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Herbicides for Sward Control among Broadleaved Amenity Trees

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Abstract

General principles concerning the action of herbicides are discussed. The use and damage symptoms of the herbicides - paraquat, glufosinate ammonium, glyphosate, clopytalid, propyzamide, isoxaben and dichlobenil are described.

Introduction

1. Research has shown that annual control of competing vegetation at the base of newly planted trees is beneficial to their establishment and early growth (Davies 1987). The maintenance of a 1m² weed-free spot for 3-5 years after planting is the minimum recommended for successful establishment. Herbicides are an effective and economical means of achieving this, but understanding the way they work is essential for their correct use.

Types of Herbicide and their Modes of Action

2. Herbicides may enter a plant by foliar absorption, root uptake or both. Residual herbicides - those which continue to act for a period after application - are taken up from the soil by plant roots. Foliar acting herbicides are absorbed through the point of contact on the leaf or stem. These are nearly always applied as liquids while residual herbicides may be applied as liquids or granules.

Selectivity of Herbicides

3. Nearly all herbicides if used incorrectly can cause damage to trees, but this disadvantage is usually outweighed by the improved survival and growth of trees gained by removing weed competition.
4. Herbicides should be used only when their mode of action or the timing of their application is such that desirable trees and shrubs are resistant. Alternatively the desirable plants must be protected from contact with the chemical. Equipment is available to guard trees and shrubs to avoid contact while the surround is sprayed. Residual herbicides may be applied during the dormant season when active meristems or leaves on broadleaved tree species are not damaged at appropriate dose rates.
5. Residual herbicides suitable for use with broadleaved trees should be applied after planting. Preplanting application with a residual herbicide may result in tree roots being damaged by contact with the chemical during planting. In addition, the soil containing the herbicide will be disturbed during planting exposing untreated areas and allowing weed growth.

A. Foliar Uptake (Contact) Herbicides

6. Paraquat (for example *Dextrone X* marketed by Nomix-Chipman, 200g/litre paraquat or *Speedway*, 8% w/w, marketed by Zeneca Professional Products and Miracle Garden Care Ltd) - disrupts the photosynthetic processes of the aerial parts of plants. Apply as 5 litres of product per hectare in water and always at medium volume and low pressure. Never apply at low or very low volume through any applicator.

Weeds should be green; otherwise there is no restriction on time of application. Almost all plants will be 'burnt off' but since paraquat does not translocate and is rendered inactive due to strong adsorption on to soil particles, rhizomatous herbs and grasses will regrow. Repeated applications may be required for complete control.

Trees must be protected during application. Symptoms of paraquat damage are rapid browning of foliage where chemical has been in contact with it. As the chemical is not translocated the zone of damage is localised.

Paraquat is subject to the Poisons Rules (Poisons Act 1972) and the appropriate precautions must be observed. Glufosinate ammonium offers the same efficacy of weed control whilst offering greater operator safety.

7. Glufosinate ammonium (for example *Dash*, 120g/litre glufosinate ammonium - marketed by Nomix Chipman). Apply as 5.0 litres of product per hectare for annual weeds, and 8 l/ha for perennial weeds, in water at medium volume. Good coverage of weeds, particularly where they are dense, is required to achieve adequate control. Glufosinate ammonium works by inhibiting activity of the enzyme which metabolises nitrates in plants resulting in the accumulation of ammonia in the green tissue. Eventually this build up kills the plant.

Glufosinate ammonium can be used up to a day before planting or post planting as a directed spray, avoiding all contact with desirable plants. It is a non-selective contact herbicide which is absorbed by actively growing green leaves and stems, but it is not translocated around the plant or down to the roots, so deep rooted perennials may require repeated applications to achieve total control.

Symptoms of damage are rapid browning of foliage where chemical has been in contact with it. As the herbicide is not translocated the damage is restricted to the area of the plant which has been sprayed.

B. Translocated herbicides

8. Glyphosate (for example *Roundup Pro Biactive* - marketed by Monsanto contains 360g/litre glyphosate). After absorption by aerial vegetative parts this herbicide is translocated throughout the plant and inhibits glutone synthesis, hence causing death.

Apply 1.5 - 2.0 litres of product per hectare for grass control. If perennial broadleaved weeds are present up to 5.0 litres of product per hectare may be applied. This product can be applied in water at medium, low or very low volume or via direct application (Lane 1990). Glyphosate can be applied at any time of year when vegetation is actively growing, but is most effective when applied April-September. Both annual and perennial weeds, are controlled including rhizomatous grasses (eg. *Agropyron* species).

For broadleaved trees, glyphosate can be used very effectively as a preplanting herbicide up to 3 days before planting. When applied after planting a guard should always be used to prevent spray contacting tree foliage, shoots, or stems. In spring and early summer damaged trees appear yellow becoming brown. Less severe symptoms develop from late summer treatments but the following year trees will be dead or severely damaged. Any buds which open will produce deformed strap-like leaves.

9. Clopyralid (*Dow Shield*, containing 200g/litre clopyralid, manufactured by Dow Elanco).

After absorption through the foliage, clopyralid is translocated throughout the plant and disrupts cell elongation and respiration, eventually causing death, through the interruption of protein synthesis. Apply at a rate of 0.5-1.0 l/ha, depending on weed species. A limited range of annual and perennial herbaceous weeds are controlled by clopyralid, in particular thistles and mayweeds. Most other herbaceous species and grasses are unlikely to be affected. Trees should be protected during applications, but many species will tolerate accidental overall spray when dormant or active. If damage does occur, it is likely to be in the form of twisting or distorting, and curling of the outer edges of leaves.

Timing of application is dependent upon the growth stage of the target weeds - in general best results will be obtained from applications to young, actively growing weeds.

C. Root Uptake (Residual) Herbicides

10. Propyzamide (for example *Kerb* marketed by Pan Britannica Industries) - a soil acting residual herbicide available as a granule, powder or liquid. Granules slowly dissolve in cold moist soil to be taken up by germinating weeds and through the roots of existing weeds, especially grasses. Herbaceous broadleaved weeds which emerge in late season will not be controlled.

Apply as 37.5 kg of 4% w/w granules (*Kerb Granules*) per hectare, as 3 kg of 50% w/w wettable powder (*Kerb 50 w*) per ha in water at medium volume or 3.75 litres of 400g/litre liquid (*Kerb Flo*) in water at medium, low or very low volume. The herbicide should be applied during October-January in Northern Britain and from October-December in the south pre- or post-planting. Application of *Kerb* granules may be extended to February in the north, and January in the south. Good control is dependent upon persistent low soil temperature following application.

Established plants of *Dactylis glomerata*, *Holcus mollis* and *Calamagrostis epigejos* will not be effectively controlled by propyzamide.

Propyzamide is very safe for use with broadleaved amenity trees. Damage has been induced only by heavy over-dosing, eg. 4 x the recommended rate. Symptoms were leaf curling and browning.

11. Isoxaben (*Flexidor 125* and *Gallery 125*, containing 125g/litre isoxaben, manufactured by Dow Elanco and Rigby Taylor respectively). A soil acting residual herbicide, which is consolidated into the top few cms of the soil by rainfall after application. It is then absorbed by, and kills, a range of newly germinating herbaceous species. Isoxaben is most effective when applied to moist soil, free of clods, brash and weeds. Grasses or established weeds are unlikely to be damaged. Applications should be made in the spring to bare soil, before trees and weeds start to grow. Isoxaben may be mixed with propyzamide to control some established herbaceous weeds and most grasses. Most tree species are tolerant of applications when dormant or in active growth, but sprays should be directed away from growing tips and trees should possess good root development.

Granular Herbicides Containing Dichlobenil

12. Three herbicide formulations, marketed as 11 products, contain dichlobenil which is a soil acting herbicide.

The three products should be applied at the rates shown in Table 1, depending on soil type, weed type and density and crop tolerance. Conifers tend to be more sensitive to dichlobenil than broadleaved trees - reference should be made to manufacturers' recommendations prior to application.

Table 1

Example Product	Manufacturer	Chemical	Rate product/ treated ha	Time of application
<i>Casoron G</i>	Zeneca	dichlobenil 6.75%	80-125 kg	Feb-March
<i>Casoron G4</i>	Miracle Garden Care Ltd Zeneca Professional Products	dichlobenil 4.00%	95-210 kg	Feb-March
<i>Prefix D</i>	Cyanamid	dichlobenil 6.75%	56-125 kg	Feb-March

All three products should be applied only to trees which have been established for at least 2 years. Unhealthy or badly planted trees are easily damaged and should not be treated.

To prevent severe tree damage, it is essential that applications are strictly within the recommended rate and that local over-dosing is avoided by spreading granules evenly around the tree over the whole of the intended spot (or band) area. Placement of granules against the stem-bark causes stem damage and in severe cases tree death.

Even at correct dose rates, trees may become yellow after treatment due to the uptake of dichlorobenzamide, the breakdown product of these granules, but it is rarely lethal and trees recover the following year.

Symptoms of damage are stem swelling at soil level followed by loss of vigour and death when the development of xylem and phloem is completely interrupted by cambial damage. Residues of the chemical in soil may cause leaf curling and browning.

All the above products have full on label approval for use in woody ornamentals. Refer to the UK Pesticide Guide for guidance on field of use, and other products that may have approval for use in these situations.

13. Tank Mixes

For products other than anti-cholinesterase compounds (none are listed in this note), tank mixes of two or more products are permitted as long as all the conditions of use for all the products to be used are complied with. However, unless such mixes are specifically listed on the product label, they are made at the users own risk.

14. Avoid Damage to trees and shrubs

Trees and shrubs may be damaged when an inappropriate herbicide is chosen. Too high a rate or careless application of herbicide, will cause damage to desirable plants or trees.

It is important to ensure there is close cooperation between those who decide how and where to control weeds, those responsible for applying the chosen herbicides, and those responsible for the trees and shrubs in and adjacent to the treated area.

Further guidance on operator and environmental safety is given in Anon (1991) and Willoughby & Dewar (1995). The latter also gives further details on weed and crop tolerance.

BEFORE USING A HERBICIDE ALWAYS READ CAREFULLY AND COMPLY WITH THE MANUFACTURER'S INSTRUCTIONS ON THE LABEL (INCLUDING ANY ACCOMPANYING LEAFLET). IT CARRIES FULL INSTRUCTIONS FOR USE AND HAS BEEN DESIGNED TO PROTECT THE ENVIRONMENT.

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