Final Report Chicory Herbicide Trial

by
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BUREAU OF SUGAR EXPERIMENT STATIONS
QUEENSLAND, AUSTRALIA

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BSES Project Number	2212
Project Title	Chicory herbicide assessment
Research Organisation	Bureau of Sugar Experiment Stations
Chief Investigator	Mr Julian Collins, Extension Officer, BSES, Bundaberg
Project Duration	December 2001 to March 2002
Project Objectives	To identify herbicides for controlling weeds in Australian chicory crops

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1.0 Introduction

Chicory is currently a commercially cultivated root crop mainly grown in Belgium. Small areas of Chicory for Whitlof production are grown in Australia mainly in the state of Victoria. The objective of this project was to identify potential herbicides for controlling a broad range of weed species found in Bundaberg District. Currently in Australia Trifluralin is the only herbicide registered for use on Chicory in Victoria. This project was conducted with the cooperation of the Queensland Department of Primary Industry. The herbicide treatments were applied to an area of a irrigation trial conducted on the Department of Primary Industry's research farm, Ashfield Rd Bundaberg. Herbicides were selected according to the spectrum of weeds controlled and the probability of crop damage. All the herbicides used were currently registered in Australia for the control of certain weeds in other crops. Crop damage and weed control were assessed to identify suitable herbicides.

2.0 Trial Details

Location: DPI Research Station, Ashfield Road, Bundaberg

Soil Type: Red Ferrosol (Australian soil classification), Euchrozem (great soil group)

Soil Description: Red light to light medium clay A horizon over neutral to alkaline red, light to light medium clay to 1.5 m.

Planting Date: 13 December 2001

Treatments:

1. Control – No herbicide, weeds chipped.
2. Broadstrike® 10 g/ha and Kerb® 0.5 L/ha at cotyledon stage then once a week for two weeks.
3. Triflan® 3 L/ha during last groud preparation and pre planting.
4. Triflan® 1.5 L/ha during last ground preparation and pre planting.
5. Treatment 3 plus and 20 g/ha Broadstrike® at first weed germination.
6. Treatment 4 plus Dual Gold® 200 ml/ha and 20 g/ha Broadstrike® at two leaf stage.
7. Treatment 2 until 4 leaf stage then Dual Gold® at 400 ml/ha plus 20 g/ha Broadstrike®.
8. Treatment 2 until 6 leaf stage then Dual Gold® at 600 ml/ha plus 20 g/ha Broadstrike®.

9a. Treatment 2 plus Sempra® at 100 g/ha on active growing nut grass.

9b. Treatment 2 plus Sempra® at 50 g/ha on active growing nut grass.

10. Treatment 3 plus Spinnaker® at 0.4 L/ha when broadleaf weeds at less than 3 leaf stage and nut grass actively growing.
11. Treatment 3 plus Spinnaker® at L/ha when broadleaf weeds at less than 3 leaf stage and nut grass actively growing.

Note: Active constituent descriptions Appendix 1.

Application Method: Treatments were applied with 200 L/ha water at 2 bar pressure (200 kpa) with the BSES motorised small plot sprayer. The Dual Gold®, Broadstrike® and Spinnaker® treatments were irrigated within 3 days of application.

Table 1. Treatment Application Dates

Date	Treatment Number	Crop Stage	Treatment
12/12/01	3, 5, 10, 11	Preplant	3 L/ha Treflan®
12/12/01	4 & 6	Preplant	1.5 L/ha Treflan®
19/12/01	2, 7, 8, 9	Cotyledon	10 g/ha Broadstrike® + 500 ml/ha Kerb®
26/12/01	5	2 Leaf	20 g/ha Broadstrike®
26/12/01	10	2 Leaf	400 ml/ha Spinnaker®
26/12/01	11	2 Leaf	200 ml/ha Spinnaker®
26/12/01	6	2 Leaf	200 ml/ha Dual Gold®+ 20 g/ha Broadstrike
26/12/01	2 & 9	2 Leaf	10 g/ha Broadstrike® + 500 ml/ha Kerb®
3/1/02	2 & 9	4 Leaf	10 g/ha Broadstrike® + 500 ml/ha Kerb®
3/1/02	7	4 Leaf	400 ml/ha Dual Gold®+ 20 g/ha Broadstrike®
9/1/02	8	6 Leaf	600 ml/ha Dual Gold® + 20 g/ha Broadstrike®
12/2/02	9a & 9b		100 & 50 g/ha Sempra®

3.0 Trial Design:

Treat 2 Cotyledon + once week for 2 weeks Broadstrike® 10 g/ha (0.1 g) + Kerb® 500 ml/ha (6.1 ml)	**Treat 7** At Cotyledon Broadstrike® 10 g/ha + Kerb® 500 ml/ha Then chicory at 4 leaf stage Dual Gold® 400 ml/ha (4.9 ml) + Broadstrike® 20 g/ha (0.2) g)	Control Chipped Treat 1	**Treat 3** Treflan® 3 L/ha	**Treat 10** Treflan® 3 L/ha Weeds less than 3 leaf Spinnaker® 400 ml/ha (4.9 ml)	**Treat 4** Treflan® 1.5 L/ha
Treat 9 Cotyledon + one week for 2 weeks Broadstrike® 10 g/ha + Kerb® 500 ml/ha Nut grass actively growing Sempra® at 100 g/ha and 50 g/ha	**Treat 8** At Cotyledon Broadstrike® 10 g/ha + Kerb® 500 ml/ha Chicory at 6 leaf stage Dual Gold® 600 ml/ha (7.3 ml) Broadstrike® 20 g/ha (0.2 g)	Control Chipped Treat 1	**Treat 5** Treflan® 3 L/ha Weeds less than 3 leaf Broadstrike® 20 g/ha (0.2 g)	**Treat 11** Treflan® 3 L/ha Weeds less than 3 leaf Spinnaker® 200 ml/ha (2.4 ml)	**Treat 6** Treflan® 1.5 L/ha When chicory at 2 leaf Dual Gold® 200 ml/ha (2.4 ml) + Broadstrike® 20 g/ha (0.2 g)

Headland

North

Plot size: 6 rows at 45 cm = 2.7m wide by 25 m long

4.0 Weather conditions

During December 2001 and January 2002 the weather in Bundaberg was quite warm humid with some intense rainfall (Table 2 & 3). The application of herbicides was restricted to periods when weather conditions permitted.

Table 2. Weather Conditions when herbicide treatments were applied.

Date	Max Temp (degrees C)	Min Temp (degrees C)	Relative Humidity (%)	Cloud Amount (0-10)
12/12/01	35	23	43	7
19/12/01	28	18	75	10
26/12/01	33	22	-	-
3/1/02	33	23	73	2
9/1/02	33	22	65	6
12/2/02	33	18	72	4

Table 3. Rainfall during trial

Date	Mm
16/12/01	17
17/12/01	12
26/12/01	2.6
31/12/01	32
1/01/02	28
3/01/02	8
6/01/02	58
8/01/02	5
13/01/02	2
16/01/02	22
17/01/02	4
5/2/02/02	7
10/02/02	22

5.0 Results:

1. Plant Counts

The trial suffered germination problems due to intense rainfall immediately after planting followed by an extended period of hot dry windy weather. Approximately 40% of the seed planted established into plants. Plant counts before and after herbicide applications were made to assess plant mortality due to the herbicide treatments. Two rows 25 m long were counted before and every week after spraying. The results are presented in Table 4.

Table 4. Chicory Plant Counts Per 25 m of Row

Treat	Row	26/12/01	7/1/02	14/1/02	24/1/02	1/2/02	11/2/02	1/3/02	% change 26/12 to 1/3
1	1	86	87	87	88	87	86	82	-5
Control	2	105	111	112	110	109	109	103	-2
	3	43	42	44	43	43	55	49	+14
	4	28	27	26	28	28	33	28	0
2	1	76	76	77	77	78	81	80	+5
	2	91	91	92	92	93	83	85	-7
3	1	19	18	17	18	18	16	19	0
	2	39	38	37	39	39	38	36	-8
4	1	42	40	42	43	43	43	42	0
	2	55	55	56	56	56	57	53	-4
5	1	98	98	99	99	99	97	85	-13
	2	69	68	69	69	70	71	68	-1
6	1	35	35	34	32	32	33	34	-3
	2	23	22	20	21	22	22	23	0
7	1	116	115	115	113	113	108	104	-10
	2	126	125	123	120	120	118	113	-10
8	1	84	85	85	85	85	73	72	-14
	2	92	93	95	103	100	95	85	-8
9	1	79	84	86	86	87	81	89	+12
	2	68	69	69	70	70	67	67	-3
10	1	29	30	31	31	31	27	25	-7
	2	39	39	42	42	43	42	43	+10
11	1	38	39	39	40	40	40	39	+1
	2	19	19	21	20	20	21	23	+21

The plant counts vary widely both within and across the herbicide treatments. None of the herbicide treatments caused any substantial plant death. Treatments 5, 7 and 8 had higher plant mortality than the control however plant death does not correspond with the herbicide applications. The poor germination made it difficult to measure the effect of the Treflan® treatments (3, 4, 5, 6, 10, 11) on chicory germination. However these treatments have similar plant counts compared to the untreated control.

2. Weed Control and Crop Damage Assessment

Each treatment was visually assessed for crop damage and herbicide efficacy.

Weeds present in the trial area.

Dicots

- Sida ritusa (*Sida rhombifolia*)
- Bell Vine (*Ipomoea plebeia*)
- Morning Glory (*Ipomoea purpurea*)
- Pigweed (*Portulaca oleracea*)
- Blackberry Nightshade (*Solanum nigrum*)
- Mexican Poppie (*Argenome ochroleuca*)
- Cobbler's Pegs (*Bidens pilosa*)

Monocots

- Barnyard Grass (*Echinochloa sp*)
- Summer Grass (*Digitaria ciliaris*)
- Green Summer Grass (*Brachiaria subquadripara*)
- Crowsfoot Grass (*Eleusine indica*)
- Nut Grass (*Cyperus rotundus*)

Treatment 2 Broadstrike® 10 g/ha and Kerb® 0.5 L/ha at cotyledon stage then once a week for two weeks.
Comments: Ipomoea sp, Sida Ritusa and Blackberry Nightshade suppressed during spraying but recovered quickly. No control of Nut Grass or monocots.
Crop damage: No visual crop damage.

Treatment 3 Treflan® 3 L/ha during last group preparation and pre planting.
Comments : Good control of monocots but no control of Nut Grass or dicot weeds.
Crop damage: No visual crop damage.

Treatment 4 Treflan® 1.5 L/ha during last ground preparation and pre planting.
Comments: No control of dicot weeds and Nut Grass, acceptable grass control, some Crowsfoot Grass.
Crop damage: No visual crop damage.

Treatment 5 Treatment 3 plus and 20 g/ha Broadstrike® at first weed germination
Comments: Sida Ritusa, Bell Vine and Cobbler's Pegs stunted, no control of monocots or Nut Grass
Crop damage: No visual crop damage.

Treatment 6 Treatment 4 plus Dual Gold® at 200 ml/ha and 20 g/ha Broadstrike® at two leaf stage.
Comments: Good control of both monocot and dicot weeds no effect on Nut

Treatment 7 Treatment 2 until 4 leaf stage then Dual Gold® 400 ml/ha plus 20 g/ha Broadstrike®.
Comments: No weed control.
Crop damage: No visual crop damage.

Treatment 8 Treatment 2 until 6 leaf stage then Dual Gold® at 600 ml/ha plus 20 g/ha Broadstrike®.
Comments: No weed control.
Crop damage: No visual crop damage.

Treatment 9a Treatment 2 plus Sempra® at 100 g/ha on active growing Nut Grass.
Comments: Nut Grass and Pigweed controlled but other monocot and dicot weeds were not controlled.
Crop damage: Slight leaf necrosis but plant recovered.

Treatment 9b Treatment 2 plus Sempra® at 50 g/ha on active growing Nut Grass.
Comments: Some yellowing in nutgrass but no control of other monocot and dicot weeds.
Crop damage: Slight leaf necrosis but plants recovered.

Treatment 10 Treatment 3 plus Spinnaker® at 0.4 L/ha when broadleaf weeds at less than 3 leaf stage and nut grass actively growing.
Comments: Nutgrass stunted and yellow, *Ipomea sp* stunted good control of monocots.
Crop damage: No visual crop damage.

Treatment 11 Treatment 3 plus Spinnaker® @ 0.2 l/ha when broad leaf weeds at less than 3 leaf stage and nut grass actively growing.
Comments: Nutgrass stunted and yellow, *Ipomea sp* stunted, good control of monocots
Crop damage: No visual crop damage.

6.0 Summary

The poor crop germination made measuring the effect of herbicide treatments on chicory growth difficult. Visual crop damage and weed control assessments indicate that:-

- The Treflan® at 1.5 and 3 L/ha treatments provided good control of monocots with no visual damage to the crop. Plant count results indicate that it had no effect on chicory germination. Further trials are needed to be certain of this result. This herbicide is cheap and widely used on other crops.
- Spinnaker® treatments provided good control of dicots and Nut Grass without any visual crop damage. This herbicide is used in legume field crops such as peanuts, soybeans and field peas.
- The 100 g/ha rate of Sempra® controlled the Nut Grass but caused slight leaf necrosis to the Chicory, the crop appeared to quickly recover. The 50g/ha rate only suppressed the nut grass and caused slight leaf necrosis. Chicory appears to be susceptible to this herbicide but yield reduction may be minor.
- Dual Gold®, Broadstrike® and Kirb® treatments were not effective at controlling monocot weeds and only suppressed the dicot weeds during the spray period. These weeds quickly recovered after spraying ceased. The Dual Gold®,

Appendix 1. Active Ingredients

Commercial Name	Active Constituent
Broadstrike®	800 g/kg Flumetsulam
Kerb®	500 g/kg Propyzamide
Treflan®	480 g/L Trifluralin
Sempra®	750 g/kg Halosulfuron – Methyl
Dual Gold®	960 g/L S-Metolachlor
Spinnaker®	240 g/L Imazethapyr