DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Form CLM 80B

062043

To: EXECUTIVE DIRECTOR, CRAWLEY

RAY FREMLIN, SILVICULTURALIST, BUSSELTON

Your Ref:
Our Ref: 243
Enquiries: Ray Fremlin
Phone: (097) 521 677

Subject: INVESTIGATION OF 'OUST' (SULFOMETURON-METHYL) TO CONTROL WEEDS AT THE ESTABLISHMENT OF P. RADIATA PLANTATIONS

Attached is a copy of the results of trials carried out over the past 3 years.

An additional trial was established at my request by Manjimup District. The results of this were not available to include in this report. Also, I have done a small amount of work with Oust and eucalypts which will form a separate report.

Ray Fremlin.

Ray Fremlin
SENIOR FORESTER (SILVICULTURE)

DIST:
Dr P. Christensen - Manjimup
Dr J. McGrath - Como
Mr R. Moore - Busselton
Mr J. Kaye - Bunbury
Mr J. Bradshaw - Manjimup
Mr G. Ellis - Manjimup
Mr K. Gillen - Albany
Mr J. Sclater - Como
Regional Managers - Northern Forest Region
Central Forest Region
Southern Forest Region

INVESTIGATION OF 'OUST' (SULFOMETURON-METHYL) TO CONTROL WEEDS AT THE ESTABLISHMENT OF P.RADIATA PLANATIONS

INTRODUCTION

In order that substantial areas of pines are established under sharefarming agreements it is necessary to accept land, that prior to the scheme, would not have been considered suitable for P.radiata

The majority of land being offered is marginal or submarginal for agriculture. Soils are predominantly sandy textured as either aolian (dunes) or alluvial deposits (seasonally waterlogged flats). The soils with dryer profiles are often dominated by Sorrel (Rumex acetocella). There is currently no 'one pass' prescription that will kill existing Sorrel and provide sufficient residual capacity to maintain the site free of Sorrel for one year. Similarly, there is no prescription that will provide sufficient residual capacity on seasonally waterlogged sites. These sites are characterised by heavy infestations of Dock, (Rumex spp), Cultivation Rush (Juncus pallidus) and Annual Rye grass (Lolium rigidum). Although it is recommended that wet sites be mounded, to date there has been insufficient time for mounds to consolidate before spraying. Consequently, in the process of settling much of the herbicide erodes off the mound, significantly reducing the efficacy. Wet sites are also characterised by high levels of soil organic matter. Herbicides adsorp readily to this material and their active life is reduced.

Seven trials were established, commencing in 1987, with the objective of developing a weed control strategy that accounts for the constraints in terms of logistics, site quality and economics that are imposed by the sharefarming scheme.

Different herbicidal combinations were evaluated for the control of Sorrel (3 trials), Cultivation Rush (1 trial), Dock and Rye Grass (1 trial) and a mixture of pasture species and Bracken (Pteridium esculentum) (2 trials).

The herbicides evaluated in this series of trials were:

Oust (750gm/kg sulfometuron-methyl)
Brush-off (600gm/kg metsulfuron-methyl)
Roundup (360gm/litre glyphosate)
Gesaprim (500gm/litre atrazine)
Velpar L (250gm/litre hexazinone)
Vorox AA (320gm/litre amitrole; 320gm/litre atrazine)

Surfactants and adjuvants were used where indicated.

RESULTS

TRIAL 1 Sorrel Control (Milgraum, Albany)
Establishment date: 25.5.87
Independent variables: herbicides. Timing of application (pre and post-planting). Soil preparation. (mounds and no mounds)
Site description: Duplex soil with loamy sands over clay, pH 4.5
Weeds: Predominately Annual Rye grass and Sorrel.
Conditions at time of spraying: soil-damp, RH 65%, dry bulb temperature 14.5°.
Total spray output: 96 l/ha
Experimental details: Complete randomisation with split plot arrangement. Three replicate plots of each treatment with 10 trees in each plot.

EFFICACY Herbicide treatments	% bare ground 5 mths after treatment	P=<.05	% bare ground 10 mths after treatment	P=<0.5
1- 0.8l/ha Roundup + 200gm/ha Oust	100	a	94	a
2- 2 " " + 400gm/ha Oust	100	a	90	a
3- 5gm/ha Brush-off + 200gm/ha Oust	100	a	89	a
4- " " + 400gm/ha Oust	99	a	85	a
5- 0.8l/ha Roundup + 10l/ha Gesaprim	96	a	74	ab
6- 5gm/ha Brush-off + 10l/ha Gesaprim	91	a	73	ab
7- 0.8l/ha Roundup + 7 l/ha Gesaprim	83	a	57	abc
8- 5gm/ha Brush-off + 7l/ha Gesaprim	76	a	44	abc
9- 5l/ha Vorox AA	55	b	38	bc
10- 2.5l/ha Velpar L + 3.5l/ha Gesaprim	45	bc	13	bc
11- 5l/ha Velpar L	24	c	33	c
12- Control	20	c	21	c

Treatments containing Oust provided best weed control. In this trial combinations of Roundup plus Oust or Gesaprim, and Brush-off plus Oust or Gesaprim were effective in controlling Sorrel throughout spring. Treatments containing Oust prevented regermination of Sorrel and it was apparent that 200gm/ha of Oust was adequate.

Weed control was significantly (p,.01) better on mounds than off mounds except for Oust treatments where there was no difference. Vorox AA and Velpar L applied alone did not provide effective weed control.

Fig 1A

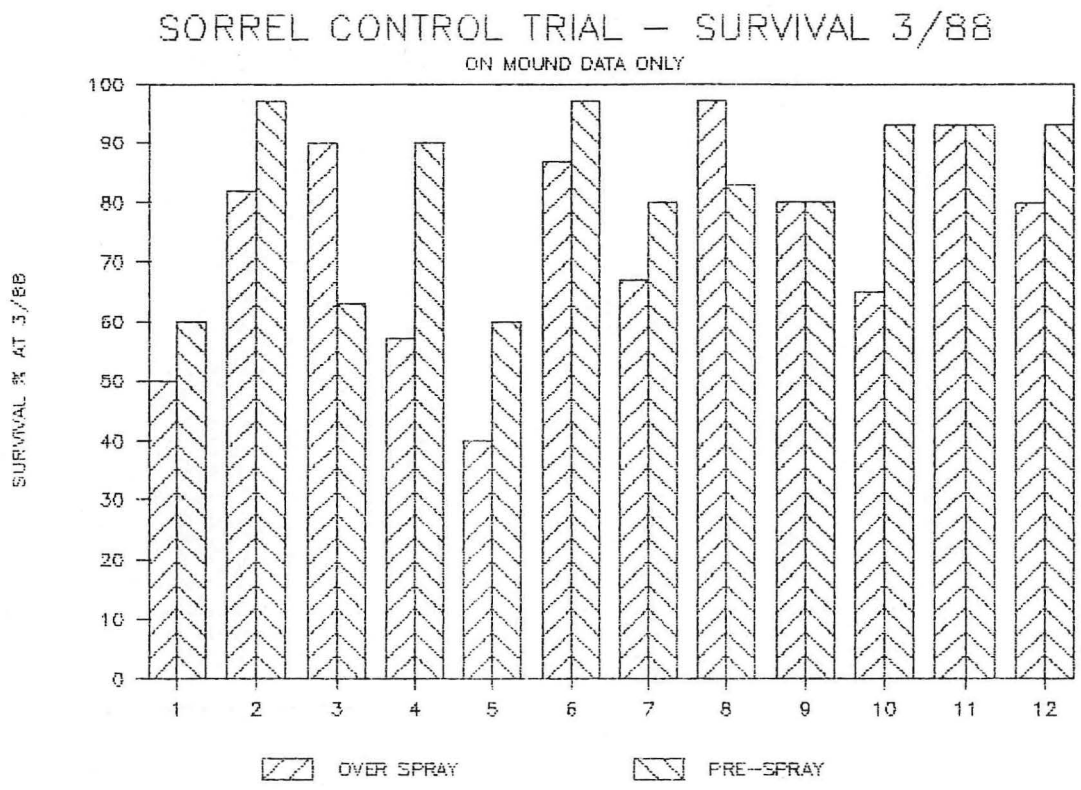

SORREL CONTROL TRIAL – SURVIVAL 3/88
ON MOUND DATA ONLY
SURVIVAL % AT 3/88
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
OVER SPRAY
PRE-SPRAY

Fig 1B

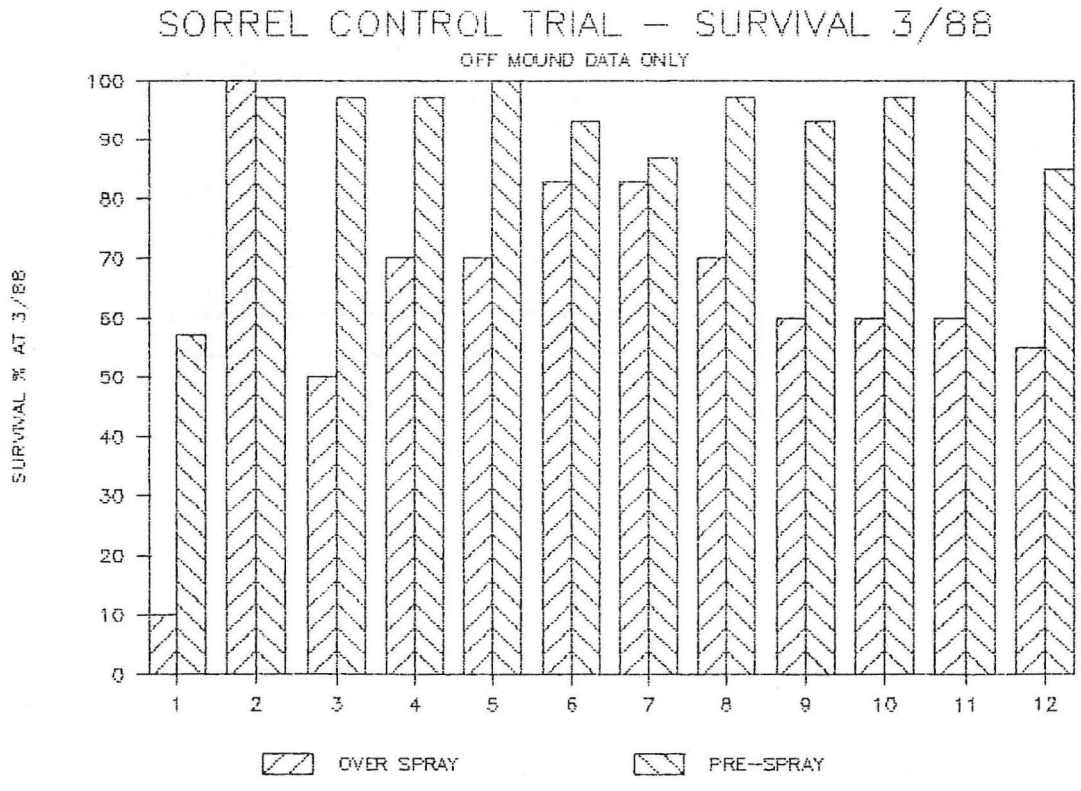

SORREL CONTROL TRIAL – SURVIVAL 3/88
OFF MOUND DATA ONLY
SURVIVAL % AT 3/88
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
OVER SPRAY
PRE-SPRAY

Fig 1C

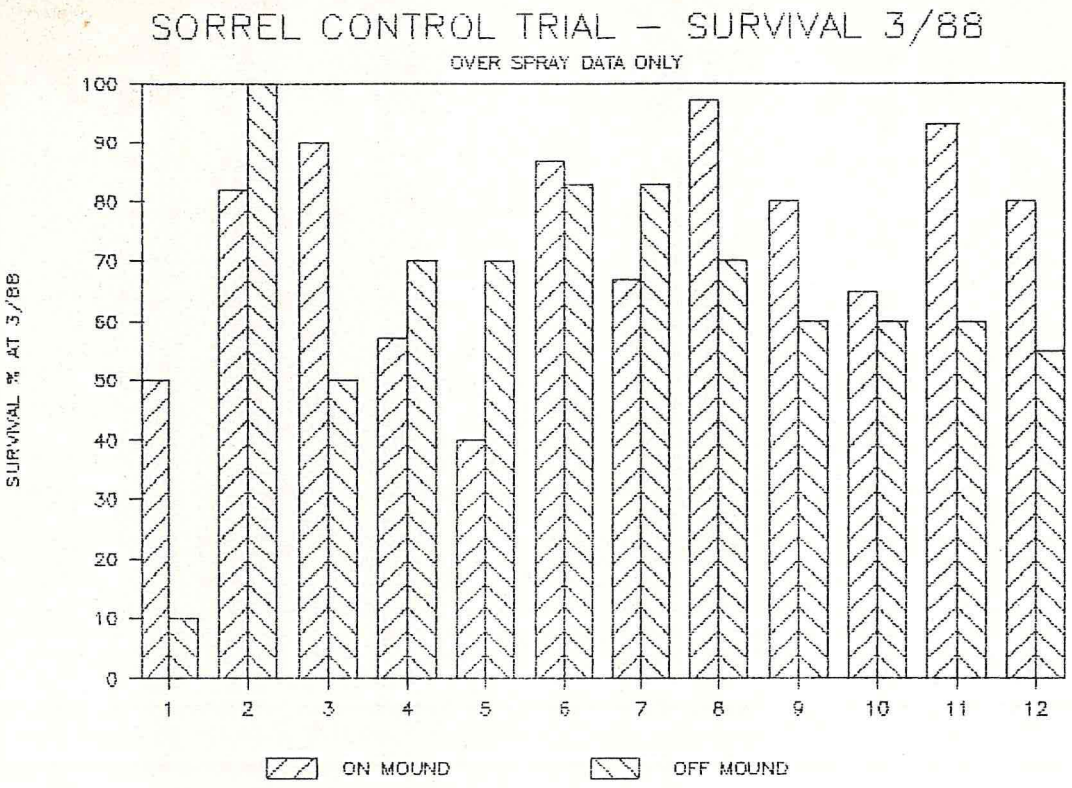

SORREL CONTROL TRIAL – SURVIVAL 3/88
OVER SPRAY DATA ONLY
SURVIVAL % AT 3/88
0
10
20
30
40
50
60
70
80
90
100
1
2
3
4
5
6
7
8
9
10
11
12
ON MOUND
OFF MOUND

Fig 1D

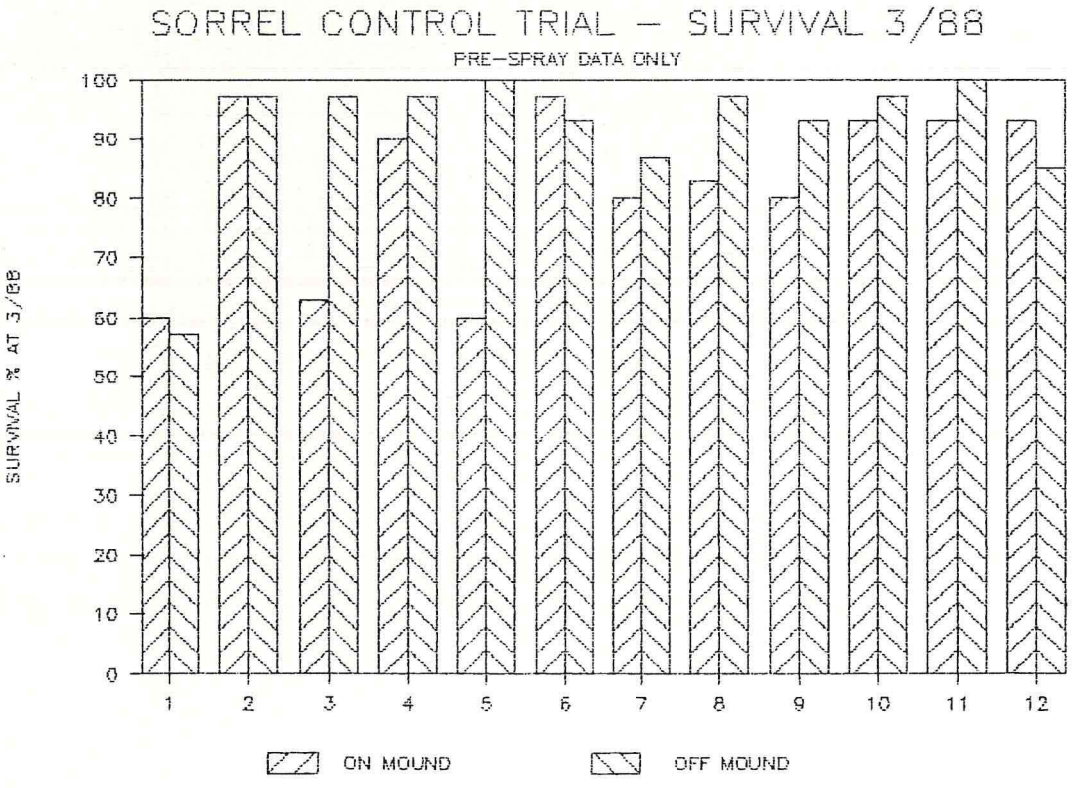

SORREL CONTROL TRIAL – SURVIVAL 3/88
PRE-SPRAY DATA ONLY
SURVIVAL % AT 3/88
0
10
20
30
40
50
60
70
80
90
100
1
2
3
4
5
6
7
8
9
10
11
12
ON MOUND
OFF MOUND

Fig 2A

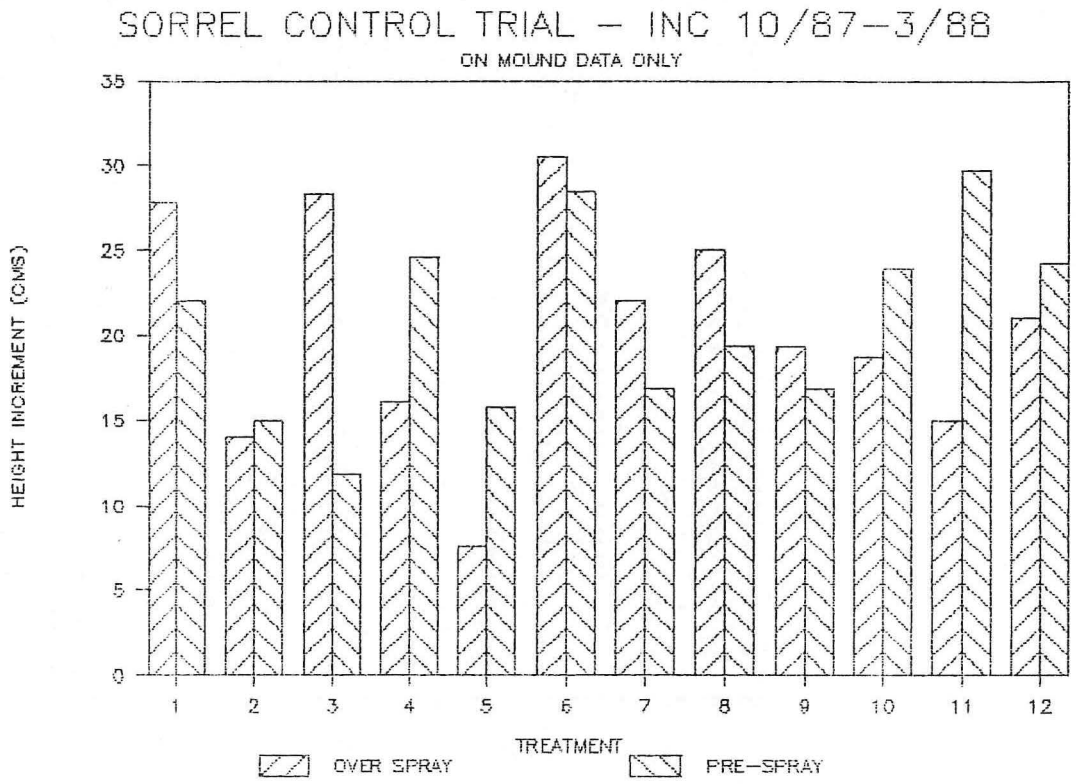

SORREL CONTROL TRIAL – INC 10/87–3/88
ON MOUND DATA ONLY
HEIGHT INCREMENT (CMS)
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
10
11
12
TREATMENT
OVER SPRAY
PRE–SPRAY

Fig 2B

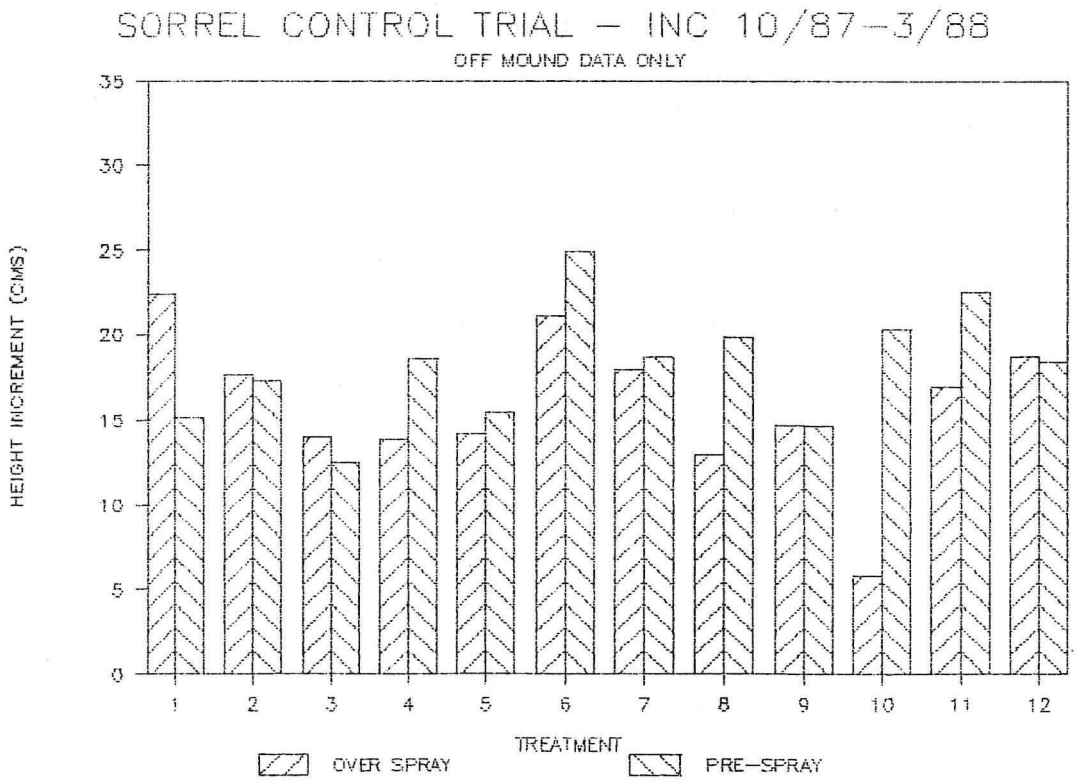

SORREL CONTROL TRIAL – INC 10/87–3/88
OFF MOUND DATA ONLY
HEIGHT INCREMENT (CMS)
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
10
11
12
TREATMENT
OVER SPRAY
PRE–SPRAY

Fig 2C

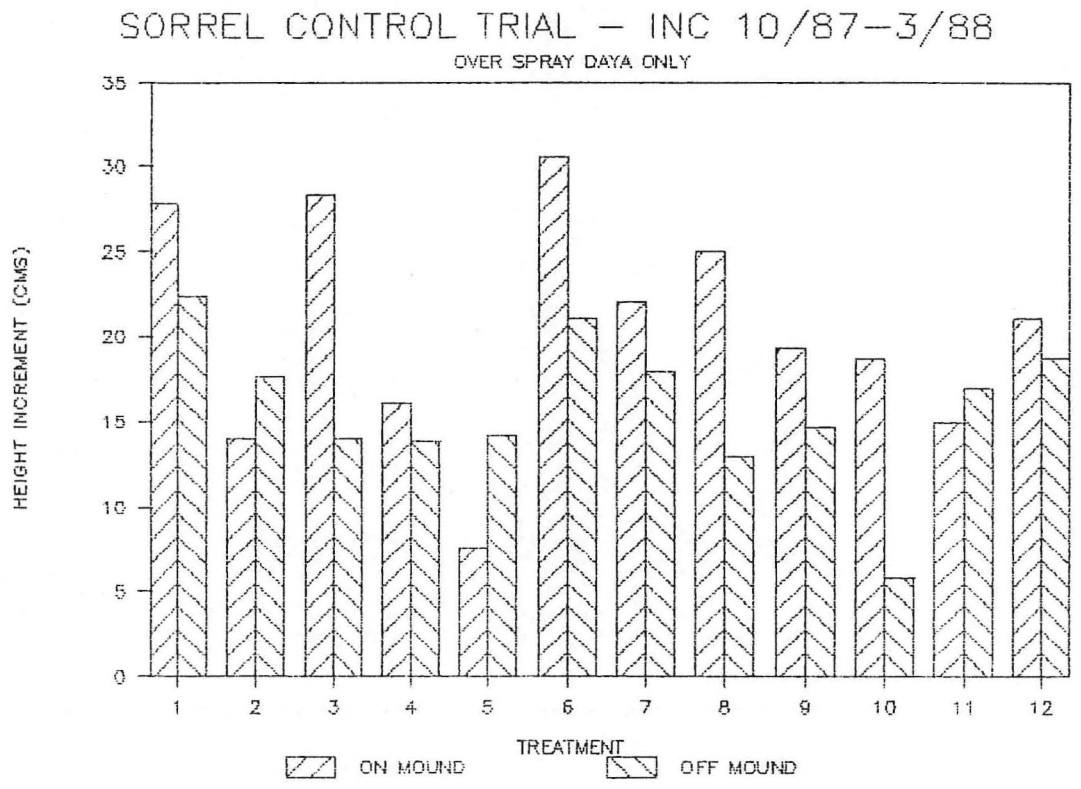
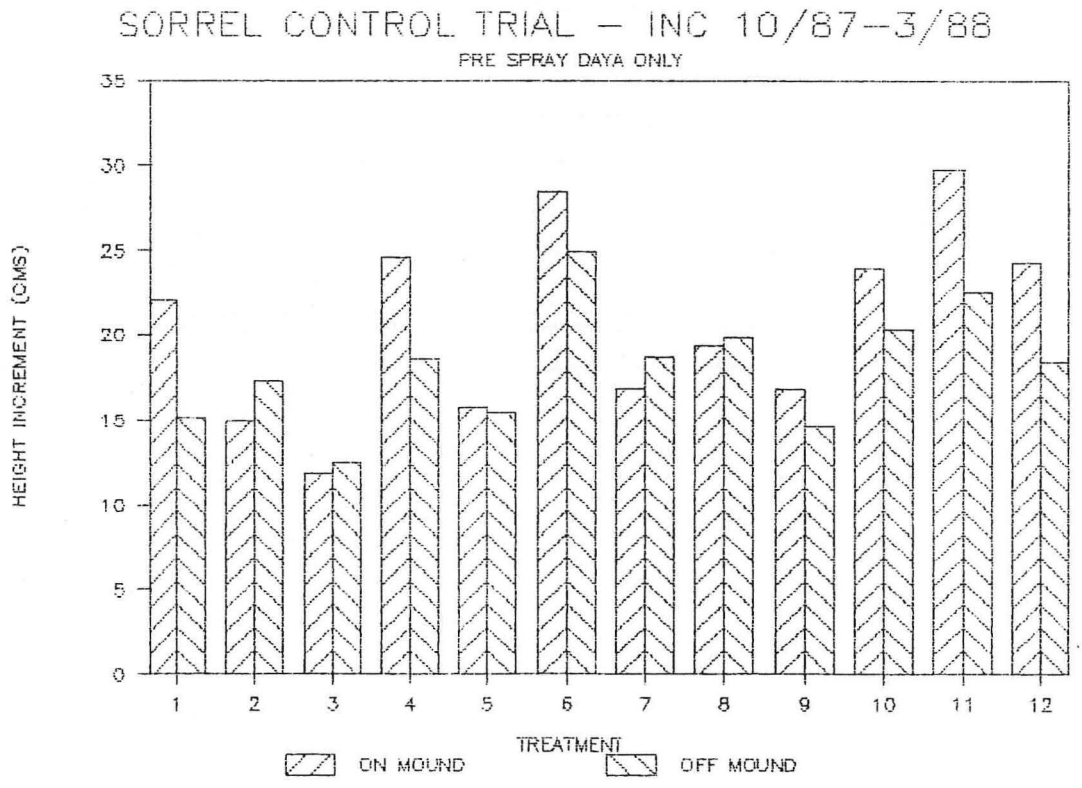

SORREL CONTROL TRIAL – INC 10/87–3/88
OVER SPRAY DAYA ONLY
HEIGHT INCREMENT (CMS)
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
10
11
12
TREATMENT
ON MOUND
OFF MOUND

Fig 2D


SORREL CONTROL TRIAL – INC 10/87–3/88
PRE SPRAY DAYA ONLY
HEIGHT INCREMENT (CMS)
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
10
11
12
TREATMENT
ON MOUND
OFF MOUND

EFFECT ON SURVIVAL

	ON MOUND	OFF MOUND
1 - 0.8l/ha Roundup + 200gm/ha Oust	*O 97	70
	P 83	97
2 -" " + 400gm/ha Oust	O 80	60
	P 80	93
3 - 5gm/ha Brush-off + 200gm/ha Oust	O 82	100
	P 97	97
4 - 5gm/ha " + 400gm/ha Oust	O 90	50
	P 63	97
5 - 0.8l/ha Roundup + 10l/ha Gesaprim	O 93	60
	P 93	100
6 - 5gm/ha Brush-off + 10l/ha Gesaprim	O 40	70
	P 60	100
7 - 0.8l/ha Roundup + 7l/ha Gesaprim	O 65	60
	P 93	97
8 - 5gm/ha Brush-off + 7l/ha Gesaprim	O 57	70
	P 90	97
9 - 5l/ha Vorox AA	O 80	55
	P 93	85
10 - 2.5l/ha Velpar L + 3.5l/ha Gesaprim	O 87	83
	P 97	95
11 - 5l/ha Velpar L	O 67	83
	P 80	87
12 - Control	55	34

*O - Overspray
P - Pre-plant spray

Differences in survival between on and off mounds was not significant (Fig. 1A, 1B).

As expected over spraying with Brush-off and Roundup resulted in significantly ($p<0.1$) lower survival than other treatments, with the exception of the control. Gesaprim had a tendency to reduce survival. However this was not statistically significant.

Pre-plant spraying of all herbicide combinations significantly ($p=<.01$) improved the chances of trees surviving compared to the control (Fig. 1C, 1D).

It was apparent that pre-plant spraying is safer off mounds than on, while over-spraying is safer on mounds than off.

EFFECT ON GROWTH

Significantly ($p<.01$) higher growth rates were associated with pre-sprayed treatments (Fig. 2C, 2D). Growth in plots sprayed with Brush-off was consistently poorer and there is evidence that Oust applied at 400gm/ha was inhibiting growth. This was particularly so for pre-plant treatments. There was a significant ($p<.01$) increase in height growth associated with mounds (Fig. 2A, 2B).

DISCUSSION

It is apparent from this trial that Oust applied at 200gm/ha as a pre or post-plant application provides an effective and safe means of controlling Sorrel. By adding Roundup to the mixture probably has little effect on the final outcome in terms of efficacy. However, Roundup will speed the "brown-off" process.

Mixtures of Roundup and Gesaprim also provided effective weed control, although Gesaprim at 7l/ha (3.5kg/ha atrazine) appears to be below the optimum rate to this site. Evidence from other trials, on similar sites suggest that the optimum rate of atrazine may be as high as 8kg/ha, and even at this rate some regermination of weeds may occur in a wet winter.

TRIAL 2 Cultivation Rush Control (Milgraum, Albany)
Establishment date: 26.5.87
Independent variables: herbicides, timing of application (pre and post planting), soil preparation (mounds and no mounds)
Weeds: Cultivation Rush, Flat weed, Lotus, Guildford (onion) grass, Sorrel
Site description: organic podzol, subject to winter water logging. PH 4.2, Southerly aspect.
Conditions at time of spraying: soil-damp, RH 90% dry bulb temperature 10.5°
Total spray output: 96 l/ha
Experimental details: complete randomisation with split plot arrangement. Three replicate plots of each treatment with 10 trees in each plot.

EFFICACY

Herbicide treatments

	% bare ground 5 months	P<.05	% bare ground after 10 months	P<.05
1 -3l/ha Roundup + 200gm/ha Oust	92	a	93	a
2 - " " + 400gm/ha Oust	91	a	91	a
3 -3l/ha Roundup + 0.1% Pulse	89	ab	84	a
4 -400gm/ha Oust + 0.1% Pulse	82	ab	83	a
5 -3l/ha Roundup + 10l/ha Gesaprim	80	ab	58	b
6 -20gm/ha Brush-off + 400gm/ha Oust	70	b	51	b
7 -20gm/ha Brush-off + 0.1% Pulse	12	e	13	c
8 -5l/ha Velpar L	7	c	5	c
9 -Control	0	c	0	c

Although not statistically significant control of Cultivation Rush was better off mounds than on. Oust alone was effective in controlling Cultivation Rush. However when combined with Roundup efficacy was improved. Brush-off was not effective and when applied alone only controlled Sorrel.

Velpar L provided only temporary control of annual weeds and Cultivation Rush, and 10 months after spraying was showing more vigorous recovery than all other treatments. Roundup mixed with Gesaprim provided short-term weed control.

EFFECT ON SURVIVAL

		ON MOUND	OFF MOUND
1	-3l/ha Roundup + 200gm/ha Oust	*O 10	17
		P 100	100
2	- " " + 400gm/ha Oust	O 17	4
		P 100	90
3	-3l/ha Roundup + 0.1% Pulse	O 20	7
		P 100	100
4	-400gm/ha Oust + 0.1% Pulse	O 93	95
		P 100	96
5	-3l/ha Roundup + 10l/ha Gesaprim	O 10	0
		P 100	100
6	-20gm/ha Brush-off + 400gm/ha Oust	O 83	87
		P 100	100
7	-20gm/ha Brush-off + 0.1% Pulse	O 75	87
		P 100	100
8	-5l/ha Velpar L	O 90	100
		P 100	100
9	-Control	100	98

*O - Overspray
P - Pre-plant spray

With the exception of Velpar L and Oust alone at 400gm/ha all other treatments significantly ($p<.05$) reduced survival when trees were oversprayed (Fig. 3A, 3B). For pre-plant spraying only Roundup plus Oust at 400gm/ha applied off mounds had significantly (P,<05) lower survival then the control. However all Oust treatments of 400gm/ha, when applied over trees, had lower survival numbers than the control.

There was no significant difference in survival attributed to trees being planted on or off mounds (Fig. 3C, 3D). However there was a trend that suggested that survival was lower off mounds if trees are oversprayed.

EFFECT OF GROWTH

There was a significant ($p<.05$) response to mounding in terms of height growth (Fig. 4A, 4B).

Pre-plant sprays of Roundup and Gesaprim at 10l/ha, Roundup and Oust at 200gm/ha and Velpar L were responsible for significant ($p<.05$) increases in growth compared to the control (Fig. 4C, 4D). Oust treatments at 400gm/ha were either similar to, or had lower growth then the control.

DISCUSSION

It was clear from this trial that mounds should be established well in advance of spraying to provide sufficient time for Cultivation Rush to emerge before herbicides are applied. Oust and Roundup combinations appear to be highly effective for controlling cultivation rush.

Fig 4A

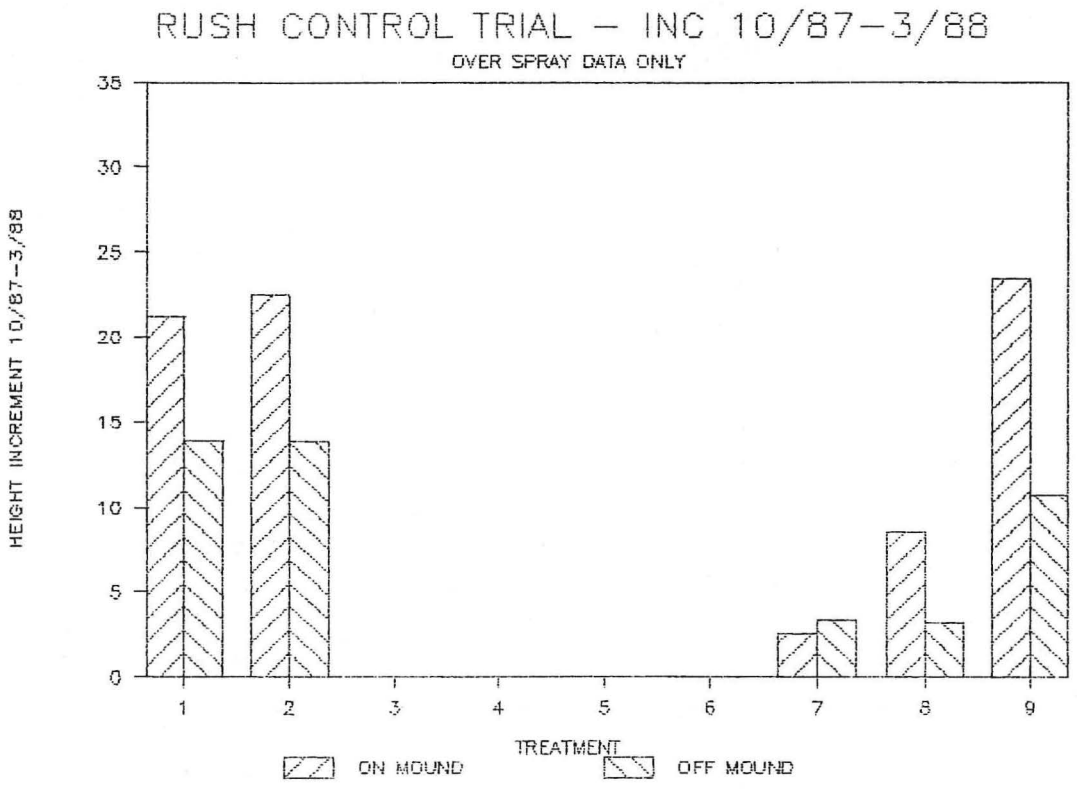

RUSH CONTROL TRIAL – INC 10/87–3/88
OVER SPRAY DATA ONLY
HEIGHT INCREMENT 10/87–3/88
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
TREATMENT
ON MOUND
OFF MOUND

Fig 4B

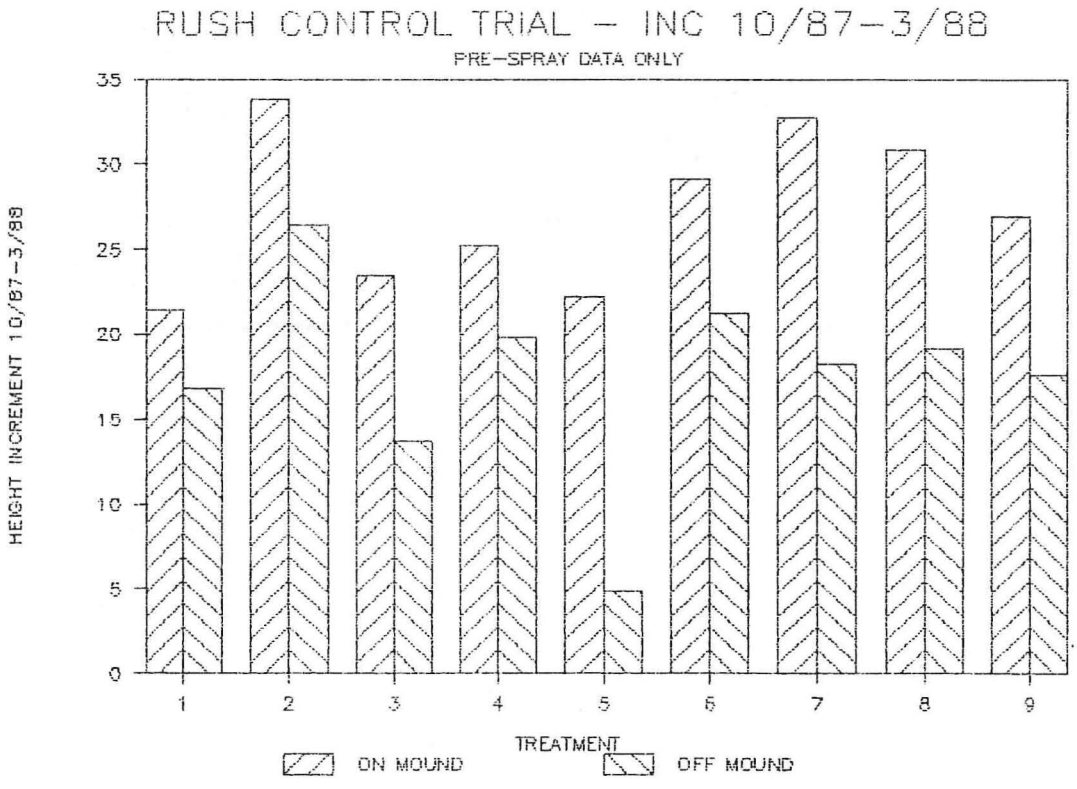

RUSH CONTROL TRIAL – INC 10/87–3/88
PRE–SPRAY DATA ONLY
HEIGHT INCREMENT 10/87–3/88
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
TREATMENT
ON MOUND
OFF MOUND

Fig 4C

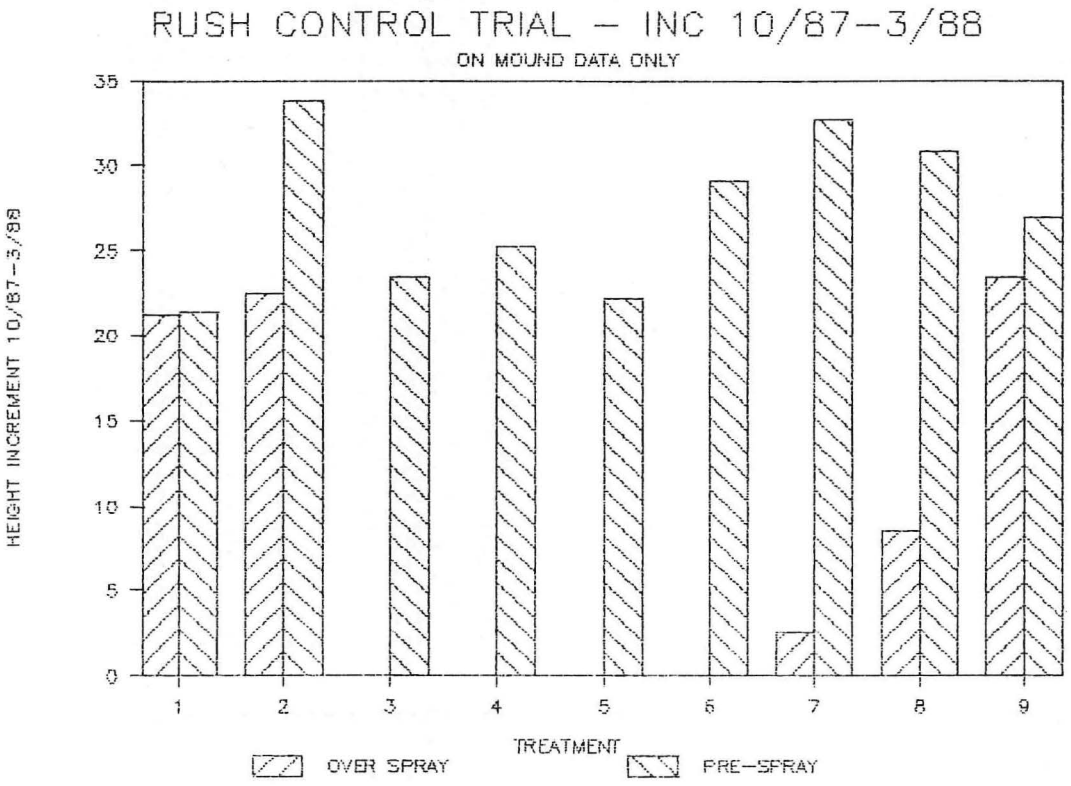

RUSH CONTROL TRIAL – INC 10/87–3/88
ON MOUND DATA ONLY
HEIGHT INCREMENT 10/87–3/88
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
TREATMENT
OVER SPRAY
PRE–SPRAY

Fig 4D

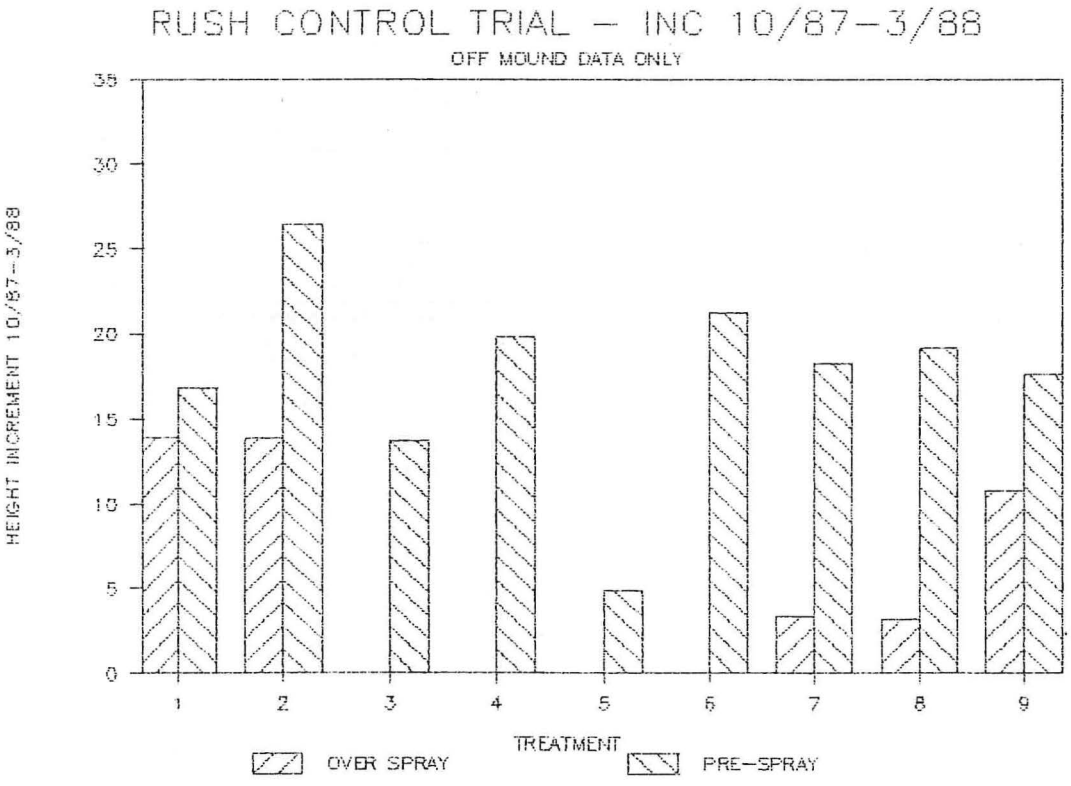

RUSH CONTROL TRIAL – INC 10/87–3/88
OFF MOUND DATA ONLY
HEIGHT INCREMENT 10/87–3/88
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
9
TREATMENT
OVER SPRAY
PRE–SPRAY

Fig 3C

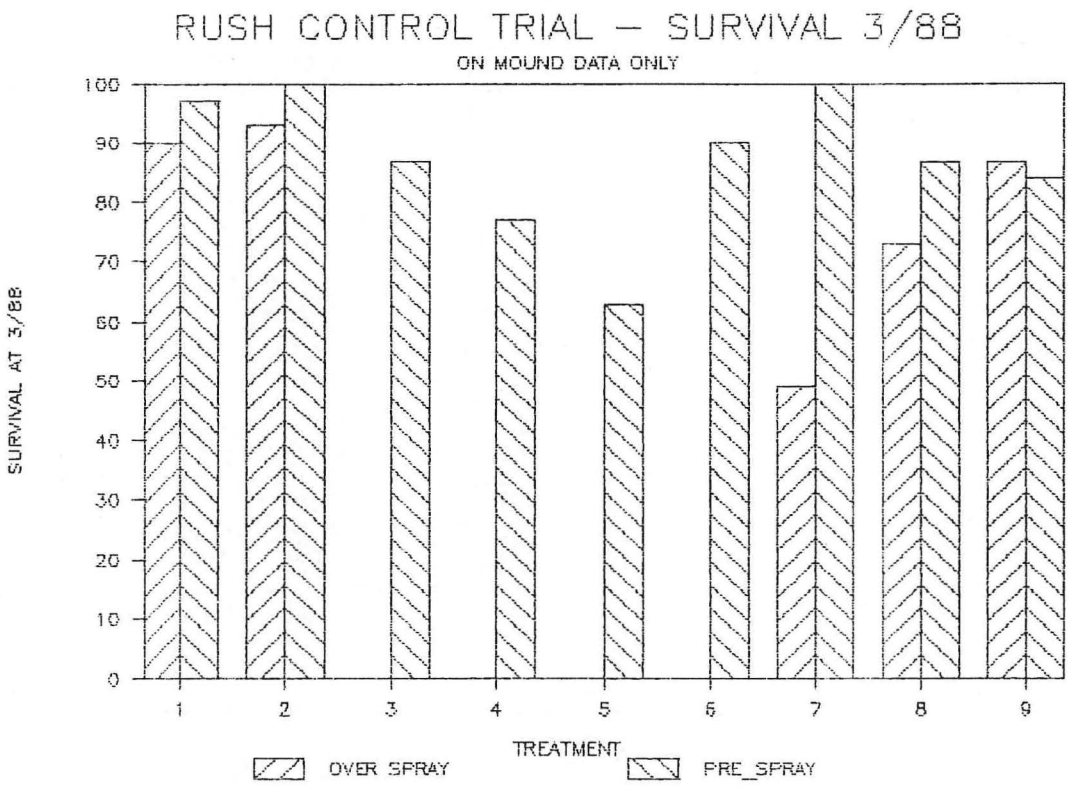

RUSH CONTROL TRIAL — SURVIVAL 3/88
ON MOUND DATA ONLY
SURVIVAL AT 3/88
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
TREATMENT
OVER SPRAY
PRE_SPRAY

Fig 3D

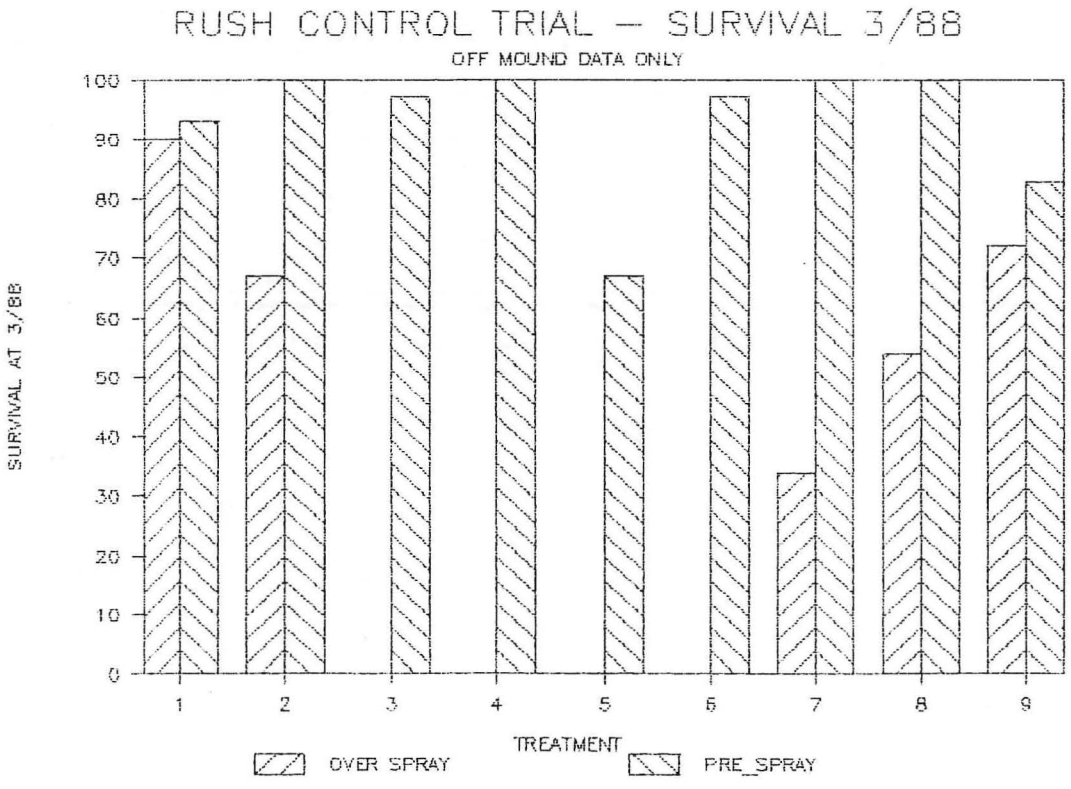

RUSH CONTROL TRIAL — SURVIVAL 3/88
OFF MOUND DATA ONLY
SURVIVAL AT 3/88
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
TREATMENT
OVER SPRAY
PRE_SPRAY

Fig 3A

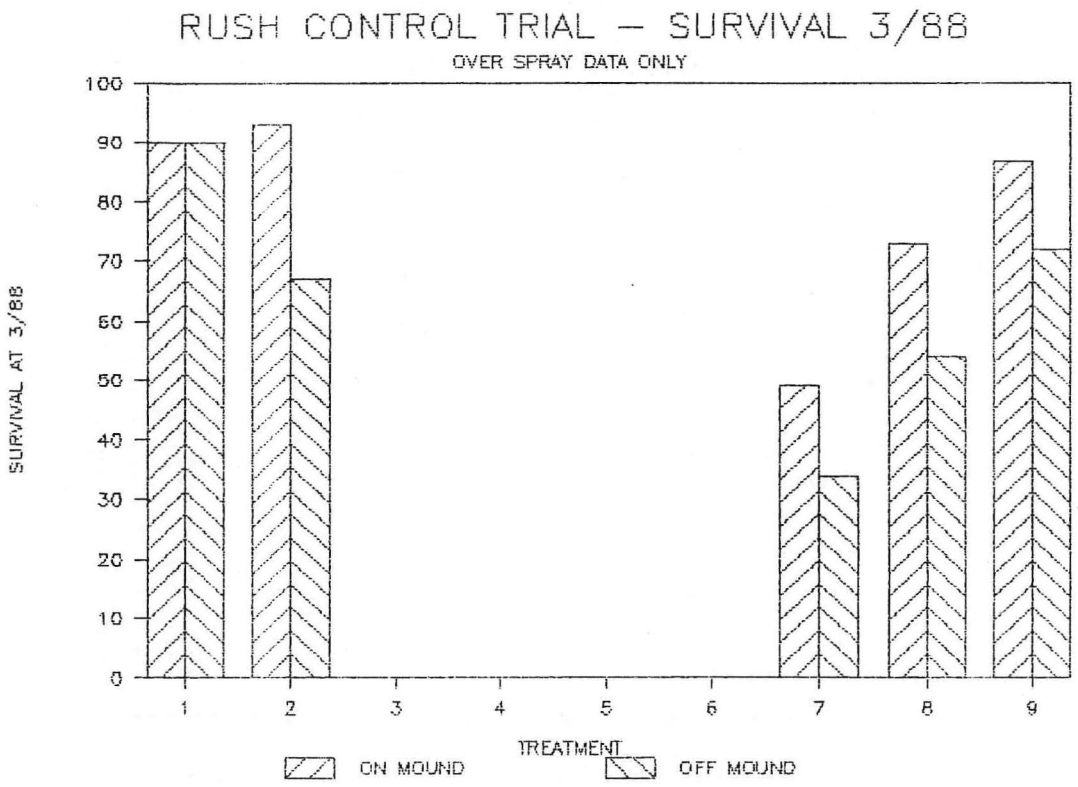
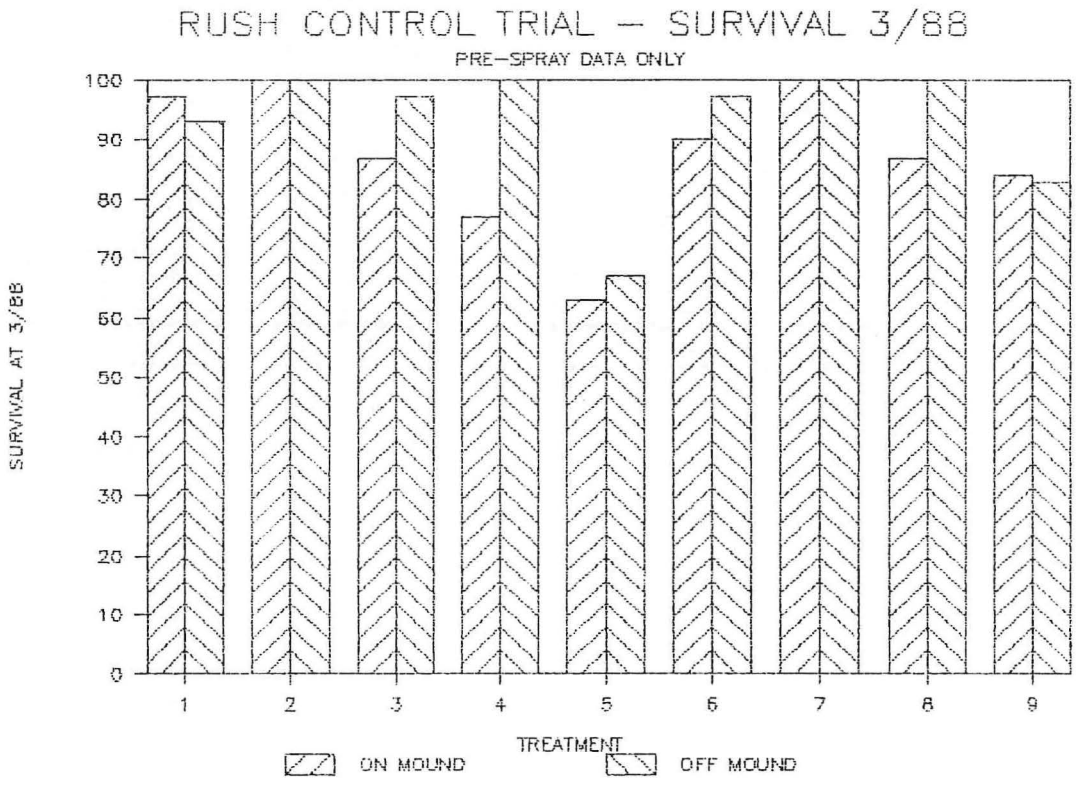

RUSH CONTROL TRIAL — SURVIVAL 3/88
OVER SPRAY DATA ONLY
SURVIVAL AT 3/88
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
TREATMENT
ON MOUND
OFF MOUND

Fig 3B


RUSH CONTROL TRIAL — SURVIVAL 3/88
PRE-SPRAY DATA ONLY
SURVIVAL AT 3/88
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
TREATMENT
ON MOUND
OFF MOUND

Although Roundup and Gesaprim provided effective short term control of weeds on this site, 10l/ha of Gesaprim (5kg/ha atrazine) was not sufficient to provide residual capacity to maintain weed free conditions throughout spring and early summer. It is noteworthy that Oust at 400gm/ha did not effect survival when applied alone either as an overspray or as a pre-plant application. While results suggest that at 400gm/ha Oust had a depressing effect on height growth, observations suggest that this may be transitory. This is explained by the fact that weed control associated with Oust is superior to other treatments consequently increasing the potential for growth in the second season.

It was apparent in this trial that there was a growth response attributable to the stimulation associated with triazine herbicides (atrazine and hexazinone). It is difficult to separate the growth response due to weed control and that provided by the enhancement of the activity of nitrifying organisms by triazines.

TRIAL 3 Bracken Control (Milgraum, Albany)
Establishment date: 26.5.87
Independent variables: herbicides, timing of application (pre and post-planting), soil preparation (mounds, no mounds)
Site description: Sandy organic podzol, pH 4.4, flat
Weeds: Bracken, Dock, Sorrel, annual pasture weeds.
Conditions at time of spraying: Soil - damp, RH 63%, dry bulb temperature 16°
Experimental details: Complete randomisation with split plot arrangement. Three replicate plots of each treatment with 10 trees in each plot

EFFICACY

	% reduction of Bracken 5 mths after treatment				% reduction of Bracken 10 mths after treatment			
	mounds	p<.05	off mound	p<.05	mounds	p<.05	off mound	p<.05
20gm/ha Brush-off + 0.1% Pulse	53	abc	72	a	38	a	37	a
20gm/ha Brush-off + 200gm/ha Oust	78	a	95	a	50	a	59	a
20gm/ha Brush-off + 400gm/ha Oust	73	a	96	a	52	a	66	a
20gm/ha Brush-off + 7l/ha Gesaprim	18	bc	57	a	22	a	42	a
20gm/ha Brush-off + 10l/ha Gesaprim	32	abc	88	a	38	a	57	a
3l/ha Roundup + 0.1% Pulse	23	bc	68	a	35	a	30	a
3l/ha Roundup + 200gm/ha Oust	58	ab	96	a	50	a	65	a
3l/ha Roundup + 400gm/ha Oust	55	ab	97	a	43	a	55	a
3l/ha Roundup + 7l/ha Gesaprim and ammonium sulphate	7	c	48	ab	0	a	0	a
3l/ha Roundup + 10l/ha Gesaprim and ammonium sulphate	20	bc	47	b	15	a	25	a
Control	0	c	0	b	0	c	0	a

Five months after treatment there was significantly less bracken off the mounds than on the mounds. This trend continued although Bracken had recovered to some extent in both treatments.

There were no significant differences between Brush-off and Roundup, although Brush-off generally achieved better results than Roundup. When Oust was mixed with either Brush-off or Roundup efficacy was improved significantly. There was no difference between the rates of Oust. It was apparent that Gesaprim improved efficacy off the mounds but had no effect on the mounds.

When all weeds were assessed the trend was for treatments containing Oust or Gesaprim at 10 l/ha to be the most effective. However, the best treatment (20gm/ha Brush-off + 400gm/ha Oust, off mounds) provided only 66% bare ground after 10 months.

EFFECTIVE OF SURVIVAL

	%Survival 5 months after treatment ON MOUND	OFF MOUND
20gm/ha Brush-off + 0.1% Pulse	O 89	61
	P 100	100
" " + 200gm/ha Oust	O 50	60
	P 93	97
" " + 400gm/ha Oust	O 51	62
	P 87	100
" " + 7l/ha Gesaprim	O 57	60
	P 100	100
" " + 10l/ha "	O 66	62
	P 97	100
3l/ha Roundup + 0.1% Pulse	O 22	43
	P 93	100
" " + 200gm/ha Oust	O 54	30
	P 100	100
" " + 400gm/ha Oust	O 23	19
	P 97	96
" " + 7l/ha Gesaprim	O 7	63
	P 100	97
3l/ha Roundup + 10l/ha Gesaprim	O 63	59
	P 100	100
Control	98	100

As expected, at the rates that Roundup and Brush-off were applied, trees that were oversprayed were either killed or were seriously damaged. There was no significant difference between the survival on or off the mounds and timing of sprays had no effect on survival.

Unfortunately cattle were inadvertently allowed to graze in the trial area and consequently growth and final survival data is unavailable for this trial.

DISCUSSION

This trial demonstrated that Roundup at 3l/ha and Brush-off at 20gm/ha are not effective in providing long term control of bracken. The addition of Oust improved control for the first few months but had marginal effect after 10 months.

Treatments were not as effective against pasture weeds as in other trials, possibly because interception of spray by the Bracken, so reducing the amount of spray reaching targets closer to the ground. Also, high soil organic content may have reduced herbicide efficacy because of greater soil adsorption.

It was noted that 6 months after spraying, trees on the mounds did not appear to be as vigorous as those off mounds. This may be attributed to the fact that mounds at this site contained a high proportion of vegetation and were more "cloddy" than mounds at other sites.

TRIAL 4 Oust Overspraying Trial (Milgraum, Albany)
Establishment date; 9.10.87
Independent variables: rates of Oust (sprayed over P.radiata 5 months after planting)
Site description: duplex soil with loamy sand over clay pH 4.5 Northerly aspect.
Weeds: Sorrel, annual rye grass and Dock. All weeds were at florescence.
Conditions of time of spraying: soil-wet, RH 77% dry bulb temperature 17°
Experimental details: complete randomisation with 3 replicates of each treatment

EFFICACY

	% Reduction compared to Control. 2 months after spraying		
	Sorrel	Dock	Annual Rye Grass
Oust at 400gm/ha + Pulse at 0.1%	93	90	100
Oust at 300gm/ha + Pulse at 0.1%	87	80	90
Oust at 200gm/ha + Pulse at 0.1%	87	87	92
Oust at 100gm/ha + Pulse at 0.1%	80	90	87
Oust at 50gm/ha + Pulse at 0.1%	63	60	77
Untreated control	0	0	0

With the exception of the lowest rate (50gm/ha) Oust provided effective control of all weeds.

EFFECT ON SURVIVAL

	% survival 5 months after spraying
Oust at 400gm/ha + Pulse at 0.1%	93
" " 300gm/ha + " " "	95
" " 200gm/ha + " " "	97
" " 100gm/ha + " " "	90
" " 50gm/ha + " " "	91
Untreated control	97

No tree mortality could be attributed to overspraying with Oust.

EFFECT ON GROWTH

	% Phytotoxic rating 2 mths after spraying*
Oust at 400gm/ha + Pulse at 0.1%	53.3
Oust at 300gm/ha + Pulse at 0.1%	53.3
Oust at 200gm/ha + Pulse at 0.1%	40.0
Oust at 100gm/ha + Pulse at 0.1%	33.3
Oust at 50gm/ha + Pulse at 0.1%	30.0
Untreated control	0

* Biomass reduction rating where the treated plots are compared to the untreated control from the same replicate.

A reduction in tree biomass was recorded for all spray treatments when assessed 2 months after trees were sprayed.

	Mean Tree height (cm) 5 mths after spraying	% biomass rating compared to control
Oust at 400gm/ha + Pulse at .01%	35	-15
Oust at 300gm/ha + Pulse at 0.1%	39	- 6
Oust at 200gm/ha + Pulse at 0.1%	44	+11
Oust at 100gm/ha + Pulse at 0.1%	42	+ 7
Oust at 50gm/ha + Pulse at 0.1%	46	+14
Untreated control	41	0

Although not statistically significant growth rates increased, compared to the control when rates of Oust were less than 200gm/ha.

DISCUSSION:

The trends established from this trial support data from other trials in that Oust appears to depress growth when applied at 400gm/ha. It appears that Oust can be sprayed over P.radiata at rates between 50 and 200gm/ha without significant damage to trees, and will provide effective control of weeds.

The growth depression observed for all Oust treatments 2 months after spraying appears to be transient with only the trees sprayed at the highest rates (300 and 400gm/ha) continuing to show a depression in growth compared to the control.

TRIAL 5 Overspray trial of 1 year old P.radiata (Thorpe, Albany)
Establishment date: 1.8.89
Independent variables: herbicides
Site description: deep uniform sand dune, pH 4.5; om (surface soil) 2.5%
Weeds: Sorrel, Capeweed, Serradella, weed health was generally very poor on this impoverished site.
Conditions at time of spraying: soil - damp, RH 59%, dry bulb temperature 17°.
Total spray output: 79 l/ha
Experiment details: complete randomization with 2 replicates of 22 treatments.

EFFICACY

	% Sorrel reduction 51 days after spraying	136 days after spraying
1 Velpar L at 6l/ha	60	50
2 Velpar L at 8l/ha	58	75
3 Velpar L at 6l/ha plus Gesaprim at 5l/ha	68	75
4 Velpar L at 6l/ha plus Gesaprim at 12l/ha	73	80
5 Velpar L at 8l/ha plus Gesaprim at 5l/ha	70	85
6 Velpar L at 8l/ha plus Gesaprim at 12l/ha	73	80
7 Velpar L at 6l/ha plus Oust at 100gm/ha	92	45
8 Velpar L at 6l/ha plus Oust at 200gm/ha	95	65
9 Velpar L at 6l/ha plus Oust at 400gm/ha	97	75
10 Velpar L at 8l/ha plus Oust at 100gm/ha	98	45
11 Velpar L at 8l/ha plus Oust at 200gm/ha	99	50
12 Velpar L at 8l/ha plus Oust at 400gm/ha	97	80
13 Oust at 100gm/ha	83	0
14 Oust at 200gm/ha	65	70
15 Oust at 400gm/ha	85	90
16 Oust at 100gm/ha plus Gesaprim at 5l/ha	79	50
17 Oust at 100gm/ha plus Gesaprim at 12l/ha	90	20
18 Oust at 200gm/ha plus Gesaprim at 5l/ha	93	70
19 Oust at 200gm/ha plus Gesaprim at 12l/ha	91	55
20 Oust at 400gm/ha plus Gesaprim at 5l/ha	88	50
21 Oust at 400gm/ha plus Gesaprim at 12l/ha	99	70
22 Untreated control	0	0

Note: all treatments had Agral 60 surfactant mixed with the spray mixture at 0.3% v/v.

Fifty one days after spraying it appeared that combinations of Velpar L and Oust, and Oust and Gesaprim were providing some synergistic interaction.

However, after 136 days the reverse appears true with the evidence suggesting an antagonistic interaction between Oust and Gesaprim (Fig. 5B). Complete recovery of Sorrel was recorded for the 100gm/ha Oust treatment while 400gm/ha of Oust maintained a high level of efficacy. Velpar L mixed with Gesaprim provided consistently good control of Sorrel after 136 days. However, mixing Oust with Velpar L does not appear to have improved control of Sorrel.

Capeweed and Serradella were totally controlled by all spray treatments.

PHYTOTOXIC EFFECTS

	% phytotoxicity rating 51 days after spraying*					
	0	1	2	3	4	5
Velpar L at 6l/ha	95	5	0	0	0	0
Velpar L at 8l/ha	68	30	3	0	0	0
Velpar L at 6l/ha plus Gesaprim at 5l/ha	66	34	0	0	0	0
Velpar L at 6l/ha plus Gesaprim at 12l/ha	63	37	0	0	0	0
Velpar L at 8l/ha plus Gesaprim at 5l/ha	68	32	0	0	0	0
Velpar L at 8l/ha plus Gesaprim at 12l/ha	57	43	0	0	0	0
Velpar L at 6l/ha plus Oust at 100gm/ha	68	32	0	0	0	0
Velpar L at 6l/ha plus Oust at 200gm/ha	57	43	0	0	0	0
Velpar L at 6l/ha plus Oust at 400gm/ha	43	46	11	0	0	0
Velpar L at 8l/ha plus Oust at 100gm/ha	73	27	0	0	0	0
Velpar L at 8l/ha plus Oust at 200gm/ha	61	31	8	0	0	0
Velpar L at 8l/ha plus Oust at 400gm/ha	56	30	14	0	0	0
Oust at 100gm/ha	66	34	0	0	0	0
Oust at 200gm/ha	87	13	0	0	0	0
Oust at 400gm/ha	70	30	0	0	0	0
Oust at 100gm/ha plus Gesaprim at 5l/ha	66	31	3	0	0	0
Oust at 100gm/ha plus Gesaprim at 12l/ha	55	43	0	2	0	0
Oust at 200gm/ha plus Gesaprim at 5l/ha	69	31	0	0	0	0
Oust at 200gm/ha plus Gesaprim at 12l/ha	67	22	11	0	0	0
Oust at 400gm/ha plus Gesaprim at 5l/ha	62	28	8	0	2	0
Oust at 400gm/ha plus Gesaprim at 12l/ha	51	41	8	0	0	0
Untreated Control	79	21	0	0	0	0

* Phytotoxicity rating: each tree was coded 0 to 5 where
0 = healthy
1 = slight necrosis or chlorosis of needles
2 = definite necrosis or chlorosis of needles
3 = sick, necrosis of chlorosis of most of the tree
4 = entire tree necrotic or chlorotic
5 = dead

Oust sprayed alone over one year old trees appeared not to cause any symptoms of phytotoxicity. However when mixed with Velpar L or Gesaprim the probability of phytotoxic symptoms developing increased, particularly at high rates of Oust and high rates of Gesaprim. The most common symptom associated with high rates of Oust and Gesaprim was temporary wilting and chlorosis of the leading tip. Necrosis of needle tips was widespread and often occurred in control plots. There appeared to be no obvious pattern associating necrosis to particular treatments.

EFFECT ON GROWTH

Overall height growth during an 8 month period was poor with each tree averaging approximately 50cm. No trend emerged with the growth for control plots being close to the average for all plots. Height increments corresponding to the different rates of herbicide were distributed evenly across the range (Fig. 5A).

DISCUSSION

The short duration of Oust activity on this site may be related to the sandy soil and low pH. As the persistence of Oust is related to the soil organic level, this explanation is probably correct. The recovery of Sorrel in plots sprayed with mixtures of Oust and Gesaprim, and to some extent Oust and Velpar cannot be explained.

Although there was consistent evidence suggesting phytotoxicity associated with high rates of Oust, this was not supported by growth data. The highest rates of Oust were ranked 5th, 6th, 7th, 16th and 17th. The only plausible explanation is that some other factor was overriding the effect of the treatments. The low adsorption capacity of this soil may have contributed to phytotoxic symptoms occurring.

TRIAL 6 Overspraying of newly planted P.radiata (Skijoring, Albany)
Establishment date: 4.9.89
Site description: Duplex soil. Dark grey loamy sand - loam 40-60cm - laterite 20cm - light clay. Site mounded, subject to seasonal water logging. pH 4.0
Weeds (at time of spraying): Annual Rye Grass, Dock. Weeds were vigorous and were overtopping the trees at the time of spraying.
Conditions at time of spraying: Soil-damp; RH 55%, dry bulb temp. 23°
Total spray output: 76.5l/ha
Experimental details: Complete randomisation of 2 replicate plots of each treatment. Approximately 22 trees in each plot.
Plot size: 50m x 1.5m

Fig 5A

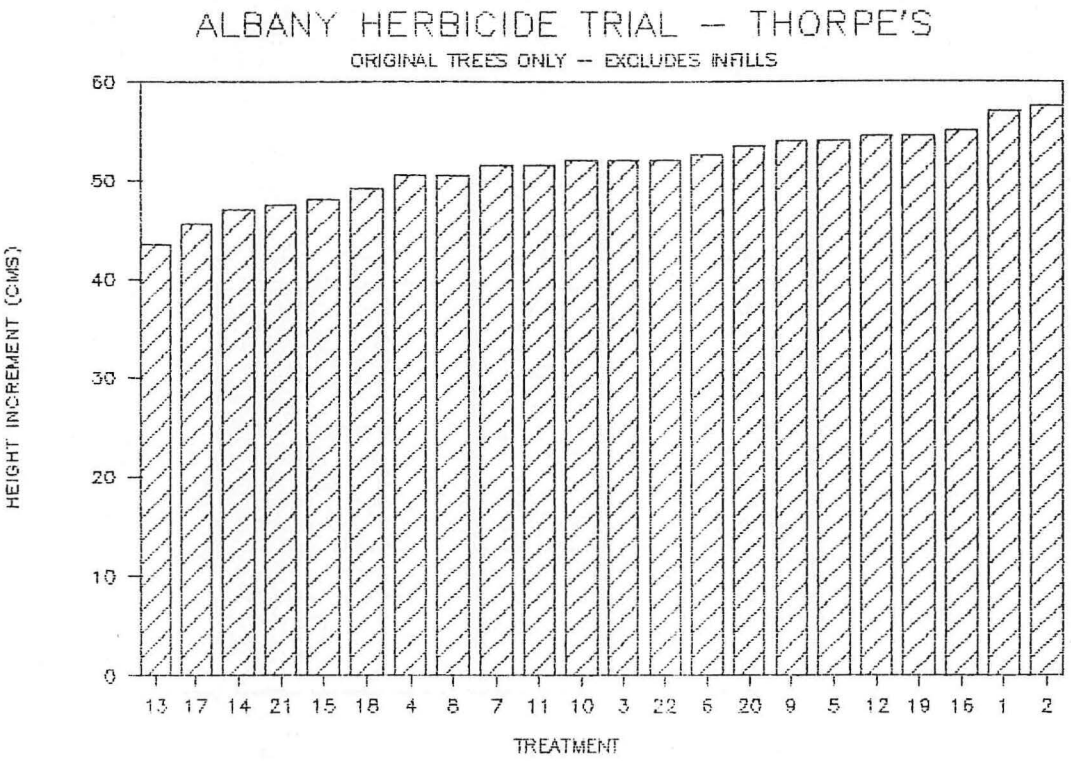
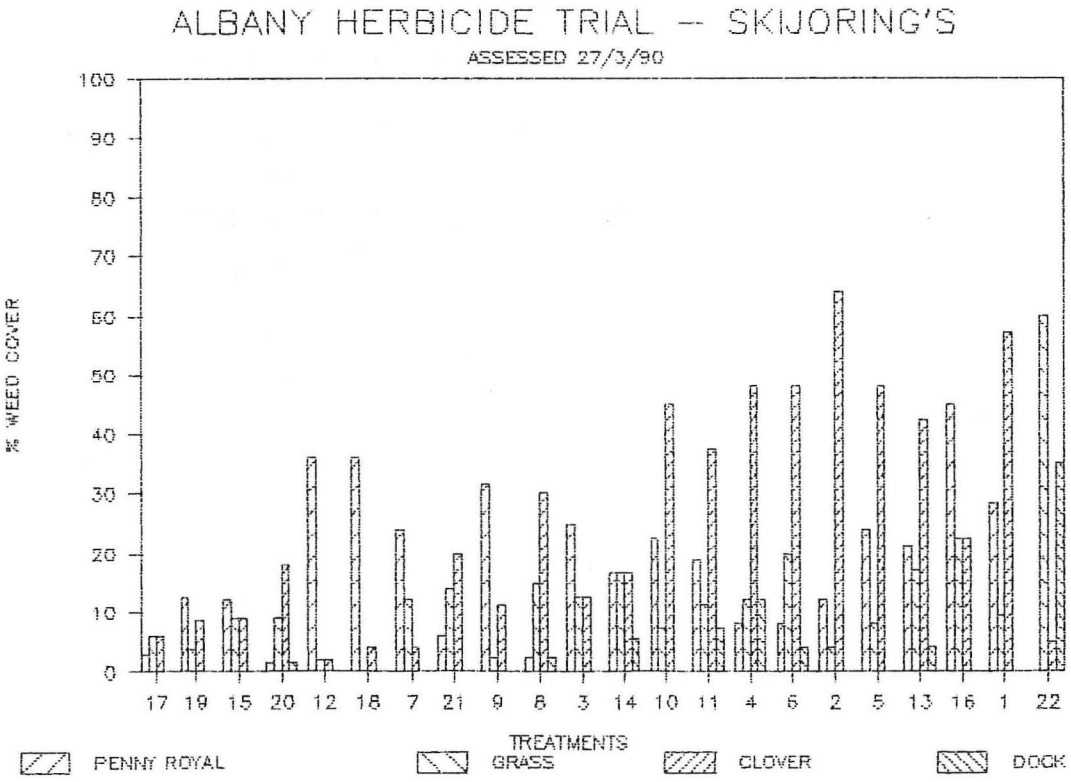

ALBANY HERBICIDE TRIAL -- THORPE'S
ORIGINAL TREES ONLY -- EXCLUDES INFILLS
HEIGHT INCREMENT (CMS)
0
10
20
30
40
50
60
13 17 14 21 15 18 4 8 7 11 10 3 22 6 20 9 5 12 19 16 1 2
TREATMENT

Fig 5B


ALBANY HERBICIDE TRIAL -- SKIJORING'S
ASSESSED 27/3/90
% WEED COVER
0
10
20
30
40
50
60
70
80
90
100
17 19 15 20 12 18 7 21 9 8 3 14 10 11 4 6 2 5 13 16 1 22
TREATMENTS
PENNY ROYAL
GRASS
CLOVER
DOCK

EFFICACY

		% bare ground	
		91 days after spraying	204 days after spraying
1	Velpar L at 6l/ha	100	5
2	Velpar L at 8l/ha	*80	20
3	Velpar L at 6l/ha plus Gesaprim at 5l/ha	*85	50
4	" " " " " " 12l/ha	*98	20
5	Velpar L at 8l/ha plus Gesaprim at 5l/ha	*95	20
6	" " " " " " 12l/ha	*98	20
7	Velpar L at 6l/ha plus Oust at 100gm/ha	**95	60
8	" " " " " " 200gm/ha	100	50
9	" " " " " " 400gm/ha	100	55
10	Velpar L at 8l/ha plus Oust at 100gm/ha	100	25
11	" " " " " " 200gm/ha	100	25
12	" " " " " " 400gm/ha	100	60
13	Oust at 100gm/ha	**98	15
14	" " 200gm/ha	100	45
15	" " 400gm/ha	100	70
16	Oust at 100gm/ha plus Gesaprim at 5l/ha	100	10
17	" " " " " " 12l/ha	100	75
18	" " 200gm/ha " " " 5l/ha	100	60
19	" " " " " " 12l/ha	100	75
20	" " 400gm/ha " " " 5l/ha	100	70
21	" " " " " " 12l/ha	100	60
22	Untreated control	0	0

* dock remained
** rye grass remained
+ regermination had occurred following the break to the season

All treatments provided effective control of Annual Rye Grass and Dock during the spring and summer following planting. As expected established Dock plants recovered to some extent on most plots that were not treated with Oust.

An assessment, after germination had occurred in the following season, revealed that some residual activity associated with the highest rate of Oust (400gm/ha) and Oust plus Gesaprim mixtures was still evident. However, weed composition was different from that prevailing at the time plots were sprayed. Pennyroyal was widespread but was in greater numbers on plot that had been treated with Gesaprim at 5l/ha, except when mixed with Oust at 400gm/ha/

Dock had not recovered to a great extent in any of the plots treated with Oust, and clover was common except on plots sprayed with Oust at 400gm/ha.

PHYTOTOXIC EFFECT

		% phytotoxic rating 17 days after spraying*					
		0	1	2	3	4	5
1	Velpar L at 6l/ha	**65	25	0	10	0	0
2	Velpar L at 8l/ha	67	33	0	0	0	0
3	Velpar L at 6l/ha plus Gesaprim at 5l/ha	75	20	5	0	0	0
4	" " " " " " 12l/ha	67	33	0	0	0	0
5	Velpar L at 8l/ha plus Gesaprim at 5l/ha	62	38	0	0	0	0
6	" " " " " " 12l/ha	41	54	5	0	0	0
7	Velpar L at 6l/ha plus Oust at 100gm/ha	66	27	6	0	0	0
8	" " " " " " 200gm/ha	68	30	2	0	0	0
9	" " " " " " 400gm/ha	61	39	0	0	0	0
10	Velpar L at 8l/ha plus Oust at 100gm/ha	74	26	0	0	0	0
11	" " " " " " 200gm/ha	87	13	0	0	0	0
12	" " " " " " 400gm/ha	73	24	0	0	3	0
13	Oust at 100gm/ha	4	53	2	0	0	0
14	" " 200gm/ha	72	28	0	0	0	0
15	" " 400gm/ha	75	25	0	0	0	0
16	Oust at 100gm/ha plus Gesaprim at 5l/ha	68	32	0	0	0	0
17	" " " " " " 12l/ha	50	42	8	0	0	0
18	" " 200gm/ha " " " 5l/ha	66	33	0	0	0	0
19	" " " " " " 12l/ha	56	38	2	2	2	0
20	" " 400gm/ha " " 5l/ha	61	39	0	0	0	0
21	" " " " " " 12l/ha	61	35	2	2	0	0
22	Untreated control	52	38	8	0	2	0

* Phytotoxic rating:
0 = healthy
1 = slight chlorosis or necrosis of needles
2 = definite chlorosis or necrosis of needles
3 = sick, chlorosis of most of the tree
4 = entire tree necrotic or chlorotic
5 = dead

** mistakenly oversprayed with Velpar L at 6l/ha plus Gesaprim at 4l/ha in addition to Velpar L at 6l/ha.

There was no evidence that any chlorosis or necrosis of needles could be attributed to any treatment except for a weak trend for more chlorosis to be associated with high rates of Gesaprim.

EFFECT OF GROWTH

In December 1989 a plague of Budworm (Heliothis punctigera) destroyed all the trees in the trial. Consequently no growth data was obtained from this experiment. However, from observations prior to the Budworm attack there did not appear to be any spray treatment that was effecting growth. All trees in sprayed plots were noticeably healthier than trees in the untreated control plots, reflecting the high level of competition in unsprayed plots.

DISCUSSION

The fact that there was no visual evidence of damage to trees by any herbicide or combination of herbicides suggests that either the observation were too early to reflect a phytotoxic effect or the soil type was contributing to the result. The latter could be explained by a low leaching rate and high absorption on a loamy, organically rich soil. However, the residual activity observed approximately 7 months after treatment is possibly explained by the fact that treatments were applied at the end of the wet season and during most of that time herbicide degradation would be slow.

TRIAL 7 Overspraying of newly planted P.radiata (Belrose, Albany)
Establishment date: 5.9.89
Independent variables: herbicides
Site description: Gradational soil, light grey sand grading downwards to light yellow loamy sand. pH 4.5. om (surface soil) 3.5%
Weeds (at time of spraying): Bracken, Capeweed, Clover, Flat Weed. Weeds were sparse:
Condition at time of spraying: Soil-damp, RH 58%, dry bulb 19.5°
Total spray output: 76.5l/ha
Experimental details: Complete randomised block of 2 replicates of each treatment. Approximately 25 trees to each plot.
Plot size: 50m x 1.5m

EFFICACY

Treatments	% bracken reduction 95 days after treatment	198 days after treatment	% bare ground (excludes bracken 95 days after treatment
1 Velpar L at 6l/ha	0	0	100
2 Velpar L at 8l/ha	0	0	100
3 Velpar L at 6l/ha plus Gesaprim at 5l/ha	0	0	100
4 Velpar L at 6l/ha plus Gesaprim at 12l/ha	0 0	0 0	100 100
5 Velpar L at 8l/ha plus Gesaprim at 5l/ha	10 10	0 0	100 100
6 Velpar L at 8l/ha plus Gesaprim at 12l/ha	0	0	100
7 Velpar L at 6l/ha plus Oust at 100gm/ha	0	0	100
8 Velpar L at 6l/ha plus Oust at 200gm/ha	90	15	100
9 Velpar L at 6l/ha plus Oust at 400gm/ha	90	30	100
10 Velpar L at 8l/ha plus Oust at 100gm/ha	100	0	95
11 Velpar L at 8l/ha plus Oust at 200gm/ha	60	0	100
12 Velpar L at 8l/ha plus Oust at 400gm/ha	80	20	100
13 Oust at 100gm/ha	0	0	100
14 Oust at 200gm/ha	90	10	100
15 Oust at 400gm/ha	90	20	100
16 Oust at 100gm/ha plus Gesaprim at 5l/ha	0	0	100
17 Oust at 100gm/ha plus Gesaprim at 12l/ha	30	0	100
18 Oust at 200gm/ha plus Gesaprim at 5l/ha	50	0	100
19 Oust at 200gm/ha plus Gesaprim at 12l/ha	100	15	100
20 Oust at 400gm/ha plus Gesaprim at 5l/ha	70	15	100
21 Oust at 400gm/ha plus Gesaprim at 12l/ha	85	20	100
22 Control (no treatment)	0	0	50

A transient effect on Bracken was recorded in treatments where Oust was applied at rates above 200gm/ha. The effect appeared to be slightly increased when Oust was mixed with Velpar L at 8l/ha. After approximately 6.5 months the effect on Bracken had almost disappeared, with only the high rates of Oust recording some reduction compared to the control.

All treatments were effective in controlling annual weeds.

PHYTOTOXIC EFFECT

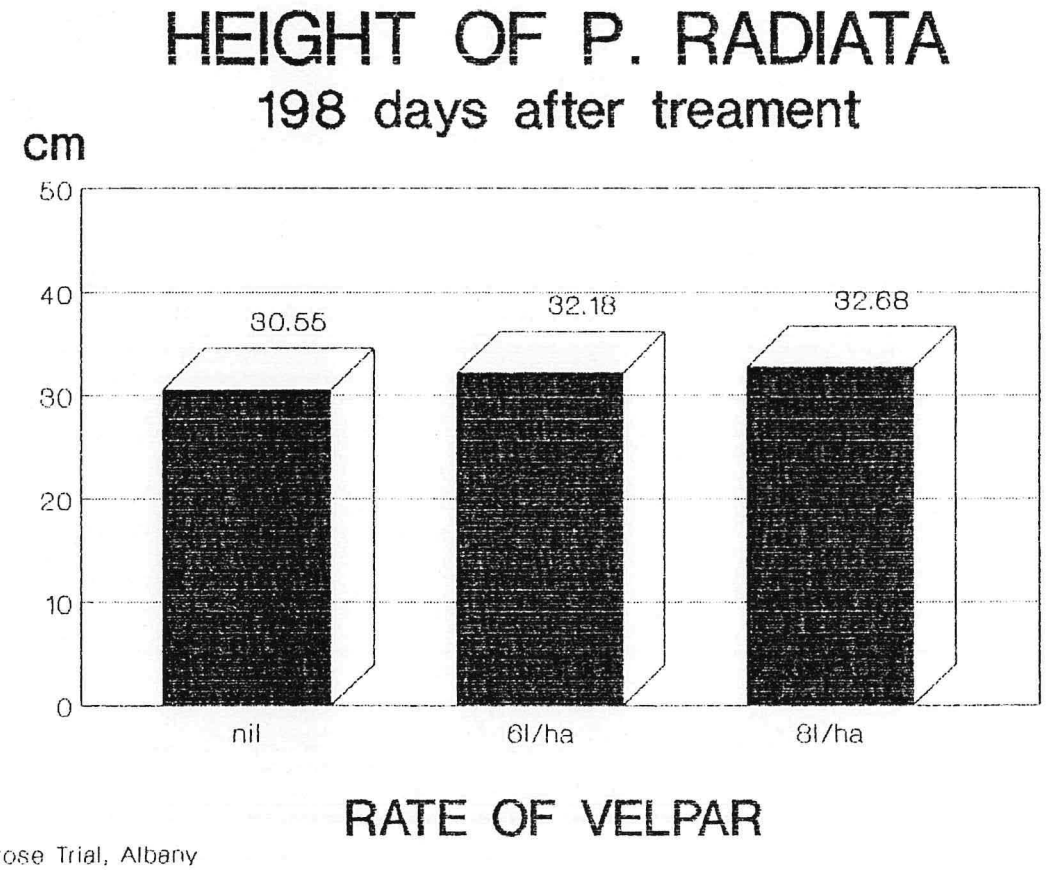
		% phytotoxic rating 17 days after treatment					
		0	1	2	3	4	5
1	Velpar L at 6l/ha	83	17	0	0	0	0
2	Velpar L at 8l/ha	74	26	0	0	0	0
3	Velpar L at 6l/ha + Gesaprim at 5l/ha	88	10	2	0	0	0
4	" " " " " 12l/ha	72	24	2	0	2	0
5	" " 8l/ha " " " 5l/ha	64	28	4	4	0	0
6	" " " " " " 12l/ha	74	26	0	0	0	0
7	Velpar L at 6l/ha + Oust at 100gm/ha	74	26	0	0	0	0
8	" " " " " " 200gm/ha	96	4	0	0	0	0
9	" " " " " " 400gm/ha	84	16	0	0	0	0
10	Velpar L at 8l/ha + Oust at 100gm/ha	92	8	0	0	0	0
11	" " " " " " 200gm/ha	75	23	2	0	0	0
12	" " " " " " 400gm/ha	83	17	0	0	0	0
13	Oust at 100gm/ha	87	13	0	0	0	0
14	Oust at 200gm/ha	72	22	6	0	0	0
15	Oust at 400gm/ha	72	22	6	0	0	0
16	Oust at 100gm/ha + Gesaprim at 5l/ha	76	22	2	0	0	0
17	" " " " " " 12l/ha	45	43	12	0	0	0
18	" " 200gm/ha " " " 5l/ha	78	20	2	0	0	0
19	" " " " " " 12l/ha	93	7	0	0	0	0
20	Oust at 400gm/ha + Gesaprim at 5l/ha	92	9	2	0	0	0
21	" " " " " " 12l/ha	80	20	0	0	0	0
22	Control (no treatment)	87	13	0	0	0	0

There was no apparent phytotoxic effect attributable to any of the herbicide treatments.

EFFECT ON GROWTH

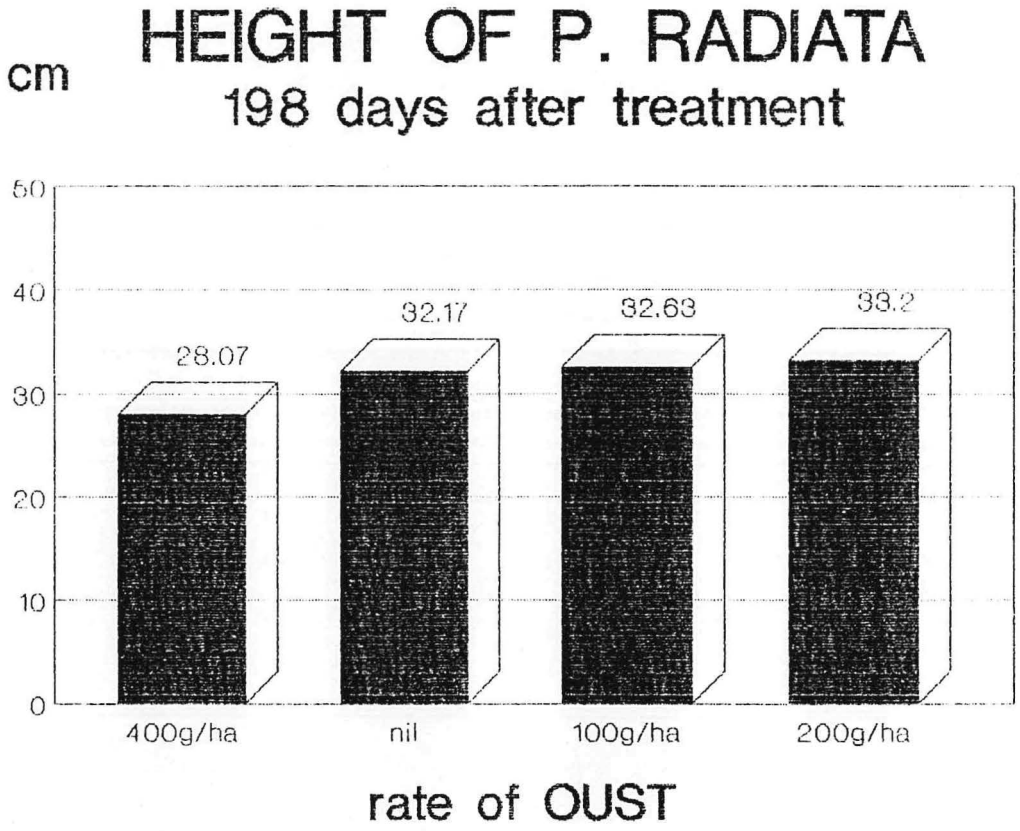
Both Gesaprim at 12l/ha and Oust at 400gm/ha significantly ($p<.01$) reduced height growth compared to the control. When each herbicide was analysed separately, treatments containing Velpar L exhibited significantly ($p,.05$) greater height growth than treatments without Velpar L (Fig. 6). Treatments containing Oust at 400gm/ha recorded significantly ($p<.01$) lower height growth then treatments containing nil, 100 or 200gm/ha of Oust (Fig. 7). Treatments without Gesaprim recorded significantly higher growth rates than treatment containing Gesaprim (Fig. 8).

Fig 6



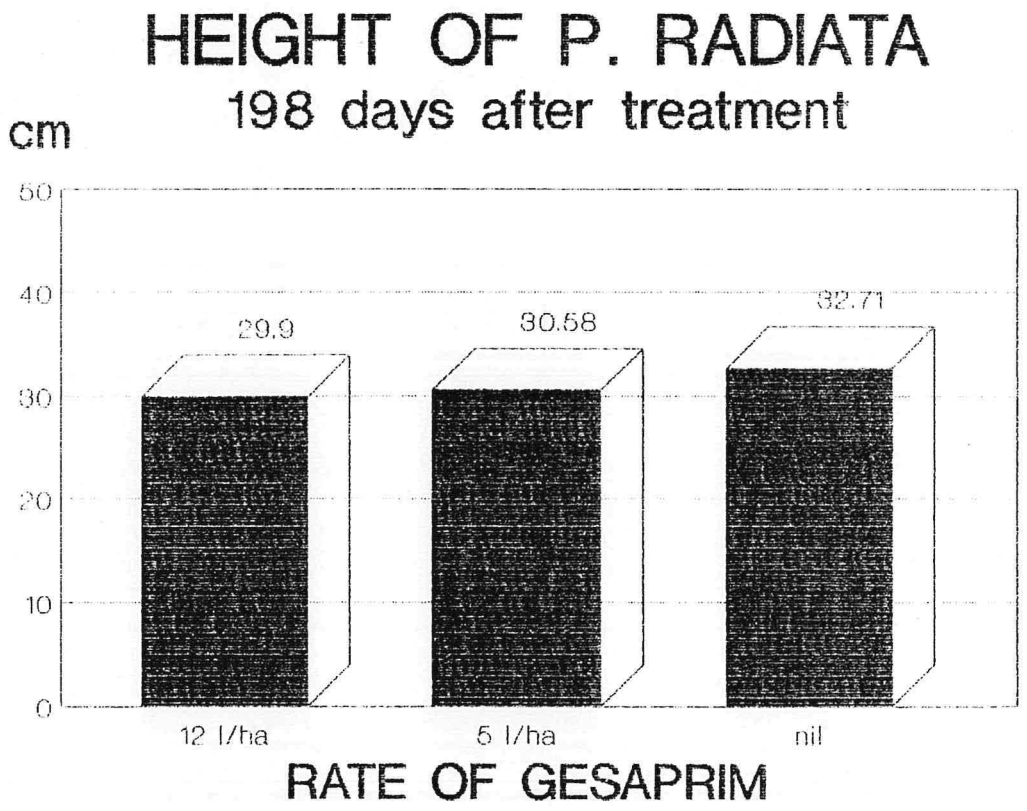
Belrose Trial, Albany

Fig 7



Belrose Trial, Albany

Fig 8



Belrose Trial, Albany.

GENERAL DISCUSSION

From the results of this series of trials Oust appears to have considerable potential to control a wide spectrum of weeds, particularly Sorrel, Dock and Cultivation Rush in P.radiata plantations. As with all herbicides in the sulfonylurea group, the behaviour of Oust in the soil is dependant, to a great extent, on soil reaction and organic content. On the moist sandy acid soils of the South Coast, Oust will be expected to have high activity and low residual life. As soil organic content increases effective residual life can be further reduced. Oust sprayed at 400gm/ha in October when rainfall was decreasing and temperature were rising exhibited some carry-over residual activity to the following April when rain recommenced. When this rate was sprayed in June residual activity had ceased by October, evidenced by germination of summer weeds in the plots.

Although there is evidence of a depression in growth of P.radiata associated with rates of Oust above 200gm/ha, this depression may be transient. There is observational evidence from trial 1 and 2 that growth on plots sprayed with high rates of Oust was greater than other treatments in the following year. This may be explained by the superior weed control attributable to Oust.

Where plantations are established on deep siliceous sands with low organic content (similar to Thorpe's, Albany) there may be an increased likelihood of phytotoxicity associated with Oust and a shorter period of activity. The hypothesis being that leaching to the root zone of the tree is uninhibited and rapid. This factor, although providing enhanced activity initially, also allows more rapid recovery of weeds, Sorrel in particular. There was evidence of this in trial 5 where recovery of Sorrel was quite rapid, even at the highest rate of Oust.

Visual symptoms of Oust toxicity on P.radiata are not obvious. At high rates, (400gm/ha) wilting of the leading shoot and slight chlorosis occurs. However, this is of short duration, although a small kink in the stem may remain.

Mixing Roundup with Oust has little benefit when the predominant weeds are Sorrel, Dock or annual broadleaved weeds and grasses. However, there appears to be some advantage where the predominant weed is Cultivation Rush. There is some benefit in mixing Roundup with Oust if rapid brown-out is necessary. In cold weather Oust is very slow and visual indications of control may take as long as two months.

There is no evidence of synergism occurring between Velpar L and Oust or Gesaprim and Oust. The latter appears to increase the probability of a growth depression of P.radiata. Velpar/Oust mixtures have more potential as Velpar L was consistently associated with higher growth rates of P.radiata. This cannot be explained by better weed control and is probably associated with the enhanced nitrifying activity in the soil that appears to occur after application of Velpar L.

The apparent synergism between Oust and Roundup and Oust and Brush-off to control Bracken was unexpected. In an earlier field trial using Oust where Bracken occurred, it was noticeable that emergence of Bracken was inhibited for up to 6 months, although there was no noticeable effect on existing fronds. This observation was confirmed in trial 7 where a reduction of Bracken emergence was recorded. However, the duration was rate dependant and transitory. The result from trial 3 suggests that further study of Oust/Roundup, Oust/Brush-off mixtures is warranted

Pre-plant applications provided consistently safer options than overspraying. The reduction in survival and growth of P.radiata when oversprayed with Roundup or Brush-off was expected, particularly at the higher rates (3l/ha and 20gm/ha respectively). Overspraying P.radiata with Oust, even at 400gm/ha has no effect on survival and the effects on growth were inconsistent. However, visual symptoms of phytotoxicity were consistently more obvious when Oust was oversprayed at 400gm/ha.

Consistent with previous studies, weed control on mounds was better than off mounds. There may be many reasons for this. Firstly herbicides are applied to bare earth, or almost bare earth, on mounds and therefore less metabolisation of herbicides by weeds occurs, or adsorption to organic matter. Mounding turns in the top organically rich soil into the mound leaving the surface of the mound relatively free of organic matter. Secondly, as mounds are above the general soil surface there is a lesser likelihood of cross-surface flow of storm water which rapidly removes material off the sprayed area. It is important however, that mounds are installed well in advance of spraying to provide time for the mound to settle and allow time for perennial weeds to re-emerge to ensure complete efficacy.

This series of trials was designed to study efficacy of Oust alone and in combination with other herbicides over the range of competing weeds that occur on the South Coast. While the effect on growth of P.radiata was recorded, the trials were not specifically designed for long-term (>2 years), monitoring of growth. In order to fully evaluate the potential of Oust, trials should be established to study the long-term responses to weed control by this chemical and determine the economic position of Oust compared to other weed control strategies.

Granular formulations of atrazine, metsulfuron-methyl, and hexazinone may offer opportunities to control weeds after trees are established without increasing the risk of damage. This must be given priority.

It appears (trial 4) that acceptable efficacy is achieved at between 100 and 200gm/ha of Oust. Assuming a rate of 150gm/ha and strip spraying, (50% coverage of each unit hectare) the cost of Oust will be $20.25/ha (cost of Oust is 27c/gm).

RECOMMENDATIONS:

1. Where infestations of Sorrel or Dock occur mix Oust at 150gm/ha with existing prescriptions and spray prior to planting, taking into account the conditions applying to the installation of mounds.

2. Establish large (>20ha) operational trials using Oust alone to control Sorrel and Dock and in mixtures with Roundup and Brush-off to control Bracken.

3. Instigate a research programme to determine the long-term (2-10 years) effect of Oust on specific weeds and on the growth of P.radiata. These trials should specifically study the use of granular formulations of Sulfometuron-methyl (Oust), atrazine, simazine and hexazinone (Velpar).

4. Establish trials to determine if a growth response can be attributed to oversprays of Oust.

5. Trials should be established to determine the implications on efficacy and phytotoxicity relative to changes in soil reaction for the establishment of P.radiata plantations.

R.R.A. Fremlin
Busselton, May 1990