Forestry Commission
Leaflet 64

Control of Heather by 2,4-D

J M Mackenzie J H Thomson K E Wallis

ABSTRACT

Problems arising from heather in conifer plantations are discussed. Prescriptions are given for medium volume, low volume and ultra low volume applications of 2,4-D esters to kill heather in plantations, using knapsack sprayer, mistblower and ultra low volume equipment respectively.

Front cover

Plate 1. Effect on crop of Sitka spruce, *Picea sitchensis*, resulting from heather control measures and fertiliser, applied to left of post only.

CONTROL OF HEATHER BY 2,4-D

by J. M. MacKenzie, B.Sc., M.I.For., J. H. Thomson and K. E. Wallis, M.W.S.O.M.

Forestry Commission

CONTENTS

1. INTRODUCTION

Heather, *Calluna vulgaris* (L.) Hull., is known as an inhibitor of growth of several tree species, particularly Sitka and Norway spruces, Silver fir, Douglas fir and Western hemlock. Pines and larches are much less affected except Corsican pine which can be severely checked.

The sensitive species are potentially high-yielding which increases the probability of financial gains from heather control to secure rapid, uniform establishment and earlier timber production. The most important species is Sitka spruce, which has been extensively planted in recent years on sites where heather can quickly dominate the ground vegetation. This leaflet is primarily concerned with the control of heather in crops of this species.

There are usually three main options with plantations checked, or likely to be checked by heather:

(1) The crop can be left in the expectation that it will overgrow and kill the heather of its own accord.

(2) The crop can be fertilised with nitrogen to assist it to suppress the heather.

(3) The heather can be killed by herbicide.

Treatment to prevent or overcome prolonged check in growth of the crop is usually desirable in economic terms and the choice will then lie between herbicide or nitrogen application. Table 1 will help to identify circumstances where herbicide application is practical and effective. Herbicide and nitrogen applications are compared in Section 14 and Table 7. Table 1 should not be used without reference to more detailed information contained in the text.

2. THE HERBICIDE

The most consistently successful herbicide tested to date on heather is the growth-regulating organic chemical 2,4-dichlorophenoxyacetic acid (2,4-D) which is used in ester form only. The sodium salt form is readily available for use on lawns, but should *not* be used on heather. Neither should the amine form be used—this is used in forestry for killing standing trees by injection. Low volatile esters such as iso-octyl and nonyl forms should be used, as there is less chance of volatilisation after spraying on warm days. It is also known that the iso-octyl ester is less toxic to fish.

Two formulations of the ester are used; one is an emulsifiable concentrate (e.c.) which is used in water when applying medium or low volumes, and the other is a specially prepared iso-octyl ester in a non-phytotoxic mineral oil which is used for ultra low volume spraying.

Rates of application are generally quoted as kilogrammes of 'acid equivalent' (a.e.) per hectare regardless of which compound is recommended.

3. TIMES FOR APPLICATION

Application is normally done within plantations but can also be done before planting.

Preplanting applications are usually justified only if they are likely to result in a *lasting* change from heather to a more favourable vegetation. This is sometimes the case on mineral soils but rarely so on peatlands where ploughing and fertilising for planting generally invigorate the heather at the expense of other ground species. In preplanting applications of 2,4-D the most reliable results are obtained by spraying in June and July.

Within plantations, 2,4-D application by knapsack sprayer is possible from early April until mid-September, but mistblower and ultra low volume applications are recommended only from mid-July to mid-September in Scotland and northern England, and only from early August to mid-September in southern England and Wales.

These recommendations are set out in Table 2.

4. RATES OF APPLICATION

The recommended normal rate of application is 4·0 kilogrammes of acid equivalent (a.e.) per

TABLE 1

DECISION CHART ON WHETHER OR NOT TO SPRAY

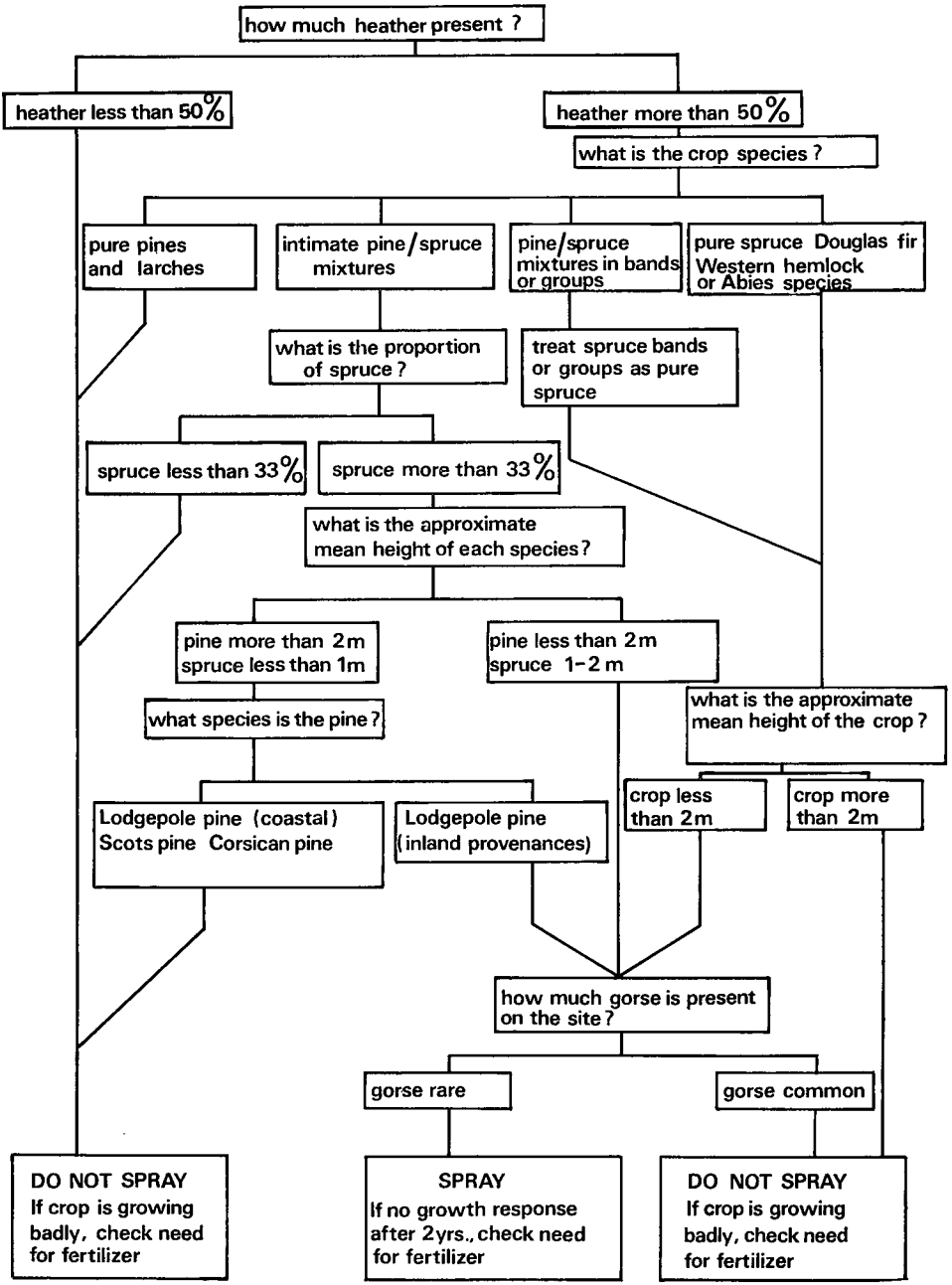

TABLE 2

SUMMARY OF RECOMMENDATIONS FOR 2,4-D APPLICATIONS IN SITKA SPRUCE PLANTATIONS IN NORTHERN BRITAIN[1]

For other conifer species the same rates may be used but time of spraying should be restricted to the period early August to early September. Where tree height is less than 1 metre, extra care is required and use of the knapsack is advised. For crops in shaded conditions lower rates are required—see Section 4.

Period / Method of Application	Recommended Rates of Application in kilogrammes acid equivalent per hectare				
	Early Spraying Period		Main Spraying Period		
	April[2]	May, June and First Half July	Second Half July and First Half August	Second Half August	First Half September[2]
Knapsack	Use only in crops over 1 metre[3] Crop damage usually slight		Damage in crops over 1 metre is negligible[3] Damage in crops under 1 metre is slight[3]		
	6	4	4	5	6
Mistblower and ULV Applicator	Not recommended		Damage in crops over 1 metre is slight[3] Damage in crops under 1 metre is moderate[3]		
			4	5	6

Notes: (1) For Southern Britain, because of the slightly longer growing-season, times and rates of application are slightly different. Rates are restricted to 4kg a.e./ha throughout but can be increased to 5 kg in September. The main spraying season starts later, early August to early September inclusive. For further information see Forestry Commission Booklet 40 *Chemical Control of Weeds in the Forest* (Brown, 1975).

(2) April and September applications are less reliable and more expensive. They should be used only when necessary for completion of large programmes.

(3) Refers to mean height.

hectare. Increased rates (up to 6·0 kg a.e./ha) are recommended for knapsack spraying in April and for all three methods of application in late August and early September for Northern Britain, as shown in Table 2.

In shaded conditions, e.g. in underplanting, trees and heather are both abnormally sensitive to 2,4-D and the rate of application must be reduced to 2·0 kilogrammes acid equivalent per hectare to avoid damage to the crop.

2,4-D ester used for treating heather is obtained dissolved in oil with the concentration of 2,4-D acid equivalent shown as a weight/volume (w/v) percentage, i.e. 100 per cent means 1 kg per litre and 50 per cent means 0·5 kg/litre. If 4 kg a.e./ha is the recommended rate, the quantity of the liquid formulation to be applied is $\frac{4}{0{\cdot}5}=8$ litres.

5. APPLICATION METHODS

Three methods of application are included in these prescriptions, namely:

(i) Medium volume application by knapsack sprayer, using 220 to 450 litres of water containing 2,4-D per hectare (where water transport problems are very difficult 220 litres/hectare has given good results).

(ii) Low volume application by mistblower, using up to 150 litres of water containing 2,4-D per hectare.

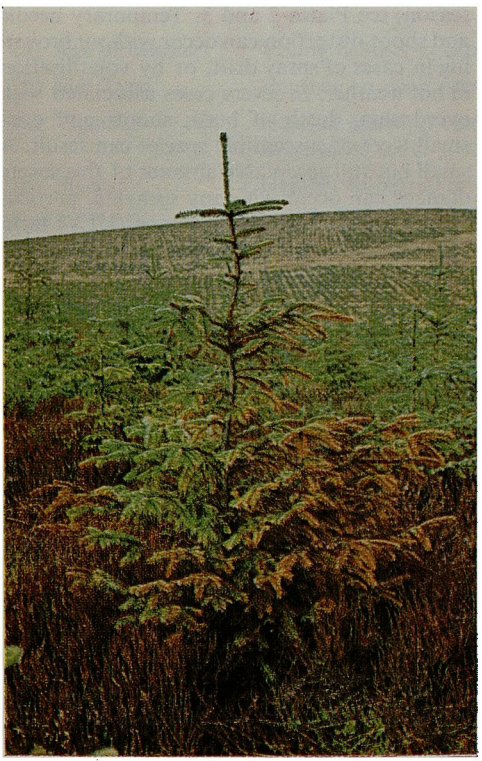

Plate 2. Sitka spruce showing 2,4-D damage by ultra low volume spraying.

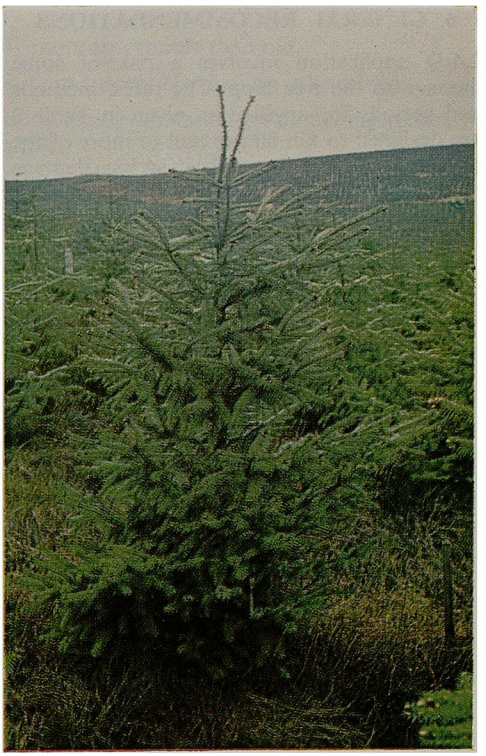

Plate 3. Sitka spruce showing recovery from 2,4-D damage.

(iii) Ultra low volume application by special ULV sprayer, using 10 litres per hectare of specially prepared 2,4-D.

Medium volume application by knapsack sprayer has consistently been the most effective of these methods in killing heather with minimum damage to the tree crop, but the comparatively large volumes of water required are a substantial disadvantage.

Both mistblower and ultra low volume methods are effective in killing a large proportion of the heather but are limited by a shorter season and strong winds.

The equipment used for each method, and detailed prescriptions are given in Sections 10 to 13 following.

6. GENERAL RECOMMENDATIONS

2,4-D application involves a risk of some damage to the tree crop. The rates, methods and periods for application given in Table 2 are designed to kill 80 per cent or more of the heather in a plantation without serious damage to Sitka spruce and *most* tree crops in *most* circumstances but a number of factors may increase the risk of crop damage. These are listed in Section 7 and no 2,4-D applications should be made without taking these factors into account. The recommended rates of application are the minimum for effective killing of heather so that, where there appears to be an abnormal risk of crop damage, this is best reduced by choice of equipment, by spraying only in ideal weather conditions, and by especial care in application, rather than by reducing the rate of application.

7. DAMAGE TO THE CROP

Some damage is inevitable if large spraying programmes are to be completed. Damage usually takes the form of foliage browning with subsequent defoliation, but the effect is temporary and not noticeable the following season; see Plates 2 and 3. Temporary needle and shoot distortion can occur without browning in cases of spray drift, or by volatilisation in hot weather. In severe cases associated with overdosing, death of buds, shoots and even small trees of susceptible species can result. A small but still acceptable amount of this severe damage can occur with any spraying, particularly when the ultra low volume (ULV) technique is used, and especially in crops under one metre mean height.

The degree of crop damage depends on the following factors:

(a) **Species:**	Moderately resistant: Sitka, Norway and Omorika spruces. Partially resistant: Scots and Corsican pines, Douglas fir, *Abies* species, Western red cedar. More susceptible: Lodgepole pine, larches, Western hemlock.
(b) **Crop height:**	Serious damage is more likely when treating crops under one metre in mean height.
(c) **Equipment:**	The knapsack sprayer has the least damage risk and ULV the highest.
(d) **Technique:**	Avoid close direct spray contact of trees to minimise damage.
(e) **Rate of Chemical:**	The risk of damage increases with increased rate of chemical.
(f) **Season of Application:**	Crops are most susceptible in the April to mid-July period but spraying then should be restricted to knapsack application and to crops over one metre in height.
(g) **Weather:**	Hot weather at, and immediately after spraying, may increase crop damage.

8. WEATHER

(a) Mild, sunny weather during and after spraying is an advantage, but not essential.

(b) Heavy rain within a few hours of spraying may decrease the effectiveness of water-borne applications, but has less effect on ULV applications. *Application by any method in the rain is not recommended.*

(c) Completely calm conditions are not desirable for ULV application. Spraying can be carried out in wind speeds up to eighteen kilometres per hour at *ground vegetation level* inside the plantation. This may be equivalent to 25 to 30 km per hour at head height. Knapsack application in crops over one metre in height can be carried out at higher wind speeds.

(d) Records indicate that, in the main spraying season of July to August, 50–60 per cent of the days should be suitable for mistblower or ULV spraying.

9. SUSCEPTIBILITY OF HEATHER TO 2,4-D

The results of heather spraying can be variable. Correct spraying technique is the major factor controlling success but several other factors may contribute to the susceptibility of the heather.

(a) **Age of heather:** Young heather is usually more susceptible than old.

(b) **Soil Type:** Heather on deep peat is more susceptible than on mineral soil.

(c) **Vigour:** Heather growing vigorously after stimulation by ploughing or fertiliser can be more susceptible.

(d) **Shade:** Heather in partial or complete shade is more susceptible than heather in the open.

(e) **Flowering:** Flowering period has been used in the past as a guide to correct application time. More reliable control can be achieved *before flowering*, during the period of maximum growth which culminates in flowering.

TABLE 3

NOZZLES FOR USE WITH THE CP3 KNAPSACK SPRAYER FOR HEATHER CONTROL

Application rate	Nozzle	Spraying pressure (kg/cm²)	Height of nozzle above heather (centimetres)	Approx. walking speed (km/hr)
220 litres of diluted herbicide per hectare	Blue Politip	0·7	60	2·0
450 litres of diluted herbicide per hectare	Red Politip	1·0 0·7	45 54	1·8 1·5

10. TYPES OF EQUIPMENT AND WORKING METHODS

(a) **Knapsack Sprayer** (Plate 4)

The applicator used by the Forestry Commission is the Cooper Pegler CP3 Forestry Model pressurised sprayer. A variety of nozzles are available for use with it and those recommended for heather control are shown in Table 3. Daily maintenance of the sprayer should include cleaning the filter which is housed in the trigger handle.

The sprayer must be equipped with a pressure control valve and pressure gauge, and a complete set of spare washers and Politip nozzles should be available. It must be thoroughly cleaned using a liquid detergent before storage at the end of the spraying season.

A 36 cm lance is fitted to the sprayer and held so that the fan nozzle sprays downwards, vertically to the ground. This gives the operator good control and reduces the risk of direct spraying of crop trees. The choice of nozzle depends on the width of spread required in relation to plant spacing, and on the amount of diluent used. Where ground conditions enable a reasonable walking speed to be maintained the blue Politip nozzle is recommended because then the amount of liquid sprayed can be minimised. The operator walks between two rows of trees, selecting his route to avoid most obstacles and holding the lance at a height which allows the outer edges of the fan spray to reach the ground at the base of each planted row of trees. This achieves the maximum coverage of heather with the minimum contact between the herbicide and trees.

(b) **Mistblower** (Plate 5)

The Stihl SG17 mistblower is suitable for

Plate 4. Applying 2,4-D by Knapsack sprayer, a Cooper Pegler, CP3.

heather spraying. It is a compact, well-balanced and mechanically reliable machine, The advantages of using a mistblower, compared with using a knapsack sprayer, are the increased speed of application and the slightly lower weight carried by the operator. The disadvantages are the high initial cost and the noise, smell and vibration of the petrol-driven engine. Mistblower applications require water as a diluent at up to 150 litres per hectare and, although the problems associated with water supply are still important, they are less acute compared with a knapsack sprayer because of the lower quantity applied per hectare.

The nozzle of the Stihl SG17 mistblower should be fitted with a tapered screen which gives a broad spray pattern. The operator walks between two rows of trees as with the knapsack sprayer. To achieve an even distribution he aims the outlet tube at the heather two metres in front of his feet, moving it slightly up and down. The outflow of the herbicide can be adjusted by a selector at the end of the nozzle. On most terrains a nozzle setting of 1 or 1½ will generally be found to be adequate.

(c) **Ultra Low Volume Applicator*** (Plate 6)

This is a comparatively new method of spraying herbicides in forestry. The ultra low volume applicator distributes small relatively even-sized droplets of herbicide. It is driven by a 12 volt electric motor powered by either disposable alkaline manganese or rechargeable batteries. Ultra low volume spraying has the advantage of using cheap lightweight equipment and relatively small quantities of herbi-

* For more detail about ultra low volume spraying see Forestry Commission Leaflet No. 62, *Ultra Low Volume Herbicide Spraying*, by E. V. Rogers (HMSO, 1975).

Plate 5. Mistblower application of 2,4-D. In this case, the machine is a Stihl SG 17.

cide which are pre-mixed. These factors make it particularly suitable for areas of rough terrain that are remote from water and roads. The disadvantage is that successful application is more dependent on favourable wind conditions than other methods.

The recommendations for nozzle size for this applicator are shown in Table 4 and are dependent on the walking speed that the operator can maintain throughout the period when he will be spraying. With this equipment only single lane application is recommended. The operator walks in the same position as with the other applicators and to achieve the best cover the applicator head should be swung from side to side like a mine detector, taking care as far as is possible to avoid direct contact between the herbicide and the trees. Where this technique is used in crops under one metre mean height, moderate damage can occur.

Multi-row, also known as *incremental* or *drift spraying* is *not* recommended because of inconsistent results in trials.

11. SUPPLIES OF DILUENT AND WORKING METHODS

Water is necessary as a diluent for knapsack sprayers and mistblowers. ULV herbicides are pre-mixed.

For ULV spraying individual one-litre bottles should be filled indoors and carried to the site in modified milk crates. The crate is left on the ride at the end of the rows; one bottle is fitted to the sprayer and another put into a locally-produced pouch attached to the operator's belt. Carrying the extra bottle minimises unproductive walking.

For knapsack and mistblower, if spraying water is imported to the site the location of containers should be carefully planned before the operation commences, as incorrect siting

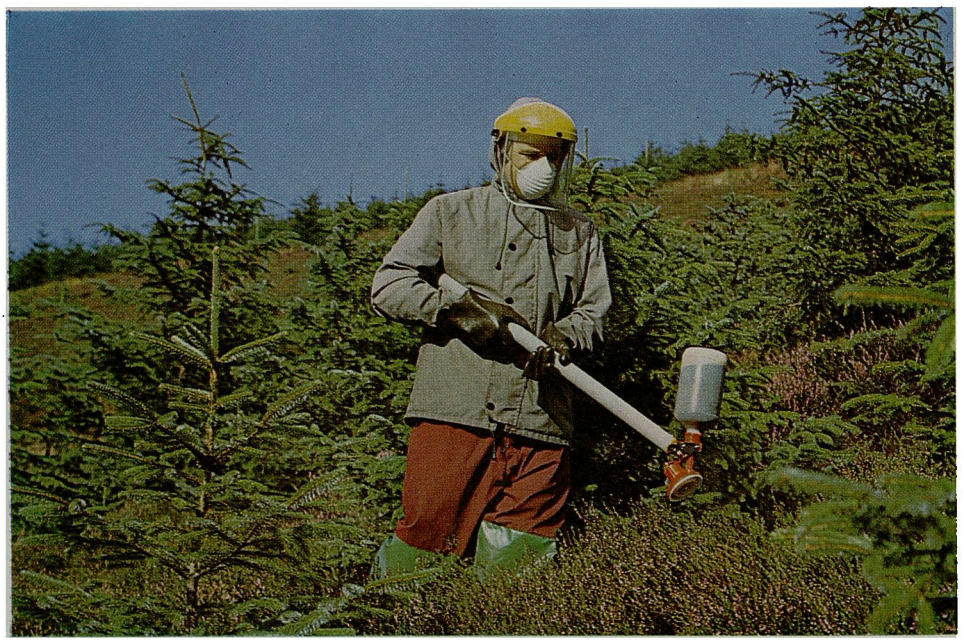

Plate 6. Ultra low volume application of 2,4-D by means of a Micron ULVA.

TABLE 4

RECOMMENDED NOZZLES FOR USE WITH ULV APPLICATOR

ULV Formulation 40% W/V 2,4-D ester	Walking Speeds at 1·8 m row spacing	Output	Nozzle
10 litres/ha	2·0 km/hr	1 ml/sec	Red
	4·0 km/hr	2 ml/sec	Grey
12·5 litres/ha	3·5 km/hr	2 ml/sec	Grey
15 litres/ha	3·0 km/hr	2 ml/sec	Grey

N.B. These output rates may be affected by imprecise moulding of the nozzle and by temperature changes.

can lead to unproductive walking. Plastic barrel liners with capacities from 136 litres to 1,360 litres are a convenient means of storing water on the site. They are extremely light, cheap and reasonably durable. Pre-mixed herbicides should not be stored in them as they are prone to vandalism. Great care must also be taken in positioning barrel liners as they may roll down the hill when filled. A graduated plastic measuring jug, clearly marked with the amount of herbicide to be added to the sprayer, is useful for mixing. The undiluted herbicide should be provided in one gallon (5 litre) cans at filling points.

On sites where there is no water available, and which are not trafficable, water will have to be pumped from a stream, a dam or a bowser into containers on the site. A light-weight pump such as the Minar "E" is suitable for this purpose but centrifugal-type fire pumps may be used if available. Centrifugal-type fire pumps are generally very heavy and it has been found that by reducing the size of the outlet hose, the unit becomes much more easily transportable. An adaptor can be made locally which will reduce the size of the outlet to correspond with the size of hose required.

This can vary from 8 mm up to the size of the original outlet and it has been found that a 19 mm hose is most suitable. However, the smaller the diameter of hose, the lower will be the rate of delivery.

A small hand pump, such as a semi-rotary No. 1 or a Gusher 8, is an easy means of filling the applicator from a container. If a vehicle can cross the ground, pre-mixed chemicals should be distributed over the site in 5 gallon drums (22·5 litres approx), 45 gallon drums (202 litres approx.) or a bowser.

12. OPERATOR PROTECTION

Although 2,4-D is not in the *Agriculture (Poisonous Substances) Regulations* some operator protection is advisable when spraying heather. It is recommended that the items of protective clothing listed in Table 5 are worn by operators when spraying.

13. OUTPUTS AND COSTS

Table 6 gives an indication of output levels. The approximate costs (July 1975) include labour, labour oncost, herbicide and distribution of diluent.

TABLE 5

RECOMMENDED PROTECTIVE CLOTHING

Clothing	Knapsack sprayer	Mistblower	Ultra low volume
Boots Wellington (Oilproof for ULV)	√	√	√
Trousers or leggings (Waterproof & thornproof)	√	√	√
Jacket (Waterproof & thornproof)	D	√	—
Gloves (plastic)	√	√	√
Face or Eye Shield	—	√	√
Respirator (3M paper mask for ULV)	D	D	√
Waterproof hat or hood	—	D	—
ULV Suit (with hood)	—	—	√

D=operator's discretion; items marked in this way have been found to reduce discomfort and should therefore be made available.

TABLE 6

OUTPUTS IN HEATHER CONTROL

Method of Application	Output in hectares per 8-hour day	Cost per hectare (1975) £
Knapsack—Medium volume	0·75–1·0	30
Mistblower—Low volume	1·0–1·25	25
Ultra low volume	1·25–2·0	17

TABLE 7

COMPARISON OF NITROGEN TREATMENT AND 2,4-D FOR HEATHER CONTROL

Factor	Nitrogen Treatment	2,4-D Treatment
1. Cost (1975):	Approx. £38/ha at 160 kg N/ha supplied as 450 kg ammonium nitrate/ha, or 350 kg urea/ha.	Currently ½ to ⅔ cost of N, i.e. £17–30/ha depending on equipment used and terrain conditions etc.
2. Ease of operation:	Easy by air. Easy by hand as no protective clothing to wear.	Scope limited for aerial application owing to fairly tight specification. Difficult job by hand.
3. Speed of operation:	Large programmes can be completed by air.	Difficult to achieve large programmes, despite flexibility in time of application allowed by different methods. Programme is restricted by man-power, and labour is short in some areas.
4. Reliability:	Aerial application subject to normal hazards of possible poor distribution.	Successful heather control depends greatly on good training and supervision.
5. Selectivity:	Difficult with aerial application but some adjacent or intermixed non N-deficient sites may also benefit from N application.	Hand application can be very selective, resulting in more even crop growth which will facilitate future harvesting.
6. Response pattern:	Early response quickly noticed but subsequent fall-off may be equally swift and more than one application may be required on some sites, when used in lieu of 2,4-D. N is better applied when crops are closer to canopy closure to avoid need for second application. Applied N can upset balance of other nutrients.	Assuming satisfactory heather control achieved, response pattern slow but sure. Fall-off can be as rapid as N treatment on poorest sites. Better balanced nutrient status with heather control (assuming other nutrients, P and K in adequate supply.
7. Conservation aspects:	There may be some reservations in reservoir catchment areas but likely to be accepted elsewhere. No harm to environment at rates likely to be used in forestry.	More risk to environment. Close liaison required with water authorities and beekeepers, etc.

14. SELECTION OF 2,4-D OR NITROGEN TREATMENT

Heather affects the nutrition of the tree crop and its control is linked with fertiliser treatment in particular and site amelioration in general. The decision to spray heather is not an easy one, and factors such as the amount and distribution of heather, heather control history in the area, type of crop (species and mixtures) and height of crop have to be considered. The primary aim of heather control is the correction of nitrogen deficiency and the manager should give consideration to the alternative of nitrogen fertiliser. It is not possible to recommend one treatment in preference to the other; both methods may be complementary in many forests. Table 7 will assist in the decision.

15. ENVIRONMENTAL EFFECTS OF 2,4-D

Increased use of 2,4-D in upland areas may raise queries on its effect on the environment. A review of literature (Aldhous 1967; Way 1969; Frank & Demint 1969; Fryer & Evans 1970; Norris 1971; Norris et al 1972; Cooke 1972) indicates that when used as recommended for heather spraying, 2,4-D presents no toxic hazard to man, mammals, birds or fish. It does not accumulate in plants or soil, but breaks down rapidly within weeks of application. It is harmless to soil micro-organisms even at very high doses.

There is some hazard to bees, through ingestion, when spraying heather in flower. This can be minimised by good liaison with bee-keepers and use of the full periods of application.

The risk of tainting water supplies may be less than was thought earlier. Recent stream sampling indicates that the current safety margin set by the limitation on the area of catchment to be treated is more than adequate (Scott, 1973). Samples confirm that dilution is a major factor in preventing unacceptable levels occurring downstream of treated areas.

The indirect effect on the environment due to change of habitat following heather removal is appreciated, but heather control is regarded as a speeding up of the normal process of long-term environmental change following afforestation.

16. OTHER HERBICIDES

The following brief information of trials of other herbicides for heather control is given as a matter of interest only and does **not** imply a recommendation for general application.

(a) Many chemicals have been tried and rejected for various reasons, such as insufficient selectivity (sodium chlorate, ammonium sulphamate, sodium arsenite, picloram), or ineffective control (aminotriazole, 2,4,5-T, dichlorprop, mecoprop). Paraquat has been used effectively, but does not provide as permanent a control as 2,4-D.

(b) To find an alternative chemical as successful as 2,4-D, should shortages or price preclude its use, current experiments include re-testing MCPA at higher rates than previously used. This herbicide might be more readily available than 2,4-D in the future, because of its widespread use in agriculture. Early results using 6 or 8 kg per hectare are promising. Two other chemicals, glyphosate and cyprazine, are being further tested after showing initial success.

(c) The use of small quantities of additive compounds, such as ammonium nitrate, aimed at improving reliability of control, has not been successful to date.

ACKNOWLEDGEMENTS

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* Not mentioned in text but useful additional reading.

APPENDIX

SUPPLIERS OF EQUIPMENT AND PROTECTIVE CLOTHING

Knapsack Sprayer

Cooper Pegler CP3 Forestry Model complete with pressure control valve and gauge	Cooper Pegler & Co. Ltd. Burgess Hill Sussex RH15 9LA

Mistblower

Stihl SG17	Thos. Niven, Ltd. 1 Dalston Road Carlisle Cumbria

Ultra Low Volume Applicator

Ultra low volume applicator	Micron Sprayers, Ltd. Three Mills Bromyard Herefordshire

Accessories

Semi Rotary Hand Pump No. 1	Lee Howl & Co. Ltd. Alexandra Road Tipton Staffordshire
Gusher 8 Hand Pump	Munster Simms Engineering Ltd. Old Belfast Road Bangor Northern Ireland
¾ inch Clear Plastic Hose	Local Builders' Merchants
Barrel Liners 1.B 26″ × 50″ (136 litres) 2.E 44″ × 79″ (340 litres) 5.D 62″ × 78″ (680 litres) 10.A 75″ × 112″ (1,360 litres)	Porter Lancastrian, Ltd. Lancastrian Works Bayley Street Bolton Lancs. BL1 3AQ

Herbicides

Silvapron "D" (for ULV application only)	Local Agents of British Petroleum
2,4–D emulsifiable concentrate	Most agricultural chemical suppliers

Protective Clothing

Boots: Edmar chemical-resistant	Clark, Hoy & Co., Ltd. Fen Street Canning Town London E16 1JT
Oil and Thornproof Protective Suit	Abridge Overalls, Ltd. Burgess Hill Sussex
Jalite ULV Suit (The length of polyurethane required on the lower part of the trousers should be stated when ordering.)	Abridge Overalls, Ltd. Burgess Hill Sussex
Gloves—Hygesan No. 485 *Face Shield*—Norths FS/1318/BW	James North & Sons, Ltd. P.O. Box 3 Hyde Cheshire SK14 1RI

Respirator—Baxter Pneu-seal with type 'A' filter	Sabre Safety Products, Ltd. 225 Ash Road Aldershot Hants.
3*Ms Paper Face Mask* Scot Brand No. 8500	Herts Packaging Co., Ltd. 53 London Road St. Albans Herts
Waterless Skin Cleaner No. 44	Rozalex, Ltd. Winsford Cheshire

General

The ultra low volume sprayers and most of the equipment associated with this technique can be supplied by G. M. Forest Supplies, Castle Acre Road, Great Massingham, Kings Lynn, Norfolk.

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