

Herbicide Update

Ian Willoughby and David Clay



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Front cover: Rhododendron – an extremely attractive, introduced woody ornamental species, but also a particularly problematic invasive weed that prevents natural regeneration and suppresses native woodland flora [42216].

Top inset Control of young rhododendron in mature woodland [41120].

Middle inset Weeds compete for moisture and nutrients, and hence reduce tree growth and survival. However, some vegetation cover can be beneficial for amenity or wildlife, particularly between weed free spots, and when trees become established. This 3-year-old poplar would still benefit from spot weeding [41440].

Bottom inset Two-year-old Norway spruce Christmas trees in a well-weeded area on Yattendon Estate, Berkshire [41642].

Back cover: Giant hogweed (*Heracleum mantegazzianum*) introduced as an ornamental species, now a pernicious invasive weed subject to the provisions of the Wildlife and Countryside Act 1981 [41447].

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Summary

This Technical Paper updates information in Forestry Commission Field Book 8 *The use of herbicides in the forest*. It provides a summary of recent Forestry Commission research findings concerning the use of herbicides in forestry, and also explains relevant changes in legislation and approved products.

Key herbicides cited in this publication

atrazine, cyanazine, cycloxydim, clopyralid, dichlobenil, diflufenican, glufosinate-ammonium, glyphosate, lenacil, metamitron, metazachlor, napropamide, oxadiazon, pendimethalin, propyzamide, simazine.

Disclaimer

This publication is not intended as an endorsement or approval of any product or service to the exclusion of others that may be available. The Forestry Commission accepts no responsibility for any loss or damage resulting from following any advice in this publication.

Research trials are by nature on a small scale compared with operational practice. Users are advised to test small areas to gain familiarity with new products and techniques, before engaging in large-scale treatments.

Chapter 1

Introduction

The changeable and seemingly complex use of herbicides in forestry can make the subject appear inaccessible to the busy forest manager.

Forestry Commission Field Book 8 *The use of herbicides in the forest* (Willoughby and Dewar, 1995) aims to reduce the subject into easily digestible sections, covering legislation, good working practices, approvals and application techniques. Forestry Commission Field Book 14 *Herbicides for farm woodlands and short rotation coppice* (Willoughby and Clay, 1996) updates the recommendations for new planting situations. For Christmas trees, Forestry Commission Field Book 15 *Weed control in Christmas tree plantations* (Willoughby and Palmer, 1997) gives comprehensive guidance on product availability and use.

Changes in legislation and new research findings make updating between revisions of the Field Books necessary. This Technical Paper is intended as a summary of all relevant changes during the past two years. It is suggested that it is kept with a copy of Field Book 8 for future reference.

If you do nothing else, consult the sections highlighted in the 'How to use' box at the right and the quick reference section in the centre of the publication.

How to use this publication

- Chapter 2 provides a summary of recent research findings covering:
 - farm woodland weed susceptibility
 - susceptibility of Compositae weeds, particularly creeping thistle
 - weed control among Sitka spruce cuttings
 - tolerance of broadleaved tree seed to pre-emergence herbicides
 - glyphosate rain-fastness

For each subject a synopsis of the experimental results is presented with a summary of new or revised recommendations.

- Chapter 3 details relevant regulatory changes

All readers are advised to refer to this chapter to familiarise themselves with the contents for subsequent reference.

- Chapter 4 covers revised herbicide approvals and includes:
 - a full list of approved products
 - guideline costs
 - recommendations for forest use and farm woodland use only.

All managers are recommended to take the time to read the description paragraphs for each herbicide section to brief themselves on whether these herbicides will be of use in their particular situation.

Chapter 2

Recent research findings

All of the following results and recommendations will be included in future revised versions of Field Book 8 *The use of herbicides in the forest*, and Field Book 14 *Herbicides for farm woodlands and short rotation coppice*.

Recent Forestry Commission field experiments, and field and pot experiments in glasshouses carried out on contract by David Clay of Avon Vegetation Research at Long Ashton Research Station, have yielded the following results.

Farm woodland weed susceptibility

A number of perennial weed species that germinate from seed can present serious problems in newly planted farm woodlands. Residual herbicides, designed for controlling annual weeds, have been tested for crop tolerance and approval gained for use in farm woodlands. However, there is little information on which newly germinating *perennial* weeds these herbicides will control. In glasshouse trials, ten herbicides were applied at three dose rates (one-ninth, one-third and recommended rate) at two dates (pre-emergence and early post-emergence of weeds) – see Table 1. All the herbicides appeared to have better than expected levels of activity, probably as a result of roots of plants being confined in pots and unable to grow away from the herbicides.

As a result, a trial was established in 1997 using field sown weeds and a limited number of the most promising herbicides identified from the glasshouse trials. Residual herbicides should be applied to moist soil, when further rainfall is likely to carry them into the top layer of the soil. However, a very dry spring reduced both weed establishment and herbicide efficacy in this trial. Table 2 shows the relative susceptibility to the herbicides tested in very dry sub-optimal field conditions. Weed species tested were: clover (*Trifolium repens*), creeping buttercup (*Ranunculus repens*), spear thistle (*Cirsium vulgare*), ragwort (*Senecio jacobaea*), common nettle (*Urtica dioica*), broadleaved dock (*Rumex obtusifolius*).

The largely complete control given by the atrazine and cyanazine mixture corresponds to its known efficacy in field situations. Creeping buttercup is known to be less susceptible to this treatment. Pendimethalin gave good pre-emergence control of all the species except the Compositae (spear thistle and ragwort) and clover. Napropamide gave reasonable control of creeping buttercup. The dose used was relatively low and information is needed on efficacy of higher doses. Metazachlor and simazine were generally ineffective on all species. The results from this field experiment contrast with those from the glasshouse experiments.

Table 1 Herbicides tested for farm woodland weed susceptibility in glasshouse pot trials

Chemical	Product	Formulation	Dose (kg a.i./ha)		
			1/9	1/3	Recommended
atrazine	Gesaprim 500 SC	500 g/l SC	0.22	0.67	2.0
cyanazine	Fortrol	500 g/l SC	0.22	0.67	2.0
clopyralid	Dow Shield	200 g/l SL	0.02	0.07	0.2
cyanazine + clopyralid	Fortrol + Dow Shield		0.22+0.02	0.67+0.07	2.0+0.2
isoxaben	Flexidor 125	125 g/l SC	0.03	0.03	0.25
metazachlor	Butisan S	500 g/l SC	0.14	0.42	1.25
napropamide	Devrinol	450 g/l SC	0.45	1.35	4.05
pendimethalin	Stomp 400 SC	400 g/l SC	0.22	0.67	2.0
propyzamide	Kerb Flo	400 g/l SC	0.17	0.50	1.5
simazine	Gesatop 500 SC	500 g/l SC	0.22	0.67	2.0

In the glasshouse pot experiments the same weed species were controlled by all the herbicides at relatively low doses, only dock being resistant to metazachlor and simazine. The field experiment was repeated in 1998, with more typical wetter spring weather. The following recommendations draw on these results.

Recommendations
Farm woodland weed susceptibility
The susceptibility of the six weed species to the herbicides tested is summarised in Table 3.
Update of information in Table 4 (page 18) of Forestry Commission Field Book 14 (Willoughby and Clay, 1996) and Table 8 (page 172) of Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Table 2 Susceptibility of six weed species to pre-emergent herbicides applied in dry, sub-optimal conditions

Herbicide	Product	Rate of active ingredient kg/ha	Equivalent l/ha product	Clover	Creeping buttercup	Spear thistle	Ragwort	Common nettle	Broadleaved dock
500 g/l atrazine + 500 g/l cyanazine	Atlas Atrazine + Fortrol	2.0 + 2.0	4.0 + 4.0	S (100)	MS (90)	S (100)	S (100)	S (100)	S (100)
500 g/l metazachlor	Butisan	1.25	2.5	R (0)	MR (61)	R (4)	R (26)	R (31)	R (29)
450 g/l napropamide	Devrinol	1.0	2.2	R (0)	MS (95)	R (0)	R (0)	R (0)	R (10)
400 g/l pendimethalin	Stomp	2.0	5.0	R (0)	S (98)	R (9)	R (22)	S (100)	S (100)
500 g/l simazine	Unicrop Simazine FL	1.1	2.2	R (0)	R (0)	R (0)	R (43)	R (44)	R (3)

Notes: Figures for actual % control in experiments given in brackets. In glasshouse trials, seedling bramble (*Rubus fruticosus*) was effectively controlled by pre-emergence applications of 3.75 l/ha Kerb Flo or 2.51 l/ha Butisan. Susceptibility given for mid growing season; some of the herbicides gave initially better control but their effect rapidly wore off.

Key: S = >95% control (complete or nearly complete kill)
 MS = 81–95% control (good kill under favourable conditions)
 MR = 50–80% control (partial kill possible)
 R = <50% control (no useful effect)

Table 3 Susceptibility of six weed species to pre-emergent herbicides applied in typical wet spring conditions

Herbicide	Product	Rate of active ingredient kg/ha	Equivalent l/ha product	Clover	Creeping buttercup	Spear thistle	Ragwort	Common nettle	Broadleaved dock
500 g/l atrazine + 500 g/l cyanazine	Atlas Atrazine + Fortrol	2.0 + 2.0	4.0 + 4.0	S (100)	MS (94)	S (100)	S (100)	S (100)	S (100)
500 g/l metazachlor	Butisan	1.25	2.5	S (97)	MR (59)	R (43)	R (49)	S (97)	R (35)
450 g/l napropamide	Devrinol	3.0	6.6	MS (89)	S (96)	R (29)	R (0)	R (46)	R (11)
450 g/l napropamide	Devrinol	4.46	9.9	MS (89)	MS (90)	R (48)	R (16)	MR (67)	R (42)
400 g/l pendimethalin	Stomp	2.0	5.0	MS (94)	S (99)	R (44)	R (3)	S (100)	S (100)

Notes and key: see Table 2.

Susceptibility of Compositae weeds

Compositae weeds can rapidly invade new plantations on fertile lowland sites, and three of them, creeping thistle (*Cirsium arvense*), spear thistle (*Cirsium vulgare*) and ragwort (*Senecio jacobaea*), are noxious weeds that may require control under the Weeds Act; see Willoughby (1996a).

Dow Shield (200 g/l clopyralid) has activity on some Compositae species, and this glasshouse pot experiment was designed to generate more data on these problematic species. Three doses of 200 g/l clopyralid were applied at six timings (weed growth stages) in 1995 and 1996 to five weed species. Results and treatments are summarised in Table 4.

The clopyralid treatments reduced growth of most species, however, there were few applications which prevented the plants from regrowing and flowering despite some very severe distortion. These plants would be competitive in crops and a source of future infestations from seed shedding.

Spear thistle was the species most susceptible to clopyralid, the higher doses applied in autumn and April killing all plants. This corresponds with field experience where relatively large plants have been

killed with full dose applications of clopyralid. These results suggest that autumn and early spring applications will be the most effective. Ragwort was relatively susceptible but only the highest dose applied in September and April killed all plants. Again with this species autumn and early spring treatment is likely to be the best timing. Growth of perennial sow thistle was generally poor and few untreated plants regrew in the second year. August and September applications had no long-term effect. The June application gave effective control at the two higher doses. Annual sow thistle was generally not controlled – the application in September to relatively small plants was the most effective. This result confirms the information on field performance, suggesting that plants with more than six leaves will not be effectively controlled (Willoughby and Clay, 1996). The generally poor results on these species may be the result of conditions at spraying. At most application dates, conditions were very dry and clopyralid is known to be less effective in such conditions.

No plants of creeping thistle were killed by any treatment; the repeat high dose caused severe damage but plants regrew normally. Further field experiments were set up to identify more effective control measures for this species.

Table 4 Effect of clopyralid applied at different dates on five Compositae species

Spray date	Dose (kg a.i./ha)	Creeping thistle (<i>Cirsium arvense</i>)	Spear thistle (<i>Cirsium vulgare</i>)	Ragwort (<i>Senecio jacobaea</i>)	Perennial sow thistle (<i>Sonchus arvensis</i>)	Annual sow thistle (<i>Sonchus oleraceus</i>)
August	0.05	o	◆◆	o	o	o
	0.1	o	◆◆	o	o	o
	0.2	o	◆◆	o	o	o
September	0.05	o	o	o	o	◆
	0.1	o	◆◆	o	o	◆◆
	0.2	o	◆◆	◆	o	◆◆
April	0.05	o	o	o	-	o
	0.1	o	◆◆	o	-	o
	0.2	o	◆◆	◆	-	o
May	0.05	o	o	o	-	o
	0.1	o	o	o	-	o
	0.2	o	o	o	-	o
April & May	0.05 (0.2)	o	◆	o	-	o
	0.1 (0.2)	o	◆◆	o	-	o
	0.2 (0.2)	o	◆◆	◆	-	◆
June	0.05	o	o	o	o	o
	0.1	o	o	o	◆	o
	0.2	o	o	o	◆	o

Summary of effects (◆◆) plants killed (o) growth reduced by 50–90%
 (◆) plant alive but regrowth reduced by 90% (-) not treated

Control of creeping thistle, *Cirsium arvense*

Creeping thistle (*Cirsium arvense*) is perhaps the biggest single problem weed species occurring on many new planting sites on better quality farmland. A field experiment was set up to compare the effectiveness of 18 different herbicide treatments, which included various mixtures and sequences of residual and contact herbicides applied at a range of application dates. The majority of creeping thistle plants grow from root fragments rather than seed, hence reducing their susceptibility to residual herbicides. Soil-acting herbicides will therefore tend to prevent emergence of most weed species, but not creeping thistle. Nevertheless, it was hoped to identify residual treatments that would give pre-emergence control of creeping thistle. Table 5 shows the treatment details and results.

No treatment gave complete control of creeping thistle. The current label recommendation is for 0.5 l/ha clopyralid applied to the rosette stage, followed by 1 l/ha clopyralid applied 3 weeks later. This treatment (30 April and 24 May in this experiment) gave fairly good control (89% kill at the end of the season).

The best treatment was a sequential dose of clopyralid, with the initial 0.5 l/ha (0.1 kg active ingredient) applied to **extending shoots** followed by 1 l/ha (0.2 kg active ingredient) three weeks later (24 May and 17 June in this experiment). **This is the treatment the Forestry Commission recommends to control creeping thistle if using clopyralid.**

Table 5 Treatment details and results for creeping thistle (*Cirsium arvense*) susceptibility

Herbicide	Dose (kg a.i./ha)	Application date	Susceptibility of creeping thistle (<i>C. arvense</i>)	
atrazine + cyanazine	2.0 + 2.0	2 April	R	6%
atrazine + cyanazine & clopyralid	2.0 + 2.0 & 0.2	2 April & 24 May	MR	64%
atrazine + cyanazine & tribenuron-methyl	2.0 + 2.0 & 0.015	2 April & 24 May	MR	47%
atrazine + cyanazine & glyphosate	2.0 + 2.0 & 1.8	2 April & 17 June	MS	92%
simazine & clopyralid	1.1 + 0.2	2 April & 24 May	MR	82%
simazine + metazachlor & clopyralid	1.1 + 1.25 & 0.2	2 April & 24 May	MS	92%
amitrole + atrazine	4.5 + 2.0	30 April	MS	82%
glufosinate-ammonium + atrazine	0.75 + 2.0	30 April	R	0%
glyphosate + atrazine	1.8 + 2.0	30 April	R	0%
clopyralid	0.2	30 April	MR	53%
clopyralid & clopyralid	0.1 & 0.2	30 April & 24 May	MS	89%
clopyralid	0.2	24 May	MS	87%
clopyralid & clopyralid	0.1 & 0.2	24 May & 17 June	S	99%
clopyralid	0.2	17 June	MS	83%
clopyralid + tribenuron-methyl	0.2 + 0.015	24 May	MS	92%
clopyralid + wetter	0.2 + 0.1%	24 May	MS	89%
clopyralid + tribenuron-methyl	0.2 + 0.015	17 June	MS	91%
tribenuron-methyl	0.015	24 May	MS	84%

Key: S = >95% control (complete or nearly complete kill)
 MS = 81–95% control (good kill under favourable conditions)
 MR = 50–80% control (partial kill possible)
 R = <50% control (no useful effect)

Table 6 Weed susceptibility following treatment with Dow Shield, 200 g/l clopyralid (at 1 l/ha)

Species	Susceptibility
Black bindweed (<i>Bilderdia convolvulus</i>)	S 2ETL
Clover (<i>Trifolium</i> spp.)	S 2ETL
Coltsfoot (<i>Tussilago farfara</i>)	MS 6ETL ⁵
Corn marigold (<i>Chrysanthemum segetum</i>)	S 6ETL
Creeping thistle (<i>Cirsium arvense</i>)	S 250 mm diameter ⁴
Groundsel (<i>Senecio vulgaris</i>)	S 6ETL
Knapweed (<i>Centaurea nigra</i>)	MS 6ETL ⁵
Knotgrass (<i>Polygonum aviculare</i>)	MS 2ETL
Pale persicaria (<i>Polygonum lapathifolium</i>)	MS 2ETL
Perennial sow thistle (<i>Sonchus arvensis</i>)	S 250 mm diameter ²
Pineapple mayweed (<i>Chamomilla suaveolens</i>)	6 ETL
Ragwort (<i>Senecio jacobaea</i>)	S 250 mm diameter ³
Redshank (<i>Polygonum persicaria</i>)	MS 2ETL
Scented mayweed (<i>Matricaria recutita</i>)	S 6ETL
Scentless mayweed (<i>Matricaria perforata</i>)	S 6ETL
Smooth sow thistle (<i>Sonchus oleraceus</i>)	S 6ETL
Spear thistle (<i>Cirsium vulgare</i>)	S 250 mm diameter ¹
Trefoils (<i>Lotus</i> spp.)	2ETL
Vetches (<i>Vicia</i> spp.)	2ETL
Wild carrot (<i>Daucus carota</i>)	2ETL
Yarrow (<i>Achillea millefolium</i>)	MS 6ETL ⁵

Key: S = susceptible
MS = moderately susceptible
ETL = extended true leaves

Notes:

- ¹ Treat with repeat dose, 0.5 l/ha, in April to rosettes, less than 250 mm diameter, followed 3–4 weeks later by 1 l/ha. Autumn applications may also be effective.
- ² Treat with repeat dose, 0.5 l/ha, applied to rosettes, less than 250 mm diameter, followed 3–4 weeks later by 1 l/ha. Plants up to 6ETL should be no more than 50 mm high or across. Plants up to 2ETL should be no more than 25 mm high or across.
- ³ Treat in spring (early April) or autumn, ideally to plants <250 mm diameter, 25 mm tall. Larger plants or treatments at other times of the year will only be moderately susceptible.
- ⁴ Apply 0.5 l/ha first to shoots extending from rosettes (usually May), followed by 1 l/ha 3–4 weeks later. Applications at other times may be much less effective.
- ⁵ Apply 0.5 l/ha in spring, followed by 1 l/ha 3 weeks later.

Recommendations

Summary of new susceptibility information for clopyralid

Dow Shield (200 g/l clopyralid) can be safely applied over actively growing trees at user's own risk, although directed sprays are safer; see Field Book 8 (Willoughby and Dewar, 1995). For sequential spraying, initial results show good crop tolerance. Although some foliage damage can result, ongoing experiments show little long-term growth effects. However, some sycamore have suffered a slight reduction in diameter increment, and Corsican pine have suffered slightly reduced height increment. As the programme of experiments has not yet been completed, it is recommended that directed sprays are used where possible pending the final results of these trials.

Table 6 gives the susceptibility of weed species to clopyralid, based upon label information, updated to take account of the results outlined earlier.

Update of Table 5 (page 22) in Forestry Commission Field Book 14 (Willoughby and Clay, 1996) and Table 8 (page 172) in Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Weed control among Sitka spruce cuttings

When propagating Sitka spruce in polytunnels, annual weeds can invade the peat beds necessitating costly hand weeding. An experiment was set up to examine herbicide alternatives.

There are a limited number of residual herbicides used on Sitka spruce in forest nurseries which may be suitable for use in polytunnels. Although most residual herbicides are ineffective on peat soils, they may be more effective in the water-saturated medium under mist propagation. Apart from propaquizafop (Falcon) for the control of annual meadow grass, there are no foliar-acting herbicides suitable for controlling problem weeds which are likely to be safe on the crop.

This experiment was designed to study the effects of four herbicides on the growth and development of the Sitka spruce cuttings and on the control of four weed species – hairy bitter cress (*Cardamine hirsuta*), annual meadow grass (*Poa annua*), ragwort (*Senecio jacobaea*) and common chickweed (*Stellaria media*).

The four herbicides were applied as follows: napropamide as Devrinol at 1 kg/ha active ingredient; propaquizafop as Falcon at 0.15 kg/ha active ingredient; propyzamide as Kerb at 1.5 kg/ha active ingredient; and simazine as Unicrop Flowable Simazine at 1.0 kg/ha active ingredient, at three dates (pre-weed emergence, post-weed emergence, and post-flushing of the Sitka spruce).

The method of planting and growing the weeds and cuttings in trays under mist appeared to be a satisfactory system for testing herbicide activity. Assessment of effects of herbicides on spruce root growth was difficult because of the amount of weed growth present and the adherence of the peat to the roots. The only herbicide treatment to have any long-term adverse effect on the Sitka spruce cuttings was the pre-emergent application of napropamide, which reduced the amount of new stem growth and root length. Hairy bitter cress and ragwort were not killed by any of the treatments. Pre-emergence application of propyzamide killed both the annual meadow grass and chickweed. The common chickweed was also killed by the post-emergence application of propyzamide. Propaquizafop was only effective on the annual meadow grass when applied to newly emerged seedlings.

This experiment indicates that propaquizafop and propyzamide may be effective on some annual weed species in polytunnels but further work would be needed to confirm their efficacy and selectivity.

Recommendations
Weed control among Sitka spruce cuttings
<p>Users should note that these products do not have approval for use on protected crops at present. No recommendations for their use in these situations are made at the present time.</p> <p>Refer to Forestry Commission Bulletin 111 <i>Forest nursery practice</i> (pages 167–178) for current recommendations on weed control in forest nurseries (Aldhous and Mason, 1994); Whitehead (1999) for guidance on products approved for use on protected crops.</p>

Tolerance of broadleaved tree species grown from seed to pre-emergence herbicides

Pre-emergence herbicides are applied after sowing in forest nurseries to prevent weed germination – established weeds around newly germinated trees

are very competitive and difficult to control. Little information exists on the tolerance of broadleaved tree species to herbicides other than simazine.

Direct seeding is an alternative method of creating new woodlands involving sowing high densities of broadleaved tree seed with an aim of establishing around 10 000 stems/ha more cheaply than planting trees at 2500 stems/ha (Willoughby *et al.*, 1996). One of the difficulties with the technique has been controlling competing vegetation amongst newly germinated trees. Identification of herbicides that could be applied post-tree sowing, to a clean site to prevent weed seedling germination, but allow tree seed emergence, would be of great value.

Nine residual herbicides at three rates were trialed on five tree species over 2 years in glasshouse trials. A summary of the treatments and susceptibilities at the highest dose rate is given in Table 7.

Recommendations
Tolerance of broadleaved tree seed to pre-emergence herbicide
<p>Based on glasshouse and field trials, the following herbicides are recommended as safe to apply as post-sowing, pre-emergent treatments to clean sites to control germinating weeds in nurseries, or in new direct-sown woodlands on improved grassland or arable sites.</p> <p>Napropamide (as Devrinol): can be safely applied as follows:</p> <ul style="list-style-type: none"> up to 6.6 l/ha to ash or sycamore at 2.2 l/ha for cherry and oak at 2–6.6 l/ha to rowan, for moderate tolerance only <p>Pendimethalin (as Stomp): can be safely applied up to 5 l/ha to ash, oak and sycamore.</p> <p>Simazine (as Unicrop Simazine FL): can be safely applied up to 4.0 kg/ha (product) to oak.</p> <p>At least 2 weeks should elapse between treatment and subsequent tree seed germination. Precise treatment timings will therefore depend on sowing date and ground conditions, but in general, for autumn sowings spray napropamide in November to February. For other herbicides, after either spring or autumn sowings, aim to spray in late February to the middle of March.</p> <p>Tree seed should be covered with soil following normal good practice guidelines, i.e. to approximately the same depth as the size of the seed itself.</p> <p>Update of Forestry Commission Research Information Note 286 <i>Weed control when establishing new farm woodlands by direct seeding</i> (Willoughby, 1996b); pages 171–173 of Forestry Commission Bulletin 111 <i>Forest nursery practice</i> (Aldhous and Mason, 1994).</p>

Table 7 Tolerance of broadleaved tree species to residual herbicides

Herbicide	Product	Rate (kg a.i./ha)	Ash	Cherry	Oak	Sycamore	Rowan
500 g/l diflufenican		0.30	-	-	-	R (0)	S (100)
125 g/l isoxaben	Flexidor 125	0.37	S (84)	S (95)	R (0)	MR (22)	MS (39)
80% w/w lenacil	Venzar	5.28	S (100)	S (100)	MS (41)	-	-
70% w/w metamitron	Goltix WG	10.50	S (70)	S (94)	R (0)	R (0)	S (100)
500 g/l metazachlor	Butisan	1.87	S (100)	S (100)	MR (21)	MS (46)	S (99)
450 g/l napropamide	Devrinol	2.97	R (0)	MS ¹ (33)	MR ¹ (21)	R (0)	MR (14)
400 g/l pendimethalin	Stomp 400 SC	3.00	R (0)	S (76)	R (0)	R (7)	S (99)
400 g/l propyzamide	Kerb Flow	2.25	S (90)	S (98)	R (9)	MS (40)	S (100)
500 g/l simazine	Unicrop Simazine FL	6.00	S (100)	S (100)	R (6)	S (66)	S (87)

Notes: Forestry Commission field trials have confirmed the safety of ash and sycamore to napropamide and pendimethalin. Trees grown in pots in glasshouse trials are likely to be somewhat more susceptible to herbicides than those grown in the field. Figures for actual control in experiments given in brackets.

Key: S = >50% reduction in growth (based on fresh weight in June, 2 months after application)
 MS = 26–50% reduction in growth
 MR = 11–25% reduction to tree growth
 R = Resistant (<10% reduction in survival and growth)
¹ Resistant at 0.99 kg/ha.

Glyphosate rain-fastness

In the wetter parts of Britain, finding a suitable weather window for herbicide applications can be problematic. To be fully effective, it is recommended by manufacturers that a rain-free period of at least 6, but preferably 24, hours should elapse after applications of glyphosate.

Table 8 shows the different glyphosate formulations and additive combinations that were trialed for rain-fastness.

Deschampsia flexuosa (wavy hair grass), *Poa annua* (annual meadow grass) and *Trifolium incarnatum* (crimson clover) were treated at 2 litres herbicide product per hectare, and *Rhododendron ponticum* at 10 litres per hectare. Each of the 264 plots were then subjected to 6 mm of artificial rainfall over 60 minutes, at either 3, 6 or 12 hours after herbicide application.

Table 8 Products tested for rain-fastness

Product / additive combination	Notes
Roundup (360 g/l glyphosate)	Generic glyphosate formulation
Roundup and Mixture B	Current recommended additive for increased efficacy / rain-fastness
Roundup and Hyspray	Modern, commonly used agricultural additive
Roundup and Bond	Latex 'sticker', to prevent wash off
Roundup ProBiactive (360 g/l glyphosate)	New Monsanto formulation
Roundup ProBiactive and Mixture B	
Hilite (144 g/l glyphosate)	Nomix-Chipman formulation, with incorporated rain-fast additives
Touchdown (330 g/l glyphosate)	Zeneca glyphosate trimesium salt formulation
Touchdown and Hyspray	
Touchdown and experimental adjuvant	

Recommendations

Glyphosphate rain-fastness

Rainfall not expected

Rhododendron

Apply conventional glyphosate formulations (360 g/l isopropylamine salt of glyphosate) at 10 l/ha with Mixture B at 2% of final spray volume. The use of imazapyr may be more effective at controlling rhododendron; see Edwards *et al.* (1993), or Willoughby and Dewar (1995).

Grass and herbaceous weeds, overall spray, trees dormant

Apply conventional glyphosate formulation or Roundup ProBiactive at 1.5–2 l/ha.

Grass and herbaceous weeds, directed or pre-plant spray

Apply conventional glyphosate or Roundup ProBiactive at 3–5 l/ha.

Deschampsia flexuosa

Difficult to control with glyphosate products, although directed applications of 5 l/ha may be satisfactory. Alternatives such as cycloxydim or imazapyr may be more appropriate; see Willoughby (1996c).

General

Touchdown at 3–5 l/ha is a satisfactory alternative as a directed or pre-plant spray, but it is **not yet approved for use in forestry situations**.

Hilite is a suitable alternative as a directed or pre-plant spray against grass and herbaceous weeds, but may be more expensive than other glyphosate formulations.

Roundup ProBiactive has no hazard rating and is not harmful to fish. This may justify its use instead of cheaper generic glyphosate products in some situations. This benefit is lost when Mixture B is added to the mix.

Rainfall expected

If rain is expected within 6 hours, use Roundup (or an alternative generic 360 g/l glyphosate formulation) with Mixture B at 2% of the final spray volume. Always aim for a minimum rain-free period of 6 hours, and preferably 24 hours after spraying. For herbaceous or woody weeds, consider using triclopyr, which is likely to be rain-fast in 2 hours.

Never overspray crop trees with any glyphosate product when using Mixture B.

Update of pages 85, 131 and 161 in Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Refer to Willoughby (1997) for the full experimental write-up; Edwards *et al.* (1993) or Willoughby and Dewar (1995) for rhododendron; Willoughby (1996c) for *Deschampsia flexuosa*.

Control of coppice regrowth

Cut stumps

Experiments funded by the Highways Agency were set up to test herbicides for the control of regrowth from cut stumps following thinning operations in roadside plantings. Of the herbicides tested, a 20% solution of 50 g/l imazapyr as Arsenal gave adequate control of ash, sycamore and birch, and an 8% solution of 480 g/l triclopyr as Timbrel gave adequate control over ash and sycamore, though slightly poorer control of birch. Both these treatments were more effective than 360 g/l glyphosate as Roundup applied as a 20% solution. Treatments were made in mid-March, and the relative efficacy of glyphosate may be better with applications made earlier in the winter.

Foliar application

A further trial showed that a 20% solution of 360 g/l glyphosate as Roundup gave the most effective control of existing foliar regrowth of ash.

Recommendations

Control of coppice regrowth

Where control of stump regrowth is required, and if existing practice of applying glyphosate has proved ineffective, consider using an 8% solution of 480 g/l triclopyr as a cut stump spray, immediately after cutting. If regrowth still occurs, spray young foliage (i.e. at no more than 30 cm in height) with a 20% solution of 360 g/l glyphosate. For pre-plant total vegetation control, a 20% solution of 50 g/l imazapyr is most effective.

Update of pages 120–121 in Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Refer to Willoughby (1999) for the full experimental write-up.

Regulatory changes

Definitions of situations where pesticides may be used

Figure 1 shows a hypothetical herbicide label to illustrate the following section. The statutory conditions box of herbicide labels (marked 'A' in Figure 1) defines the situations where the product can be used. It is illegal to use the product outside this situation.

Pesticides have an approved **field of use** (marked 'B' in Figure 1), and an approved **situation/crop** (marked 'C' in Figure 1). Both of these terms appear in the product's statutory box on the front of the herbicide label, and by law must be complied with. A **field of use** gives the broad area of use of the product, and identifies if certification is required.

Foresters are usually concerned with FORESTRY, HORTICULTURAL or AGRICULTURAL fields of use, all of which require user certification. The **situation** defines more closely where the product can be used (e.g. CONIFER PLANTATIONS). In agricultural products a crop species is often defined, but this is usually left to the non-statutory sections of forestry products. To complicate matters further, forestry products often have a FORESTRY **field of use**, and a FORESTRY **situation**, neither of which seem to have an agreed definition. A wide range of terms are currently used on herbicide labels to describe forestry situations, and this often leads to confusion and ambiguity. In an attempt to clarify matters, the Pesticides Safety Directorate has completed a consultation exercise to develop revised, fewer and

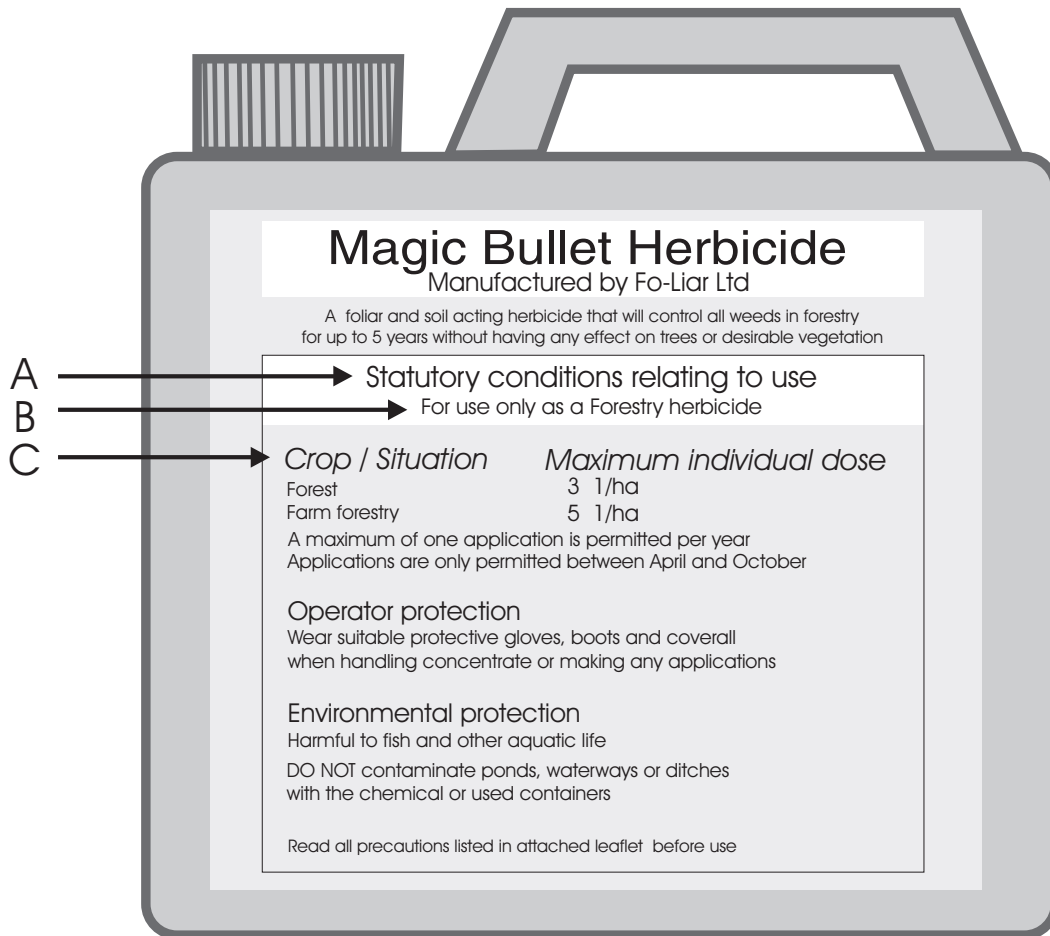


Figure 1 Hypothetical herbicide label for illustrative purposes

Table 9 Herbicide definitions relevant to forestry

Situation / crop term	Field of use	Definition	Notes
Forest	Forestry	Groups of trees being grown in their final positions, e.g. after planting out from a forest nursery, or from natural regeneration, colonisation or coppicing. Covers all woodland grown for whatever objective, including commercial timber production, amenity and recreation, conservation and landscaping, ancient traditional coppice and farm forestry. This includes restocking of established woodlands, and new planting on both improved and unimproved land.	This is a very broad definition covering all land types and tree species. It covers farm woodlands, plantations of broadleaves or conifers, and semi-natural woodlands, established by any method. It also includes the management of vegetation within forests not directly related to establishing trees, such as the management of tracks and ride-sides, and areas used for public recreation. It includes Christmas trees although these are currently covered by separate long term off-label arrangements allowing the use of any approved product, with certain restrictions. Any specific exclusion period for the public will appear on the label. Small groups or individual trees in parkland or roadside verges fall under Amenity use, whereas larger groups of trees on roadsides or in community forests fall under the Forest definition. Between these two cases there will be some overlap. It is the responsibility of the users to ensure that, in deciding which category is applicable, the safety of humans and the environment is ensured when choosing and applying pesticide products.
Farm forestry or farm woodland (terms are interchangeable)	Forestry	Groups of trees established on arable land or improved grassland including those planted for short rotation coppicing.	All new planting on arable or improved grassland as defined in the Woodland Grant Scheme III is classed as farm woodland or Farm forestry , which is a subset of the Forest category. Some pesticides normally used on arable crops are needed in the establishment phase of farm woodlands, and these products may gain approval in this situation. New hedges planted as boundaries around arable fields are also included. Trees planted on land restored from, for example, mineral workings, using agricultural soil, or planted with a grass sward, may also be considered arable or improved grassland, and hence be covered by this definition.
Forest nursery	Horticultural	Areas where young trees are raised outside for subsequent forest planting.	Areas where young trees are grown, for subsequent transplanting to forest and amenity plantings. Crucially, wildlife and the public have restricted access.

Situation / crop term	Field of use	Definition	Notes
Amenity vegetation	Agricultural/horticultural	Areas of semi-natural or planted herbaceous plants, trees and shrubs. If only one type is allowed, this will be specified, e.g. amenity vegetation – trees and shrubs.	Can include small grassy areas mixed with other vegetation, semi-natural areas not intended for grazing such as heathland, and planted areas such as rose beds and tree and shrub plantings. Individual or small groups of trees in parkland or on roadsides will be covered. There is some overlap with the Forest situation in the latter two cases – see earlier. The label should be checked to see if application in rooting zones of trees and shrubs is safe.
Ornamental plant production	Horticultural	This includes all ornamental plants that are grown for sale or are produced for replanting into their final growing position.	Forest nurseries are included if the label recommends treatment of relevant individual tree species, or a separate approval may be granted for Forest nurseries alone.
Land not intended to bear vegetation	Industrial/horticultural	Soil or man-made surfaces where it is intended that no or minimal vegetation will be grown for several years. It does not include the land between rows of crops.	Covers bare soil, but also that covered by hardcores, gravel and tarmac. Thus this situation may be relevant to weed control on forest roads or around buildings.
Managed amenity turf	Horticultural	Frequently mown, intensively managed turf.	Parks, sports fields, golf courses, etc. of little or no relevance to forestry.
Amenity grassland	Agricultural/horticultural	Semi-natural or planted grassland with minimal management.	Railway/road embankments and grassland nature reserves, not intended for grazing. Open space within forests is likely to be covered by the Forest situation.
Green cover on land temporarily removed from production	Agricultural/horticultural	This includes fields covered by grass and herbaceous natural regeneration or by a planted green cover crop which will not be consumed by humans or livestock. These fields will be growing harvested crops in other years.	For example set-aside land. Not applicable to forestry – if trees are planted on set-aside it becomes a Forest or Farm forestry situation.
In or near water	Use in or near water	Includes drainage channels, streams, rivers, ponds, lakes, reservoirs, canals and dry ditches.	Also covered is the control of vegetation growing on the banks, or areas immediately adjacent to such water bodies, but not the control of vegetation growing on nearby cropped or amenity land. It is recommended by the Forestry Commission that only pesticides approved for use in this situation are used within 10 m of watercourses, or 20 m of lakes and reservoirs.

clearer definitions. These new definitions have been used on all products approved since 10 October 1997. However, for some time after this date both the old and new definitions may be found on different products.

As always, the message to the user is to carefully READ THE PRODUCT LABEL for clarification.

Table 9 summarises the new definitions for the forestry and amenity fields, and other non-edible crop situations. More detailed information is available in Godson (1994, 1996).

Buffer zones

To reduce the risk of contamination, Forestry Commission Field Book 8 gives recommended buffer zones adjacent to watercourses where pesticides should not normally be used. If there is no alternative to pesticide use, it is recommended that only products with approval in or near water are used. When using low volume sprayers or for aerial applications these buffer zones should be extended. The following buffer zones are recommended.

Conventional sprayers (hand-held and mechanised)

- 10 m from watercourses
- 20 m from lakes or reservoirs.

Hand-held incremental applicators (ULVA drift sprayers)

- 50 m from watercourses, lakes or reservoirs.

Aerial spraying

- 160 m from watercourses, lakes or reservoirs.

These distances may need to be increased depending on wind conditions and spray droplet size.

Disposal of waste pesticide

Forestry Commission Field Book 8 gives guidance on the safe disposal of waste arising from pesticide applications. This information is based upon the HSC Approved Code of Practice – *The safe use of pesticides for non-agricultural purposes* (HSC, 1994). The essence of these arrangements is as follows.

- Unused pesticide concentrate should be offered back to the supplier, or disposed of through a licensed waste disposal contractor. A waste transfer note needs to be obtained from the contractor and retained for 2 years.
- Contaminated solid material (old clothing, used containers, etc.) should be disposed of through a licensed waste disposal contractor as above.
- Waste washings need to be disposed of in the same way as unused dilute product, unless the washings are collected in a sealed bund system in a pesticide store, for later disposal by a licensed waste disposal contractor.
- For unused dilute product or waste washings there are three potential methods of disposal.
 1. They can be collected and disposed of by a licensed waste disposal contractor.
 2. Alternatively, they can be sprayed on to previously treated cropland (take care not to exceed label recommendations) or on to untreated areas of the crop.
 3. Until the 1 April 1999 users were also able to spray on to non-crop land, with approval from the Environment Agency or the Scottish Environment Protection Agency.

Users must now obtain a formal authorisation to permit them to dispose of washings and unused dilute pesticide on non-crop land. Apply to the Environment Agency or the Scottish Environment Protection Agency.

Chapter 4

Herbicide approvals and recommendations

Label approvals

A list of forestry approved products and guideline indicative costs are provided later in this chapter (see pages 17–19).

2,4-D/Dicamba/Triclopyr (Broadshot)

Broadshot was approved for the control of herbaceous and woody weeds. Manufacture has ceased for commercial reasons. A similar product, NuFarm Nushot, with the same active ingredients, has recently been given approval for use in forestry.

Cycloxydim (Laser)

Full approval has been granted for the use of Laser (200 g/l cycloxydim) in forestry. Details in the Herbicide recommendations section (pages 20–48) follow the format of Forestry Commission Field Book 8 for ease of future reference.

Atrazine

Manufacturers of atrazine products are involved in a process of modifying their labels to prevent their use in forestry. However, Atlas Atrazine may still be used under a full label approval for forestry, on conifers at 9.0 litres per hectare. (Note: we are unsure how long this approval will last, but the manufacturers have no plans to change the label at the time of publication.)

Although not specified on the label, the Pesticides Safety Directorate have ruled that the Atlas Atrazine approval also permits applications to be made to broadleaved trees, at user's own risk. Only dormant alder, ash, beech, birch, maple, oak, rowan and sycamore should be treated, at rates of up to 6.75 litres per hectare. Applications to hazel, lime, poplar, willow and hawthorn should be treated with more caution. Unhealthy or poorly planted trees, and those on sandy soils, are more susceptible to damage – application rates should be reduced, or alternative products considered. To reduce the risk of damage to broadleaves, users should consider only treating trees which have been established for at least 12 months on heavy soil.

When using atrazine products, only spot or band applications should be used, and no applications should take place within 10 m of watercourses or 20 m of lakes and reservoirs.

Users must wear suitable protective jacket, trousers, gloves, boots, face shield and disposable filtering respirator when making applications or handling the concentrate.

Note that the minimum volume rate for Atlas Atrazine is 200 litres of diluent per hectare. An off-label approval has been granted by the Pesticides Safety Directorate to allow application at reduced volumes through the Ulvaforest sprayer. See section on Herbicide recommendations and off-label approvals for the precise conditions of the off-label approval.

An alternative to using high rates of atrazine may be to use a tank mix of 1.5 – 2 l/ha glyphosate with 3 – 5 l/ha atrazine. The glyphosate may still control established grass, whilst the atrazine gives residual control.

Off-label approvals

General

All off-label applications are made at the user's own risk. The off-label approval text itself must be obtained and referred to, and all conditions of use contained in it and on the product label complied with. Note that off-label approvals are granted for specific products by the Pesticides Safety Directorate. **Simply ignoring product label instructions is not an off-label use – it is an illegal offence that may leave you liable to prosecution.** Relevant off-label approval texts are included later in this chapter (see pages 20–48).

Forest off-label approvals

Off-label approval has been obtained for the use of Casoron G (6.75% w/w dichlobenil) in forest situations. The section on Herbicide recommendations and off-label approvals contains recommendations for use following the format of Forestry Commission Field Book 8.

Off-label approval has also been obtained for Unicrop Simazine FL (500 g/l simazine), and Goltix WG (70% w/w metamitron), but these are primarily of use in farm forestry situations, and the recommendations given (pages 37 and 43) reflect this.

Off-label approval has been granted to use Fortrol (500 g/l cyanazine) in forestry. Cyanazine by itself is primarily of use for pre-emergence control of germinating arable weeds in farm forestry. Full details for the use of this product in farm woodlands can be found in Forestry Commission Field Book 8 or Field Book 14.

The main use for cyanazine in conventional forestry is in mixture with atrazine, for controlling established and subsequently germinating grass and herbaceous weeds. Recommendations in the section on Herbicide recommendations and off-label approvals reflect this use.

Farm forestry off-label approvals

Off-label approval has been obtained for the use of Devrinol (450 g/l napropamide), Ronstar Liquid (250 g/l oxadiazon) and Venzar Flowable (440 g/l lenacil) for use in farm forestry situations. See pages 40, 34, 46 for recommendations.

Amitrole (Weedazol)

Off-label approval has been obtained for the use of Weedazol (225 g/l amitrole) in farm forestry situations. However, this product should only be used in short rotation coppice, over dormant poplar and willow after cut back, at rates of up to 20 l/ha. The recommendation in Forestry Commission Field Book 14 remains unchanged.

Off-label arrangements for Christmas trees

Forestry Commission Field Book 15 *Weed control in Christmas tree plantations* (Willoughby and Palmer, 1997) deals with the extensive range of products that may be available to users under the long-term off-label arrangements for growing Christmas trees as hardy ornamental nursery stock. In general, to take advantage of these extensions of use, Christmas trees must be grown in a separate fenced-off horticultural holding where there is no intention of growing trees on to form a final timber crop, no risk of exposure to the public, wildlife, or non-target fauna, and where there is no risk of run-off to watercourses and surrounding areas. Refer to Field Book 15 for full details.

List of approved products

Products with full forestry label approval

<i>Active ingredient</i>	<i>Product (manufacturer)</i>
ammonium sulphamate	Amcide (BH&B) Root-out (Dax Products)
asulam	Asulox (RP Environmental)
atrazine	Atlas atrazine (Atlas)
cycloxydim	Laser (BASF) Stratos (BASF) Standon cycloxydim (Standon)
2,4-D	Dicotox Extra (RP Environmental) MSS 2,4-D Ester (Mirfield)
2,4-D/dicamba/triclopyr	Broadsword (United Phosphorus) Nufarm Nushot (Nufarm)
dicamba	Tracker (PBI) <i>Note: Still approved, but manufacture has ceased.</i>
diquat/paraquat	Farmon PDQ (Zeneca) <i>Note: Still approved, but manufacture has ceased.</i>
fosamine ammonium	Krenite (Du Pont / Selectokill) <i>Note: Still approved, but manufacture has ceased.</i>
glufosinate-ammonium	Challenge (AgrEvo) Harvest (AgrEvo)
glyphosate	Alpha Glyphogan (Makhteshim) Barbarian (Barclay) Barclay Gallup Barclay Gallup Amenity (Barclay) Barclay Garryowen (Barclay) Clinic (Nuform) Glyphos (Cheminova) Glypher (PBI) Glyphos Proactive (Nomix-Chipman) Hilite (Nomix-Chipman) – CDA formulation Helosate (Helm) MSS Glyfield (Mirfield) Portman Glyphosate (Portman) Rival (Monsanto) Roundup Amenity (Monsanto) Roundup Pro (Monsanto) Roundup ProBiactive (Monsanto) Stefes Glyphosate (Stefes) Stefes Kickdown 2 (Stefes) Stirrup (Nomix-Chipman) – CDA formulation
imazapyr	Arsenal 50 (Nomix-Chipman)
isoxaben	Gallery 125 (Dow AgroSciences) Flexidor 125
paraquat	Barclay Total (Barclay) Dextrone X (Nomix Chipman) Gramoxone 100 (Zeneca / AgrEvo)

propryzamide	Headland Judo (Headland) Headland Redeem flowable (Headland) Kerb Flo (PBI) Kerb 50W (PBI) Kerb Granules (PBI) Kerb Pro Granules (PBI) Kerb Pro Flo (PBI)
triclopyr	Garlon 4 (Dow AgroSciences) Timbrel (Dow AgroSciences) Chipman Garlon 4 (Nomix-Chipman)

Products with full farm forestry label approval

<i>Active ingredient</i>	<i>Product (manufacturer)</i>
propaquizafop	Falcon (Cyanamid) Landgold PQF 100 (Landgold) Standon propaquizafop (Standon)
fluazifop-p-butyl	Fusilade 250 EW (Zeneca) Citadel (Zeneca) Corral (Zeneca)

Products with forestry off-label approval

<i>Active ingredient</i>	<i>Product (manufacturer)</i>
atrazine	Atlas Atrazine (Atlas)
clopyralid	Dow Shield (Dow AgroSciences)
cyanazine	Fortrol (Cyanamid)
dichlobenil	Casoron G (Miracle)
metamitron	Goltix WG (Bayer)
simazine	Unicrop Simazine FL (Unicrop)

Products with farm forestry off-label approval

<i>Active ingredient</i>	<i>Product (manufacturer)</i>
amitrole	Weedazol (Bayer)
lenacil	Venzar Flowable (DuPont)
metazachlor	Butisan S (BASF)
napropamide	Devrinol (Rhone Poulenc / United Phosphorus)
oxadiazon	Ronstar (Rhone Poulenc)
pendimethalin	Stomp (Cyanamid)

Full details of the method of use for products containing these active ingredients can be found in Forestry Commission Field Book 8 (Willoughby and Dewar, 1995) and Forestry Commission Field Book 14 (Willoughby and Clay, 1996). Only products that are expected to be available for purchase are included, as listed by Whitehead (1999). For some active ingredients such as glyphosate, many more products have approval, but are not expected to be actively marketed. Check the product label of any product for its field of use, and if any doubt remains the Forestry Commission or Pesticides Safety Directorate retain a full list of forestry approved products.

ALWAYS READ THE PRODUCT LABEL

Forestry approved herbicides: guideline costs at March 1999

Active ingredient	Cost per litre or kg (£)	Cost of herbicide per treated ha (£)
amitrole	6.00	120.00
ammonium sulphamate	6.00	Variable
asulam	9.00	45.00 – 90.00
atrazine	3.00	27.00 – 40.50
clopyralid	71.00	35.00 – 71.00
cyanazine	12.00	60.00
cycloxydim	34.00	34.00 – 76.50
2,4-D	5.00	40.00 – 65.00
2,4-D / dicamba / triclopyr	22.00	44.00 – 110.00
dichlobenil	6.00	336.00 – 750.00
fluazifop-p-butyl (250 g/l)	72.00	36.00 – 108.00
glufosinate ammonium	13.00	39.00 – 65.00
glyphosate	5.00	7.50 – 50.00
imazapyr	22.00	165.00 – 330.00
isoxaben	55.00	110.00
lenacil	34.00	136.00
metamitron	23.00	113.00
metazachlor	22.00	55.00
napropamide	20.00	44.00 – 180.00
oxadiazon	35.00	280.00
paraquat	8.00	24.00 – 44.00
pendimethalin	7.00	35.00
propaquizafop	34.00	24.00 – 51.00
propyzamide: granules	6.00	228.00
wettable powder	29.00	87.00
flowable	24.00	90.00
simazine	3.00	7.00
triclopyr	28.00	56.00 – 224.00

Notes: The above costs are indicative only and do not take account of VAT, any discounts, or extra costs for order size or delivery, etc. The costs per hectare shown are per treated hectare for herbicide only and do not include the cost of application. Thus, if spots or strips around trees are treated instead of the whole area, costs will be considerably lower (e.g. 50 – 75 % less at 2500 stems/ha) for a gross hectare of woodland. Field Book 8 gives details on the calculation of costs of herbicide treatment depending on area treated and application technique used.

Herbicide recommendations and off-label approvals

Forest use

Atrazine and cyanazine

Products

Atlas Atrazine	500 g/l atrazine (Atlas, Tel: 01924 411138).
Fortrol	500 g/l cyanazine (Cyanamid, Tel: 01329 224000).

Description

A tank mix of 5 l/ha Atlas Atrazine (500 g/l atrazine) with 5 l/ha Fortrol (500 g/l cyanazine), which will give the same active ingredient dose as the commercially withdrawn product Holtox. This forms a herbicide mix with contact (root uptake) and soil action, which will control most germinating grass and broadleaved weeds. Some established grass and herbaceous weeds will also be effectively controlled. Spring application may give adequate control throughout the growing season. Planting can be carried out immediately after treatment, but the level of weed control will be reduced if the soil is disturbed following application.

Atrazine has full label approval. Cyanazine (as Fortrol) has an off-label approval – all applications are made at user's own risk. A copy of the off-label approval follows this section; it must be referred to before any applications are made. The specific off-label approval for the use of atrazine through the Ulvaforest sprayer also follows.

Crop tolerance

Sitka spruce, Norway spruce, Scots Pine, Corsican pine, lodgepole pine, larch, grand fir, Douglas fir, Serbian spruce, ash, alder, birch, beech, oak, rowan and whitebeam are all tolerant of treatment before the start of bud burst in the spring. Western hemlock, western red cedar, sycamore, cherry, sweet chestnut, poplar and willow (unrooted sets) are tolerant of the products applied separately. It is advisable to initially only treat small areas to determine field tolerance of these species to the mix of the two products. Atrazine and cyanazine are very soluble. Only apply to well planted, unstressed trees, that are not on sandy, man made or waterlogged sites, and not on areas prone to drought cracking. To reduce risk of crop damage, only apply to trees established at least 12 months.

Do not apply to light textured (sandy) soils.

Product rate

Apply a tank mix of 5 l/ha atrazine with 5 l/ha cyanazine.

Methods of application

Pre- or post-plant, band or spot application only.

Apply through mechanised or hand-held sprayers, at no less than 200 l/ha – medium volume (MV).

Timing of application

Optimum control will be obtained by applications made just prior to weed germination, or active growth of established weeds. Apply in the spring, from February to March, before tree flushing.

Additional information

- 1. Weed control**
 - a. On sites with heavy infestations of perennial weeds rates might be increased to:
Conifers: 8.3 l/ha atrazine with 5.2 l/ha cyanazine.
Broadleaves: 6.75 l/ha atrazine with 5.2 l/ha cyanazine.
As this increases the risk of crop damage, it is recommended that users only consider this on heavy (clay, sandy clay, silty clay) soils, to healthy trees established for at least 12 months.
 - b. For optimum weed control apply to moist soil, where some rainfall is expected soon after application. Applications to dry sites will reduce the level of weed control.

ALWAYS READ THE PRODUCT LABEL

- c. Weed control will be reduced on soils with an organic peat layer.
- d. Do not apply to steep slopes – heavy rainfall can cause soil creep and surface run-off before the herbicides have penetrated the soil.
- e. Do not use on trees grown for Christmas trees.
- f. Most annual grass and herbaceous species will be controlled pre-emergence (prior to germination). The combination of atrazine and cyanazine gives a wider range of control than each product used separately.
- g. Table 10 gives details of weed susceptibility.

2. Protective clothing

Operators must wear suitable protective trousers, jacket (or coverall), gloves, face shield and disposable respirator when handling the concentrates, mixing, or applying the products. Jacket, trousers (or coverall), gloves and boots must be worn when applying herbicides by vehicle sprayers, or when handling contaminated surfaces.

3. Special precautions

Harmful if swallowed or in contact with skin.

Harmful to fish and other aquatic life – do not contaminate ponds, watercourses or ditches with the chemical or used containers.

Users must plant grass strips, or leave strips, as buffer zones 10 m wide from watercourses, and 20 m wide from lakes and reservoirs.

Users must refer to the off-label approval text following this section. All applications are made at user's own risk.

The label on the herbicide container has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Table 10 Weed susceptibility to atrazine and cyanazine

Weed species	Susceptibility	
	Post-emergence	Pre-emergence
American willowherb (<i>Epilobium adenocaulon</i>)		MS ⁺
Annual meadow grass (<i>Poa annua</i>)	S	S
Barren brome (<i>Bromus sterilis</i>)		S
Bent grasses (<i>Agrostis</i> spp.)	MS	S
Black bindweed (<i>Bilderdykia convolvulus</i>)	S 200 mm	S
Black grass (<i>Alopecurus myosuroides</i>)		S
Black nightshade (<i>Solanum nigrum</i>)	S 200 mm	S
Bracken (<i>Pteridium aquilinum</i>)	R	
Bramble (<i>Rubus fruticosus</i>)	R	MS
Briars (<i>Rosa rubiginosa</i>)	R	
Broadleaved dock (<i>Rumex obtusifolius</i>)		S ⁺
Charlock (<i>Sinapis arvensis</i>)	S 200 mm	S
Cleavers (<i>Galium aparine</i>)	R	MR
Clover (<i>Trifolium</i> spp.)		S ⁺
Cock's foot (<i>Dactylis glomerata</i>)	MS	MR
Common chickweed (<i>Stellaria media</i>)	S 200 mm	S
Common couch (<i>Elymus repens</i>)	MS	MS
Common fumitory (<i>Fumaria officinalis</i>)	S 1ETL	S
Common hemp nettle (<i>Galeopsis tetralit</i>)	S 200 mm	S
Common orache (<i>Atriplex patula</i>)	S 1ETL	S
Common poppy (<i>Papaver rhoeas</i>)	S 200 mm	S
Common/perennial/stinging nettle (<i>Urtica dioica</i>)		S ⁺
Corn buttercup (<i>Ranunculus arvensis</i>)		R
Corn chamomile (<i>Anthemis arvensis</i>)		S
Corn marigold (<i>Chrysanthemum segetum</i>)		S
Corn spurrey (<i>Spergula arvensis</i>)	S 200 mm	S
Creeping bent (<i>Agrostis stolonifera</i>)		S
Creeping buttercup (<i>Ranunculus repens</i>)		MS ⁺
Creeping soft grass (<i>Holcus mollis</i>)	MS	MR
Creeping thistle (<i>Cirsium arvense</i>)		R ⁺
Crested dog's tail (<i>Cynosurus cristatus</i>)	S	
Deadnettle (<i>Lamium</i> spp.)	S 200 mm	S
False oat grass (<i>Arrhenatherum elatius</i>)	S	S
Fat hen (<i>Chenopodium album</i>)	S 1ETL	S
Fescues (<i>Festuca</i> spp.)	S	S
Field forget-me-not (<i>Myosotis arvensis</i>)	S 200 mm	S
Field pansy (<i>Viola arvensis</i>)	S 200 mm	S

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Weed species	Susceptibility	
	Post-emergence	Pre-emergence
Golden oat grass (<i>Trisetum flavescens</i>)	S	
Gorse (<i>Ulex</i> spp.)	R	
Groundsel (<i>Senecio vulgaris</i>)	R	S
Heather (<i>Calluna vulgaris</i>)	R	
Knotgrass (<i>Polygonum aviculare</i>)	S 1ETL	S
Mat grass (<i>Nardus stricta</i>)	S	
Mayweed spp. (<i>Chamomilla</i> spp., <i>Matricaria</i> spp., <i>Anthemis</i> spp.)	S 1ETL	S
Meadow foxtail (<i>Alopecurus pratensis</i>)	S	
Mustard spp.	S 200 mm	S
Pale persicaria (<i>Polygonum lapathifolium</i>)	S 200 mm	S
Parsley piert (<i>Aphanes arvensis</i>)		S
Purple moor grass (<i>Molinia caerulea</i>)	MS	MS
Radish (<i>Raphanus raphanistrum</i>)	S 200 mm	S
Ragwort (<i>Senecio jacobaea</i>)		S [†]
Redshank (<i>Polygonum persicaria</i>)	S 200 mm	S
Rosebay willowherb (<i>Epilobium angustifolium</i>)		R
Rough stalked meadow grass (<i>Poa trivialis</i>)	MS	S
Rhododendron (<i>Rhododendron ponticum</i>)	R	
Rush (<i>Juncus</i> spp.)	R	
Ryegrasses (<i>Lolium</i> spp.)	S	S
Scarlet pimpernel (<i>Anagallis arvensis</i>)	S 200 mm	S
Sheep's sorrel (<i>Rumex acetosella</i>)		MR
Shepherd's purse (<i>Capsella bursa-pastoris</i>)	S 200 mm	S
Small nettle (<i>Urtica urens</i>)		S
Smooth stalked meadow grass (<i>Poa pratensis</i>)	S	MS
Soft brome (<i>Bromus mollis</i>)	S	
Spear thistle (<i>Cirsium vulgare</i>)		S [†]
Speedwell spp. (<i>Veronica</i> spp.)	S 200 mm	S
Stinking chamomile (<i>Anthemis cotula</i>)		S
Sweet vernal grass (<i>Anthoxanthum odoratum</i>)	S	S
Thale cress (<i>Arabidopsis thaliana</i>)		S
Timothy (<i>Phleum pratense</i>)	S	
Tufted hair grass (<i>Deschampsia caespitosa</i>)	MS	MS
Volunteer cereals		MS
Wavy hair grass (<i>Deschampsia flexuosa</i>)	MR	S
Wild oat (<i>Avena fatua</i>)	R	MS
Yorkshire fog (<i>Holcus lanatus</i>)	S	S

Key: S = susceptible MS = moderately susceptible MR = moderately resistant ETL = extended true leaves

Notes: Pre-emergence susceptibility based on activity of atrazine or cyanazine separately, except those marked †, which are based on recent experimental results. Activity of the two combined products is likely to be greater than each product used separately.

ALWAYS READ THE PRODUCT LABEL

Revised recommendations

Summary of new susceptibility information for clopyralid

Dow Shield (200 g/l clopyralid) can be safely applied over actively growing trees at user's own risk, although directed sprays are safer; see Field Book 8 (Willoughby and Dewar, 1995). For sequential spraying, initial results show good crop tolerance. Although some foliage damage can result, ongoing experiments show little long-term growth effects. However, some sycamore have suffered a slight reduction in diameter increment, and Corsican pine have suffered slightly reduced height increment. As the programme of experiments has not yet been completed, it is recommended that directed sprays are used where possible pending the final results of these trials.

Table 6 gives the susceptibility of weed species to clopyralid, based upon label information, updated to take account of the experimental results.

Update of Table 5 (page 22) in Forestry Commission Field Book 14 (Willoughby and Clay, 1996) and Table 8 (page 172) in Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Farm woodland weed susceptibility

The susceptibility of six weed species (clover, creeping buttercup, spear thistle, ragwort, common nettle, broadleaved dock) to six pre-emergent residual herbicides tested is summarised in Table 3.

Update of information in Table 4 (page 18) of Forestry Commission Field Book 14 (Willoughby and Clay, 1996) and Table 8 (page 172) of Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Herbicide Update

Quick reference guide to information provided on:

- revised recommendations
- regulatory changes
- revised herbicide approvals

Weed control among Sitka spruce cuttings

Herbicides tested (napropamide, propaquizafop, propyzamide, simazine) do not have approval for use on protected crops at present. No recommendations for their use in these situations are made at the present time.

Refer to Forestry Commission Bulletin 111 *Forest nursery practice* (pages 167–178) for current recommendations on weed control in forest nurseries (Aldhous and Mason, 1994); Whitehead (1999) for guidance on products approved for use on protected crops.

Revised herbicide approvals

- Label approvals
- Off-label approvals
 - for forest use: atrazine, cyanazine, cycloxydim, dichlobenil
 - for farm woodland use only: oxadiazon, simazine, napropamide, metamitron, lenacil
- Guideline costs for forestry approved herbicides

Tolerance of broadleaved tree seed to pre-emergence herbicide

Based on glasshouse and field trials, the following herbicides are recommended as safe to apply as post-sowing, pre-emergent treatments to clean sites to control germinating weeds in nurseries, or in new direct-sown woodlands on improved grassland or arable sites.

Napropamide (as Devrinol): can be safely applied as follows:

- up to 6.6 l/ha to ash or sycamore
- at 2.2 l/ha for cherry and oak
- at 2–6.6 l/ha to rowan, for moderate tolerance only

Pendimethalin (as Stomp): can be safely applied up to 5 l/ha to ash, oak and sycamore.

Simazine (as Unicrop Simazine FL): can be safely applied up to 4.0 kg/ha to oak.

At least 2 weeks should elapse between treatment and subsequent tree seed germination. Precise treatment timings will therefore depend on sowing date and ground conditions, but in general, for autumn sowings spray napropamide in November to February. For other herbicides, after either spring or autumn sowings, aim to spray in late February to the middle of March.

Tree seed should be covered with soil following normal good practice guidelines, i.e. to approximately the same depth as the size of the seed itself.

Update of Forestry Commission Research Information Note 286 *Weed control when establishing new farm woodlands by direct seeding* (Willoughby, 1996b); pages 171–173 of Forestry Commission Bulletin 111 *Forest nursery practice* (Aldhous and Mason, 1994).

Control of coppice regrowth

Where control of stump regrowth is required, and if existing practice of applying glyphosate has proved ineffective, consider using an 8% solution of 480 g/l triclopyr as a cut stump spray, immediately after cutting. If regrowth still occurs, spray young foliage (i.e. at no more than 30 cm in height) with a 20% solution of 360 g/l glyphosate. For pre-plant total vegetation control, a 20% solution of 50 g/l imazapyr is most effective.

Update of pages 120–121 in Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Refer to Willoughby (1999) for the full experimental write-up.

Glyphosate rain-fastness

Rainfall not expected

Rhododendron Apply conventional glyphosate formulations (360 g/l isopropylamine salt of glyphosate) at 10 l/ha with Mixture B at 2% of final spray volume. The use of imazapyr may be more effective at controlling rhododendron; see Edwards *et al.* (1993), or Willoughby and Dewar (1995).

Grass and herbaceous weeds, overall spray, trees dormant Apply conventional glyphosate formulation or Roundup ProBiactive at 1.5–2 l/ha.

Grass and herbaceous weeds, directed or pre-plant spray Apply conventional glyphosate or Roundup ProBiactive at 3–5 l/ha.

Deschampsia flexuosa Difficult to control with glyphosate products, although directed applications of 5 l/ha may be satisfactory. Alternatives such as cycloxydim or imazapyr may be more appropriate; see Willoughby (1996).

General Touchdown at 3–5 l/ha is a satisfactory alternative as a directed or pre-plant spray, but it is **not yet approved for use in forestry situations**.

Hilite is a suitable alternative as a directed or pre-plant spray against grass and herbaceous weeds, but may be more expensive than other glyphosate formulations.

Roundup ProBiactive has no hazard rating and is not harmful to fish. This may justify its use instead of cheaper generic glyphosate products in some situations. This benefit is lost when Mixture B is added to the mix.

Rainfall expected

If rain is expected within 6 hours, use Roundup (or an alternative generic 360 g/l glyphosate formulation) with Mixture B at 2% of the final spray volume. Always aim for a minimum rain-free period of 6 hours, and preferably 24 hours after spraying. For herbaceous or woody weeds, consider using triclopyr, which is likely to be rain-fast in 2 hours. **Never overspray crop trees with any glyphosate product when using Mixture B.**

Update of pages 85, 131 and 161 in Forestry Commission Field Book 8 (Willoughby and Dewar, 1995).

Refer to Willoughby (1997) for the full experimental write-up; Edwards *et al.* (1993) or Willoughby and Dewar (1995) for rhododendron; Willoughby (1996a) for *Deschampsia flexuosa*.

Regulatory changes

- Definitions of situations where pesticides may be used
- Recommended buffer zones next to watercourses, lakes or reservoirs
- Safe disposal of waste pesticide

Off-label approval Cyanazine

NOTICE OF APPROVAL NO. 0317/97

**FOOD AND ENVIRONMENT PROTECTION ACT 1985
CONTROL OF PESTICIDES REGULATIONS 1986
(S.I. 1986 NO. 1510):**

APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT

This approval provides for the use of the product named below in respect of crops and situations, other than those included on the product label. Such 'off-label use', as it is known, is at all times done at the user's choosing, and the commercial risk is entirely his or hers.

The conditions below are statutory. They must be complied with when the off-label use occurs. Failure to abide by the conditions of approval may constitute a breach of that approval, and a contravention of the Control of Pesticides Regulations 1986. The conditions shown below supersede any on the label which would otherwise apply.

- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Fortrol containing
- Active ingredient:* 500 g/l cyanazine
- Marketed by:* Cyanamid Agriculture UK under MAFF No. 07009 subject to the conditions relating to off-label use set out below:
- Date of issue:* 27 February 1997
- Date of expiry:* unlimited (subject to the continuing approval of MAFF 07009)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Situation:* Forest (tree establishment)
- Maximum individual dose:* 5.2 litres product per hectare
- Maximum total dose:* 5.2 litres product per hectare
- Operator protection:*
- (1) Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment:

Operators must wear suitable protective gloves and face protection (face shield) when handling the concentrate.
 - (2) However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection.
- Environmental protection:* Since this product is harmful to fish or other aquatic life, surface waters or ditches must not be contaminated with chemical or used container.

Other specific restrictions: (1) This product must only be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.

(2) Treated plants must not be used for human or animal consumption.

(3) The container must not be re-used for any purpose.

Signed: Mark Wilson (Authorised signatory)

Date: 27 February 1997

EXPLANATORY NOTES

1. Application Reference Number: **COP 94/00724.**
2. This Notice of Approval is Number 0317 of 1997.
3. This Notice will be reproduced in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Fortrol' as a forestry herbicide on newly planted and young trees (tree establishment) with a single application of 5.2 litres product per hectare or multiple applications up to a maximum total dose of 5.2 litres product per hectare applied via conventional tractor-mounted or hand-held hydraulic sprayers in 200–450 litres of water per hectare.

Off-label approval Reduced Volume Applications of Atrazine

NOTICE OF APPROVAL Number 0431/99

**FOOD AND ENVIRONMENT PROTECTION ACT 1985
CONTROL OF PESTICIDES REGULATIONS 1986 (S.I. 1986 NO. 1510):
APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT**

This approval provides for the use of the product named below in respect of crops and situations, other than those included on the product label. Such 'off-label use', as it is known, is at all times done at the user's choosing, and the commercial risk is entirely his or hers.

The conditions below are statutory. They must be complied with when the off-label use occurs. Failure to abide by the conditions of approval may constitute a breach of that approval, and a contravention of the Control of Pesticides Regulations 1986. The conditions shown below supersede any on the label which would otherwise apply.

- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Atlas atrazine containing
- Active ingredient:* 500 g/l atrazine
- Marketed by:* Atlas Crop Protection Limited under MAFF Number 07702 subject to the conditions relating to off-label use set out below:
- Date of expiry:* Unstipulated (subject to the continuing approval of MAFF 07702)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Situations:* Forest
- Maximum individual dose:* 9 litres product per hectare. (Also see 'Other specific restrictions')
- Maximum total dose:* 9 litres product per hectare per annum
- Operator protection:*
- (1) Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment:
 - (a) Operators must wear suitable protective clothing (coveralls) and suitable protective gloves when handling contaminated surfaces.
 - (b) Operators must wear suitable protective clothing (coveralls) when applying by vehicle-mounted equipment.
 - (c) Operators must wear suitable protective clothing (coveralls), suitable protective gloves and face protection (face shield) when handling the concentrate.
 - (2) However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection.
- Environmental protection:* (1) Since this product is dangerous to fish or other aquatic life, surface waters or ditches must not be contaminated with chemical or used container.

- (2) Since there is a risk to aquatic life from use, direct spray from ground based vehicle-mounted/drawn sprayers must not be allowed to fall within 6 m of surface waters or ditches; direct spray from hand-held sprayers must not be allowed to fall within 2 m of surface waters or ditches; spray must be directed away from water.

Other specific restrictions: (1) This product must only be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.

- (2) Use must be restricted to one product containing atrazine either to a single application at a maximum approved rate or to any number of reduced dose applications up to the maximum approved rate for a single application.

- (3) The maximum concentration must not exceed 9 litres of product in 20 litres of water per hectare for vehicle-mounted equipment with rotary atomisers or twin-fluid nozzles.

- (4) When applying through CDA equipment, the spray droplet spectrum produced must be of a minimum Volume Median Diameter (VMD) of 200 microns.

Adverse effects

Approval holders are under an ongoing obligation to submit immediately any new information on the potentially dangerous effects of a product or of residues of an active substance contained in a product, on human or animal health, ground water or the environment.

Signed: (For the Pesticides Safety Directorate)

Date of issue: 25 February 1999

EXPLANATORY NOTES

1. Application Reference Number: COP 98/00721
2. This Notice of Approval is Number 0431 of 1999 and supersedes Notice of Approval Number 0356 of 1999 which will be revoked with immediate effect.
3. This Notice will be published in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Atlas atrazine' as a general forestry herbicide for use in forests (coniferous and broadleaved trees) to control grass and herbaceous weeds.

To be applied at a maximum concentration of 9 litres product in 20 litres water per hectare by vehicle-mounted equipment with rotary atomisers or twin-fluid nozzles. When applying through CDA equipment, the spray droplet spectrum produced must be of a minimum Volume Median Diameter (VMD) of 200 microns.

No overall sprays are permitted. Applications must be made as band or spot sprays only (round or over trees), such that a maximum of 50% of the planting site is ever treated; 50% must be left unsprayed each year. Broadleaves should only be treated before bud burst, at rates of up to 6 litres per hectare. Users are advised that it is good forestry practice to leave a 10 m wide strip unsprayed next to watercourses, and a 20 m wide strip unsprayed next to lakes and reservoirs. Atrazine should only be used during the establishment of the forest crop.

For broadleaves, only dormant trees should be treated, at rates of up to 6.75 l/ha. Unhealthy or poorly planted trees, and those on sandy or light textured soils are most susceptible to damage, should not be treated.

To reduce soil run-off, especially in forestry plantations, users are advised to plant grass strips or leave strips 6 m wide between treated areas and surface waters.

Cycloxydim

Products

Laser	200 g/l cycloxydim
Stratos	200 g/l cycloxydim (BASF, Tel: 0161 485 6222).

Description

A foliar-acting herbicide that will control some grass species, but will have little or no effect on trees or herbaceous vegetation. It is adsorbed mainly through leaves, and then translocated to growing points, resulting in decay of stem and root tissues. It is of particular use in new farm woodland plantings, where grass starts to reinvade a site in the growing season, if residual herbicides have not been used, or as their effectiveness diminishes. It is also very effective as a substitute for atrazine in controlling *Deschampsia flexuosa* – see Willoughby (1996c). Overseas work suggests that a wider range of forest grasses may also be controlled, and experiments are in place to examine these claims – initial results are promising. Cycloxydim may be of use in certain conservation projects as grasses can be controlled with little likelihood of damage to desirable herbaceous species.

Crop tolerance

Sitka spruce, Norway spruce, Douglas fir, Noble fir, Corsican pine, Scots pine, lodgepole pine, western red cedar, Japanese larch, oak, ash, sycamore, beech, cherry, birch, alder, sweet chestnut, poplar, willow and Norway maple have been shown to be tolerant to overall applications when in active growth. However, directed sprays are always safer, particularly when treating trees with tender young growth and in hot and bright conditions.

Product rate

Apply 0.75 – 2.25 l/ha depending on weed species. Two applications may be made per year up to a maximum total application of 3.25 l/ha. See Table 11.

Methods of application

Pre- or post-plant (directed, overall, band or spot).

Hand-held or mechanised sprayers, at volume rates of 100–330 l/ha (LV MV).

Timing of application

Applications will generally be most effective when made to young weeds in active growth, from April to July. **However, refer to Table 6 for important information** on specific timing, depending on weeds present.

Additional information

- 1. Weed control**
 - a. Always apply with Actipron adjuvant oil at 0.8% of final spray volume.**
 - Best results will be achieved by applications when weeds are actively growing under warm conditions with adequate soil moisture. Effects may take 3–4 weeks to become evident. Under cool conditions activity will be slower.
 - For perennial grass species, do not cultivate for 14 days after spraying (or longer in poor growing conditions), to allow translocation to below ground rhizomes. A second application of 1.0 l/ha may be required if regrowth occurs.
- 2. Protective clothing**

Operators should wear suitable protective trousers, jacket (or coverall), boots, and gloves when making applications. In addition, when handling the concentrate, they should wear a face shield.
- 3. Special precautions**

Irritating to eyes and skin.
Harmful to fish and other aquatic life – do not contaminate ponds, watercourses or ditches with the chemical or used containers.

The label on the herbicide container has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Table 11 Weed susceptibility and timing for cycloxydim

Weed	Rate	Timing
From label Cultivated/wild oats (<i>Avena</i> spp.)	0.75–1.0 l/ha	2 expanded true leaves (ETL)→end of tillering (tillering is the shooting or branching at the base of the plant)
Barley (volunteer) (<i>Hordeum</i> spp.)	0.75–1.0 l/ha	2 ETL→end of tillering (optimum to early tillering)
Loose silky bent (<i>Apera spica-venti</i>)	0.75–1.0 l/ha	2 ETL→end of tillering (optimum to early tillering)
Canary grass (<i>Phalaris canariensis</i>)	0.75–1.0 l/ha	2 ETL→end of tillering (optimum to early tillering)
Black grass (<i>Alopecurus myosuroides</i>)	1.0–1.25 l/ha	2 ETL→end of tillering (optimum to early tillering)
Wheat (volunteer) (<i>Triticum aestivum</i>)	1.0–1.25 l/ha	2 ETL→end of tillering (optimum to early tillering)
Black bent (<i>Agrostis gigantea</i>)	1.5–2.0 l/ha	4 ETL→end of tillering (optimum to early tillering)
Creeping bent (<i>Agrostis stolonifera</i>)	2.25 l/ha	Shoots emerged, optimum 15 cm tall (4-9 ETL→end of tillering)
Common couch (<i>Elymus repens</i>)	2.25 l/ha	Shoots emerged, optimum 15 cm tall (4-9 ETL→end of tillering)
Red fescue (<i>Festuca rubra</i>)	Resistant	
Annual meadow grass (<i>Poa annua</i>)	Resistant	
Rough meadow grass (<i>Poa trivialis</i>)	Moderately resistant	
From Forestry Commission trials Wavy hair grass (<i>Deschampsia flexuosa</i>)	2.25 l/ha	Fully emerged plants in active growth, April→September

Dichlobenil

Product

Casoron G 6.75% w/w dichlobenil (Miracle, Tel: 01483 410210).

Description

A soil-acting residual granular herbicide giving long-term (6–12 months) control of most germinating annual and perennial grass and herbaceous weeds. A range of established weeds will also be controlled.

Crop tolerance

Oak, beech, ash, birch, rowan, sycamore and hawthorn are tolerant up to 125 kg/ha (i.e. 12.5 g/m²).

Cherry, willow, pine and spruce should only be treated at rates up to 80 kg/ha (i.e. 8 g/m²).

Do not treat larch, Douglas fir or western red cedar.

Only treat healthy, vigorous trees established for at least two years after planting. It is relatively easy to overdose and cause crop damage with this granular product. Take extreme care to avoid local overdosing. Do not use on unhealthy or poorly planted trees, or on sandy or gravelly soils, as crop tolerance will be reduced. Apply to soil – ensure granules do not lodge on crop species.

Product rate

56–125 kg/ha (5.6–12.5 g/m²), depending on weed species and crop tolerance.
A maximum of one application is allowed per year.

Method of application

Through a suitable granular applicator, for example the pepperpot applicator.

Timing of application

Apply to dormant trees (January–March).

Additional information

- 1. Weed control**
 - a. Best results will be achieved from applications to moist soil, when subsequent rainfall is likely.
 - b. Do not apply to frozen or waterlogged ground.
 - c. Although probably too expensive for overall use, the treatment of 1–1.5 m diameter spots may be economic and give a good degree of long-term weed control.
 - d. Palmer (1998) provides useful information on this herbicide.
 - e. Table 12 gives detailed weed susceptibility.
- 2. Protective clothing**

Wear suitable protective trousers (or coverall), gloves and boots when applying the granules. In addition, wear protective jacket (or coverall) and face shield and disposable respirator when decanting the granules.
- 3. Special precautions**
 - a. Harmful to fish and other aquatic life – do not contaminate surface waters or ditches with the chemical or used container.
 - b. This herbicide has off-label approval for use in forestry. Users must refer to the off-label approval that follows this section. All applications are made at user's own risk.

The label on the herbicide bottle has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Off-label approval Dichlobenil

NOTICE OF APPROVAL Number 0050/98

**FOOD AND ENVIRONMENT PROTECTION ACT 1985
CONTROL OF PESTICIDES REGULATIONS 1986 (S.I. 1986 NO. 1510):
APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT**

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- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Casoron G containing
- Active ingredient:* 6.75% w/w dichlobenil
- Marketed by:* Miracle Professional under MAFF Number 07926 subject to the conditions relating to off-label use set out below:
- Date of issue:* 12 January 1998
- Date of expiry:* Unstipulated (subject to the continuing approval of MAFF 07926)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Situations:* Forest
- Maximum individual dose:* 125 kg product/hectare
- Maximum number of treatments:* One per year
- Environmental protection:* Since this product is harmful to fish or other aquatic life, surface waters or ditches must not be contaminated with chemical or used container.
- Other specific restrictions:* (1) This product must only be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.
- (2) Treated plants must not be used for human or animal consumption.
- Signed:* David Meredith (For the Pesticides Safety Directorate)
- Date:* 12 January 1998

EXPLANATORY NOTES

1. Application Reference Number: COP 86/01216W
2. This Notice of Approval is Number 0050 of 1998
3. This Notice will be published in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Casoron G' in coniferous and broadleaved woodland for the control of annual and broadleaved weeds and grass. Applications to be made via suitable granule spreader.

Table 12 Weed susceptibility for dichlobenil

Product rate			
56 kg/ha	80 kg/ha	100 kg/ha	125 kg/ha
Control of most germinating annual and perennial weeds and light infestation of the following established annuals:	Provides greater persistence. Some established perennial weeds may also be suppressed.	Broadens weed control to include the following established perennial weeds:	Broadens weed control to include the following established weeds:
Annual meadow-grass (<i>Poa annua</i>)		Colt's foot (<i>Tussilago farfara</i>)	Annual mercury (<i>Mercurialis annua</i>)
Black-grass (<i>Alopecurus myosuroides</i>)		Common dandelion (<i>Taraxacum vulgaria</i>)	Black bindweed (<i>Bilderdykia convolvulus</i>)
Charlock (<i>Sinapis arvensis</i>)		Common mallow (<i>Malva sylvestris</i>)	Cleavers (<i>Galium aparine</i>)
Common chickweed (<i>Stellaria media</i>)		Creeping soft-grass (<i>Holcus mollis</i>)	Knotgrass (<i>Polygonum aviculare</i>)
Common mouse-ear (<i>Cerastium fontanum</i>)		Dock (<i>Rumex</i> spp.)	Redshank (<i>Polygonum persicaria</i>)
Common orache (<i>Atriplex patula</i>)		Field horsetail (<i>Equisetum arvense</i>)	Shepherd's purse (<i>Capsella bursa-pastoris</i>)
Corn marigold (<i>Chrysanthemum segetum</i>)		Plantain (<i>Plantago</i> spp.)	Speedwell (<i>Veronica</i> spp.)
Corn spurrey (<i>Spergula arvensis</i>)		Smooth-stalked meadow-grass (<i>Poa pratensis</i>)	Established perennials:
Fat-hen (<i>Chenopodium album</i>)		Thistle (<i>Cirsium</i> spp.)	Bracken (<i>Pteridium aquilinum</i>)
Groundsel (<i>Senecio vulgaris</i>)		Willowherb (<i>Epilobium</i> spp.)	Cock's-foot (<i>Dactylis glomerata</i>)
Hedge mustard (<i>Sisymbrium officinale</i>)			Common couch (<i>Agropyron repens</i>)
Poppy (<i>Papaver</i> spp.)			Common nettle (<i>Urtica dioica</i>)
Scentless mayweed (<i>Matricaria perforata</i>)			Creeping yellowcress (<i>Rorippa sylvestris</i>)
Small nettle (<i>Urtica urens</i>)			Ground-elder (<i>Aegopodium podagraria</i>)
Sow-thistle (<i>Sonchus</i> spp.)			Hoary cress (<i>Cardaria draba</i>)
Stinking chamomile (<i>Antemis cotula</i>)			Perennial ryegrass (<i>Lolium perenne</i>)
Wild-oat (<i>Avena fatua</i>)		Rough meadow-grass (<i>Poa trivialis</i>)	

Farm woodland use only

Oxadiazon

Product

Ronstar liquid 250 g/l oxadiazon (Rhône-Poulenc, Tel: 01277 301301; marketed by Hortichem, Tel: 01980 676500).

Description

A soil- and foliar-acting residual herbicide for the pre-emergence control of germinating annual grass and herbaceous weeds, and the post-emergence control of young, established herbaceous weeds in farm woodland only. Particularly effective against established or germinating bindweed.

Full weed susceptibility is given in Forestry Commission Field Book 15, Tables 3 and 4, pages 12–25.

Crop tolerance

Spruce, pine, larch, Douglas fir, ash, beech, oak, sycamore, birch and cherry are tolerant as container-grown stock, so should be safe when planted normally. Oxadiazon forms a layer on the surface of the soil, and is taken up by emerging shoots or when sprayed onto growing plants. For this reason, only apply when trees are deeply dormant, from January to early March. Applications at other times of the year may result in scorching of foliage unless very carefully directed.

Product rate

Apply at 8 l/ha (4 l/ha for pre-emergence control of herbaceous species only).

Method of application

Through hand-held or mechanised sprayers, at 200–450 l/ha of diluent (MV).

Timing of application

Apply after planting in winter to dormant trees, between January and early March. See Crop tolerance.

Additional information

- 1. Weed control**
 - a. For optimum activity, apply to moist, brash-free soil, cultivated to a firm fine tilth, when subsequent rainfall is likely. Under these conditions, activity may last for 4–6 months.
 - b. Do not apply to soils with organic matter content >10%.
- 2. Protective clothing**

Operators should wear suitable protective jackets, trousers (or coverall), gloves and boots when making applications. In addition, operators should wear a face shield when handling the concentrate.
- 3. Special precautions**
 - a. Irritating to eyes.
 - b. Dangerous to fish and other aquatic life – do not contaminate surface waters or ditches with chemical or used containers.
 - c. This product has an off-label approval for use in farm woodland. Users must refer to the off-label approval that follows this section. All applications are made at user's own risk.

The label on the herbicide container has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Off-label approval Oxadiazon

NOTICE OF APPROVAL Number 1281/97

**FOOD AND ENVIRONMENT PROTECTION ACT 1985
CONTROL OF PESTICIDES REGULATIONS 1986 (S.I. 1986 NO. 1510):
APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT**

This approval provides for the use of the product named below in respect of crops and situations, other than those included on the product label. Such 'off-label use', as it is known, is at all times done at the user's choosing, and the commercial risk is entirely his or hers.

The conditions below are statutory. They must be complied with when the off-label use occurs. Failure to abide by the conditions of approval may constitute a breach of that approval, and a contravention of the Control of Pesticides Regulations 1986. The conditions shown below supersede any on the label which would otherwise apply.

- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Ronstar Liquid containing
- Active ingredient:* 250 g/l oxadiazon
- Marketed by:* Rhône-Poulenc Agriculture under MAFF Number 06766 subject to the conditions relating to off-label use set out below:
- Date of issue:* 26 June 1997
- Date of expiry:* Unlimited (subject to the continuing approval of MAFF 06766)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Crops/situations:* Farm woodland
- Maximum individual dose:* 8.0 litres product per hectare
- Maximum total dose:* 8.0 litres product per hectare per year
- Operator protection:*
- (1) Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment:

Operators must wear suitable protective gloves and face protection (face shield) when handling the concentrate.
 - (2) However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection.
- Environmental protection:* Since this product is dangerous to fish or other aquatic life, surface waters or ditches must not be contaminated with chemical or used container.

- Other specific restrictions:* (1) This product must only be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.
- (2) For spot treatment, the maximum concentration must not exceed 100 ml product in 10 litres water.
- (3) Treated plants must not be used for human or animal consumption.

Signed: D. M. Meredith (Authorised signatory)
Date: 26 June 1997

EXPLANATORY NOTES

1. Application Reference Number: COP 90/00141
2. This Notice of Approval is Number 1281 of 1997
3. This Notice will be published in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Ronstar liquid' as a forestry herbicide on newly planted and young trees in farm woodland with a single application per year of 8.0 litres product per hectare in 200–450 litres water applied via conventional tractor-mounted or hand-held hydraulic sprayers.

Simazine

Product

Unicrop Simazine FL 500 g/l simazine (Unicrop, Tel: 01628 526083).

Description

A soil-acting residual herbicide for the pre-emergence control of germinating, herbaceous and grass weeds primarily in farm woodland. It may be of use in combination with glyphosate to give some residual control after established weeds have been killed. Detailed weed control recommendations are given in Forestry Commission Field Book 14, Table 4, pages 18–21.

Crop tolerance

Norway spruce, Sitka spruce, Scots pine, lodgepole pine, Corsican pine, Douglas fir, Lawson cypress, western red cedar, western hemlock, hybrid larch, Japanese larch, noble fir, grand fir, oak, beech and sweet chestnut are tolerant if treated before bud burst in the spring.

Only treat trees established for at least 12 months. Do not apply on light (sand and gravel) soils, or to badly planted or stressed trees, as damage may result.

Do not treat ash.

Product rate

3.0 l/ha.

Method of application

By hand-held or mechanised sprayers, at 200 l/ha diluent (MV).

Timing of application

Apply to dormant trees, before weed emergence (January–March).

Additional information

- 1. Weed control**
 - a. Do not apply to steep slopes – heavy rain can cause soil creep and surface run-off.
 - b. Do not use on soils with more than 10% organic matter.
 - c. Best results will be obtained from applications to moist, clod and brash-free soil when subsequent rainfall is likely.
- 2. Protective clothing**

Operators should wear suitable protective jacket, trousers (or coverall), boots, gloves, face shield and disposable respirator when making applications or handling the concentrate.
- 3. Special precautions**
 - a. Dangerous to fish and other aquatic life. Users must plant grass strips, or leave strips as buffer zones, 10 m wide from watercourses and 20 m from lakes and reservoirs. Do not contaminate water bodies with chemical or used containers.
 - b. Use on a site is restricted to one product containing either atrazine or simazine, not both.
 - c. This herbicide has off-label approval for use in forest situations, but will only normally be of use in farm woodland. Users must refer to the off-label approval that follows this section. All applications are made at user's own risk.

The label on the herbicide container has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Off-label approval Simazine

NOTICE OF APPROVAL Number 1267/97

**FOOD AND ENVIRONMENT PROTECTION ACT 1985
CONTROL OF PESTICIDES REGULATIONS 1986 (S.I. 1986 NO. 1510):
APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT**

This approval provides for the use of the product named below in respect of crops and situations, other than those included on the product label. Such 'off-label use', as it is known, is at all times done at the user's choosing, and the commercial risk is entirely his or hers.

The conditions below are statutory. They must be complied with when the off-label use occurs. Failure to abide by the conditions of approval may constitute a breach of that approval, and a contravention of the Control of Pesticides Regulations 1986. The conditions shown below supersede any on the label which would otherwise apply.

- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Unicrop Simazine FL containing
- Active ingredient:* 500 g/l simazine
- Marketed by:* Universal Crop Protection Ltd under MAFF Number 08032 subject to the conditions relating to off-label use set out below:
- Date of issue:* 25 June 1997
- Date of expiry:* Unlimited (subject to the continuing approval of MAFF 08032)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Crops/situations:* Forestry (for use in tree establishment)
- Maximum individual dose:* 3.0 litres product per hectare
- Maximum number of treatments:* One per year
- Operator protection:*
- (1) Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment:
 - (a) Operators must wear suitable protective clothing (coveralls), suitable protective gloves and face protection (face shield) when handling the concentrate.
 - (b) Operators must wear suitable protective clothing (coveralls) when applying by vehicle-mounted equipment.
 - (c) Operators must wear suitable protective clothing (coveralls), suitable protective gloves, rubber boots, face protection (face shield) and suitable respiratory protective equipment when applying by hand-held equipment.
 - (d) Operators must wear suitable protective clothing (coveralls) and suitable protective gloves when handling contaminated surfaces.

- (2) However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection.

Environmental protection: (1) Since this product is dangerous to fish or other aquatic life, surface waters or ditches must not be contaminated with chemical or used container.

- (2) Since there is a risk to aquatic life from use, direct spray from ground-based vehicle-mounted/drawn sprayers must not be allowed to fall within 6 m of surface waters or ditches; direct spray from hand-held sprayers must not be allowed to fall within 2 m of surface waters or ditches; spray must be directed away from water.

Other specific restrictions: (1) This product must be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.

- (2) Use must be restricted to one product containing atrazine or simazine either to a single application at a maximum approved rate or (subject to any existing maximum permitted number of treatments) to several applications at lower doses up to the maximum approved rate for a single application.

Signed: Janet Ash (Authorised signatory)
Date: 25 June 1997

EXPLANATORY NOTES

1. Application Reference Number: COP 95/00109
2. This Notice of Approval is Number 1267 of 1997
3. This Notice will be published in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Unicrop Simazine FL' as a forestry herbicide for use in tree establishment with a single application at a rate of 3.0 litres product per hectare in a minimum 200 litres water per hectare. Applications to be made via conventional hydraulic equipment (tractor-mounted/drawn or hand-held sprayers).

Napropamide

Product

Devrinol 450 g/l napropamide (United Phosphorus, Tel: 01925 633232).

Description

A soil-acting residual herbicide for the pre-emergence control of germinating herbaceous and grass weeds in farm woodland only. Also of use in the direct sowing of tree seed in farm woodland, as it will control germinating weeds without damaging germinating tree seed. Detailed weed control recommendations are given in Forestry Commission Field Book 14, Table 4, pages 18–21.

Crop tolerance

Trials have shown dormant established transplants of ash, beech, cherry, oak, alder, poplar and willow to be tolerant of applications at 9.0 l/ha. It is likely that most conifers will also be tolerant.

Do not treat poorly planted, shallow rooted plants, or those in poor condition.

Small-scale trials indicate that napropamide can be safely sprayed over sown tree seed pre-emergence up to 6.6 l/ha for ash or sycamore, and up to 2.2 l/ha for cherry and oak. Rowan seed is moderately tolerant at 2.2 l/ha. Tree seed should be covered with soil as per normal practice, i.e. to the same depth as the seed itself. At least two weeks should elapse between treatment and subsequent tree seed germination.

Product rate

2.2–9.0 l/ha, depending on crop tolerance. A maximum of two applications per year are permitted.

Methods of application

By mechanised applicators, at 200–480 l/ha diluent (MV). Napropamide must not be applied by hand-held sprayers.

Timing of application

For optimum results, apply from November to February, before tree or weed seed germination.

Additional information

- 1. Weed control**
 - a. Only germinating weeds will be controlled – established weeds will not be affected.
 - b. Napropamide is broken down by sunlight – it should be applied to a moist tilth, and requires rainfall to incorporate it into the soil. Applications after the end of February are unlikely to be as effective. Napropamide may be applied during March and April as long as 25 mm of irrigation is provided within 24 hours of spraying.
 - c. For best results, apply to a brash and weed-free soil, cultivated to a firm, fine, moist tilth.
 - d. Do not apply to sand, or soils with more than 10% organic matter.
- 2. Protective clothing**

Operators should wear suitable protective boots, trousers, jacket (or coverall) and gloves when making applications. In addition, a face shield should be worn when handling the concentrate.
- 3. Special precautions**
 - a. Irritating to skin and eyes.
 - b. Harmful to fish or other aquatic life. Do not contaminate surface waters or ditches with the chemical or used containers.
 - c. This product has off-label approval for use in farm woodland only. Users must refer to the off-label approval that follows this section. All applications are made at user's own risk.

The label on the herbicide container has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Off-label approval Napropamide

NOTICE OF APPROVAL Number 0822/99

**FOOD AND ENVIRONMENT PROTECTION ACT 1985
CONTROL OF PESTICIDES REGULATIONS 1986 (S.I. 1986 NO. 1510):
APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT**

This approval provides for the use of the product named below in respect of crops and situations, other than those included on the product label. Such 'off-label use', as it is known, is at all times done at the user's choosing, and the commercial risk is entirely his or hers.

The conditions below are statutory. They must be complied with when the off-label use occurs. Failure to abide by the conditions of approval may constitute a breach of that approval, and a contravention of the Control of Pesticides Regulations 1986. The conditions shown below supersede any on the label which would otherwise apply.

- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Devrinol containing
- Active ingredient:* 450 g/l napropamide
- Marketed by:* Rhône-Poulenc Agriculture under MAFF Number 09375 subject to the conditions relating to off-label use set out below:
- Date of issue:* 26 June 1997
- Date of expiry:* Unlimited (subject to the continuing approval of MAFF 09375)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Crops/situations:* Farm woodland
- Maximum individual dose:* 9.0 litres product per hectare
- Maximum number of treatments:* Two per year
- Latest time of application:* Before the end of April (see 'Other specific restrictions')
- Operator protection:*
- (1) Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment:

Operators must wear suitable protective gloves when handling the concentrate or contaminated surfaces.
 - (2) However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection.
- Environmental protection:* Since this product is harmful to fish or other aquatic life, surface waters or ditches must not be contaminated with chemical or used container.

- Other specific restrictions:*
- (1) This product must only be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.
 - (2) Applications to farm woodland must be made after 1 November and before the end of April.
 - (3) This product must not be applied by knapsack or other hand-held sprayers.
 - (4) Treated plants must not be used for human or animal consumption.

Signed: C. Flaherty (Authorised signatory)
Date: 26 June 1997

EXPLANATORY NOTES

1. Application Reference Number: COP 99/00234
2. This Notice of Approval is Number 0822 of 1999 and supersedes Notice of Approval Number 1280 of 1997 which will be revoked with effect from 30 April 2000.
3. This Notice will be published in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Devrinol' as a forestry herbicide on newly planted and young trees in farm woodland with a single application per year of 9.0 litres product per hectare in 200–480 litres water between 1 November and end of February applied via conventional tractor-mounted hydraulic sprayers.

Metamitron

Product

Goltix WG 70% w/w metamitron (Bayer, Tel: 01284 763200).

Description

A soil- and foliar-acting residual herbicide for the control of annual herbaceous and grass weeds primarily in farm woodland. Detailed weed susceptibilities are given in Forestry Commission Field Book 14, Tables 4 and 5, pages 18–25.

Crop tolerance

In small-scale trials, tree survival and height growth of Norway spruce, Japanese larch, oak, wild cherry, sycamore, beech, hazel, spindle, poplar, willow, hawthorn, field maple and ash were not affected by overall sprays when the trees were dormant. Some minor transient foliar damage occurred to trees that were sprayed in active growth. Ideally use directed sprays, particularly if trees are in active growth.

Product rate

Apply 5.0 kg/ha. Maximum number of treatments 2 per year.

Methods of application

Apply through hand-held or mechanised sprayers at 200 l/ha diluent (MV).

Timing of application

Apply after planting, to dormant trees, before weed germination (March).

Additional information

1. Weed control

- a. This herbicide is primarily of use for controlling germinating weeds – only very small established weeds at the cotyledon stage will be controlled.
- b. For best results apply to a brash and weed-free soil, cultivated to achieve a firm, moist tilth.
- c. Soil must be moist, and rainfall occur after application, for effective weed control.
- d. Under dry conditions, to enhance post-emergence control add 5 l/ha Actipron to the mix. Do not overspray actively growing trees with this mix.
- e. Effectiveness will be severely reduced in soils with over 10% organic matter content.

2. Protective clothing

Operators should wear suitable protective trousers, jacket (or coverall), boots and gloves when making applications. In addition, when handling the concentrate, they should wear a face shield.

3. Special precautions

- a. Do not contaminate ponds, watercourses or ditches with the chemical or used containers.
- b. This herbicide has off-label approval for use in forest situations, but will be primarily of use only in farm woodland. Users must refer to the off-label approval that follows this section. All applications are made at user's own risk.

The label on the herbicide container has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Off-label approval Metamitron

NOTICE OF APPROVAL Number 0902/98

FOOD AND ENVIRONMENT PROTECTION ACT 1985 CONTROL OF PESTICIDES REGULATIONS 1986 (S.I. 1986 NO. 1510): APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT

This approval provides for the use of the product named below in respect of crops and situations, other than those included on the product label. Such 'off-label use', as it is known, is at all times done at the user's choosing, and the commercial risk is entirely his or hers.

The conditions below are statutory. They must be complied with when the off-label use occurs. Failure to abide by the conditions of approval may constitute a breach of that approval, and a contravention of the Control of Pesticides Regulations 1986. The conditions shown below supersede any on the label which would otherwise apply.

- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Goltix WG containing
- Active ingredient:* 70% metamitron
- Marketed by:* Bayer plc under MAFF Number 02430 subject to the conditions relating to off-label use set out below:
- Date of issue:* 15 April 1998
- Date of expiry:* Unstipulated (subject to the continuing approval of MAFF 02430)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Crops/situations:* Forest
- Maximum individual dose:* 5 kg product/hectare
- Maximum number of treatments:* 2 per year
- Operator protection:*
- (1) Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment:

Operators must wear suitable protective gloves when applying by knapsack sprayer.
 - (2) However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection.
- Other specific restrictions:*
- (1) This product must only be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.
 - (2) Treated plants must not be used for human or animal consumption.

Signed: Mark Wilson (For the Pesticides Safety Directorate)
Date: 15 April 1998

EXPLANATORY NOTES

1. Application Reference Number: COP 90/00133
2. This Notice of Approval is Number 0902 of 1998
3. This Notice will be published in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Goltix WG' as a forestry herbicide for weed control in farm woodland plantings.

Lenacil

Product

Venzar Flowable 440 g/l lenacil (DuPont, Tel: 01483 734000).

Description

A soil-acting residual herbicide for the pre-emergence control of germinating annual herbaceous and grass weeds in farm woodland only. Detailed weed susceptibility recommendations are given in Forestry Commission Field Book 14, Table 4, pages 18–21.

Crop tolerance

In small-scale trials, survival and height growth of Norway spruce, Japanese larch, oak, wild cherry, sycamore, beech, hazel, spindle, poplar, willow, hawthorn, field maple and ash were not affected by overall sprays when trees were dormant. Transient scorching occurred when cherry and larch were sprayed in active growth. For this reason, only treat dormant trees for maximum safety.

Product rate

Apply 4 l/ha. Maximum number of treatments 1 per year.

Method of application

Apply through hand-held or mechanised sprayers at 200 l/ha diluent (MV).

Timing of application

Apply after planting, to dormant trees, before weed germination (March).

Additional information

- 1. Weed control**
 - a. Only germinating weeds will be effectively controlled.
 - b. For best results, apply to a brash and weed-free soil, cultivated to achieve a firm, moist tilth.
 - c. Soil must be moist, and rainfall must occur after application, for effective weed control.
 - d. Do not apply to sands, stony or gravelly soils, or soils containing more than 10% organic matter.
- 2. Protective clothing**

Operators should wear suitable protective trousers, jacket (or coverall), boots and gloves when making applications. In addition, when handling the concentrate, a face shield should be worn.
- 3. Special precautions**
 - a. Harmful to fish or other aquatic life – do not contaminate ponds, watercourses or ditches with the chemical or used containers.
 - b. This product has an off-label approval for use in farm woodland situations only. Users must refer to the off-label approval that follows this section. All applications are made at user's own risk.

The label on the herbicide container has been designed for your protection – **ALWAYS READ THE INSTRUCTIONS ON THE PRODUCT LABEL.**

Off-label approval Lenacil

NOTICE OF APPROVAL Number 1282/97

**FOOD AND ENVIRONMENT PROTECTION ACT 1985
CONTROL OF PESTICIDES REGULATIONS 1986 (S.I. 1986 NO. 1510):
APPROVAL FOR OFF-LABEL USE OF AN APPROVED PESTICIDE PRODUCT**

This approval provides for the use of the product named below in respect of crops and situations, other than those included on the product label. Such 'off-label use', as it is known, is at all times done at the user's choosing, and the commercial risk is entirely his or hers.

The conditions below are statutory. They must be complied with when the off-label use occurs. Failure to abide by the conditions of approval may constitute a breach of that approval, and a contravention of the Control of Pesticides Regulations 1986. The conditions shown below supersede any on the label which would otherwise apply.

- Level and scope:* In exercise of the powers conferred by Regulation 5 of the Control of Pesticides Regulations 1986 (SI 1986/1510) and of all other powers enabling them in that behalf, the Minister of Agriculture, Fisheries and Food and the Secretary of State hereby jointly give full approval for the use of
- Product name:* Venzar Flowable containing
- Active ingredient:* 440 g/l lenacil
- Marketed by:* DuPont (UK) Ltd under MAFF Number 06907 subject to the conditions relating to off-label use set out below:
- Date of issue:* 26 June 1997
- Date of expiry:* Unlimited (subject to the continuing approval of MAFF 06907)
- Field of use:* **ONLY AS A FORESTRY HERBICIDE**
- Crops/situations:* Farm woodland
- Maximum individual dose:* 5.0 litres product per hectare
- Maximum number of treatments:* One per year
- Environmental protection:* Since this product is harmful to fish or other aquatic life, surface waters or ditches must not be contaminated with chemical or used container.
- Other specific restrictions:* (1) This product must only be applied in accordance with the terms of this approval, the product label and/or leaflet and any additional guidance on off-label approvals.
- (2) Treated plants must not be used for human or animal consumption.
- Signed: D. M. Meredith (Authorised signatory)
Date: 26 June 1997

EXPLANATORY NOTES

1. Application Reference Number: COP 97/00088
2. This Notice of Approval is Number 1282 of 1997
3. This Notice will be published in the Pesticides Register.

ADVISORY INFORMATION

This approval relates to the use of 'Venzar Flowable' as a forestry herbicide on newly planted and young trees in farm woodland with a single application per year of 5.0 litres product per hectare in 200–450 litres water applied via conventional tractor-mounted or hand-held/knapsack hydraulic sprayers.

References

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Herbicide update provides a summary of recent research findings concerning chemical weed control in forestry. It brings up to date information published in Forestry Commission Field Book 8 *The use of herbicides in the forest*, and complements the specialist information to be found in Field Book 14 *Herbicides for farm woodlands and short rotation coppice* and Field Book 15 *Weed control in Christmas tree plantations*.

This update is an essential reference book for all woodland managers. As a minimum, readers are advised to consult:

- The box summaries of new or revised recommendations.
- Relevant regulatory changes.
- Revised herbicide approvals including products, costs and guidance on use.

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