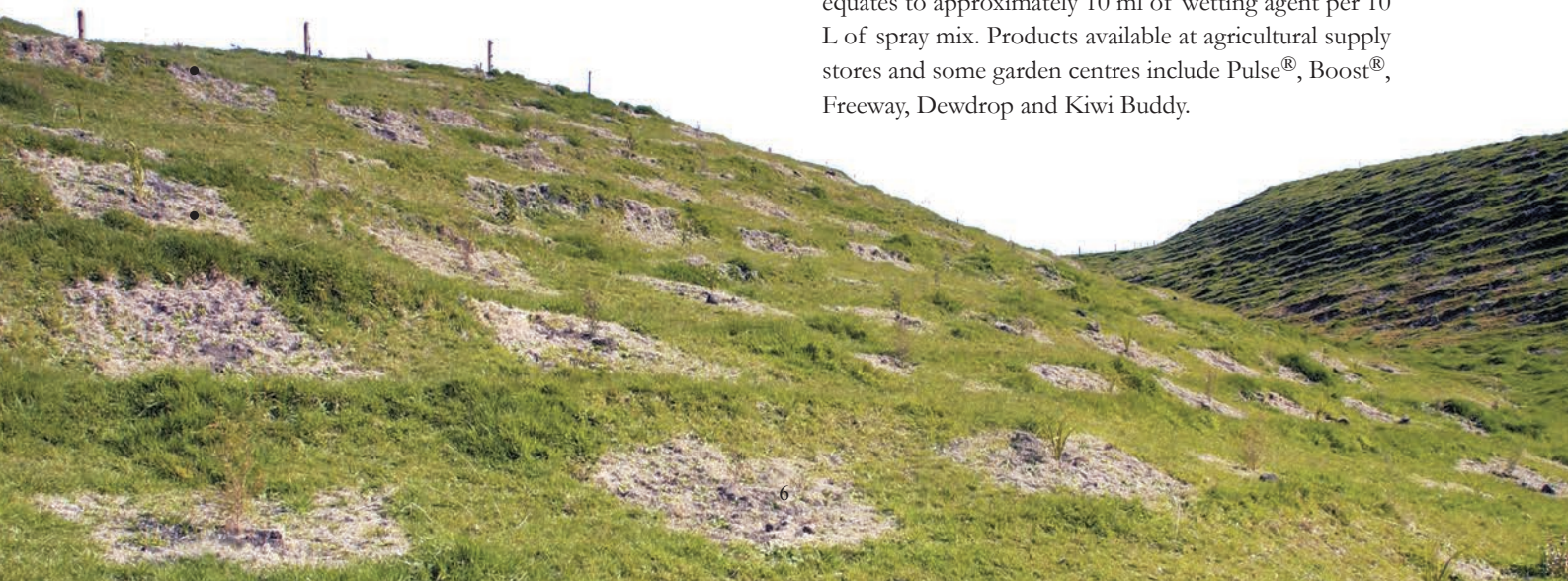


Marker dye indicates where spray has been applied and reduces “skips and overlaps”.

listed on manufacturers’ labels and in Fact Sheets, but in general include improving the:

- Ability of herbicides to penetrate leaf cuticle or stomata, thereby raising effectiveness and lowering cost though lower application rates or need for re-spraying; and
- Rapid uptake of herbicide, thereby reducing rainfast periods significantly so that spray operations may be carried out more successfully before any pending rain.

Wetting agents should always be added last to the spray mix to prevent foaming. Rates are normally 0.1% (or 1 part wetting agent per 1000 parts of spray mix), which equates to approximately 10 ml of wetting agent per 10 L of spray mix. Products available at agricultural supply stores and some garden centres include Pulse®, Boost®, Freeway, Dewdrop and Kiwi Buddy.



CARE WITH HERBICIDES

Herbicides can be hazardous and require careful handling and use. Before purchasing or using any herbicide, it is important to read carefully the product labels and Safety Data Sheets provided by suppliers. Many local authority websites also offer advice on choice and use of herbicides. There are various recommendations when using herbicides, listed by Porteous (1993) and others, including:

- Follow manufacturer's recommendations carefully for determining the correct chemical, handling instructions and application methods and quantities of herbicide;
- Use protective clothing as needed;
- Determine the most appropriate equipment including spray nozzle;
- Become familiar with safety warnings, precautions and first aid measures;
- Follow recommended precautions to avoid spray drift to neighbouring properties and contaminating waterways;
- Spray only in calm conditions when rain is not expected for several hours; and
- Prevent non-target species from being sprayed (usually as a result of spray drift).

ALTERNATIVES TO HERBICIDES

Where there is concern at use of herbicides, there are a range of alternative methods for controlling grasses - mostly involving physical reduction or removal of the grass cover. While many of these methods, in various combinations, are being practiced successfully within small planting projects, most are not practical for large-scale planting programmes.

Screefing of the grass cover immediately before planting involves the skimming-off of surface vegetation with a spade or grubber (Porteous 1993). This immediately reduces competition for water and light in the short-term, although the loss of ground cover could exacerbate moisture loss in drought-prone areas.

Areas cleared of grass turf create disturbed ground which can be readily reinvaded by weeds. On some sites, weed growth may be even more vigorous than the surrounding grass sward. Therefore, confining the clearance of grass and associated ground disturbance to a relatively small patch to allow planting of each seedling (max. 30 cm x 30 cm) may be preferable to large-scale clearance.

For large scale projects where ground is accessible, use of tractor-drawn giant discs or similar equipment to turn



Protective clothing should be used as recommended by manufacturer's instructions.



An alternative to pre-plant spraying with herbicide is removing the grass turf by spade (screefing).

the grass sward and seed bank of grass and weed seeds over to expose the mineral soil can leave a relatively clear site for the planting of natives. There may be sufficient time for establishment of natives planted at a high density before weeds become established.

Turning the ground over also works well for bracken (*Pteridium esculentum*)-dominated sites controlling regrowth for up to two years (Ian Barton, pers. comm.).



“Best Bet Guidelines” for establishing native plants

With many years of research on the planting and management of native trees, Nick Ledgard and David Henley of Scion, based in Christchurch, provide the following guidelines for increasing the success of planting programmes with natives (Ledgard and Henley 2009):

- Do not to take on a large area – better to prepare, plant and maintain a small area and do it well.
- Successful establishment means plants are alive and growing well two years after planting. “Planting” only means placing seedlings in the ground, which is a waste of time if they die.
- Keep on top of weeds – lack of weed control is the biggest killer of planted natives!
- Do not begin any plant establishment unless capable of implementing all the following steps:
 - Good site preparation
 - Use good quality planting stock
 - Matching species to appropriate planting sites
 - Undertaking monitoring to ensure timely maintenance, particularly weed and pest animal control, is carried out.

WARNING / DISCLAIMER

The information on selection, rates and use of herbicides in this article, is based on information reviewed from a range of sources, but must be assessed on a case by case basis and/or specific technical advice sought. It is recommended that users of herbicides follow manufacturers instructions at all times.

Accordingly, Tāne's Tree Trust will not be liable on any ground for any loss, claim, liability or expense arising from or due to any errors, omissions or advice provided within this article or from the use of herbicides or consequences arising from the use of herbicides.

References:

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Porteous, T. 1993: *Native forest restoration. A practical guide for landowners*. Queen Elizabeth II National Trust, Wellington.

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