Click here for previous

Table 40

The costs, including labour, of using various grass cutting machines.
Tamworth Borough Council Work Studies Department

Machine	Use	Cost £ ha^{-1}	No. cuts per year	Cost £ ha^{-1} $year^{-1}$
Pedestrian-controlled				
20" Auto Certes	Bowling greens	40	48	1920
24" Matador	Lawns, tees	34	24	816
19" Flymo	Banks	84	?4	?336
Strimmer	Around trees, lamposts	374	1	374
Pedestrian Flail	Overgrown areas	78	2	156
Ride-on machines				
Hahn Triplex	Golf greens	52	48	2496
Ransomes Triple	Verges, housing estates	32	12	384
Toro 70	Tee & bunker banks	42	24	1008
Tractor-mounted				
3 Gang Mower	Football pitches	16	24	384
5/7 Hydromower	Major open spaces	6	24	144
Rear-mounted flail	Rough vegetation	45	2	90
Side-arm flail	Rough banks	68	2	136

Amenity areas require better standards than two flail cuts, and it is in this situation that growth retardants will be useful. Improved standards can be achieved by an autumn tidying cut, an application of retardant in spring, and where necessary, followed by a post-spraying cut.

Higher standards may be maintained by cutting in late summer. So, some proposed maintenance programmes might read as follows:

	Standard 1	Standard 2	Standard 3
	Cost (£ ha^{-1})		
Retardant in April	50	50	50
Cut 10-14 days later	-	95	95
Cut in August	-	-	95
Cut in Oct./Nov.	95	95	95
Total £ ha^{-1}	145	240	335

(500 mm pedestrian rotary mower)

These figures give a rough estimate of costs involved. What the costs do not reflect is any improvement in the sward composition induced by the retardant. The encouragement of a finer sward may allow cutting to be reduced. Increases in desirable dicotyledons, while probably having no financial effect, will satisfy visitors, for whom the sites have been created.

4. SCRUB CONTROL

4.1. Introduction

Scrub plants are a common problem in undergrazed and undermanaged situations. A lack of management frequently allows scrub to develop, and its eradication, where this is desired, poses several questions. In sites where a cutting or cutting and grazing regime can be re-established, the scrub can be checked. Where a regular cutting regime is not possible, other techniques are needed, herbicides being the one practical method.

Coniferous species tend not to present a problem as cut plants seldom regrow. However, most deciduous species regrow from stumps, hence the practice of coppicing. In selecting a method for controlling woody plants, the land manager must decide whether or when to cut down scrub. Herbicides usually work best on young regrowth. Tall scrub, over shoulder height, presents problems of physically applying sprays. From the aesthetic viewpoint tall dead sprayed bushes are unattractive. The options for the manager are four-fold; short scrub can be sprayed with foliage-acting herbicides, or soil-acting chemicals applied to the roots, and dead plants left to decompose *in situ*; or taller scrub can be sprayed and subsequently cleared; or scrub can be cut and regrowth sprayed; or scrub can be cut down and the stumps treated to prevent regrowth. In the past, 2,4,5-T has proved to be an effective and cheap chemical for controlling woody plants, either sprayed onto foliage or applied to cut stumps or to cuts in the bark. A reluctance to use 2,4,5-T has increased the interest in its alternatives. Some small demonstration trials of possible compounds for scrub control have been set out.

4.2. Demonstration trials of chemical scrub control

4.2.1. *Crataegus monogyna* (hawthorn). NC-12-80.

Two areas on Butser Hill, Queen Elizabeth Country Park, containing hawthorn scrub regrowing from stumps were selected. A series of chemical treatments were applied to 5 bushes each in both area A and area B on 19.9.80. Three compounds were applied to the foliage using a knapsack sprayer; two compounds were applied as a concentrated solution by syringe to the soil near the stem bases. One treatment involved cutting the bushes down and painting a glyphosate solution onto the cut stumps.

Bush height and numbers of live bushes were assessed in September 1981 and 1982. Extra treatments were made in 1981. Picloram-impregnated sticks (6 mg) were placed in drilled holes (1 per bush) in hawthorn stems as follows:

Area A: 5 bushes, on 10.7.81
Areas A & B: 5 bushes each, on 16.9.81.

1980 chemical treatments were as follows:

Chemical	Application concentration (% product)	Application method
Hexazinone	2.5% (5 kg ha^{-1})	Syringe to soil
Tebuthiuron	5% (8 kg ha^{-1})	Syringe to soil
Fosamine	3%	Knapsack
Triclopyr	1%	"
Glyphosate	2%	"
Glyphosate	2%	Cut stump paint

Results

The results, in terms of maximum bush height and percentage number of bushes killed, are shown for the two areas (A and B) in Fig.7. Considering area A, results indicated that glyphosate, as a spray or painted onto stumps,

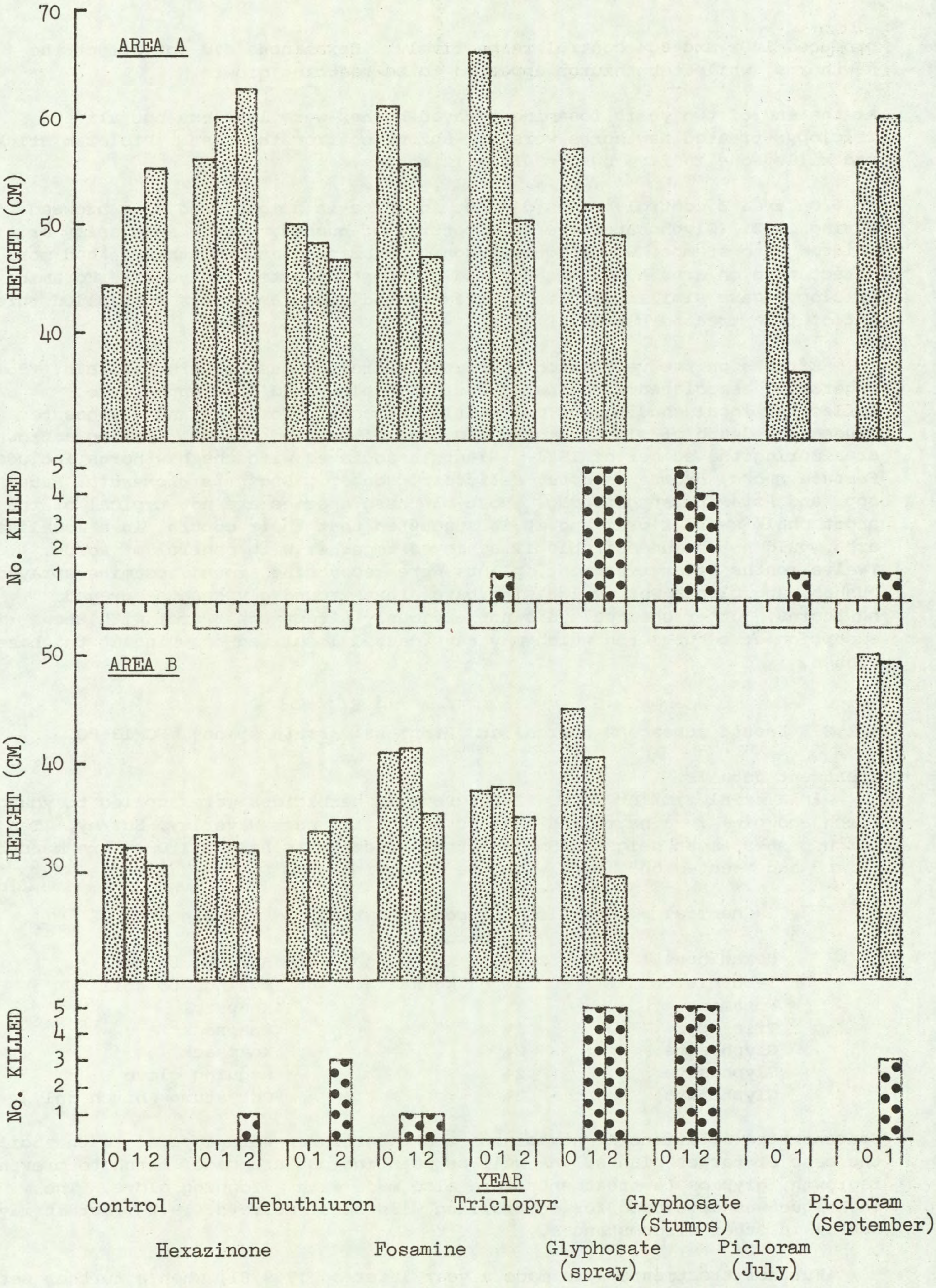

Fig.7. The heights of hawthorn bushes and numbers killed, one and two years after treatment with herbicides. Experiment NC-12-80.

produced 100% and 80% control respectively. Hexazinone did not affect the hawthorns, while tebuthiuron appeared to be reducing growth.

At the end of two years fosamine-sprayed bushes were leafless but alive. Triclopyr-treated hawthorns were all sprouting from the base. Picloram sticks had killed one in five bushes after 12 months.

On area B control bushes did not increase in height, and were browsed during 1982. Glyphosate gave 100% control of bushes, either as a spray or painted onto stumps, within one season. Hexazinone and tebuthiuron had more effect than on area A, giving 20% and 60% control after two years. Fosamine and triclopyr gave similar results to area A, and picloram sticks controlled three out of five treated bushes.

Effects on the vegetation surrounding treated bushes were variable. Some vegetation associated with the base of each plant had poor appearance, reflecting local shading and competition effects. Fosamine and glyphosate caused the death of plants around the base of sprayed bushes, leaving a brown area during the summer of 1981. Plants associated with the hawthorns included *Festuca rubra*, *Bromus erectus*, *Helictotrichon* sp., *Dactylis glomerata*, *Rubus* spp. and *Poterium sanguisorba*. Most of these species are not typical of the short chalk sward flora, and it is suggested that their control in a localised area would not be undesirable if achieved together with control of scrub. Twelve months after treatment, plants were recovering around fosamine-sprayed bushes, and plants were colonising bare areas around glyphosate-sprayed hawthorns. Other chemicals did not obviously affect the sward, with the exception of tebuthiuron which may have caused localised browning at the base of bushes.

4.2.2. *Betula pubescens* (birch) and *Pinus sylvestris* (pine) NC-13-80

Treatment details

In a trial similar to NC-12-80, several herbicides were applied to young birch and pine in a heathland area at Mare Hill, near Waverley, Surrey. Ten birch bushes (mean height 1.5m) and four pines (mean height 1.0m) were measured, marked and treated on 3.9.80 with the following:

Chemical	Application concentration (% product)	Method
Hexazinone	2.5% (5 kg ha^{-1})	Syringe to soil
Tebuthiuron	5% (8 kg ha^{-1})	Syringe to soil
Fosamine	3%	Knapsack
Triclopyr	1%	Knapsack
Glyphosate	2%	Knapsack
Glyphosate	2%	Roguing glove
Glyphosate	2%	Cut stump (birch only)

Concentrated solutions of hexazinone and tebuthiuron were applied to the soil at the base of target plants. As well as painting cut stumps of birch to prevent regrowth, glyphosate treatments were also made with a roguing glove. The technique was developed for controlling wild oats (Holroyd, 1972), but it may be useful in other circumstances.

Further treatments were made a year later on 17.9.81, when a further set of ten birch bushes (regrowth) were cut down and the stumps painted with 5% "Roundup" (glyphosate). Sticks containing 6 mg picloram were inserted into three birch bushes and seven alders.

Results - birch

Average height of birch trees and the number killed in the three years are shown in Fig.8. Glyphosate applied by knapsack sprayer was the most effective treatment, killing all bushes in the first season. Triclopyr and fosamine-treated birch had no leaves after one year, except where a "pruning" effect was seen with unsprayed branches in leaf. At the end of the second year five and six bushes had been killed by fosamine and triclopyr respectively, though regrowth was found on one bush for each treatment. Hexazinone had no effect on the birch, and tebuthiuron had only minor effects. After two years one bush had been killed by tebuthiuron, but there were no statistical differences between hexazinone and tebuthiuron height increases. Roguing glove treatments using 2% "Roundup" solution gave 40% control after two years and checked the growth of birch. Cut stumps treated with 2% Roundup gave no apparent control of regrowth at the end of one year, but 30% control was achieved in the second year after treatment. Cut stumps painted with a 5% solution showed 40% control after one season, with only one stump producing vigorous regrowth over 10 cm (reaching 49 cm in 1982). Picloram sticks produced leaf death but not control.

Results - pines

Tebuthiuron, glyphosate spray and triclopyr could kill pines (Fig.9.) Consistent control was given by tebuthiuron which killed all treated pines after two seasons. Glyphosate killed 3 pines, while triclopyr killed one. Hexazinone had no effects, while roguing glove treatments of glyphosate checked the growth of one tree. Nevertheless, roguing glove treated trees had a similar height increase to controls. Triclopyr caused a significant ($P < 0.001$) growth check, and fosamine also reduced height increases ($P < 0.05$).

Results - understorey vegetation.

The main species at Mare Hill were *Calluna vulgaris*, *Pteridium aquilinum*, *Erica cinerea*, *Vaccinium* sp., *Deschampsia flexuosa*, *Ulex europaeus* and *Quercus robur*. No effects were observed on grasses, bracken or bilberry. Gorse was adversely affected by frost during the 1981/82 winter. Tebuthiuron, while not obviously affecting the understorey vegetation, seriously damaged pines up to 60 cm from the point of application. Both fosamine and triclopyr produced a pruning effect on sprayed branches of adjacent oak and birch. Glyphosate had some effect on surrounding *C.vulgaris*, but the damage was no longer significant after 12 months.

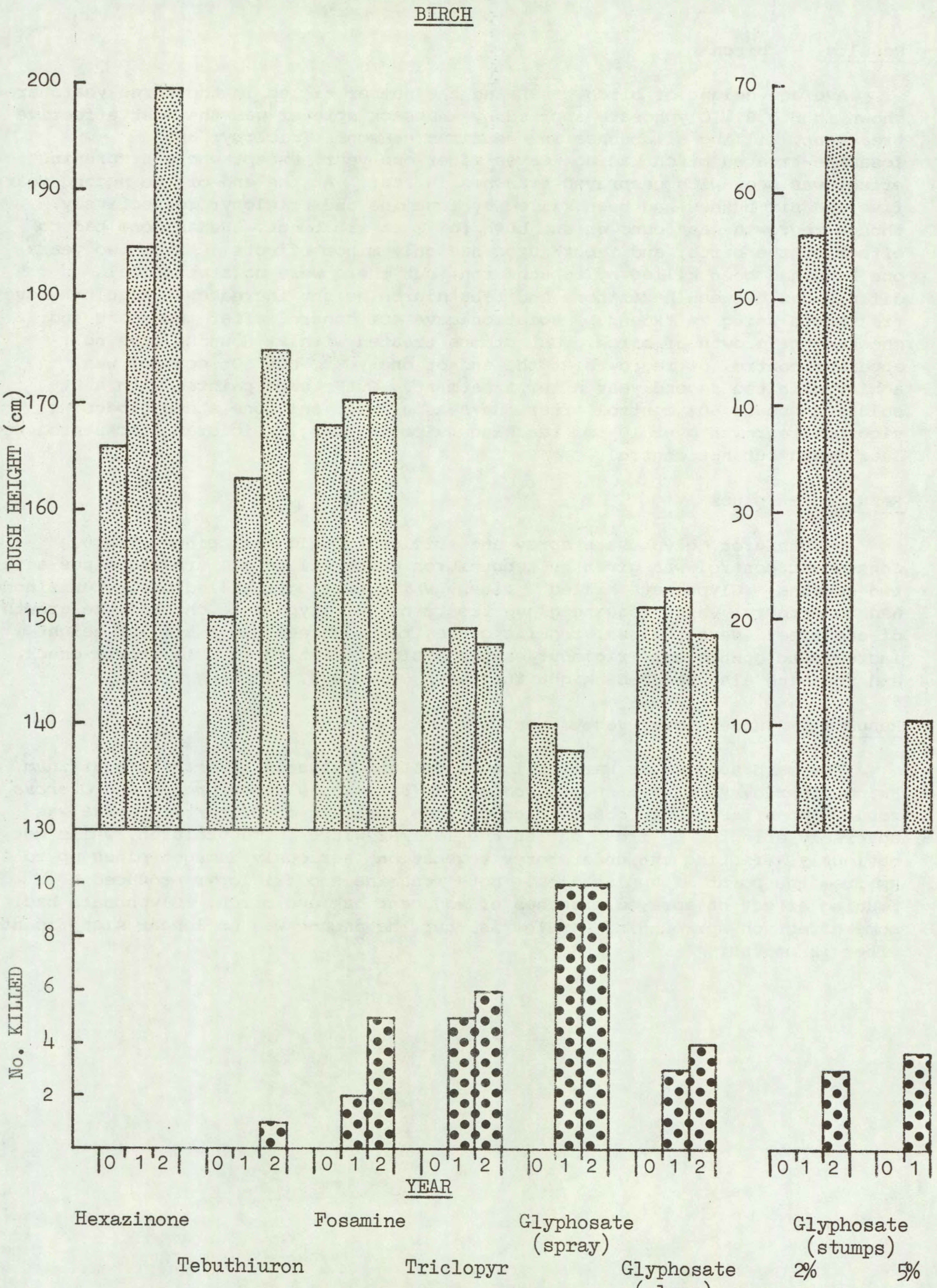

Fig.8. Heights of birch (Betula pubescens) and numbers of bushes killed (out of 10), one and two years after treatment with herbicides.

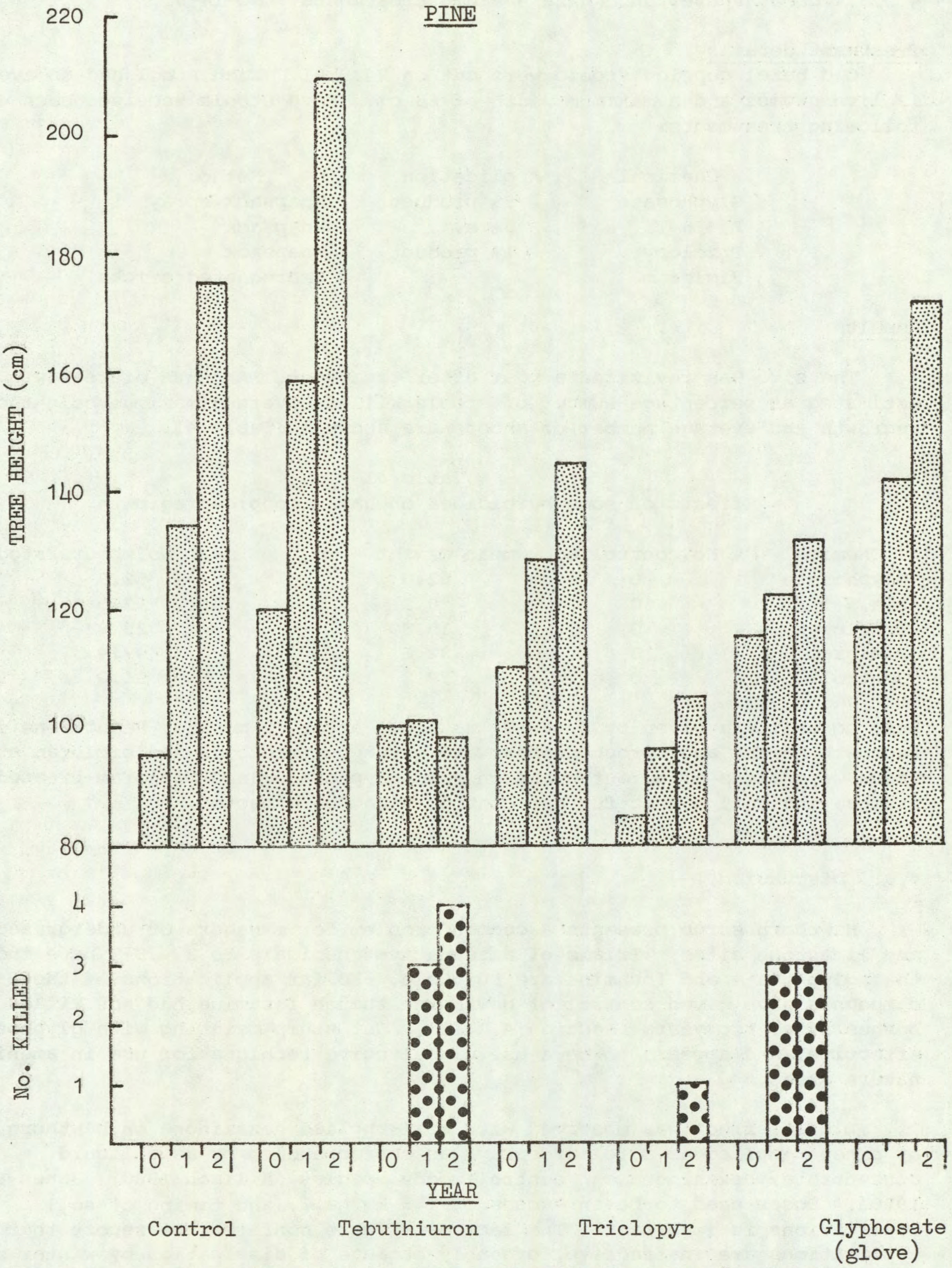

Fig.9. Heights of pines (Pinus sylvestris) and number killed (out of 4), one and two years after treatment with herbicides.

4.2.3. *Corylus avellana* (hazel) stump treatments. NC-14-81.

Treatment details

Old hazel coppice stools were cut on 24.9.81. Each stool had an average of 13 live stumps and a maximum width of 65 cm. Five stools received each of the following treatments:

Chemical	Application	Method
Glyphosate	5% product	Knapsack spray
2,4,5-T	2.5% a.i.	Knapsack
Triclopyr	1% product	Knapsack
Picloram	-	Impregnated sticks

Results

The site was revisited a year after treatment. Amounts of regrowth, estimated as percentage number of stools killed, average maximum height of regrowth and average number of shoots are shown in Table 41.

Table 41
Effects of some herbicides on hazel coppice regrowth.

Chemical	% No.controlled	mean max.ht. (cm)	mean No.spouts/stool
Glyphosate	0	62.0	52.8
2,4,5-T	60	8.2	3.0**
Triclopyr	0	15.8	25.8*
Picloram	0	32.6	47.4
Control	0	59.2	96.0

Best control was given by 2,4,5-T, as shown after 12 months. Reductions in regrowth height and sprout number were given by triclopyr and picloram sticks. There were signs of sprout death on some glyphosate- and picloram-treated stumps, indicating that further control might be expected.

4.3. Discussion.

Hawthorn scrub presents a common problem for managers of undergrazed chalk and limestone sites. Trials of alternative chemicals to 2,4,5-T have indicated that glyphosate and fosamine are suitable. Foliar applications of these compounds have given control of hawthorn, though fosamine had not killed the bushes after two years (Section 4.2.1.). Cut stump painting with glyphosate was effective, and appears to be a useful selective techique for use in amenity or nature areas.

Little effect was observed with soil-applied hexazinone on hawthorn, birch or pine. Applied as a foliar spray, as macrogranules or as a liquid concentrate, hexazinone can control woody species (Allison 1980; Jones & Jones, 1980). Doses need to be in excess of 1.5 kg ha^{-1}, and timing of soil applications is important. The lack of effects confirms the report that autumn applications are ineffective, probably because of dissipation by winter rainfall (Allison, 1980). Soil application of tebuthiuron gave some control of hawthorn, but the effect was slow. Autumn application may have reduced efficacy.

Birch was killed by glyphosate applied to the foliage. The estimated amount of glyphosate per bush was 0.5 g (a.i.). Assuming a bush area of 1 m^2, the dose rate of 5 kg ha^{-1} was three times that recommended. Lower doses could be investigated further, using 0.8 to 1.0% solutions of "Roundup". As glyphosate has a broad spectrum of activity, care needs to be taken when spraying to avoid desirable plants. Cut stump painting with a 5% Roundup solution gave better control than a 2% solution. Roguing glove applications, perhaps surprisingly, checked birch growth and killed 4 out of 10 bushes. Investigations of the recommended 20% Roundup solution, as opposed to the 2% solution used, are indicated. Foliar-applied fosamine and triclopyr gave good control of birch, with leaf growth only present on unsprayed side branches. Both these compounds do not affect heather and would therefore be suitable for use in heathland. However, good spray coverage of the foliage is required, otherwise pruning effects are produced. Hexazinone did not affect birch and tebuthiuron had no significant effect.

Pines were affected by the foliar-applied herbicides. Glyphosate killed three out of four pines, triclopyr killed one and significantly ($P < 0.001$) reduced the rate of growth; fosamine also reduced height increase. Tebuthiuron was highly toxic to pines, giving 100% control after two years.

Hazel stump treatments indicated that 2,4,5-T gave more effective control than glyphosate or triclopyr. Only 2,4,5-T and triclopyr significantly reduced numbers of regrowth sprouts.

The trials have demonstrated that foliar herbicides, particularly glyphosate, can be used against regrowing scrub species. Care in applying glyphosate is required, if desirable species are to be avoided. Soil-acting herbicides have proved to be disappointing, though further work on the timing of applications is indicated. Localised application techniques may be useful for control of scrub in amenity areas, particularly if voluntary labour is used. The roguing glove may be useful in this respect, for use against non-thorny species. The picloram-impregnated sticks may be time-consuming to use and need further evaluation. Experiments with treatments of cut stumps have shown that glyphosate can be effective, especially against hawthorn. Alternatives to 2,4,5-T are available.

In terms of cost of herbicide, the following gives a comparison of treatments:

Chemical	Dose (kg ha^{-1})	Estimated cost (£ ha^{-1})
2,4,5-T	3.5	43.50
Glyphosate	2.0	78.00
Fosamine	4.8	45.00
Triclopyr	4.0	Not known
Tebuthiuron	8.0	Not known
Hexazinone	2.0/5.0	84.00/208.00

The figures are estimates only, and do not include the cost of labour. 2,4,5-T remains the cheapest treatment, though savings in herbicide costs might be achieved by direct localised application, e.g. with the roguing glove.

5. WILDFLOWER SEED INTRODUCTION

5.1. Introduction

In situations where there are only small amounts of wildflowers, e.g. newly-sown grass areas, it may be desirable to introduce species. The idea of creating, or re-creating, a meadow flora has gained popularity and one proposed technique to achieve it is by cutting and removing grass clippings. However the method is only partially fulfilling its objective. Production can be reduced, but a coincident increase in species is not always observed (Pers. comm. J. van Groenendael). Species may have to be introduced. The work of Wells (1979) on creating attractive grass swards from scratch by sowing wildflower seed mixtures, has pioneered this idea. The seed industry have taken up these methods and some local authorities are already following the recommendations given by Wells *et al.* (1981).

In established grassland a possible technique for introducing seed is the slot seeder, a machine developed at WRO (Haggar & Squires, 1979) for introducing legumes and for renovating pastures. The machine cuts and removes a ribbon of turf and places seed into the 2.5cm wide slot. The potential of the technique for amenity use has been noted (Marshall, 1982), but no work on seeding wildflower mixtures through a slot-seeder has been reported. A single experiment to test the feasibility of the technique has been carried out (NC-3-82).

5.2. Treatment details

A trial divided into two parts was set up on an area of established *L.perenne* (50%) grassland. In Part A a grass and wildflower seed mixture from Suffolk Herbs was put through a Gibbs "GB" Slot Seeder. In Part B dicotyledons in the mixture, obtained in separate packets, were hand sown into cut slots to assess germination and survival.

Part A: The Gibbs machine was used, with a bandspray of glyphosate at 1.4 kg ha^{-1} a.i.. The seed mixture from Suffolk Herbs was for alluvial and loam soils, and contained 8 grasses (80% by weight) and 18 dicotyledon species (19.9% by weight). A carrier was thought to be needed, and three seed/sawdust mixtures were used. Calibration of the slot-seeder in a static position, using seed aperture No. 35 (Diameter = 14 mm), indicated the following seeding rates:

Mixture	Seed rate (g m^{-1} slot)
A: No carrier	0.29
B: 20g seed to 40g sawdust	0.89
C: 20g seed to 100g sawdust	0.17

Each mixture was placed in two of the six coulters on the machine, and two passes of 10m length were made in the field on 28:4:82. Slug pellets were broadcast over the area to minimise seedling predation. The grass was cut when it reached approximately 15 cm.

Part B: At the same time Part A was set out, slots were cut and bandsprayed with glyphosate but no seed put through the machine. 17 of the dicotyledon species in the mixture, purchased in individual packets with the wildflower mixture from Suffolk Herbs, were handsown into cut slots; seeds were placed 3 cm apart in 1m lengths (32 seeds) at random across the treated area. Four replicate lengths, totalling 128 seeds, were set out.

As with Part A, slug pellets were broadcast and the area mown when the grass reached approximately 15 cm.

Seeds were also sown in the greenhouse to facilitate identification in the field.

5.3. Results

Part A

Seedlings present in the slots were identified and counted in 50 cm lengths at points 0.5, 3.0, 5.5 and 8.0m along the slots. As there were two coulters per mixture, and two replicate passes, mean seedling numbers are from 2m of slot. Table 42. gives average total and dicotyledon seedlings per metre of slot 7, 13 and 20 weeks after sowing.

Table 42.

Numbers of seedlings (m^{-1}) at successive distances down cut slots. Three seed/carrier mixtures (A,B,C).

	Distance along slot (m)											
	0.5			3.0			5.5			8.0		
	Seed mixture											
	A	B	C	A	B	C	A	B	C	A	B	C
Total number of seedlings												
Weeks												
7	81	27	15	103	59	49	38	41	23	21	34	30
13	102	41	30	82	55	54	41	43	30	15	41	38
20	97	48	39	71	65	55	39	30	29	21	38	46
Dicotyledon seedlings												
Weeks												
7	12	6	2	14	8	9	5	6	1	3	5	3
13	23	11	5	16	11	11	7	8	4	3	7	5
20	22	11	5	17	10	10	7	7	3	3	5	5

As expected, the dicotyledons contributed only a small proportion of the total number of introduced seedlings.

Part B

Handsown seedlings were counted on five dates after sowing (4,7,9,13 and 20 weeks); from 7 weeks seedlings were mapped, so that survival and germination could be measured.

Table 43.
Dicotyledon species handsown into slots, their % germination and % natural mortality in the field, and % germination in the greenhouse

Species	% germination	% mortality	% germination in greenhouse
Medicago lupulina	6.3	63	* 33
Silene vulgaris	8.6	29	75
Hypochaeris glabra	45.3	13	100
Primula veris	0	-	0
Galium verum	28.9	8	77
Chrysanthemum leucanthemum	29.7	16	92
Lychnis flos-cuculi	3.9	20	77
Sanguisorba minor	25.5	22	21
Prunella vulgaris	7.0	22	92
Saponaria officinalis	3.3	75	0
Rhinanthus minor	0	-	0
Tragopogon pratensis	27.0	18	79
Malva moschata	7.0	13	8
Plantago lanceolata	33.6	7	92
Hypericum perforatum	0.8	-	62
Silene alba	16.4	47	85
Daucus carota	11.7	7	25

* = scarified seed.

In general, % germination in the slots was not good (Table 43.); no species achieved 50% germination. Data published by Grime *et al.* (1981) indicate that *P.veris*, *S.officinalis* and *R.minor* require chilling for germination, a treatment absent from this trial with late spring sowing. *D.carota* shows improved germination with chilling, and *M.lupulina* shows significantly greater germination following seed scarification. Other data indicate that light is needed for *D.carota*, *Hypericum perforatum*, *L.flos-cuculi* and *P.vulgaris* (Grime *et al.*, 1981). These factors or absence of them may have affected field germination.

Germination in the greenhouse was generally improved, though *P.veris*, *S.officinalis* and *R.minor* did not germinate, and no large difference to field data were found for *S.minor*, *M.moschata*, and *D.carota*. Improved greenhouse germination, where it occurred, almost certainly reflected the improved moisture conditions. April and May 1982 were particularly dry months with only 26.1 mm and 23.1 mm of rainfall, whereas the ten year monthly averages are 29.8 mm and 46.2 mm respectively. In fact no rain fell in the two weeks before sowing, and only 6.5 mm in the three weeks following.

5.4. Discussion

The wildflower and grass seed mixtures used in the slot-seeder gave variable results (Table 42.). The most important factor was probably the range of seed sizes in the mixture. At 0.5m the machine may still have been equilibrating, as total seedlings were highest for mixture A at this distance but not for the sawdust mixtures B and C. At successive intervals the amount of seed reaching A slots was diminishing. Seed with no carrier may have been used rapidly, or may have become blocked in the seed hopper, as observed in static calibrations. The B and C mixtures did not show such an obvious decline, indicating that the carrier did facilitate transfer. Nevertheless, sawdust was an unsatisfactory carrier giving patchy seeding especially with the C mixture.

The amounts of seed mixture reaching the slots can be estimated using data of % field germination, seed weight and % of the mixture of a given species. Three species, *P.lanceolata*, *H.glabra*, and *G.verum* occurred in the slots in sufficient numbers to estimate seed rates. Data used were:

Species	Seed wt (mg)	% in mixture by weight
P.lanceolata	2.169	3.0
H.glabra	0.50	0.7
G.verum	0.390	0.7

Calculated seed rates at 3 distances for the 3 mixtures are given in Table 44.

Table 44.
Calculated rates of seed mixture reaching mechanically-cut slots (g m^{-1})

	Distance (m)								
	3.0			5.5			8.0		
	Seed mixture								
Species	A	B	C	A	B	C	A	B	C
P.lanceolata	0.75	0.32	0.22	0.22	0.11	0.11	0.22	0	0.11
H.glabra	0.71	0.39	0.39	0.39	0.32	0.16	0.16	0.39	0.32
G.verum	0.48	0.19	0.48	0.19	0.48	0.19	0	0.56	0.29
Mean	0.63	0.30	0.36	0.27	0.30	0.15	0.13	0.32	0.24

The B mixture gave most consistent rates, but in comparison to the expected rates from static calibrations the amounts were lower.

Within the limits of the experiment, it appears that the slot-seeding technique has some promise for wildflower introduction. A carrier would seem essential for seeding a mixture of seeds with widely different sizes and shapes (e.g. longest dimensions: *Tragopogon pratensis* = 20 mm; *Lychnis flos-cuculi* = 0.5mm). Further examinations of seedling survival to the second year are needed, but work on different carriers, e.g. sand, different seed mixtures, especially dicotyledon-only mixes, would probably result in a practical technique for the amenity market.

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APPENDIX

Rural Amenity Grass Management Objectives

Introduction

The Weed Research Organization is conducting a feasibility study of the use of chemicals for vegetation management of rural amenity areas. The project, which is funded by the Countryside Commission, is currently concentrating on grassland areas, such as picnic sites and country parks.

In order to gain a concensus on the objectives of grassland management, we are seeking the opinions of managers and hope to produce a list of priorities for (1) heavy wear areas, eg tracks and play areas and (2) intermittent wear areas, eg picnic sites. We would be most grateful if you would complete the score sheet below:

Priorities

Please order the ten factors given below in decreasing order of importance, from 1 to 10,

eg if you consider a short sward to be the first priority, score 1; if you consider low maintenance to be the second priority, score 2, etc.

Please add and score other factors which you feel should be included.

A. Heavy wear areas, eg paths

	ORDER
Few flowering heads of grasses	
No bare patches in the sward	
Short sward	
Low maintenance requirement	
Low cost of maintenance	
Lack of rank weeds, eg nettles	
Lack of coarse grasses	
Presence of common flowers	
Tolerance to wear	
Absence of yellowing on vegetation	

B. Intermittent wear areas, eg picnic areas

	ORDER
Few flowing heads of grasses	
No bare patches in the sward	
Short sward	
Low maintenance requirement	
Low cost of maintenance	
Lack of rank weeds, eg nettles	
Lack of coarse grasses	
Presence of common flowers	
Tolerance to wear	
Absence of yellowing on vegetation	

Use of chemicals

We are also seeking information on the current use of chemicals and would appreciate your answer to the following question:

Does your organization use chemicals for vegetation control? YES/NO

If YES, do you know what chemicals are used, where and for what purpose?

eg MCPA - picnic sites - thistle control
Maleic hydrazide - road verges - grass suppression.

CHEMICAL	SITE	PURPOSE

ABBREVIATIONS

ångström	Å
Abstract	Abs.
acid equivalent*	a.e.
acre	ac
active ingredient*	a.i.
approximately equal to*	≃
aqueous concentrate	a.c.
bibliography	bibl.
boiling point	b.p.
bushel	bu
centigrade	C
centimetre*	cm
concentrated	concd
concentration	concn
concentration x time product	ct
concentration required to kill 50% test animals	LC50
cubic centimetre*	cm^3
cubic foot*	ft^3
cubic inch*	in^3
cubic metre*	m^3
cubic yard*	yd^3
cultivar(s)	cv.
curie*	Ci
degree Celsius*	^oC
degree centigrade	^oC
degree Fahrenheit*	^oF
diameter	diam.
diameter at breast height	d.b.h.
divided by*	÷ or /
dry matter	d.m.
emulsifiable concentrate	e.c.
equal to*	=
fluid	fl.
foot	ft

freezing point	f.p.
from summary	F.s.
gallon	gal
gallons per hour	gal/h
gallons per acre	gal/ac
gas liquid chromatography	GLC
gramme	g
hectare	ha
hectokilogram	hkg
high volume	HV
horse power	hp
hour	h
hundredweight*	cwt
hydrogen ion concentration*	pH
inch	in.
infra red	i.r.
kilogramme	kg
kilo ($x10^3$)	k
less than	<
litre	l.
low volume	LV
maximum	max.
median lethal dose	LD50
medium volume	MV
melting point	m.p.
metre	m
micro ($x10^{-6}$)	μ
microgramme*	μg
micromicro (pico: $x10^{-12}$)*	μμ
micrometre (micron)*	μm (or μ)
micron (micrometre)*†	μm (or μ)
miles per hour*	mile/h
milli ($x10^{-3}$)	m
milliequivalent*	m.equiv.
milligramme	mg
millilitre	ml

† The name micrometre is preferred to micron and μm is preferred to μ.

millimetre*	mm
millimicro* (nano: $x10^{-9}$)	n or mµ
minimum	min.
minus	-
minute	min
molar concentration*	M (small cap)
molecule, molecular	mol.
more than	>
multiplied by*	x
normal concentration*	N (small cap)
not dated	n.d.
oil miscible concentrate	o.m.c. (tables only)
organic matter	o.m.
ounce	oz
ounces per gallon	oz/gal
page	p.
pages	pp.
parts per million	ppm
parts per million by volume	ppmv
parts per million by weight	ppmw
percent(age)	%
pico (micromicro: $x10^{-12}$)	p or µµ
pint	pint
pints per acre	pints/ac
plus or minus*	$\pm$
post-emergence	post-em
pound	lb
pound per acre*	lb/ac
pounds per minute	lb/min
pound per square inch*	lb/in^2
powder for dry application	p. (tables only)
power take off	p.t.o.
precipitate (noun)	ppt.
pre-emergence	pre-em.
quart	quart
relative humidity	r.h.
revolution per minute*	rev/min
second	s
soluble concentrate	s.c.
soluble powder	s.p.
solution	soln
species (singular)	sp.
species (plural)	spp.
specific gravity	sp. gr.
square foot*	ft^2
square inch	in^2
square metre*	m^2
square root of*	$\sqrt{\ }$
sub-species*	ssp.
summary	s.
temperature	temp.
ton	ton
tonne	t
ultra-low volume	ULV
ultra violet	u.v.
vapour density	v.d.
vapour pressure	v.p.
varietas	var.
volt	V
volume	vol.
volume per volume	v/v
water soluble powder	w.s.p. (tables only)
watt	W
weight	wt
weight per volume*	w/v
weight per weight*	w/w
wettable powder	w.p.
yard	yd
yards per minute	yd/min

* Those marked * should normally be used in the text as well as in tables etc.

WEED RESEARCH ORGANIZATION

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(Price includes surface mail; airmail £2.00 extra)
(* denotes Reports now out of print)

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15. Methods of Analysis for herbicide residues. February 1977. (second edition) - price £5.75

16. Report on a joint survey of the presence of wild oat seeds in cereal seed drills in the United Kingdom during Spring 1970. November 1970. J G Elliott and P J Attwood. Price - £0.25

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