



*Know-how for Horticulture™*

## **Weed management in carrots**

Phillip Frost  
Serve-Ag Research Pty Ltd

Project Number: VG01066

## **VG01066**

This report is published by Horticulture Australia Ltd to pass on information concerning horticultural research and development undertaken for the vegetable industry.

The research contained in this report was funded by Horticulture Australia Ltd with the financial support of the vegetable industry.

All expressions of opinion are not to be regarded as expressing the opinion of Horticulture Australia Ltd or any authority of the Australian Government.

The Company and the Australian Government accept no responsibility for any of the opinions or the accuracy of the information contained in this report and readers should rely upon their own enquiries in making decisions concerning their own interests.

ISBN 0 7341 1056 1

Published and distributed by:  
Horticultural Australia Ltd  
Level 1  
50 Carrington Street  
Sydney NSW 2000  
Telephone: (02) 8295 2300  
Fax: (02) 8295 2399  
E-Mail: [horticulture@horticulture.com.au](mailto:horticulture@horticulture.com.au)

© Copyright 2005



*Know-how for Horticulture™*



# FINAL REPORT

## Weed Management in Carrots

*Client:* Horticulture Australia Ltd

*Author:* Phillip Frost B.Agr.Sc.(Hons.)

*Project Number:* VG01066

*Report Date:* 10 December 2004

**Serve-Ag Research Pty Ltd**

ABN: 97 109 472 559

**Head Office:** 16 Hillcrest Road  
Devonport Tas 7310 Australia

Telephone: +61 3 6423 2044

Facsimile: +61 3 6423 4876

Email: [sar@serve-ag.com.au](mailto:sar@serve-ag.com.au)

Web: <http://www.serveagresearch.com.au/>



Horticulture Australia Ltd Project VG01066

10 December 2004

**Principal Investigator -** Mr Phillip Frost  
Serve-Ag Research Pty Ltd  
16 Hillcrest Road  
Devonport Tasmania 7310  
Ph: (03) 6423 2044  
Fax: (03) 6423 4876  
Email: pfrost@serve-ag.com.au

This report was funded by Horticulture Australia Ltd, the vegetable industry and the Australian Government, to screen new herbicides for use in carrot crops.

Any recommendations contained in this publication do not necessarily represent current Horticulture Australia policy. No person should act on the basis of the contents of this publication, whether as to matters of fact or opinion or other content, without first obtaining specific, independent professional advice in respect of the matters set out in this publication.

**Funding Sources:**

- Horticulture Australia Ltd
- Vegetable Industry (levies)
- Australian Government

## Table of Contents

<b>MEDIA SUMMARY .....</b>	<b>1</b>
<b>TECHNICAL SUMMARY .....</b>	<b>2</b>
<b>RECOMMENDATIONS.....</b>	<b>3</b>
<b>INTRODUCTION.....</b>	<b>3</b>
BACKGROUND .....	3
AIMS.....	3
<b>MATERIALS AND METHODS .....</b>	<b>4</b>
TRIAL SITE DETAILS.....	4
WEED LIST .....	5
PRODUCT LIST.....	6
APPLICATION EQUIPMENT .....	6
ASSESSMENTS .....	7
<b>RESULTS .....</b>	<b>8</b>
TABLE 1 (SITE 1) - WHOLE PLOT CROP TOLERANCE, 15/08/02 & 23/09/02 .....	8
TABLE 2 (SITE 1) - WHOLE PLOT WEED CONTROL FOR POLYGONUM SPP., 23/09/02 & 03/12/02 .....	8
TABLE 3 (SITE 1) - WHOLE PLOT WEED CONTROL FOR COMMON HELIOTROPE, 23/09/02 .....	9
TABLE 4 (SITE 1) - WHOLE PLOT WEED CONTROL FOR STEMLESS THISTLE, 23/09/02 & 03/12/02.....	9
TABLE 5 (SITE 2) - WHOLE PLOT CROP TOLERANCE, 05/07/02 & 04/10/02 .....	10
TABLE 6 (SITE 2) - WHOLE PLOT WEED CONTROL FOR CAPEWEED AND RYEGRASS, 04/10/02, 121DAA1/91DAA2.....	10
TABLE 7 (SITE 2) - WEED CONTROL FOR BARNYARD GRASS,04/10/02, 121DAA1/91DAA2.....	11
TABLE 8 (SITE 3) - WHOLE PLOT CROP TOLERANCE, 23/09/02 & 28/10/02 .....	11
TABLE 9 (SITE 3) - WHOLE PLOT BROADLEAF WEED CONTROL, 28/10/02, 35DAA2.....	12
TABLE 10 (SITE 3) - WHOLE PLOT BROADLEAF WEED CONTROL (CONT.), 28/10/02, 35DAA2 .....	12
TABLE 11 (SITE 3) - WHOLE PLOT WEED CONTROL FOR POLYGONUM SPP., 28/10/02 & 03/12/02 .....	13
TABLE 12 (SITE 3) - WHOLE PLOT GRASS WEED CONTROL, 28/10/02 & 03/12/02.....	13
TABLE 13 (SITE 3) - WHOLE PLOT WEED CONTROL FOR STEMLESS THISTLE, 28/10/02 & 03/12/02.....	14
TABLE 14 (SITE 4) - CROP VIGOUR ASSESSMENTS, 21/10/03, 20/11/03 & 09/12/03.....	14
TABLE 15 (SITE 4) - WEED COVER, 21/10/03 (54DAA1).....	15
TABLE 16 (SITE 4) - STINGING NETTLE CONTROL, 20/11/03 (84DAA1, 16DAA2).....	15
TABLE 17 (SITE 4) - FAT HEN CONTROL, 20/11/03 AND 09/12/03 .....	16
TABLE 18 (SITE 5) - CROP VIGOUR, 21/01/04 (37DAA1) .....	16
TABLE 19 (SITE 5) - WEED CONTROL, 21/01/04 (37DAA1).....	17
TABLE 20 (SITE 6) - CROP VIGOUR, 08/04/04, 27/04/04 27/05/04 AND 22/06/04.....	17
TABLE 21 (SITE 6) - WEED COVER, 08/04/04, 27/04/04, 27/05/04 AND 22/09/04 .....	18
TABLE 22 (SITE 6) - COMMON HELIOTROPE, SOW THISTLE, AND WIRE WEED PLANTS PER SQUARE METRE, 27/04/04 (47DAA1/19DAA2).....	18
TABLE 23 (SITE 6) - YIELD AT HARVEST, 22/09/04 .....	19
<b>DISCUSSION .....</b>	<b>20</b>
<b>APPENDICES .....</b>	<b>22</b>
APPENDIX I - HERBICIDE GROUPS .....	22
APPENDIX II - RATING SCALES.....	23
APPENDIX III - COMPLETE DATA.....	24
APPENDIX IV - ACKNOWLEDGMENTS .....	44

## **Media Summary**

Carrot production in Australia is a \$150 million dollar industry, supplying domestic markets and increasing export markets to Asia and the Middle East. Victoria is the largest carrot producing state, producing approximately 40% of Australia's carrots.

The availability of herbicides to manage weeds in carrot crops is currently limited in Australia. Victorian carrot growers currently rely on linuron, trifluralin, pendimethalin and prometryn for control of broadleaf weeds. The active ingredient metoxuron was commonly used in carrots; however, it was withdrawn from registration and is unlikely to be re-registered in carrots in Australia. Metoxuron was an effective herbicide for the control of a range of broadleaf weeds in carrot crops.

The herbicides currently available to carrot growers for broadleaf weed control are limited to two "mode of action" groups, which have a number of weed escapes. Common weed escapes in Victorian carrot crops include stemless thistle (*Onopordum acaulon*), various grasses and wire weed (*Polygonum aviculare*).

A total of six replicated field trials were conducted in Victoria to screen new herbicides for carrot crops. Products evaluated in the trials included Command (clomazone), Raft (oxadiargyl), Pledge (flumioxazine), MCPA, Goal WP (oxyfluorfen), Sniper (picolinafen), Affinity (carfentrazone), Raptor (imazamox), Sencor (metribuzin), Exporsan (bensulide), CIPC and Lontrel (clopyralid). These products were chosen from those used in carrot crops in other countries, which are also available in Australia, or from new actives that had just recently become available in Australia.

Many of these products caused phytotoxicity in some or all of the trials they were included in. Crops grown on the light textured, low organic matter soils in some carrot production regions of Victoria are prone to damage from herbicides that are often safe to the crop on heavier textured soils. Pledge, MCPA, Affinity and Raptor caused phytotoxicity and do not warrant further evaluation. CIPC, Lontrel, Exporsan, Command, Sencor, Raft and Goal WP showed crop safety at rates that provided useful weed control. These products warrant further evaluation, although some phytotoxicity occurred with Raft, Lontrel, Sencor and Goal WP at high rates.

## **Technical Summary**

The availability of herbicides to manage weeds in carrot crops is currently limited in Australia. Victorian carrot growers rely on linuron, trifluralin, pendimethalin and prometryn for control of broadleaf weeds. Residual effects of pendimethalin and trifluralin are an issue in some production areas. There is also a range of selective post-emergent grass herbicides registered for use in carrots. Carrotex, containing the active ingredient metoxuron, was commonly used in carrots; however, it was withdrawn from registration and is unlikely to be re-registered in carrots in Australia. Metoxuron was an effective herbicide for the control of a range of broadleaf weeds in carrot crops.

The herbicides currently available to carrot growers for broadleaf weed control are limited to two "mode of action" groups, which have a number of weed escapes. Common weed escapes in Victorian carrot crops include stemless thistle (*Onopordum acaulon*), various grasses and wire weed (*Polygonum aviculare*).

Growers in the UK commonly use metoxuron, metribuzin, linuron, clomazone and prometryn. Work in the UK has also shown aclonifen and prosulfocarb to be effective herbicides in carrot crops, and registration is being sought; however, neither of these products is currently available in Australia. Screening work in the USA has found flumioxazine, flufenacet + metribuzin, sulfentrazone, mesotrione and oxyfluorfen to be safe to carrots.

A total of six replicated field trials were conducted to screen new herbicides for carrot crops. Products evaluated in the trials included Command (clomazone), Raft (oxadiargyl), Pledge (flumioxazine), MCPA, Goal WP (oxyfluorfen), Sniper (picolinafen), Affinity (carfentrazone), Raptor (imazamox), Sencor (metribuzin), Exporsan (bensulide), CIPC and Lontrel (clopyralid). These products were chosen from those used in carrot crops in other countries, which are also available in Australia, or from new actives that had just recently become available in Australia.

Many of these products caused phytotoxicity in some or all of the trials they were included in. Crops grown on the light textured, low organic matter soils in some carrot production regions of Victoria are prone to damage from herbicides that are often safe to the crop on heavier textured soils. Pledge, MCPA, Affinity and Raptor caused phytotoxicity and do not warrant further evaluation. CIPC, Lontrel, Exporsan, Command, Sencor, Raft and Goal WP showed crop safety at rates that provided useful weed control. These products warrant further evaluation, although some phytotoxicity occurred with Raft, Lontrel, Sencor and Goal WP at high rates.



## **Recommendations**

- CIPC, clopyralid, bensulide, clomazone, metribuzin, oxadiargyl and oxyfluorfen WP showed crop safety at rates that provided useful weed control, and warrant further evaluation in carrot crops throughout Australia.
- Flumioxazine, MCPA, carfentrazone and imazamox caused phytotoxicity and do not warrant further evaluation.

## **Introduction**

### **Background**

Carrot production in Australia is a \$150 million dollar industry, supplying domestic markets and increasing export markets to Asia and the Middle East. Victoria is the largest carrot producing state, producing approximately 40% of Australia's carrots.

The availability of herbicides to manage weeds in carrot crops is currently limited in Australia. Victorian carrot growers rely on linuron, trifluralin, pendimethalin and prometryn for control of broadleaf weeds. Residual effects of pendimethalin and trifluralin are an issue in some production areas. There is also a range of selective post-emergent grass herbicides registered for use in carrots. Carrotex, containing the active ingredient metoxuron, was commonly used in carrots; however, it was withdrawn from registration and is unlikely to be re-registered in carrots in Australia. Metoxuron was an effective herbicide for the control of a range of broadleaf weeds in carrot crops.

The herbicides currently available to carrot growers for broadleaf weed control are limited to two "mode of action" groups and have a number of weed escapes. Common weed escapes in Victorian carrot crops include stemless thistle (*Onopordum acaulon*), various grasses and wire weed (*Polygonum aviculare*).

Growers in the UK commonly use metoxuron, metribuzin, linuron, clomazone and prometryn. Work in the UK has also shown aclonifen and prosulfocarb to be effective herbicides in carrot crops and registration is being sought; however, neither of these products is currently available in Australia. Screening work in the USA has found flumioxazine, flufenacet + metribuzin, sulfentrazone, mesotrione and oxyfluorfen to be safe to carrots.

### **Aims**

- To identify a range of new herbicides for carrot production.
- To evaluate new herbicides for crop safety and weed efficacy in Victoria.
- To collect efficacy and crop safety data to support registration / permit applications for new herbicides.

## Materials and Methods

### *Trial Site Details*

Site No.	1	2	3
Grower	Lammatina & Sons	Ben Kelly	Lammatina & Sons
Location	Wemen, Vic	Yarrawonga, Vic	Wemen, Vic
Soil Type	Sandy loam	Sandy loam	Sandy loam
Crop	Carrot	Carrot	Carrot
Variety	Ricardo	Kendo	Mojo
Trial Design	Randomised complete block	Randomised complete block	Randomised complete block
Replicates	4	4	4
Plot Size	2.5 m x 8 m	2.5 m x 8 m	2.5 m x 8 m
Plant Spacing	4.2 cm	5.0 cm	4.2 cm
Row Spacing	50 cm	50 cm	50 cm
Planting Date	04/06/02	05/06/02	08/07/02

Site No.	4	5	6
Grower	Ben Kelly	John Cochrane	Ben Kelly
Location	Burramine North, Victoria	Rosebud, Victoria	Burramine North, Victoria
Soil Type	Sandy loam	Sandy loam	Clay loam
Crop	Carrot	Carrot	Carrot
Variety	Stefano	Stefano	Travisio
Trial Design	Randomised complete block	Randomised complete block	Randomised complete block
Replicates	4	4	4
Plot Size	1 m x 7 m	1.1 m x 7 m	1 m x 7 m
Planting Date	28/08/03	12/12/03	10/03/04

## Materials and Methods (Cont.)

### Weed List

BAYER CODE *	WEED
-	Stemless thistle ( <i>Onopordum acaulon</i> )
AMARE	Red-root amaranth ( <i>Amaranthus retroflexus</i> )
AROCA	Capeweed ( <i>Arctotheca calendula</i> )
CHEAL	Fat hen ( <i>Chenopodium album</i> )
CHRVE	Windmill grass ( <i>Chloris truncata</i> )
DATSS	Thornapple ( <i>Datura</i> spp.)
ECHSS	Barnyard grass ( <i>Echinochloa crus-galli</i> )
ERAME	Stink grass ( <i>Eragrostis cilianensis</i> )
FUMSS	Fumitory ( <i>Fumaria</i> spp.)
HEOEU	Common heliotrope ( <i>Heliotropium europaeum</i> )
LITAR	White iron weed ( <i>Buglossoides arvensis</i> )
LOLSS	Ryegrass ( <i>Lolium</i> spp.)
MALPA	Marshmallow ( <i>Malva parviflora</i> )
POLAV	Wire weed ( <i>Polygonum aviculare</i> )
POLPA	Tree hogweed ( <i>Polygonum patulum</i> )
SENVU	Common groundsel ( <i>Senecio vulgaris</i> )
SOLNI	Black nightshade ( <i>Solanum nigrum</i> )
SOLTU	Volunteer potato ( <i>Solanum tuberosum</i> )
SONAS	Prickly sow thistle ( <i>Sonchus asper</i> )
SONOL	Sow thistle ( <i>Sonchus oleraceus</i> )
SSYOR	Indian hedge mustard ( <i>Sisymbrium orientale</i> )
URTUR	Stinging nettle ( <i>Urtica urens</i> )

\* Codes as outlined in "Important Crops of the World and their Weeds" (2<sup>nd</sup> edn. 1992), published by Business Group Crop Protection, Bayer Ag, Germany.

## Materials and Methods (Cont.)

### **Product List**

<b>PRODUCT NAME</b>	<b>ACTIVE INGREDIENT (ai) **</b>	<b>CONCENTRATION OF ACTIVE</b>	<b>FORMULATION</b>	<b>CHEMICAL GROUP *</b>
Affinity	carfentrazone	400 g/kg	Water dispersible granule	G
Chloro IPC	chloropham	400 g/L	Emulsifiable concentrate	K
Command	clomazone	480 g/L	Emulsifiable concentrate	F
Exporsan	bensulide	500 g/L	Emulsifiable concentrate	E
Gesagard	prometryn	500 g/L	Suspension concentrate	C
Goal WP	oxyfluorfen	400 g/kg	Wettable powder	G
Linuron	linuron	500 g/kg	Water dispersible granules	C
Lontrel	clopyralid	300 g/L	Emulsifiable concentrate	I
MCPA	MCPA	500 g/L	Liquid	I
Pledge	flumioxazine	500 g/kg	Wettable powder	G
Raft	oxadiargyl	400 g/L	Suspension concentrate	C
Raptor	imazamox	700 g/kg	Water dispersible granule	B
Sencor	metribuzin	480 g/L	Suspension concentrate	C
Sniper	picolinafen	750 g/kg	Water dispersible granule	F

\* The chemical group, used for resistance management, was developed by Avcare (Appendix i)

\*\* Common name

### **Application Equipment**

<b>Equipment</b>	Small plot pressurised sprayers
<b>Nozzles</b>	Flat fan jets
<b>Volume</b>	200 L/ha
<b>Pressure</b>	180 kPa

---

## **Materials and Methods (Cont.)**

### **Assessments**

#### **1. CROP TOLERANCE ASSESSMENTS (EWRS Rating)**

- TIMING - 5 - 121 days after application
- SAMPLE SIZE - Whole plot
- METHOD - Visual assessment
- RATING SCALE - Appendix ii
- SUMMARISED RESULTS - Tables 1 - 23
- COMPLETE DATA - Appendix iii

#### **2. WEED ASSESSMENTS (% Control Compared to Untreated Control)**

- TIMING - 5 - 121 days after application
- SAMPLE SIZE - Various sized quadrats
- METHOD - Number of weeds counted, converted to number of weeds per m<sup>2</sup> and expressed as percentage control compared to the untreated control.
- SUMMARISED RESULTS - Tables 1-23
- COMPLETE DATA - Appendix iii

#### **3. WEED ASSESSMENTS (EWRS Rating)**

- TIMING - 5 - 121 days after application
- SAMPLE SIZE - Whole plot
- METHOD - Visual assessment
- RATING SCALE - Appendix ii
- SUMMARISED RESULTS - Table 5
- COMPLETE DATA - Appendix iii

#### **4. YIELD ASSESSMENTS**

- TIMING - Harvest
- SAMPLE SIZE - Two double rows by one metre in length
- METHOD - Each plot was sown with two double rows of carrot seed. One metre of double row each side of the plot was randomly selected, the carrots dug and divided into marketable and unmarketable carrots (forked or too small). The carrots from each group were counted and weighed.
- SUMMARISED RESULTS - Table 23
- COMPLETE DATA - Appendix iii

**Results****Table 1 (Site 1) - Whole plot crop tolerance, 15/08/02 & 23/09/02**

No.	TREATMENT TIMING (Crop stage)		MEAN CROP RATING (EWRS)	
	Pre-emergence	Post-emergence	72DAA1/0DAA2	111DAA1/39DAA2
1	Raft 500 mL		5.3	2.3
2	Pledge 100 g		9.0	9.0
3	Command 250 mL		4.3	2.3
4	Linuron 2000 g	Pledge 100 g	1.0	1.0
5	Linuron 2000 g	MCPA 500 mL	1.0	2.3
6	Linuron 2000 g	Goal WP 500 g	1.0	1.0
7	Linuron 2000 g	Sniper 50 g	1.0	1.0
8	Linuron 2000 g	Affinity 60 g	1.0	1.0
9	Linuron 2000 g	Raptor 45 g	1.0	8.0
10	Linuron 2000 g	Sencor 280 mL	1.0	1.0
11	Linuron 2000 g	Gesagard 1700 mL	1.0	2.0
12	Untreated Control		1.0	1.0

DAA = days after application

**Table 2 (Site 1) - Whole plot weed control for Polygonum spp., 23/09/02 & 03/12/02**

No.	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF WEEDS PER PLOT		
	Pre-emergence	Post-emergence	POLSS 39DAA2	POLAV 110DAA2	POLPA 110DAA2
1	Raft 500 mL		23.0 b	2.0 b	4.0 bc
2	Pledge 100 g		5.5 a	0.8 ab	4.5 c
3	Command 250 mL		0.0 a	0.0 a	0.3 a
4	Linuron 2000 g	Pledge 100 g	1.3 a	0.8 ab	1.8 ab
5	Linuron 2000 g	MCPA 500 mL	1.5 a	0.8 ab	1.5 a
6	Linuron 2000 g	Goal WP 500 g	0.0 a	0.8 ab	0.5 a
7	Linuron 2000 g	Sniper 50 g	0.0 a	0.0 a	0.3 a
8	Linuron 2000 g	Affinity 60 g	0.3 a	0.3 a	0.8 a
9	Linuron 2000 g	Raptor 45 g	0.8 a	1.5 ab	0.3 a
10	Linuron 2000 g	Sencor 280 mL	0.3 a	0.8 ab	0.3 a
11	Linuron 2000 g	Gesagard 1700 mL	0.0 a	0.5 ab	0.0 a
12	Untreated Control		19.5 b	5.3 c	10.5 d
p-value			0.003	0.000	0.000
F-Ratio			3.31	6.18	13.95
LSD			12.75	1.64	2.35

Means within columns followed by the same letter are not significantly different at the 5% level using Duncan's New Multiple Range Test.

DAA = days after application

**Results (cont.)****Table 3 (Site 1) - Whole plot weed control for common heliotrope, 23/09/02**

No	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF HEOEU PER PLOT	
	Pre-emergence	Post-emergence	39DAA2	
1	Raft 500 mL		49.5	b
2	Pledge 100 g		3.3	a
3	Command 250 mL		0.0	a
4	Linuron 2000 g	Pledge 100 g	0.0	a
5	Linuron 2000 g	MCPA 500 mL	0.0	a
6	Linuron 2000 g	Goal WP 500 g	0.0	a
7	Linuron 2000 g	Sniper 50 g	7.5	a
8	Linuron 2000 g	Affinity 60 g	36.8	ab
9	Linuron 2000 g	Raptor 45 g	0.0	a
10	Linuron 2000 g	Sencor 280 mL	0.0	a
11	Linuron 2000 g	Gesagard 1700 mL	0.0	a
12	Untreated Control		172.5	c
p-value			0.00	
F-Ratio			29.65	
LSD			39.19	

Means within columns followed by the same letter are not significantly different at the 5% level using Duncan's New Multiple Range Test.  
DAA = days after application

**Table 4 (Site 1) - Whole plot weed control for stemless thistle, 23/09/02 & 03/12/02**

No.	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF <i>O. acaulon</i> PER PLOT	
	Pre-emergence	Post-emergence	39DAA2	
			39DAA2	110DAA2
1	Raft 500 mL		1.0	0.8
2	Pledge 100 g		0.0	0.3
3	Command 250 mL		0.0	0.0
4	Linuron 2000 g	Pledge 100 g	0.3	0.3
5	Linuron 2000 g	MCPA 500 mL	0.0	0.0
6	Linuron 2000 g	Goal WP 500 g	0.3	0.3
7	Linuron 2000 g	Sniper 50 g	0.5	0.5
8	Linuron 2000 g	Affinity 60 g	0.0	0.0
9	Linuron 2000 g	Raptor 45 g	0.0	0.0
10	Linuron 2000 g	Sencor 280 mL	0.0	0.3
11	Linuron 2000 g	Gesagard 1700 mL	0.0	0.0
12	Untreated Control		1.0	1.0

DAA = days after application

**Results (cont.)****Table 5 (Site 2) - Whole plot crop tolerance, 05/07/02 & 04/10/02**

No.	TREATMENT TIMING (Crop stage)		MEAN CROP RATING (EWRS)	
	Pre-emergence	Post-emergence	30DAA1/0DAA2	121 DAA1/91DAA2
1	Raft 1000 mL		7.8	8.5
2	Pledge 150 g		9.0	9.0
3	Command 500 mL		7.0	8.3
4	Linuron 2000 g	Pledge 100 g	4.0	7.3
5	Linuron 2000 g	MCPA 500 mL	3.0	7.8
6	Linuron 2000 g	Goal WP 500 g	4.0	6.8
7	Linuron 2000 g	Sniper 50 g	3.3	7.5
8	Linuron 2000 g	Affinity 60 g	3.5	8.0
9	Linuron 2000 g	Raptor 45 g	3.3	7.0
10	Linuron 2000 g	Sencor 400 mL	3.5	6.5
11	Linuron 2000 g	Linuron 1700 g	3.5	5.0
12	Untreated Control		1.0	1.0

DAA = days after application

**Table 6 (Site 2) - Whole plot weed control for capeweed and ryegrass, 04/10/02, 121DAA1/91DAA2**

No.	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF WEEDS PER PLOT	
	Pre-emergence	Post-emergence	AROCA	LOLSS
1	Raft 1000 mL		0.0	1.3
2	Pledge 150 g		0.5	5.8
3	Command 500 mL		0.3	2.3
4	Linuron 2000 g	Pledge 100 g	0.5	3.5
5	Linuron 2000 g	MCPA 500 mL	0.0	4.3
6	Linuron 2000 g	Goal WP 500 g	0.8	3.3
7	Linuron 2000 g	Sniper 50 g	0.0	2.8
8	Linuron 2000 g	Affinity 60 g	0.0	2.5
9	Linuron 2000 g	Raptor 45 g	0.0	3.0
10	Linuron 2000 g	Sencor 400 mL	0.0	1.5
11	Linuron 2000 g	Linuron 1700 g	0.0	1.5
12	Untreated Control		4.0	9.5
p-value			0.158	0.062
F-Ratio			1.55	1.97
LSD			N/A	N/A

Means within columns are not significantly different at the 5% level.

DAA = days after application



**Results (cont.)****Table 7 (Site 2) - Weed control for barnyard grass, 04/10/02, 121DAA1/91DAA2**

No.	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF ECHSS PER m <sup>2</sup>	
	Pre-emergence	Post-emergence		
1	Raft 1000 mL		6.7	a
2	Pledge 150 g		63.8	bc
3	Command 500 mL		8.3	a
4	Linuron 2000 g	Pledge 100 g	7.1	a
5	Linuron 2000 g	MCPA 500 mL	42.9	bc
6	Linuron 2000 g	Goal WP 500 g	7.5	a
7	Linuron 2000 g	Sniper 50 g	37.1	b
8	Linuron 2000 g	Affinity 60 g	93.3	de
9	Linuron 2000 g	Raptor 45 g	97.5	e
10	Linuron 2000 g	Sencor 400 mL	42.5	bc
11	Linuron 2000 g	Linuron 1700 g	45.4	bc
12	Untreated Control		69.2	cd
p-value			0.000	
LSD			27.899	

Means within the column followed by the same letter are not significantly different at the 5% level using Duncan's New Multiple Range Test.  
DAA = days after application

**Table 8 (Site 3) - Whole plot crop tolerance, 23/09/02 & 28/10/02**

No.	TREATMENT TIMING (Crop stage)		MEAN CROP TOLERANCE (EWRS)	
	Pre-emergence	Post-emergence	75DAA1/0DAA2	110DAA1/35DAA2
1	Raft 500 mL		2.8	1.8
2	Pledge 100 g		9.0	8.3
3	Command 250 mL		5.5	4.8
4	Linuron 2000 g	Pledge 100 g	1.5	2.0
5	Linuron 2000 g	MCPA 500 mL	1.0	7.8
6	Linuron 2000 g	Goal WP 500 g	1.3	2.0
7	Linuron 2000 g	Sniper 45 g	1.5	1.5
8	Linuron 2000 g	Affinity 60 g	2.0	6.5
9	Linuron 2000 g	Raptor 45 g	1.0	8.0
10	Linuron 2000 g	Sencor 280 mL	2.8	1.3
11	Linuron 2000 g	Gesagard 1700 mL	1.5	1.5
12	Untreated Control		1.0	1.0

**Results (cont.)****Table 9 (Site 3) - Whole plot broadleaf weed control, 28/10/02, 35DAA2**

No	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF WEEDS PER PLOT		
	Pre-emergence	Post-emergence	AROCA	FUMSS	HEOEU
1	Raft 500 mL		0.8 a	0.0 a	74.8 c
2	Pledge 100 g		0.0 a	0.0 a	0.3 a
3	Command 250 mL		0.3 a	0.0 a	0.8 a
4	Linuron 2000 g	Pledge 100 g	0.0 a	0.0 a	0.0 a
5	Linuron 2000 g	MCPA 500 mL	0.0 a	0.3 a	6.0 a
6	Linuron 2000 g	Goal WP 500 g	0.0 a	0.0 a	0.0 a
7	Linuron 2000 g	Sniper 45 g	0.0 a	0.0 a	4.5 a
8	Linuron 2000 g	Affinity 60 g	0.0 a	0.0 a	11.0 a
9	Linuron 2000 g	Raptor 45 g	0.0 a	0.0 a	1.3 a
10	Linuron 2000 g	Sencor 280 mL	0.0 a	0.0 a	0.0 a
11	Linuron 2000 g	Gesagard 1700 mL	0.0 a	0.0 a	0.0 a
12	Untreated Control		2.3 b	6.3 b	56.8 b
p-value			0.00	0.00	0.00
F-Ratio			3.87	4.04	23.71
LSD			0.96	2.57	14.84

Means within columns followed by the same letter are not significantly different at the 5% level using Duncan's New Multiple Range Test.  
DAA = days after application number

**Table 10 (Site 3) - Whole plot broadleaf weed control (Cont.), 28/10/02, 35DAA2**

No	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF WEEDS PER PLOT		
	Pre-emergence	Post-emergence	LITAR	SONAS	SSYOR
1	Raft 500 mL		0.5 a	0.0 a	2.3 b
2	Pledge 100 g		0.0 a	0.3 a	0.3 a
3	Command 250 mL		0.0 a	0.0 a	0.5 a
4	Linuron 2000 g	Pledge 100 g	0.0 a	0.0 a	0.0 a
5	Linuron 2000 g	MCPA 500 mL	0.0 a	0.0 a	0.0 a
6	Linuron 2000 g	Goal WP 500 g	0.0 a	0.0 a	0.0 a
7	Linuron 2000 g	Sniper 45 g	0.0 a	0.0 a	0.0 a
8	Linuron 2000 g	Affinity 60 g	0.0 a	0.0 a	0.0 a
9	Linuron 2000 g	Raptor 45 g	0.0 a	0.0 a	0.0 a
10	Linuron 2000 g	Sencor 280 mL	0.0 a	0.0 a	0.0 a
11	Linuron 2000 g	Gesagard 1700 mL	0.0 a	0.0 a	0.0 a
12	Untreated Control		6.8 b	3.5 b	12.5 c
p-value			0.00	0.00	0.00
F-Ratio			5.23	25.4	44.67
LSD			2.43	0.57	1.54

Means within columns followed by the same letter are not significantly different at the 5% level using Duncan's New Multiple Range Test.  
DAA = days after application number

**Results (cont.)****Table 11 (Site 3) - Whole plot weed control for *Polygonum* spp., 28/10/02 & 03/12/02**

No.	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF WEEDS PER PLOT		
	Pre-emergence	Post-emergence	POLSS 35DAA2	POLAV 71DAA2	POLPA 71DAA2
1	Raft 500 mL		0.3 a	1.0 a	0.0
2	Pledge 100 g		0.0 a	0.0 a	0.0
3	Command 250 mL		0.0 a	0.0 a	0.0
4	Linuron 2000 g	Pledge 100 g	0.0 a	0.0 a	0.0
5	Linuron 2000 g	MCPA 500 mL	0.0 a	0.0 a	0.3
6	Linuron 2000 g	Goal WP 500 g	0.3 a	0.5 a	0.0
7	Linuron 2000 g	Sniper 45 g	0.3 a	0.3 a	0.0
8	Linuron 2000 g	Affinity 60 g	0.0 a	0.0 a	0.0
9	Linuron 2000 g	Raptor 45 g	0.0 a	0.0 a	0.0
10	Linuron 2000 g	Sencor 280 mL	0.0 a	0.0 a	0.0
11	Linuron 2000 g	Gesagard 1700 mL	0.0 a	0.0 a	0.0
12	Untreated Control		6.8 b	7.0 b	1.0
p-value			0.00	0.00	0.09
F-Ratio			5.54	7.40	1.81
LSD			2.35	2.11	n/a

Means within columns followed by the same letter are not significantly different at the 5% level according to Duncan's New Multiple Range Test.  
DAA = days after application number

**Table 12 (Site 3) - Whole plot grass weed control, 28/10/02 & 03/12/02**

No.	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF WEEDS PER PLOT	
	Pre-emergence	Post-emergence	LOLSS 35DAA2	ERAME 71DAA2
1	Raft 500 mL		1.5 a	4.0 ab
2	Pledge 100 g		0.5 a	31.3 d
3	Command 250 mL		0.0 a	0.3 a
4	Linuron 2000 g	Pledge 100 g	0.0 a	0.0 a
5	Linuron 2000 g	MCPA 500 mL	0.0 a	21.5 cd
6	Linuron 2000 g	Goal WP 500 g	0.0 a	0.8 a
7	Linuron 2000 g	Sniper 45 g	0.0 a	11.0 abc
8	Linuron 2000 g	Affinity 60 g	0.3 a	19.0 c
9	Linuron 2000 g	Raptor 45 g	0.0 a	14.3 bc
10	Linuron 2000 g	Sencor 280 mL	0.0 a	0.0 a
11	Linuron 2000 g	Gesagard 1700 mL	0.5 a	0.0 a
12	Untreated Control		9.8 b	*
p-value			0.00	0.00
F-Ratio			18.99	7.87
LSD			1.83	11.21

Means within columns followed by the same letter are not significantly different at the 5% level according to Duncan's New Multiple Range Test.

\* No weeds germinated in UTC plots due to overcrowding by other weeds.

DAA = days after application number

**Results (cont.)****Table 13 (Site 3) - Whole plot weed control for stemless thistle, 28/10/02 & 03/12/02**

No.	TREATMENT TIMING (Crop stage)		MEAN NUMBER OF <i>O. acaulon</i> PER PLOT	
	Pre-emergence	Post-emergence	35DAA2	71DAA2
1	Raft 500 mL		0.3	0.3
2	Pledge 100 g		0.0	0.0
3	Command 250 mL		0.0	0.0
4	Linuron 2000 g	Pledge 100 g	0.0	0.0
5	Linuron 2000 g	MCPA 500 mL	0.0	0.0
6	Linuron 2000 g	Goal WP 500 g	0.3	0.5
7	Linuron 2000 g	Sniper 45 g	0.0	0.0
8	Linuron 2000 g	Affinity 60 g	0.3	0.3
9	Linuron 2000 g	Raptor 45 g	0.3	0.3
10	Linuron 2000 g	Sencor 280 mL	0.0	0.0
11	Linuron 2000 g	Gesagard 1700 mL	0.0	0.0
12	Untreated Control		0.3	0.3

DAA = days after application number

**Table 14 (Site 4) - Crop vigour assessments, 21/10/03, 20/11/03 & 09/12/03**

No.	TREATMENT TIMING (Crop stage)		CROP VIGOUR (%)		
	Post-sowing pre-emergent	Post-emergent	54DAA1	84DAA1/16DAA 2	103DAA1/35DAA 2
1	Command 100 mL		99.5	98.0	97.0 cd
2	Command 200 mL		99.0	97.0	98.0 cd
3	Exporsan 5 L		100	100	100 d
4	Exporsan 10 L		100	99.0	99.5 cd
5	Chloro IPC 4 L		93.5	96.3	97.5 cd
6	Chloro IPC 6 L		65.0	97.8	99.5 cd
7		Lontrel 50 mL	98.3	94.8	95.5 abc
8		Lontrel 100 mL	98.3	87.0	89.0 a
9		Lontrel 200 mL	100	94.3	84.3 a
10		Sencor 280 mL	96.5	93.8	91.8 ab
11	Linuron 2 kg	Gesagard 1.7 L	92.8	99.0	97.5 bcd
12	Untreated control		99.5	92.5	90.0 a
p-value			Not analysed	0.13	0.00
5% LSD				n/a	#

# Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test after ARCSIN $\times$  transformation of data.

**Results (cont.)****Table 15 (Site 4) - Weed cover, 21/10/03 (54DAA1)**

No.	TREATMENT TIMING (Crop stage)		Weed Cover (%)
	Post-sowing, pre-emergent	Post-emergent	
1	Command 100 mL		22.0 bc
2	Command 200 mL		9.0 ab
3	Exporsan 5 L		2.3 a
4	Exporsan 10 L		3.8 a
5	Chloro IPC 4 L		2.5 a
6	Chloro IPC 6 L		6.3 a
7		Lontrel 50 mL	21.3 *
8		Lontrel 100 mL	17.5 *
9		Lontrel 200 mL	10.8 *
10		Sencor 280 mL	19.5 *
11	Linuron 2 kg	Gesagard 1.7 L	2.0 a
12	Untreated control		26.8 c
p-value			0.00
5% LSD			na

# Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test after ARCSIN@x transformation of data.

\* Plots were untreated at time of assessment

**Table 16 (Site 4) - Stinging nettle control, 20/11/03 (84DAA1, 16DAA2)**

No.	TREATMENT TIMING (Crop stage)		Stinging nettle per m <sup>2</sup>	Stinging nettle control (%)#
	Post-sowing, pre-emergent	Post-emergent		
1	Command 100 mL		14.5 bc	3.3 a
2	Command 200 mL		9.5 ab	36.7 a
3	Exporsan 5 L		1.5 a	90.0 bc
4	Exporsan 10 L		3.0 a	80.0 bc
5	Chloro IPC 4 L		0.0 *	100.0 c
6	Chloro IPC 6 L		0.5 a	96.7 c
7		Lontrel 50 mL	26.7 c	0.0 *
8		Lontrel 100 mL	19.5 bc	0.0 *
9		Lontrel 200 mL	9.5 ab	36.7 ab
10		Sencor 280 mL	11.5 ab	23.3 abc
11	Linuron 2 kg	Gesagard 1.7 L	0.0 *	100.0 c
12	Untreated control		15.0 bc	0.0 *
p-value			0.00	0.00
5% LSD			15.69	n/a^

\* Not included in analysis

\*\* Numbers too small for analysis

^ Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test on ARCSINSQRT(x/100) transformed data.

# Results were highly variable as there were more stinging nettle plants per square metre compared to the untreated control for some replicates.

**Results (cont.)****Table 17 (Site 4) - Fat hen control, 20/11/03 and 09/12/03**

No.	TREATMENT TIMING (Crop stage)		84DAA1, 16DAA2		103DAA1, 35DAA2	
	Post-sowing pre-emergent	Post-emergent	Fat hen per m <sup>2</sup>	Fat hen control (%)	Fat hen per m <sup>2</sup>	Fat hen control (%)
1	Command 100 mL		2.5	75.0	1.0	75.0 abc
2	Command 200 mL		1.0	86.7	0.3	93.2 c
3	Exporsan 5L		1.0	86.7	0.0	99.0 c
4	Exporsan 10 L		0.5	93.3	0.1	96.1 c
5	Chloro IPC 4 L		3.0	75.0	1.5	68.2 abc
6	Chloro IPC 6 L		3.5	53.3	2.3	51.7 ab
7		Lontrel 50 mL	4.0	55.0	2.5	49.8 ab
8		Lontrel 100 mL	1.5	80.0	0.5	85.4 bc
9		Lontrel 200 mL	3.0	60.0	0.9	74.8 abc
10		Sencor 280 mL	4.0	48.3	2.0	44.7 a
11	Linuron 2 kg	Gesagard 1.7 L	0.0*	100	0.0	100 c
12	Untreated control		7.5	0*	3.7	0.0
p-value			0.30	0.46	0.13	0.05
5% LSD			n/a	n/a	n/a	56.46

\* Not included in analysis

**Table 18 (Site 5) - Crop vigour, 21/01/04 (37DAA1)**

No.	Treatment		Crop vigour (%)
	Post-sowing, pre-emergent	Post-emergent	
1	Command 100 mL		92.0
2	Command 200 mL		97.0
3	Exporsan 5L		97.8
4	Exporsan 10 L		83.3
5	Chloro IPC 4 L		82.0
6	Chloro IPC 6 L		93.3
7		Lontrel 50 mL	80.8*
8		Lontrel 100 mL	68.8*
9		Lontrel 200 mL	91.5*
10		Sencor 280 mL	85.0*
11	Linuron 2 kg	Gesagard 1.7 L	98.0
12	Untreated control		79.8
p-value			0.24
5% LSD			n/a

\* Plots were untreated at time of assessment

**Results (cont.)****Table 19 (Site 5) - Weed control, 21/01/04 (37DAA1)**

No.	Treatment		Weed cover (%)	Reduction in weed vigour (%)
	Post-sowing, pre-emergent	Post-emergent		
1	Command 100 mL		89.3 abc	0.0
2	Command 200 mL		75.0 a	67.5
3	Exporsan 5L		99.5 d	0.0
4	Exporsan 10 L		90.0 abcd	0.0
5	Chloro IPC 4 L		97.0 bcd	0.0
6	Chloro IPC 6 L		90.8 ab	27.5
7		Lontrel 50 mL	99.5 d	0.0
8		Lontrel 100 mL	100.0 d	0.0
9		Lontrel 200 mL	98.8 cd	0.0
10		Sencor 280 mL	98.8 bcd	0.0
11	Linuron 2 kg	Gesagard 1.7 L	93.0 abc	20.0
12	Untreated control		100.0 d	0.0
p-value			0.01	Not analysed
5% LSD			n/a*	

\*Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test on ARCSINSQRT(x/100) transformed data.

**Table 20 (Site 6) - Crop vigour, 08/04/04, 27/04/04 27/05/04 and 22/06/04**

No.	Product rate (mL or g/ha)		Crop vigour (%)			
	Post-sowing, pre-emergent	Post-emergent	8/04/04 28DAA1 0DAA2	27/04/04 47DAA1 19DAA2	27/05/04 77DAA1 49DAA2	22/06/04 103DAA1 75DAA2
1	Command 100 mL		89	85 d	86	83
2	Command 200 mL		79	72 bcd	85	86
3	Command 300 mL		84	83 d	88	88
4	Command 400 mL		48	39 ab	46	49
5	Exporsan 10,000 mL		62	35 ab	59	67
6	Chloro IPC 6,000 mL		69	57 bcd	69	71
7	Linuron 2000 g	Sencor 280 mL	73	42 abc	73	73
8	Linuron 2000 g	Sencor 400 mL	52	14 a	44	50
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	74	51 abcd	65	73
10	Untreated control		78	80 cd	92	93
p-value			0.62	0.00 <sup>^</sup>	0.12	0.23
5% LSD			n/a	n/a	n/a	n/a

\* Untreated control plots were hand weeded 27/04/04<sup>^</sup> Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test on ASINSQRT(x/100) transformed data.

**Results (cont.)****Table 21 (Site 6) - Weed cover, 08/04/04, 27/04/04, 27/05/04 and 22/09/04**

No	Product rate (mL or g/ha)		Weed cover (%)			
	Post-sowing pre-emergent	Post-emergent	28DAA1 0DAA2	47DAA1 19DAA2	77DAA1 49DAA2	195DAA1 167DAA2
1	Command 100 mL		4 bc	9 d	18	80 bc
2	Command 200 mL		2 ab	2 abc	1	49 ab
3	Command 300 mL		5 bc	4 bcd	8	53 bc
4	Command 400 mL		1 a	2 abc	2	66 bc
5	Exporsan 10,000 mL		1 a	5 cd	5	88 c
6	Chloro IPC 6,000 mL		3 ab	7 d	9	80 bc
7	Linuron 2000 g	Sencor 280 mL	1 a	1 ab	1	13 a
8	Linuron 2000 g	Sencor 400 mL	1 a	0 a	0	9 a
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	2 ab	1 ab	1	54 bc
10	Untreated control		6 c	16 e	n/a*	79 bc
p-value			0.00 <sup>^</sup>	0.00 <sup>^</sup>	Not analysed <sup>#</sup>	0.00
5% LSD			n/a	n/a		n/a

\* Untreated control plots were hand weeded 27/04/04

<sup>^</sup> Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test on ASINSQRT(x/100) transformed data.

<sup>#</sup> Data did not conform to the assumption of normality for ANOVA and a suitable transformation could not be found to satisfy the assumption of normality

**Table 22 (Site 6) - Common heliotrope, sow thistle, and wire weed plants per square metre, 27/04/04 (47DAA1/19DAA2)**

No.	Product rate (mL or g/ha)		Mean number of plants/m <sup>2</sup>		
	Post-sowing pre-emergent	Post-emergent	Common heliotrope/m <sup>2</sup>	Sow thistle/m <sup>2</sup>	Wire weed/m <sup>2</sup>
1	Command 100 mL		5.5 c	0.3 a	0.4 a
2	Command 200 mL		1.4 b	0.1 a	0.1 a
3	Command 300 mL		0.4 ab	0.0 a	0.0 a
4	Command 400 mL		0.1 a	0.1 a	0.1 a
5	Exporsan 10,000 mL		0.4 ab	0.3 a	2.3 b
6	Chloro IPC 6,000 mL		4.4 c	1.2 b	0.0 a
7	Linuron 2000 g	Sencor 280 mL	0.0 *	0.0 *	0.1 a
8	Linuron 2000 g	Sencor 400 mL	0.0 *	0.0 *	0.0 *
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	0.0 *	0.0 *	0.0 a
10	Untreated control		11.5 d	2.6 b	2.0 b
p-value			0.00	0.00	0.00
5% LSD			n/a <sup>^</sup>	n/a <sup>#</sup>	n/a <sup>#</sup>

\* Not included in analysis. Where values of zero were included in the analysis, the means have been rounded down to zero i.e. these treatments did not eradicate a particular weed.

<sup>^</sup> Means followed by the same letter are not significantly different at the 5% level according to Fisher's LSD test.

<sup>#</sup> Means followed by the same letter are not significantly different at the 5% level according to Fisher's LSD test conducted on log(x+ 1) transformed data. Note that data did not fit a normal distribution.



**Results (cont.)****Table 23 (Site 6) - Yield at harvest, 22/09/04**

No.	Product rate (mL or g/ha)		195DAA1, 167DAA2			
	Post-sowing pre-emergent	Post-emergent	Weight of marketable carrots (t/ha)	Weight of unmarketable carrot (t/ha)	Total weight of carrots (t/ha)	Weight per 100 carrots (kg)
1	Command 100 mL		20.0	2.1 bc	22.1	7.9
2	Command 200 mL		20.8	2.4 c	23.2	7.8
3	Command 300 mL		27.4	2.2 bc	29.6	8.7
4	Command 400 mL		15.6	0.4 a	16.0	8.7
5	Exporsan 10,000 mL		19.2	1.5 abc	20.4	7.6
6	Chloro IPC 6,000 mL		13.5	1.7 bc	15.1	6.7
7	Linuron 2000 g	Sencor 280 mL	25.8	1.5 abc	27.4	8.5
8	Linuron 2000 g	Sencor 400 mL	14.0	2.2 bc	16.3	6.3
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	22.1	1.1 ab	23.2	7.5
10	Untreated control		24.7	1.5 abc	26.1	8.1
p-value			0.53	0.05	0.51	0.72
5% LSD			n/a	1.62	n/a	n/a

Untreated control plots were hand weeded 27/04/04

^ Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test on untransformed data.

## **Discussion**

A total of six replicated field trials were conducted in Victoria to screen new herbicides for carrot crops. Products included in the trials included, Command (clomazone), Raft (oxadiargyl), Pledge (flumioxazine), MCPA, Goal WP (oxyfluorfen), Sniper (picolinafen), Affinity (carfentrazone), Raptor (imazamox), Sencor (metribuzin), Exporsan (bensulide), CIPC, Lontrel (clopyralid). These products were chosen based on their use in carrots crops in other countries and also some new actives that had just recently become available in Australia. Products which aren't available in Australia were not included in trials.

Many of the products used caused phytotoxicity in some or all of the trials they were included in. Crops grown on the light textured low organic matter soils in some carrot production regions of Victoria are prone to damage from herbicides which are often safe to the crop on heavier textured soils. Pledge, MCPA, Affinity and Raptor caused phytotoxicity and do not warrant further evaluation. CIPC, Lontrel, Exporsan, Command, Sencor, Raft and Goal WP showed crop safety at rates which provided useful weed control and warrant further evaluation although, some phytotoxicity did occur with Raft, Lontrel, Sencor and Goal WP at high rates.

### **Command**

Command (480 g ai clomazone) is a Group F herbicide registered in Australia for the control of selected annual weeds in various crops including potatoes, beans, cucurbits, poppies and tobacco. This product has both pre and early post-emergence activity on a number of broadleaf and grass weeds. Command is registered in the United Kingdom in carrots and is currently being developed in New Zealand in carrots.

Australian trials conducted as part of this project showed Command to be a particularly effective herbicide for control of certain weeds including hogweed, stemless thistle, heliotrope and sowthistle.

Command caused some phytotoxicity with higher rates on light textured soils. Rates of between 100 and 300 mL/ha were safe in trials.

### **CIPC**

CIPC is registered in New Zealand at rates of 6-8 L applied pre crop emergence for control of a range of weeds. Some mild crop phytotoxicity was observed with this product. CIPC was particularly effective on stinging nettle but also provided some control of other weeds.

### **Raft**

Raft (400 g ai oxadiargyl) is a Group G herbicide registered in Australia for control of summer grass and winter grass in couch turf grass. It is currently being evaluated in a range of other crops. Raft has pre and early post-emergent activity on a range of broadleaf weeds, as well as grasses.

Trials in Europe have shown that Raft is safe to carrots at a rate of 500 mL/ha. Trials conducted as part of this project show that Raft at 500 mL/ha was safe to the crop but rates of 1L caused severe phyto toxicity.

### **Goal WP**

Goal WP is a wettable powder formulation of oxyfluorfen. This formulation has greater safety when applied post emergence and is being developed in Australia for brassica and onion crops. Goal WP caused some phytotoxicity at site 2 however even the industry standard Linuron caused crop damage at this site.

### **Exporsan**

Exporsan is registered in Australia in turf for control of certain grass weeds. The product is registered in the US in lettuce and other vegetable crops. Exporsan was safe to carrot crops when applied pre crop emergence at rates of between 5 and 10 L/ha and provided some control of stinging nettle and heliotrope.

## **Discussion (Cont.)**

### **Metribuzin**

Metribuzin is registered in a range of crops in Australia for control of a number of weeds. Metribuzin is commonly used in Europe and the USA for post emergent weed control in carrot crops. Sencor at 400 mL/ha caused phytotoxicity at some sites while a rate of 280 mL was safe to the crops. Sencor has a similar mode of action and belongs to the same chemical group as Linuron and Gesagard which are currently registered in carrots.

### **Lontrel**

Lontrel was screened at rates of between 50 and 200 mL/ha applied post crop emergence. The higher rates caused some crop damage however the 50 and 100 mL/ha rates were safe on the crop. Lontrel controls thistles and may have a place in carrots for control of weeds such as stemless thistle. Further work would be required to test the crop safety and efficacy of Lontrel.

## **Technology Transfer**

### **Product Development**

As this project focused on screening of new herbicides results were not directly communicated to growers throughout the project as the herbicides needed to be tested over multiple seasons and permits / registrations needed to be in place before products could be recommended to growers.

### **Publications**

A range of written material was produced throughout the project, such as milestone reports, annual reports, project updates and conference proceedings (Table 9). A poster titled "Weed Management in Carrots" was presented at the Australian weeds conference in Wagga Wagga in September 2004.

## Appendices

### **Appendix i - Herbicide Groups**

Herbicide grouping based on mode of action (Developed by Avcare)

<b>Group</b>	<b>Mode of Action</b>	<b>Chemical Group</b>
A	Inhibitors of acetyl CoA carboxylase	aryloxyphenoxypropionate ("fops") cyclohexanedione ("dims")
B	Inhibitors of acetolactate synthase	sulfonyl urea imidazolinone sulfonamid
C	Inhibitors of photosynthesis at photosystem II	triazine triazinone urea nitrile benzothiadiazole acetamide pyridazinone phenyl-pyridazinone uracil
D	Inhibitors of tubulin formation	dinitroaniline benzoic acid
E	Inhibitors of mitosis	thiocarbamate carbamate organophosphorus
F	Inhibitors of carotenoid biosynthesis	nicotinamide triazole pyridazinone
G	Inhibitors of protoporphyrinogen oxidase	diphenyl ether oxidiazole
H	Inhibitors of protein synthesis	thiocarbamate
I	Disrupters of cell growth	phenoxy benzoic acid pyridine
J	Inhibitors of fat synthesis	alkanoic acid
K	Herbicides with diverse sites of action	amide organoarsenic carbamate aminopropionate benzofuran phthalamate nitrile
L	Inhibitors of photosynthesis at photosystem I	bipyridyl
M	Inhibitors of EBSP synthase	glycine (glyphosate; glyphosate-trimesium)
N	Inhibitors of glutamine synthetase	glycine

**Appendices (Cont.)****Appendix ii - Rating Scales**

<b>EWRS SCALE FOR CROP TOLERANCE</b>		
<b>RATING</b>	<b>% EFFECT</b>	
1	0	Healthy plant
2	0.1 - 2	Very mild symptoms
3	2.1 - 5	Mild but clearly recognisable symptoms
4	5.1 - 10	More severe symptoms without necessarily an effect on yield
	-----	Limit of commercial acceptability
5	10.1 - 18	Reduction in yield expected
6	18.1 - 30	Heavy damage to total kill
7	30.1 - 45	
8	45.1 - 70	
9	70.1 - 100	

<b>EWRS SCALE FOR WEED CONTROL</b>		
<b>RATING</b>	<b>% EFFECT</b>	
1	100	Complete weed kill
2	99.9 - 98	
3	97.9 - 95	
4	94.9 - 90	
	-----	Limit of commercial acceptability
5	89.9 - 82	
6	81.9 - 70	
7	69.9 - 55	
8	54.9 - 30	
9	29.9 - 0	Little to no effect on weeds

The EWRS (European Weed Research System) scale is based on comparison of the treated plots with the untreated control plot. The aim is to assess as accurately as possible the decrease in the natural number of plants per weed species (still visible in the untreated plot). This decrease in the weed population corresponds to the action of the product. The EWRS scale is logarithmic, the intervals decreasing as the action increases. This enables detailed assessment in the range of effective herbicide action.

Reference: Puntener W. 1981. Manual for Field Trials in Plant Protection. Second Edition. Ciba-Geigy Limited, Basle, Switzerland.

**Appendices (Cont.)**

**Appendix iii - Complete Data**

**Site 1, Crop Tolerance, 15/8/02 & 23/9/02**

No.	TREATMENT (Crop stage)		Rep	Crop Tolerance (EWRS)	
	Post-plant, Pre-emergent	Post-emergent		15/8/02	23/9/02
1	Raft 500 mL		1	6	3
			2	4	1
			3	5	2
			4	6	3
			Mean	5.25	2.25
2	Pledge 100 g		1	9	9
			2	9	9
			3	9	9
			4	9	9
			Mean	9.00	9.00
3	Command 250 mL		1	5	2
			2	4	3
			3	4	2
			4	4	2
			Mean	4.25	2.25
4	Linuron	Pledge 100 g	1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00
5	Linuron 1000 g	MCPA 5000 mL	1	1	1
			2	1	3
			3	1	3
			4	1	2
			Mean	1.00	2.25
6	Linuron 1000 g	Goal WP 500 g	1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00
7	Linuron 1000 g	Sniper 50 g	1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00
8	Linuron 1000 g	Affinity 60 g	1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00
9	Linuron 1000 g	Raptor 45 g	1	1	8
			2	1	8
			3	1	8
			4	1	8
			Mean	1.00	8.00
10	Linuron 1000 g	Sencor 280 mL	1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00
11	Linuron 1000 g	Gesagard 1700 mL	1	1	3
			2	1	1
			3	1	3
			4	1	1
			Mean	1.00	2.00
12	Untreated Control		1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 1, *Polygonum* spp. Control, 23/09/02 & 3/12/02**

No.	TREATMENT (Crop stage)		Rep	Number of weeds per plot		
	Post-plant, Pre-emergent	Post-emergent		POLSS 23/09/02	POLAV 3/12/02	POLPA 3/12/02
1	Raft 500 mL		1	5	2	5
			2	67	2	0
			3	11	4	4
			4	9	0	7
			Mean	23.00	2.00	4.00
2	Pledge 100 g		1	7	0	6
			2	0	1	2
			3	9	2	5
			4	6	0	5
			Mean	5.50	0.75	4.50
3	Command 250 mL		1	0	0	0
			2	0	0	1
			3	0	0	0
			4	0	0	0
			Mean	0.00	0.00	0.25
4	Linuron	Pledge 100 g	1	0	0	0
			2	0	0	7
			3	5	0	0
			4	0	3	0
			Mean	1.25	0.75	1.75
5	Linuron 1000 g	MCPA 5000 mL	1	1	1	1
			2	1	1	2
			3	3	1	2
			4	1	0	1
			Mean	1.50	0.75	1.50
6	Linuron 1000 g	Goal WP 500 g	1	0	2	0
			2	0	0	1
			3	0	1	0
			4	0	0	1
			Mean	0.00	0.75	0.50
7	Linuron 1000 g	Sniper 50 g	1	0	0	0
			2	0	0	0
			3	0	0	1
			4	0	0	0
			Mean	0.00	0.00	0.25
8	Linuron 1000 g	Affinity 60 g	1	0	0	0
			2	0	0	0
			3	1	1	1
			4	0	0	2
			Mean	0.25	0.25	0.75
9	Linuron 1000 g	Raptor 45 g	1	0	2	0
			2	0	1	1
			3	0	0	0
			4	3	3	0
			Mean	0.75	1.50	0.25
10	Linuron 1000 g	Sencor 280 mL	1	0	0	0
			2	1	2	0
			3	0	1	1
			4	0	0	0
			Mean	0.25	0.75	0.25
11	Linuron 1000 g	Gesagard 1700 mL	1	0	1	0
			2	0	0	0
			3	0	0	0
			4	0	1	0
			Mean	0.00	0.50	0.00
12	Untreated Control		1	13	5	11
			2	14	2	12
			3	29	7	12
			4	22	7	7
			Mean	19.50	5.25	10.50

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 1, Common Heliotrope and Stemless Thistle Control**

No.	TREATMENT (Crop stage)		Rep	Number of weeds per plot		
	Post-plant, Pre-emergent	Post-emergent		HELEU 23/09/02	<i>O. acaulon</i> 23/09/02	<i>O. acaulon</i> 3/12/02
1	Raft 500 mL		1	20	1	1
			2	83	0	0
			3	35	1	0
			4	60	2	2
			Mean	49.50	1.00	0.75
2	Pledge 100 g		1	0	0	0
			2	0	0	0
			3	5	0	1
			4	8	0	0
			Mean	3.25	0.00	0.25
3	Command 250 mL		1	0	0	0
			2	0	0	0
			3	0	0	0
			4	0	0	0
			Mean	0.00	0.00	0.00
4	Linuron	Pledge 100 g	1	0	0	0
			2	0	1	0
			3	0	0	1
			4	0	0	0
			Mean	0.00	0.25	0.25
5	Linuron 1000 g	MCPA 5000 mL	1	0	0	0
			2	0	0	0
			3	0	0	0
			4	0	0	0
			Mean	0.00	0.00	0.00
6	Linuron 1000 g	Goal WP 500 g	1	0	1	1
			2	0	0	0
			3	0	0	0
			4	0	0	0
			Mean	0.00	0.25	0.25
7	Linuron 1000 g	Sniper 50 g	1	0	1	1
			2	0	0	0
			3	0	0	0
			4	30	1	1
			Mean	7.50	0.50	0.50
8	Linuron 1000 g	Affinity 60 g	1	0	0	0
			2	0	0	0
			3	65	0	0
			4	82	0	0
			Mean	36.75	0.00	0.00
9	Linuron 1000 g	Raptor 45 g	1	0	0	0
			2	0	0	0
			3	0	0	0
			4	0	0	0
			Mean	0.00	0.00	0.00
10	Linuron 1000 g	Sencor 280 mL	1	0	0	0
			2	0	0	0
			3	0	0	1
			4	0	0	0
			Mean	0.00	0.00	0.25
11	Linuron 1000 g	Gesagard 1700 mL	1	0	0	0
			2	0	0	0
			3	0	0	0
			4	0	0	0
			Mean	0.00	0.00	0.00
12	Untreated Control		1	99.0	2	2
			2	175	1	0
			3	280	1	1
			4	136	0	1
			Mean	172.50	1.00	1.00



**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 2, Crop Tolerance, 5/07/02 & 4/10/02**

No.	TREATMENT (Crop stage)		Rep	Crop Tolerance (EWRS)	
	Post-plant, Pre-emergent	Post-emergent		5/07/02	4/10/02
1	Raft 1000 mL		1	6	8
			2	7	8
			3	9	9
			4	9	9
			Mean	7.75	8.50
2	Pledge 150 g		1	9	9
			2	9	9
			3	9	9
			4	9	9
			Mean	9.00	9.00
3	Command 500 mL		1	6	8
			2	6	8
			3	8	8
			4	8	9
			Mean	7.00	8.25
4	Linuron 2000 g	Pledge 100 g	1	4	8
			2	4	7
			3	3	6
			4	5	8
			Mean	4.00	7.25
5	Linuron 2000 g	MCPA 500 mL	1	2	8
			2	5	9
			3	2	6
			4	3	8
			Mean	3.00	7.75
6	Linuron 2000 g	Goal WP 500 g	1	4	7
			2	4	6
			3	3	6
			4	5	8
			Mean	4.00	6.75
7	Linuron 2000 g	Sniper 50 g	1	3	8
			2	3	7
			3	3	7
			4	4	8
			Mean	3.25	7.50
8	Linuron 2000 g	Affinity 60 g	1	3	8
			2	3	8
			3	3	8
			4	5	8
			Mean	3.50	8.00
9	Linuron 2000 g	Raptor 45 g	1	5	7
			2	1	6
			3	4	7
			4	3	8
			Mean	3.25	7.00
10	Linuron 2000 g	Sencor SC 400 mL	1	5	8
			2	1	4
			3	4	6
			4	4	8
			Mean	3.50	6.50
11	Linuron 2000 g	Linuron 1700 g	1	3	6
			2	3	5
			3	4	4
			4	4	5
			Mean	3.50	5.00
12	Untreated Control		1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 2, Capeweed and Ryegrass Control, 4/10/02**

No.	TREATMENT (Crop stage)		Rep	Number of weeds per plot	
	Post-plant, Pre-emergent	Post-emergent		LOLSS	AROCA
1	Raft 1000 mL		1	2	0
			2	0	0
			3	1	0
			4	2	0
			Mean	1.25	0.00
2	Pledge 150 g		1	4	1
			2	5	0
			3	11	1
			4	3	0
			Mean	5.75	0.50
3	Command 500 mL		1	0	1
			2	6	0
			3	3	0
			4	0	0
			Mean	2.25	0.25
4	Linuron 2000 g	Pledge 100 g	1	1	0
			2	8	2
			3	2	0
			4	3	0
			Mean	3.50	0.50
5	Linuron 2000 g	MCPA 500 mL	1	2	0
			2	4	0
			3	0	0
			4	11	0
			Mean	4.25	0.00
6	Linuron 2000 g	Goal WP 500 g	1	7	0
			2	4	3
			3	1	0
			4	1	0
			Mean	3.25	0.75
7	Linuron 2000 g	Sniper 50 g	1	7	0
			2	2	0
			3	0	0
			4	2	0
			Mean	2.75	0.00
8	Linuron 2000 g	Affinity 60 g	1	1	0
			2	5	0
			3	2	0
			4	2	0
			Mean	2.50	0.00
9	Linuron 2000 g	Raptor 45 g	1	3	0
			2	3	0
			3	0	0
			4	6	0
			Mean	3.00	0.00
10	Linuron 2000 g	Sencor SC 400 mL	1	1	0
			2	1	0
			3	1	0
			4	3	0
			Mean	1.50	0.00
11	Linuron 2000 g	Linuron 1700 g	1	0	0
			2	4	0
			3	0	0
			4	2	0
			Mean	1.50	0.00
12	Untreated Control		1	8	13
			2	7	1
			3	4	1
			4	19	1
			Mean	9.50	4.00

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 2, Barnyard Grass Control, 4/10/02**

No.	TREATMENT (Crop stage)		Rep	Number of weeds per m <sup>2</sup>						AVERAGE
	Post-plant, Pre-emergent	Post-emergent		COUNT1	COUNT2	COUNT3	COUNT4	COUNT5	COUNT6	
1	Raft 1000 mL		1	10	10	10	0	0	0	5.0
			2	10	0	0	0	30	0	6.7
			3	10	10	10	0	10	10	8.3
			4	0	0	0	20	20	0	6.7
			Mean	7.5	5.0	5.0	5.0	15.0	2.5	6.7
2	Pledge 150 g		1	80	0	0	40	40	40	33.3
			2	70	80	50	70	50	40	60.0
			3	20	20	60	40	30	30	33.3
			4	70	90	80	50	200	280	128.3
			Mean	60.0	47.5	47.5	50.0	80.0	97.5	63.8
3	Command 500 mL		1	10	0	0	0	30	10	8.3
			2	0	0	0	0	0	0	0.0
			3	0	20	0	0	10	10	6.7
			4	10	20	10	10	60	0	18.3
			Mean	5.0	10.0	2.5	2.5	25.0	5.0	8.3
4	Linuron 2000 g	Pledge 100 g	1	0	0	0	0	0	0	0.0
			2	20	0	0	10	20	0	8.3
			3	0	0	10	0	0	0	1.7
			4	10	0	10	20	10	60	18.3
			Mean	7.5	0.0	5.0	7.5	7.5	15.0	7.1
5	Linuron 2000 g	MCPA 500 mL	1	120	30	10	20	80	40	50.0
			2	30	10	0	40	40	40	26.7
			3	90	10	50	20	180	130	80.0
			4	20	0	20	10	20	20	15.0
			Mean	65.0	12.5	20.0	22.5	80.0	57.5	42.9
6	Linuron 2000 g	Goal WP 500 g	1	10	0	0	0	20	0	5.0
			2	0	0	0	0	0	0	0.0
			3	0	0	0	0	0	90	15.0
			4	10	40	10	0	0	0	10.0
			Mean	5.0	10.0	2.5	0.0	5.0	22.5	7.5
7	Linuron 2000 g	Sniper 50 g	1	50	10	90	90	70	30	56.7
			2	70	30	30	80	90	50	58.3
			3	10	0	0	10	30	20	11.7
			4	60	10	30	20	10	0	21.7
			Mean	47.5	12.5	37.5	50.0	50.0	25.0	37.1
8	Linuron 2000 g	Affinity 60 g	1	60	30	70	40	10	20	38.3
			2	30	150	10	40	30	100	60.0
			3	180	270	240	220	210	30	191.7
			4	50	60	10	90	90	200	83.3
			Mean	80.0	127.5	82.5	97.5	85.0	87.5	93.3
9	Linuron 2000 g	Raptor 45 g	1	60	50	80	40	100	130	76.7
			2	10	10	30	90	10	20	28.3
			3	10	60	150	30	180	160	98.3
			4	180	130	70	140	290	310	186.7
			Mean	65.0	62.5	82.5	75.0	145.0	155.0	97.5
10	Linuron 2000 g	Sencor SC 400 mL	1	150	20	130	20	0	0	53.3
			2	30	20	20	0	0	0	11.7
			3	0	100	30	40	20	0	31.7
			4	30	80	100	140	60	30	73.3
			Mean	52.5	55.0	70.0	50.0	20.0	7.5	42.5
11	Linuron 2000 g	Linuron 1700 g	1	50	10	30	60	10	30	31.7
			2	0	100	0	60	40	180	63.3
			3	0	10	0	0	10	0	3.3
			4	140	60	40	60	40	160	83.3
			Mean	47.5	45.0	17.5	45.0	25.0	92.5	45.4
12	Untreated Control		1	20	30	110	90	30	50	55.0
			2	120	50	30	30	10	10	41.7
			3	30	60	30	60	110	130	70.0
			4	30	80	170	190	70	120	110.0
			Mean	50.0	55.0	85.0	92.5	55.0	77.5	69.2

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 3, Crop Tolerance, 23/09/02 & 28/10/02**

No.	TREATMENT (Crop stage)		Rep	Crop Tolerance (EWRS)	
	Post-plant, Pre-emergent	Post-emergent		23/09/02	28/10/02
1	Raft 500 mL		1	6	2
			2	1	1
			3	1	1
			4	3	3
			Mean	2.75	1.75
2	Pledge 100 g		1	9	9
			2	9	9
			3	9	7
			4	9	8
			Mean	9.00	8.25
3	Command 250 mL		1	8	8
			2	6	5
			3	5	5
			4	3	1
			Mean	5.50	4.75
4	Linuron 2000 g	Pledge 100 g	1	1	2
			2	1	1
			3	3	3
			4	1	2
			Mean	1.50	2.00
5	Linuron 2000 g	MCPA 500 mL	1	1	8
			2	1	8
			3	1	8
			4	1	7
			Mean	1.00	7.75
6	Linuron 2000 g	Goal WP 500 g	1	1	3
			2	1	1
			3	2	3
			4	1	1
			Mean	1.25	2.00
7	Linuron 2000 g	Sniper 50 g	1	3	3
			2	1	1
			3	1	1
			4	1	1
			Mean	1.50	1.50
8	Linuron 2000 g	Affinity 60 g	1	1	7
			2	1	4
			3	3	7
			4	3	8
			Mean	2.00	6.50
9	Linuron 2000 g	Raptor 45 g	1	1	8
			2	1	8
			3	1	8
			4	1	8
			Mean	1.00	8.00
10	Linuron 2000 g	Sencor SC 280 mL	1	6	2
			2	3	1
			3	1	1
			4	1	1
			Mean	2.75	1.25
11	Linuron 2000 g	Gesagard 1700 mL	1	1	1
			2	1	3
			3	3	1
			4	1	1
			Mean	1.50	1.50
12	Untreated Control		1	1	1
			2	1	1
			3	1	1
			4	1	1
			Mean	1.00	1.00

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 3, Weed Control, 28/10/02**

No.	TREATMENT (Crop stage)		Rep	Number of weeds per plot					
	Post-plant, Pre-emergent	Post-emergent		AROCA	FUMSS	HELEU	SSYOR	SONAS	LITAR
1	Raft 500 mL		1	0	0	44	2	0	1
			2	0	0	88	2	0	0
			3	1	0	92	3	0	1
			4	2	0	75	2	0	0
			Mean	0.75	0.00	74.75	2.25	0.00	0.50
2	Pledge 100 g		1	0	0	1	1	0	0
			2	0	0	0	0	0	0
			3	0	0	0	0	0	0
			4	0	0	0	0	1	0
			Mean	0.00	0.00	0.25	0.25	0.25	0.00
3	Command 250 mL		1	0	0	0	0	0	0
			2	0	0	0	0	0	0
			3	1	0	3	2	0	0
			4	0	0	0	0	0	0
			Mean	0.25	0.00	0.75	0.50	0.00	0.00
4	Linuron 2000 g	Pledge 100 g	1	0	0	0	0	0	0
			2	0	0	0	0	0	0
			3	0	0	0	0	0	0
			4	0	0	0	0	0	0
			Mean	0.00	0.00	0.00	0.00	0.00	0.00
5	Linuron 2000 g	MCPA 500 mL	1	0	0	0	0	0	0
			2	0	0	14	0	0	0
			3	0	1	4	0	0	0
			4	0	0	6	0	0	0
			Mean	0.00	0.25	6.00	0.00	0.00	0.00
6	Linuron 2000 g	Goal WP 500 g	1	0	0	0	0	0	0
			2	0	0	0	0	0	0
			3	0	0	0	0	0	0
			4	0	0	0	0	0	0
			Mean	0.00	0.00	0.00	0.00	0.00	0.00
7	Linuron 2000 g	Sniper 50 g	1	0	0	1	0	0	0
			2	0	0	4	0	0	0
			3	0	0	13	0	0	0
			4	0	0	0	0	0	0
			Mean	0.00	0.00	4.50	0.00	0.00	0.00
8	Linuron 2000 g	Affinity 60 g	1	0	0	11	0	0	0
			2	0	0	1	0	0	0
			3	0	0	3	0	0	0
			4	0	0	29	0	0	0
			Mean	0.00	0.00	11.00	0.00	0.00	0.00
9	Linuron 2000 g	Raptor 45 g	1	0	0	0	0	0	0
			2	0	0	1	0	0	0
			3	0	0	1	0	0	0
			4	0	0	3	0	0	0
			Mean	0.00	0.00	1.25	0.00	0.00	0.00
10	Linuron 2000 g	Sencor SC 280 mL	1	0	0	0	0	0	0
			2	0	0	0	0	0	0
			3	0	0	0	0	0	0
			4	0	0	0	0	0	0
			Mean	0.00	0.00	0.00	0.00	0.00	0.00
11	Linuron 2000 g	Gesagard 1700 mL	1	0	0	0	0	0	0
			2	0	0	0	0	0	0
			3	0	0	0	0	0	0
			4	0	0	0	0	0	0
			Mean	0.00	0.00	0.00	0.00	0.00	0.00
12	Untreated Control		1	1	6	37	15	2	0
			2	0	15	87	9	3	5
			3	4	3	65	10	4	8
			4	4	1	38	16	5	14
			Mean	2.25	6.25	56.75	12.50	3.50	6.75

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 3, Weed Control, 28/10/02 & 3/12/02**

No.	TREATMENT (Crop stage)		Rep	Number of weeds per m <sup>2</sup>						
	Post-plant, Pre-emergent	Post-emergent		POLSS 28/10/02	POLAV 3/12/02	POLPA 3/12/02	LOLSS 28/10/02	ERAME 3/12/02	STEMLESS 28/10/02	STEMLESS 3/12/02
1	Raft 500 mL		1	0	1	0	2	2	0	0
			2	0	1	0	0	11	0	0
			3	1	2	0	2	3	0	0
			4	0	0	0	2	0	1	1
			Mean	0.25	1	0	1.50	4	0.25	0.25
2	Pledge 100 g		1	0	0	0	0	35	0	0
			2	0	0	0	0	48	0	0
			3	0	0	0	2	17	0	0
			4	0	0	0	0	25	0	0
			Mean	0.00	0	0	0.50	31.25	0.0	0.0
3	Command 250 mL		1	0	0	0	0	0	0	0
			2	0	0	0	0	1	0	0
			3	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	0
			Mean	0.00	0	0	0.00	0.25	0.00	0
4	Linuron 2000 g	Pledge 100 g	1	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	0
			Mean	0.00	0	0	0.00	0	0.00	0
5	Linuron 2000 g	MCPA 500 mL	1	0	0	0	0	35	0	0
			2	0	0	1	0	16	0	0
			3	0	0	0	0	21	0	0
			4	0	0	0	0	14	0	0
			Mean	0.00	0	0.25	0.00	21.5	0.00	0
6	Linuron 2000 g	Goal WP 500 g	1	0	0	0	0	0	0	1
			2	0	0	0	0	0	0	0
			3	1	1	0	0	2	0	0
			4	0	1	0	0	1	1	1
			Mean	0.25	0.5	0	0.00	0.75	0.25	0.5
7	Linuron 2000 g	Sniper 50 g	1	0	0	0	0	7	0	0
			2	0	0	0	0	18	0	0
			3	1	1	0	0	12	0	0
			4	0	0	0	0	7	0	0
			Mean	0.25	0.25	0	0.00	11	0.00	0
8	Linuron 2000 g	Affinity 60 g	1	0	0	0	0	8	0	0
			2	0	0	0	0	11	0	0
			3	0	0	0	0	40	0	0
			4	0	0	0	1	17	1	1
			Mean	0.00	0	0	0.25	19	0.25	0.25
9	Linuron 2000 g	Raptor 45 g	1	0	0	0	0	8	0	0
			2	0	0	0	0	26	0	0
			3	0	0	0	0	22	0	0
			4	0	0	0	0	1	1	1
			Mean	0.00	0	0	0.00	14.25	0.25	0.25
10	Linuron 2000 g	Sencor SC 280 mL	1	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	0
			Mean	0.00	0	0	0.00	0	0.00	0
11	Linuron 2000 g	Gesagard 1700 mL	1	0	0	0	1	0	0	0
			2	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	0
			4	0	0	0	1	0	0	0
			Mean	0.00	0	0	0.50	0	0.00	0
12	Untreated Control		1	4	4	1	15	mv	0	0
			2	1	3	0	6	mv	0	0
			3	8	7	3	11	mv	0	0
			4	14	14	0	7	mv	1	1
			Mean	6.75	7	1	9.75	mv	0.25	0.25

mv = missing value

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 4, Crop Vigour and Weed Cover Assessments**

No.	Post sowing pre-emergent (Product rate/ha)	Post emergent (Product rate/ha)	Rep	Crop vigour (%) 21/10/03	Weed cover (%) 21/10/03	Crop vigour (%) 20/11/03	Crop vigour (%) 9/12/03
1	Command 100 mL		1	98	55	92	88
			2	100	4	100	100
			3	100	25	100	100
			4	100	4	100	100
			Mean	99.5	22.0	98.0	97.0
2	Command 200 mL		1	100	12	98	92
			2	100	7	90	100
			3	100	15	100	100
			4	96	2	100	100
			Mean	99.0	9.0	97.0	98.0
3	Exporsan 5 L		1	100	3	100	100
			2	100	2	100	100
			3	100	1	100	100
			4	100	3	100	100
			Mean	100	2.3	100	100
4	Exporsan 10 L		1	100	2	100	100
			2	100	2	96	100
			3	100	4	100	100
			4	100	7	100	98
			Mean	100	3.8	99.0	99.5
5	Chloro IPC 4 L		1	85	5	85	90
			2	95	2	100	100
			3	96	2	100	100
			4	98	1	100	100
			Mean	93.5	2.5	96.3	97.5
6	Chloro IPC 6 L		1	60	3	98	100
			2	65	2	98	100
			3	40	10	95	100
			4	95	10	100	98
			Mean	65.0	6.3	97.8	99.5
7	Lontrel 50 mL		1	100	17	95	98
			2	100	55	88	92
			3	100	12	100	96
			4	93	1	96	96
			Mean	98.3	21.3	94.8	95.5
8	Lontrel 100 mL		1	100	12	100	98
			2	95	3	93	80
			3	98	40	60	80
			4	100	15	95	98
			Mean	98.3	17.5	87.0	89.0
9	Lontrel 200 mL		1	100	7	98	97
			2	100	20	90	70
			3	100	15	97	80
			4	100	1	92	90
			Mean	100.0	10.8	94.3	84.3
10	Sencor 280 mL		1	100	60	95	85
			2	98	10	92	92
			3	90	4	90	92
			4	98	4	98	98
			Mean	96.5	19.5	93.8	91.8
11	Linuron 2000 g	Gesagard 1700 mL	1	98	1	100	92
			2	75	1	96	98
			3	100	5	100	100
			4	98	1	100	100
			Mean	92.8	2.0	99.0	97.5
12	Untreated Control		1	100	45	95	88
			2	98	17	95	90
			3	100	40	80	85
			4	100	5	100	97
			Mean	99.5	26.8	92.5	90.0

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 4, Stinging Nettle Control, 20/11/03 and 9/12/03**

No.	Post sowing pre-emergent (Product rate/ha)	Post emergent (Product rate/ha)	Rep	Stinging nettle/m <sup>2</sup> 20/11/03	Stinging nettle control (%) 20/11/2003	Total stinging nettle per plot 9/12/03	Stinging nettle/m <sup>2</sup> 9/12/03
1	Command 100 mL		1	32	-113.3	3.0	0.4
			2	10	33.3	2.0	0.3
			3	14	6.7	4.0	0.6
			4	2	86.7	1.0	0.1
			Mean	14.5	3.3	2.5	0.4
2	Command 200 mL		1	12	20.0	2.0	0.3
			2	12	20.0	0.0	0.0
			3	12	20.0	2.0	0.3
			4	2	86.7	0.0	0.0
			Mean	9.5	36.7	1.0	0.1
3	Exporsan 5 L		1	0	100.0	0.0	0.0
			2	4	73.3	0.0	0.0
			3	0	100.0	1.0	0.1
			4	2	86.7	0.0	0.0
			Mean	1.5	90.0	0.3	0.0
4	Exporsan 10 L		1	0	100.0	0.0	0.0
			2	0	100.0	0.0	0.0
			3	2	86.7	0.0	0.0
			4	10	33.3	0.0	0.0
			Mean	3	80.0	0.0	0.0
5	Chloro IPC 4 L		1	0	100.0	0.0	0.0
			2	0	100.0	0.0	0.0
			3	0	100.0	0.0	0.0
			4	0	100.0	0.0	0.0
			Mean	0	100.0	0	0
6	Chloro IPC 6 L		1	0	100.0	0.0	0.0
			2	2	86.7	0.0	0.0
			3	0	100.0	0.0	0.0
			4	0	100.0	0.0	0.0
			Mean	0.5	96.7	0.0	0.0
7	Lontrel 50 mL		1	36	-140.0	3.0	0.4
			2	26	-73.3	7.0	1.0
			3	18	-20.0	6.0	0.9
			4	2	86.7	0.0	0.0
			Mean	20.5	-36.7	4.0	0.6
8	Lontrel 100 mL		1	24	-60.0	0.0	0.0
			2	14	6.7	0.0	0.0
			3	16	-6.7	10.0	1.4
			4	24	-60.0	4.0	0.6
			Mean	19.5	-30.0	3.5	0.5
9	Lontrel 200 mL		1	8	46.7	1.0	0.1
			2	20	-33.3	2.0	0.3
			3	10	33.3	2.0	0.3
			4	0	100.0	0.0	0.0
			Mean	9.5	36.7	1.3	0.2
10	Sencor 280 mL		1	34	-126.7	0.0	0.0
			2	8	46.7	0.0	0.0
			3	4	73.3	0.0	0.0
			4	0	100.0	0.0	0.0
			Mean	11.5	23.3	0.0	0.0
11	Linuron 2000 g	Gesagard 1700 mL	1	0	100.0	0.0	0.0
			2	0	100.0	0.0	0.0
			3	0	100.0	0.0	0.0
			4	0	100.0	0.0	0.0
			Mean	0	100.0	0	0.0
12	Untreated Control		1	20		4.0	0.6
			2	16		1.0	0.1
			3	22		10.0	1.4
			4	2		0.0	0.0
			Mean	15		3.8	0.5



**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 4, Fat hen control, 20/11/03 and 9/12/03**

No.	Post sowing pre-emergent (Product rate/ha)	Post emergent (Product rate/ha)	Rep	Fat hen/m <sup>2</sup> 20/11/03	Fat hen control (%) 20/11/03	Total fat hen per plot 9/12/03	Fat hen/m <sup>2</sup> 9/12/03	Fat hen control (%) 9/12/03
1	Command 100 mL		1	10	0.0	27.0	3.9	0.0
			2	0	100.0	0.0	0.0	100.0
			3	0	100.0	0.0	0.0	100.0
			4	0	100.0	0.0	0.0	100.0
			Mean	2.5	75.0	6.8	1.0	75.0
2	Command 200 mL		1	0	100.0	0.0	0.0	100.0
			2	4	46.7	7.0	1.0	72.8
			3	0	100.0	0.0	0.0	100.0
			4	0	100.0	0.0	0.0	100.0
			Mean	1.0	86.7	1.8	0.3	93.2
3	Exporsan 5 L		1	0	100.0	0.0	0.0	100.0
			2	0	100.0	0.0	0.0	100.0
			3	0	100.0	1.0	0.1	96.1
			4	4	46.7	0.0	0.0	100.0
			Mean	1.0	86.7	0.3	0.0	99.0
4	Exporsan 10 L		1	0	100.0	0.0	0.0	100.0
			2	0	100.0	4.0	0.6	84.5
			3	2	73.3	0.0	0.0	100.0
			4	0	100.0	0.0	0.0	100.0
			Mean	0.5	93.3	1.0	0.1	96.1
5	Chloro IPC 4 L		1	12	0.0	34.0	4.9	0.0
			2	0	100.0	5.0	0.7	80.6
			3	0	100.0	0.0	0.0	100.0
			4	0	100.0	2.0	0.3	92.2
			Mean	3.0	75.0	10.3	1.5	68.2
6	Chloro IPC 6 L		1	6	20.0	40.0	5.7	0.0
			2	6	20.0	21.0	3.0	18.4
			3	2	73.3	3.0	0.4	88.3
			4	0	100.0	0.0	0.0	100.0
			Mean	3.5	53.3	16.0	2.3	51.7
7	Lontrel 50 mL		1	10	0.0	45.0	6.4	0.0
			2	2	73.3	16.0	2.3	37.9
			3	4	46.7	7.0	1.0	72.8
			4	0	100.0	3.0	0.4	88.3
			Mean	4.0	55.0	17.8	2.5	49.8
8	Lontrel 100 mL		1	0	100.0	0.0	0.0	100.0
			2	6	20.0	12.0	1.7	53.4
			3	0	100.0	3.0	0.4	88.3
			4	0	100.0	0.0	0.0	100.0
			Mean	1.5	80.0	3.8	0.5	85.4
9	Lontrel 200 mL		1	4	46.7	0.0	0.0	100.0
			2	2	73.3	10.0	1.4	61.2
			3	6	20.0	15.0	2.1	41.7
			4	0	100.0	1.0	0.1	96.1
			Mean	3.0	60.0	6.5	0.9	74.8
10	Sencor 280 mL		1	2	73.3	21.0	3.0	18.4
			2	8	0.0	14.0	2.0	45.6
			3	6	20.0	18.0	2.6	30.1
			4	0	100.0	4.0	0.6	84.5
			Mean	4.0	48.3	14.3	2.0	44.7
11	Linuron 2000 g	Gesagard 1700 mL	1	0	100	0.0	0.0	100.0
			2	0	100	0.0	0.0	100.0
			3	0	100	0.0	0.0	100.0
			4	0	100	0.0	0.0	100.0
			Mean	0.0	100	0.0	0.0	100.0
12	Untreated Control		1	22		68.0	9.7	
			2	4		30.0	4.3	
			3	2		0.0	0.0	
			4	2		5.0	0.7	
			Mean	7.5	0.0	25.8	3.7	0.0

**Appendices (Cont.)**

**Appendix iii - Complete Data (Cont.)**

**Site 4, Sow thistle control, 09/12/03**

No.	Post sowing pre-emergent (Product rate/ha)	Post emergent (Product rate/ha)	Rep	Total sow thistle per plot 9/12/03	Sow thistle/m <sup>2</sup> 9/12/03
1	Command 100 mL		1	0.0	0.0
			2	0.0	0.0
			3	0.0	0.0
			4	0.0	0.0
			Mean	0.0	0.0
2	Command 200 mL		1	0.0	0.0
			2	0.0	0.0
			3	0.0	0.0
			4	0.0	0.0
			Mean	0.0	0.0
3	Exporsan 5 L		1	4.0	0.6
			2	2.0	0.3
			3	0.0	0.0
			4	1.0	0.1
			Mean	1.8	0.3
4	Exporsan 10 L		1	0.0	0.0
			2	1.0	0.1
			3	2.0	0.3
			4	2.0	0.3
			Mean	1.3	0.2
5	Chloro IPC 4 L		1	7.0	1.0
			2	4.0	0.6
			3	0.0	0.0
			4	2.0	0.3
			Mean	3.3	0.5
6	Chloro IPC 6 L		1	3.0	0.4
			2	2.0	0.3
			3	2.0	0.3
			4	6.0	0.9
			Mean	3.3	0.5
7	Lontrel 50 mL		1	4.0	0.6
			2	2.0	0.3
			3	8.0	1.1
			4	0.0	0.0
			Mean	3.5	0.5
8	Lontrel 100 mL		1	3.0	0.4
			2	1.0	0.1
			3	7.0	1.0
			4	5.0	0.7
			Mean	4.0	0.6
9	Lontrel 200 mL		1	6.0	0.9
			2	8.0	1.1
			3	3.0	0.4
			4	0.0	0.0
			Mean	4.3	0.6
10	Sencor 280 mL		1	6.0	0.9
			2	3.0	0.4
			3	2.0	0.3
			4	2.0	0.3
			Mean	3.3	0.5
11	Linuron 2000 g	Gesagard 1700 mL	1	0.0	0.0
			2	0.0	0.0
			3	0.0	0.0
			4	0.0	0.0
			Mean	0.0	0.0
12	Untreated Control		1	22.0	3.1
			2	10.0	1.4
			3	9.0	1.3
			4	3.0	0.4
			Mean	11.0	1.6

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 5, Crop vigour, 21/01/04**

No.	Post-sowing pre-emergent (Product rate/ha)	Post-emergent (Product rate/ha)	Rep	Crop vigour (%) 21/01/04	Weed cover (%) 21/01/04	Reduction in weed vigour (%) 21/01/04
1	Command 100 mL		1	95	90	0
			2	98	97	0
			3	95	70	0
			4	80	100	0
			Mean	92.00	89.25	0
2	Command 200 mL		1	96	85	70
			2	100	85	80
			3	92	40	60
			4	100	90	60
			Mean	97.00	75.00	67.50
3	Exporsan 5 L		1	98	98	0
			2	100	100	0
			3	95	100	0
			4	98	100	0
			Mean	97.75	99.50	0
4	Exporsan 10 L		1	100	100	0
			2	85	100	0
			3	98	60	0
			4	50	100	0
			Mean	83.25	90.00	0
5	Chloro IPC 4 L		1	90	90	0
			2	98	99	0
			3	40	100	0
			4	100	99	0
			Mean	82.00	97.00	0
6	Chloro IPC 6 L		1	98	95	15
			2	90	85	25
			3	100	98	40
			4	85	85	30
			Mean	93.25	90.75	27.50
7		Lontrel 50 mL	1	95	98	0
			2	100	100	0
			3	88	100	0
			4	40	100	0
			Mean	80.75	99.50	0
8		Lontrel 100 mL	1	95	100	0
			2	50	100	0
			3	40	100	0
			4	90	100	0
			Mean	68.75	100.00	0
9		Lontrel 200 mL	1	100	97	0
			2	85	100	0
			3	85	100	0
			4	96	98	0
			Mean	91.50	98.75	0
10		Sencor 280 mL	1	95	98	0
			2	100	100	0
			3	85	98	0
			4	60	99	0
			Mean	85.00	98.75	0
11	Linuron 2000 g	Gesagard 1700 mL	1	100	95	30
			2	98	95	40
			3	100	92	10
			4	94	90	0
			Mean	98.00	93.00	20.00
12	Untreated control	Untreated	1	90	100	0
			2	60	100	0
			3	75	100	0
			4	94	100	0
			Mean	79.75	100.00	0

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 6, Crop vigour(emergence %) and weed cover, 8/04/04**

No.	Post-sowing pre-emergent	Post-emergent	Rep	Crop vigour (emergence %) 8/04/04	Weed cover (%) 8/04/04
1	Command 100 mL/ha		1	98	5
			2	92	7
			3	70	2
			4	94	2
			Mean	88.50	4.00
2	Command 200 mL/ha		1	60	6
			2	75	0.5
			3	94	2
			4	88	1
			Mean	79.25	2.38
3	Command 300 mL/ha		1	50	1
			2	99	10
			3	88	5
			4	98	4
			Mean	83.75	5.00
4	Command 400 mL/ha		1	65	1
			2	88	0.5
			3	10	0.5
			4	30	2
			Mean	48.25	1.00
5	Exporsan 10 L/ha		1	85	1
			2	40	0.5
			3	88	1
			4	35	2
			Mean	62.00	1.13
6	Chloro IPC 6 L/ha		1	96	8
			2	40	2
			3	45	0.5
			4	96	1
			Mean	69.25	2.88
7	Linuron 2000 g	Sencor 280 mL/ha	1	20	0.5
			2	96	1
			3	80	1
			4	95	0.5
			Mean	72.75	0.75
8	Linuron 2000 g	Sencor 400 mL/ha	1	60	1
			2	15	0.5
			3	40	0.5
			4	92	0.5
			Mean	51.75	0.63
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	1	98	2
			2	20	1
			3	90	1
			4	88	3
			Mean	74.00	1.75
10	UTC		1	90	8
			2	30	5
			3	96	7
			4	95	3
			Mean	77.75	5.75

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 6, Crop vigour and weed control, 27/04/04**

No.	Post-sowing pre-emergent	Post-emergent	Rep	Crop vigour (%)	Weed cover (%)	Heliotrope per m <sup>2</sup>	Sow thistle per m <sup>2</sup>	Milk thistle per m <sup>2</sup>	Wire weed per m <sup>2</sup>	Capeweed per m <sup>2</sup>
1	Command 100 mL/ha		1	88	10	8.0	0.8	1.0	0.8	0.5
			2	88	18	7.0	0.2	0.2	0.3	1.7
			3	80	3	5.2	0.2	0.0	0.5	0.2
			4	85	3	2.0	0.0	0.0	0.0	0.5
			Mean	85.25	8.50	5.5	0.3	0.3	0.4	0.7
2	Command 200 mL/ha		1	65	2	3.5	0.3	0.0	0.0	0.0
			2	60	1	1.3	0.0	0.0	0.3	0.0
			3	92	2	0.5	0.0	0.0	0.0	0.2
			4	70	1	0.2	0.0	0.0	0.2	0.2
			Mean	71.75	1.50	1.4	0.1	0.0	0.1	0.1
3	Command 300 mL/ha		1	40	1	0.7	0.2	0.2	0.0	0.0
			2	100	9	0.7	0.0	0.0	0.0	4.3
			3	90	3	0.0	0.0	0.0	0.0	0.0
			4	100	2	0.2	0.0	0.0	0.2	0.2
			Mean	82.50	3.75	0.4	0.0	0.0	0.0	1.1
4	Command 400 mL/ha		1	60	2	0.5	0.0	0.0	0.2	0.2
			2	80	1	0.0	0.0	0.0	0.0	0.2
			3	5	0	0.0	0.0	0.0	0.0	0.0
			4	10	3	0.0	0.5	0.0	0.2	0.0
			Mean	38.75	1.50	0.1	0.1	0.0	0.1	0.1
5	Exporsan 10 L/ha		1	76	3	0.0	0.7	1.0	0.5	0.2
			2	20	1	1.0	0.3	0.3	0.2	0.0
			3	25	11	0.3	0.2	0.0	6.0	0.0
			4	20	4	0.3	0.2	0.0	2.3	0.0
			Mean	35.25	4.75	0.4	0.3	0.3	2.3	0.0
6	Chloro IPC 6 L/ha		1	85	6	3.5	1.5	1.7	0.0	2.8
			2	40	14	7.0	1.8	2.5	0.0	1.0
			3	15	7	4.0	1.2	0.0	0.0	0.0
			4	87	2	3.2	0.3	0.0	0.2	0.2
			Mean	56.75	7.25	4.4	1.2	1.0	0.0	1.0
7	Linuron 2000 g	Sencor 280 mL/ha	1	15	1	0.0	0.0	0.0	0.0	0.0
			2	55	1	0.0	0.0	0.0	0.3	0.0
			3	15	2	0.0	0.0	0.0	0.0	0.0
			4	84	0	0.0	0.0	0.0	0.0	0.0
			Mean	42.25	1.00	0.0	0.0	0.0	0.1	0.0
8	Linuron 2000 g	Sencor 400 mL/ha	1	20	0	0.0	0.0	0.0	0.0	0.0
			2	10	1	0.0	0.0	0.0	0.0	0.0
			3	10	0	0.0	0.0	0.0	0.0	0.0
			4	15	0	0.0	0.0	0.0	0.0	0.0
			Mean	13.75	0.25	0.0	0.0	0.0	0.0	0.0
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	1	70	1	0.0	0.0	0.0	0.2	0.0
			2	20	0	0.0	0.0	0.0	0.0	0.0
			3	88	1	0.0	0.0	0.0	0.0	0.0
			4	25	1	0.0	0.0	0.0	0.0	0.0
			Mean	50.75	0.75	0.0	0.0	0.0	0.0	0.0
10	UTC		1	89	20	7.5	3.7	3.5	2.2	0.5
			2	40	12	8.2	5.2	0.2	0.7	0.2
			3	98	15	15.7	1.3	0.2	2.7	0.5
			4	93	15	14.5	0.3	0.3	2.3	0.5
			Mean	80.00	15.50	11.5	2.6	1.0	2.0	0.4

\* Note: data for milk thistle and capeweed not included in the report due to low populations

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 6, Weed control compared to the untreated control, 27/04/04**

No.	Post-sowing pre-emergent	Post-emergent	Rep	Heliotrope control (%)	Sow thistle control (%)	Wire weed control (%)
1	Command 100 mL/ha		1	30.2	68.3	57.4
			2	38.9	93.7	83.0
			3	54.9	93.7	74.5
			4	82.5	100.0	100.0
			Mean	51.6	88.9	78.7
2	Command 200 mL/ha		1	69.5	87.3	100.0
			2	88.4	100.0	83.0
			3	95.6	100.0	100.0
			4	98.5	100.0	91.5
			Mean	88.0	96.8	93.6
3	Command 300 mL/ha		1	94.2	93.7	100.0
			2	94.2	100.0	100.0
			3	100.0	100.0	100.0
			4	98.5	100.0	91.5
			Mean	96.7	98.4	97.9
4	Command 400 mL/h		1	95.6	100.0	91.5
			2	100.0	100.0	100.0
			3	100.0	100.0	100.0
			4	100.0	81.0	91.5
			Mean	98.9	95.2	95.7
5	Exporsan 10 L/ha		1	100.0	74.6	74.5
			2	91.3	87.3	91.5
			3	97.1	93.7	-206.4
			4	97.1	93.7	-19.1
			Mean	96.4	87.3	0.0
6	Chloro IPC 6 L/ha		1	69.5	42.9	100.0
			2	38.9	30.2	100.0
			3	65.1	55.6	100.0
			4	72.4	87.3	91.5
			Mean	61.5	54.0	97.9
7	Linuron 2000 g	Sencor 280 mL/ha	1	100.0	100.0	100.0
			2	100.0	100.0	83.0
			3	100.0	100.0	100.0
			4	100.0	100.0	100.0
			Mean	100.0	100.0	95.7
8	Linuron 2000 g	Sencor 400 mL/ha	1	100.0	100.0	100.0
			2	100.0	100.0	100.0
			3	100.0	100.0	100.0
			4	100.0	100.0	100.0
			Mean	100.0	100.0	100.0
9	Linuron 2000 g	Gesagard 400 L + Linuron 400 g	1	100.0	100.0	91.5
			2	100.0	100.0	100.0
			3	100.0	100.0	100.0
			4	100.0	100.0	100.0
			Mean	100.0	100.0	97.9
10	UTC		1			
			2			
			3			
			4			
			Mean	0.0	0.0	0.0

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 6, Crop vigour 27/05/04 and 22/06/04 and weed cover 27/05/04**

No.	Post-sowing pre-emergent	Post-emergent	Crop vigour (%) 27/05/04	Weed cover (%) 27/05/04	Crop vigour (%) 22/06/04
1	Command 100 mL/ha		85	7	75
			98	60	99
			70	4	65
			90	1	90
			85.75	18.00	82.25
2	Command 200 mL/ha		75	1	75
			90	1	90
			94	1	92
			80	2	85
			84.75	1.25	85.50
3	Command 300 mL/ha		55	1	55
			100	30	100
			98	1	97
			100	0	100
			88.25	8.00	88.00
4	Command 400 mL/ha		65	2	80
			100	1	99
			10	2	5
			8	3	10
			45.75	2.00	48.50
5	Exporsan 10 L/ha		85	3	87
			40	3	40
			65	8	80
			45	7	60
			58.75	5.25	66.75
6	Chloro IPC 6 L/ha		92	15	89
			70	15	88
			35	5	30
			80	1	75
			69.25	9.00	70.50
7	Linuron 2000 g	Sencor 280 mL/ha	40	2	35
			97	0	97
			60	0	60
			94	0	99
			72.75	0.50	72.75
8	Linuron 2000 g	Sencor 400 mL/ha	45	0	40
			25	0	45
			45	1	55
			60	0	60
			43.75	0.25	50.00
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	90	1	85
			35	2	30
			96	1	98
			40	1	80
			65.25	1.25	73.25
10	UTC		98	-	92
			70	-	85
			100	-	100
			99	-	95
			91.75	-	93.00

\* The untreated control was hand-weed on 27/04/04, therefore weed control assessments for the untreated control were not conducted after this date

**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 6, Crop yield at harvest 22/09/04**

No.	PSPE	Post em	No of Marketable carrots/ha	Wt. of Marketable carrots/ha	No of unmarketable carrots/ha	Wt of unmarketable carrots/ha	Total number of carrots/ha	Total wt. Of carrots /ha	Wt per 100 carrots
1	Command 100 mL/ha		216645	18887	99990	3333	316635	22220	7.0
			233310	19998	16665	1111	249975	21109	8.4
			127765	8888	105545	3333	233310	12221	5.2
			288860	32219	16665	555.5	305525	32774.5	10.7
			216645	19998	59716.25	2083.125	276361.25	22081.13	7.9
2	Command 200 mL/ha		211090	16109.5	33330	2222	244420	18331.5	7.5
			272195	25553	33330	1666.5	305525	27219.5	8.9
			244420	21664.5	55550	2777.5	299970	24442	8.1
			277750	19998	61105	2777.5	338855	22775.5	6.7
			251363.75	20831.25	45828.75	2360.875	297192.5	23192.13	7.8
3	Command 300 mL/ha		133320	12221	27775	1111	161095	13332	8.3
			449955	33330	38885	2777.5	488840	36107.5	7.4
			266640	29441.5	38885	2222	305525	31663.5	10.4
			344410	34441	83325	2777.5	427735	37218.5	8.7
			298581.25	27358.38	47217.5	2222	345798.75	29580.38	8.7
4	Command 400 mL/ha		144430	18331.5	16665	1111	161095	19442.5	12.1
			322190	34996.5	11110	555.5	333300	35552	10.7
			22220	1111	0	0	22220	1111	5.0
			111100	7777	11110	0	111100	7777	7.0
			149985	15554	9721.25	416.625	156928.75	15970.63	8.7
5	Exporsan 10 L/ha		277750	29997	16665	1666.5	294415	31663.5	10.7
			199980	17220.5	0	0	199980	17220.5	8.6
			266640	18331.5	83325	2222	349965	20553.5	5.9
			183315	11110	61105	2222	244420	13332	5.5
			231921.25	19164.75	40273.75	1527.625	272195	20692.4	7.3
6	Chloro IPC 6 L/ha		172205	11665.5	5555	555.5	177760	12221	6.9
			149985	14443	5555	555.5	155540	14998.5	9.6
			99990	4444	111100	3333	211090	7777	3.7
			327745	23331	66660	2222	394405	25553	6.5
			187481.25	13470.88	47217.5	1666.5	234698.75	15137.38	6.7
7	Linuron 2000 g/ha	Sencor 280 mL/ha	94435	6666	33330	1111	127765	7777	6.1
			322190	34441	27775	1666.5	349965	36107.5	10.3
			294415	25553	33330	1666.5	327745	27219.5	8.3
			366630	36663	38885	1666.5	405515	38329.5	9.5
			269417.5	25830.75	33330	1527.625	302747.5	27358.38	8.5
8	Linuron 2000 g/ha	Sencor 400 mL/ha	166650	10554.5	66660	1666.5	233310	12221	5.2
			138875	10554.5	38885	1666.5	177760	12221	6.9
			166650	13887.5	77770	2777.5	244420	16665	6.8
			299970	21109	72215	2777.5	372185	23886.5	6.4
			193036.25	14026.38	63882.5	2222	256918.75	16248.38	6.3
9	Linuron 2000 g	Gesagard 400 mL + Linuron 400 g	333300	29997	16665	555.5	349965	30552.5	8.7
			188870	13887.5	0	0	188870	13887.5	7.4
			377740	31108	55550	2222	433290	33330	7.7
			199980	13332	38885	1666.5	238865	14998.5	6.3
			274972.5	22081.13	27775	1111	302747.5	23192.13	7.5
10	UTC		227755	19998	33330	1666.5	261085	21664.5	8.3
			161095	11110	27775	555.5	188870	11665.5	6.2
			355520	38329.5	38885	2222	394405	39996	10.1
			349965	29441.5	55550	1666.5	405515	31108	7.7
			273583.75	24719.75	38885	1527.625	312468.75	26247.38	8.1



**Appendices (Cont.)****Appendix iii - Complete Data (Cont.)****Site 6, Weed cover 22/09/04**

No.	PSPE	Post em	% weed cover
1	Command 100 mL/ha		70
			95
			98
			55
			79.50
2	Command 200 mL/ha		85
			40
			45
			25
			48.75
3	Command 300 mL/ha		90
			100
			15
			7
			53.00
4	Command 400 mL/h		20
			50
			95
			100
			66.25
5	Exporsan 10 L/ha		70
			100
			95
			88
			88.25
6	Chloro IPC 6 L/ha		80
			80
			70
			90
			80.00
7	Linuron 2000 g	Sencor 280 mL/ha	20
			5
			20
			5
			12.50
8	Linuron 2000 g	Sencor 400 mL/ha	5
			10
			5
			15
			8.75
9	Linuron 2000 g	Gesagard 400 + Linuron 400	40
			50
			30
			95
			53.75
10	UTC		90
			70
			70
			85
			78.75

## **Appendices (Cont.)**

### ***Appendix iv - Acknowledgments***

The assistance of Lammatina & Sons, Ben Kelly and John Cochrane, who provided trial sites, is gratefully acknowledged.

Serve-Ag staff who contributed to this project included Matt Sherriff, Lauren O'Connor, Greg Barnes, Mary Trebilco, Ian Macleod, Tim Hingston and Sarah Lamprey.