A REPORT TO THE HORTICULTURAL DEVELOPMENT COUNCIL
18 LAVANT STREET, PETERSFIELD, HANTS, GU32 3EW

LETTUCE: EVALUATION OF HERBICIDES AND THEIR OPTIMAL TIMING (FV118)

PART 1

ANNUAL REPORT

Project Number:	FV118 (C382)
Project Title:	Lettuce: Evaluation of herbicides and their optimal timing.
Project Leader:	Julian Davies
Location of Project:	Horticulture Research International Stockbridge House Cawood Selby North Yorkshire YO8 0TZ Tel: 0757 268275 Fax: 0757 268996
Project Coordinators:	Peter Barton and David Barney
Report Date:	October 1993
Date Project Commenced:	May 1993
Date Completion Due:	November 1993
Key Words:	Lettuce, herbicides, weed control

Contents

Authentication

I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

Signature .....J S Davies.....

Julian Davies
Project Leader

Date ....29.10.93.....

Report authorised by .....M R Bradley...
(signature)

M R Bradley
Head of Station
HRI Stockbridge House
Cawood
Selby
North Yorkshire
YO8 0TZ

Date ....1.11.93.....

Relevance to Growers and Practical Application

Application

A trial was carried out establish the effect of a range of herbicides on weed control and crop yield for summer planted crisp lettuce.

At harvest in late July there were few differences in maturity with the only significant delay being where Ramrod Flo plus Treflan applied pre-planting had been used. Ramrod Flo plus Kerb, CIPC and Sovereign plus Ramrod gave high Class I yields and good weed control.

Background and Objective

Weed control in lettuce is restricted by the small number of products currently approved for use on the crop. This project was set up at the request of growers to identify the best weed control programmes and to explore the potential for pre and post-planting applications of Ramrod Flo, Tribunil and Sovereign.

Summary

Lettuce were planted on 26 May following pre-planting herbicide applications. Post-planting applications were made on 28 May.

Early crop vigour was generally similar for all treatments but was reduced where Ramrod Flo plus Treflan had been applied pre-planting and where Sovereign had been used post-planting. By the first harvest all treatments had similar vigour.

By late June weed control was similar for all chemical treatments and significantly better than the handweeded control which was not weeded until early July. By 12 July those treatments which included Treflan, CIPC, Kerb, or Sovereign in tank mixes all gave good weed control mainly due to improved control of Chickweed. The only other main weeds present were Knotgrass and Mayweed but they were at low levels and similar for most treatments.

At harvest there were few differences in maturity with the only significant delay being where Ramrod Flo plus Treflan had been used. All treatments except those which affected early vigour gave similar marketable yields but Class I yields were highest where Ramrod Flo at 4 or 6 l/ha (post-planting), Ramrod Flo plus Kerb, CIPC and Sovereign plus Ramrod had been used. The number of marketable heads was similar for all treatments except Ramrod plus Treflan and Sovereign applied post-planting where numbers were reduced.

Action Points for Growers

* Herbicide tank mixes must be carefully selected in order to minimise any detrimental effect on crop vigour. In this respect Ramrod Flo appeared safer and gave a better crop when applied post-planting rather than according to the current SOLA. Work underway within the SOLA residues project is generating data for submission to PSD to legalise its use post-planting.

* The standard tank mix of Ramrod Flo plus Kerb is very effective but so is the use of Sovereign applied pre-planting plus Ramrod Flo applied post-planting.

* Banded applications of Ramrod Flo between the rows of lettuce looks a promising technique to reduce the overall use of herbicides whilst maintaining adequate weed control.

Summary

A range of herbicides was evaluated on crisp lettuce at different rates and timings for their effect on crop vigour, weed control and crop quality. The treatments included a comparison between Ramrod Flo applied pre-planting and post-planting either on its own or in combination with Kerb, Treflan or in a programme with CIPC.

The trial was planted on 26 May following the pre-planting applications. The post-planting applications were made on 28 May.

Early crop vigour was generally similar for all treatments but was reduced where Ramrod Flo plus Treflan had been applied pre-planting and where Sovereign had been used post-planting. By the first harvest all treatments had similar vigour.

By late June weed control was similar for all chemical treatments and significantly better than the handweeded control which was not weeded until early July. By 12 July those treatments which included Treflan, CIPC, Kerb, or Sovereign in tank mixes all gave good weed control mainly due to improved control of Chickweed. The only other main weeds present were Knotgrass and Mayweed but they were at low levels and similar for most treatments.

At harvest there were few differences in maturity with the only significant delay being where Ramrod Flo plus Treflan had been used. All treatments except those which affected early vigour gave similar marketable yields but Class I yields were highest where Ramrod Flo at 4 or 6 l/ha (post-planting), Ramrod Flo plus Kerb, CIPC and Sovereign plus Ramrod had been used. The number of marketable heads was similar for all treatments except Ramrod plus Treflan and Sovereign applied post-planting where numbers were reduced.

Introduction

Weed control in lettuce is restricted by the small number of products currently approved for use on the crop. The number of options for the transplanted crop is greater than that for the drilled crop but there is an increased risk of scorch when using herbicides post-planting.

There is at present a Specific Off-Label Approval (0518/88) for the pre-planting use of Ramrod Flo at 6 l/ha. This is an important addition to the herbicide range due to its control of a wide range of weeds, including Groundsel, which are otherwise difficult to control. Use of this pre-planting application has the disadvantage that the herbicide layer is disturbed during transplanting and this can result in reduced residual activity.

In a trial undertaken in 1992 (FV118) early crop vigour was reduced where Ramrod Flo had been used pre-planting. Applications after planting appeared safer and generally gave better weed control. The pre-planting use of Ramrod Flo delayed crop maturity and lowered the number of Class I heads at harvest in early July. The number of marketable heads was similar for all treatments.

The trial was repeated in 1993, but expanded to include two rates of Tribunil (methabenzthiazuron) and Sovereign (pendimethalin). A similar trial was also repeated on a peaty soil in Cambridgeshire and will be reported separately.

Objective

To assess a range of herbicides on lettuce at various rates and timings for their effect on weed control, crop maturity and crop quality. The trial will be carried out on both mineral and peaty soil types.

Materials and Methods

Site

HRI Stockbridge House, Cawood, Selby, North Yorkshire YO8 0TZ.

Soil Type

Sandy loam of the Quorndon Series.

Design

The experimental design was a randomised block with four replicates. Each plot consisted of four rows at 37.5 cm per 1.83 m bed with 20 plants per row spaced at 30 cm. Each plot was 11 m^2.

Statistical Analysis

Data were subjected to analysis of variance. Where appropriate the data was angularly transformed to improve the validity of the analysis. The least significant differences (LSDs) are provided where the differences between treatments were significant at the 5% level. Where the differences were not significant then this is indicated by NS (not significant) and this indicates that results were similar for all treatments.

Treatments

1. Untreated control.

2. Ramrod Flo @ 6 l/ha pre-planting (off-label approval).

3. Ramrod Flo @ 6 l/ha + Treflan @ 1.2 l/ha incorporated pre-planting.

4. Ramrod Flo @ 2 l/ha post-planting.

5. Ramrod Flo @ 4 l/ha post-planting.

6. Ramrod Flo @ 6 l/ha post-planting.

7. CIPC @ 2.8 l/ha pre-planting.

8. CIPC @ 2.8 l/ha pre-planting + Ramrod Flo @ 2 l/ha post-planting.

9. Ramrod Flo @ 3 l/ha + Kerb 50 WP @ 1.1 kg/ha post-planting.

10. Ramrod Flo @ 3 l/ha pre-planting + 2 l/ha post-planting.

11. Ramrod Flo @ 6 l/ha post-planting as an inter-row band treatment.

12. Tribunil @ 0.5 kg/ha pre-planting.

13. Tribunil @ 1.0 kg/ha pre-planting.

14. Sovereign @ 4 l/ha pre-planting + Ramrod Flo @ 2 l/ha post-planting.

15. Sovereign @ 4 l/ha pre-planting + Ramrod Flo @ 4 l/ha post-planting.

16. Sovereign @ 4 l/ha post-planting.

All herbicides were applied in 500 l/ha water using a hand held Oxford Precision Sprayer operated at a pressure of 2 bar using 11003T jet nozzles.

All treatments except 1, 2, 3 and 7 were carried out using an experimental permit and the crop was destroyed.

Records

1. Crop vigour on 16 June and 12 July (10 plants/plot).
2. Number of each weed species on 29 June.
3. Yield and quality at harvest (30 plants/plot).

Husbandry

Lettuce, cultivar Saladin (Royal Sluis), was sown into peat blocks on 21 April in an unheated glasshouse. Half of the trial area was irrigated on 20 May to determine the effect of soil moisture level on herbicide efficacy. The pre-planting herbicide treatments were applied on 24 May. The trial was planted by hand on 25 May. The post-planting applications were made on 28 May. All crop husbandry details are given in Appendix I.

Results and Discussion

The trial established well in late May and all treatments looked equally vigorous.

The crop vigour was assessed on 16 June and 12 July (Table 1).

The vigour of the lettuce in mid June was similar for all treatments except where Ramrod plus Treflan had been applied pre-planting when it was reduced. The post-planting application of Sovereign also appeared to adversely affect plant vigour.

By early July all the treatments were equally vigorous and the early differences were less apparent.

Table 1: Crop Vigour.

Treatment		16 June	12 July
1.	Control	7.4	6.5
2.	Ramrod 6 l pre-planting	6.9	6.3
3.	Ramrod 6 l + Treflan pre-planting	5.7	5.9
4.	Ramrod 2 l post-planting	7.3	6.4
5.	Ramrod 4 l post-planting	7.4	6.8
6.	Ramrod 6 l post-planting	6.7	6.6
7.	CIPC pre-planting	6.9	6.8
8.	CIPC pre-planting + Ramrod 2 l post-planting	7.2	6.7
9.	Ramrod 3 l + Kerb 1.1 kg post-planting	7.5	7.0
10.	Ramrod 3 l pre + 2 l post-planting	7.1	6.7
11.	Ramrod 6 l band post-planting	6.9	6.9
12.	Tribunil 0.5 kg pre-planting	7.6	6.7
13.	Tribunil 1.0 kg pre-planting	7.2	6.5
14.	Sovereign 4 l pre + Ramrod Flo 2 l post-planting	7.5	6.5
15.	Sovereign 4 l pre + Ramrod Flo 4 l post-planting	7.2	6.4
16.	Sovereign 4 l post-planting	6.6	5.8
SED (45 df) to compare all treatments		0.40	0.35
LSD (5%)		0.82	0.71

Note: 1 = Poor growth, stunted and yellow
9 = Excellent growth, dark green foliage

The number of each weed species on each plot is summarised in Table 2. The data have not been statistically analysed due to the low number of weeds within the trial area.

Table 2: Number of each weed species on 29 June (based on 11 m^2)

Treatment		CC	GS	KG	MW
1.	Control	87	5	5	5
2.	Ramrod 6 l pre-planting	37	1	5	1
3.	Ramrod 6 l + Treflan pre-planting	1	1	0	1
4.	Ramrod 2 l post-planting	41	0	6	5
5.	Ramrod 4 l post-planting	31	1	6	1
6.	Ramrod 6 l post-planting	25	1	4	4
7.	CIPC pre-planting	9	5	1	7
8.	CIPC pre-planting + Ramrod 2 l post-planting	8	2	2	4
9.	Ramrod 3 l + Kerb 1.1 kg post-planting	12	1	1	3
10.	Ramrod 3 l pre + 2 l post-planting	28	1	3	3
11.	Ramrod 6 l band post-planting	38	1	2	3
12.	Tribunil 0.5 kg pre-planting	39	2	4	2
13.	Tribunil 1.0 kg pre-planting	23	1	4	1
14.	Sovereign 4 l pre + Ramrod Flo 2 l post-planting	4	2	4	2
15.	Sovereign 4 l pre + Ramrod Flo 4 l post-planting	3	0	2	1
16.	Sovereign 4 l post-planting	3	2	1	2

Key: CC Common Chickweed
GS Groundsel
KG Knotgrass
MW Mayweed

The main weeds on the control plots were Common Chickweed, Knotgrass, Groundsel and Mayweed. The use of Ramrod either pre or post-planting gave poor control of Common Chickweed except when used in a tank mix. Sovereign applied either pre or post-planting gave good control of Chickweed.

The percentage of the ground covered by weeds on 29 June and 12 July is shown in Appendix II. Those treatments where the weed control was better than the control included Ramrod Flo plus Treflan and Sovereign. By 12 July the level of weed control was worse, with 37% weed cover, where Ramrod Flo had been applied pre-planting. Those treatments which included Treflan, CIPC, Kerb or Sovereign gave the best weed control. Increasing the rate of Ramrod Flo post-planting improved weed control.

The irrigation treatment applied to two replicates prior to herbicide application did not appear to enhance the control of Chickweed (Appendix III), in contrast to 1992 where Ramrod Flo applied to moist soil enhanced control. The soil moisture levels in 1993 were similar on all plots as 10 mm rain fell on 21 May.

At harvest heads were cut when they reached the required density and then trimmed to remove the outer leaves. The heads were weighed and graded according to quality. Class I heads were dense, and weighed a minimum of 500 g, Class II heads were less dense or slightly mis-shapen but weighed a minimum of 500 g.

The date of 50% harvest was delayed where Ramrod Flo at 6 l/ha plus Treflan had been used pre-planting and where Sovereign at 4 l/ha post-planting had been applied.

The number of Class I heads (iceberg quality) was reduced where Ramrod Flo at 6 l/ha had been used pre-planting according to the Off-Label Approval and in combination with Treflan. The use of Ramrod Flo post-planting at both 4 and 6 l/ha gave good results at harvest. Where Ramrod Flo had been applied at only 2 l/ha the number of Class I heads was lower due to less effective weed control.

The number of marketable heads was highest where Ramrod Flo at 4 l/ha had been applied post-planting. The Ramrod plus Treflan and Sovereign applied post-planting seriously reduced marketability due to a decrease in head size.

Table 3: Date of 50% harvest and number of heads in each quality grade based on the number planted (%).

Treatment		Harvest Date	Cl.I (%)	Cl.II (%)	Mkt. (%)
1.	Control	23 Jul	76	12	88
2.	Ramrod 6 l pre-planting	24 Jul	67	20	87
3.	Ramrod 6 l + Treflan pre-planting	27 Jul	67	6	73
4.	Ramrod 2 l post-planting	24 Jul	68	20	88
5.	Ramrod 4 l post-planting	23 Jul	81	13	94
6.	Ramrod 6 l post-planting	24 Jul	83	6	88
7.	CIPC pre-planting	22 Jul	82	6	88
8.	CIPC pre-planting + Ramrod 2 l post-planting	23 Jul	73	16	89
9.	Ramrod 3 l + Kerb 1.1 kg post-planting	22 Jul	84	7	91
10.	Ramrod 3 l pre + 2 l post-planting	23 Jul	78	9	87
11.	Ramrod 6 l band post-planting	24 Jul	82	12	93
12.	Tribunil 0.5 kg pre-planting	22 Jul	75	15	90
13.	Tribunil 1.0 kg pre-planting	23 Jul	70	18	88
14.	Sovereign 4 l pre + Ramrod Flo 2 l post-planting	22 Jul	75	10	85
15.	Sovereign 4 l pre + Ramrod Flo 4 l post-planting	23 Jul	80	10	90
16.	Sovereign 4 l post-planting	26 Jul	47	8	55
SED (45 df) to compare all treatments		1.2	-	-	-
LSD (5%)		2.4	-	-	-

The mean weight of sound heads was generally similar for all treatments except for the Sovereign applied post-planting (Appendix V). Crop quality was very good with only negligible numbers of unmarketable heads due mainly to low head weights.

Conclusions

1. Ramrod Flo when used according to the current Specific Off-Label Approval (SOLA) did not adversely affect crop vigour but poor control of Chickweed resulted in a reduced number of Class I heads at harvest.

2. Ramrod Flo when used at 2, 4 or 6 l/ha post-planting appeared safe to the crop and provided moderate control of weeds. The highest rate of Ramrod Flo improved the control of Chickweed. Crop maturity was not delayed and a high proportion of Class I heads were produced where Ramrod Flo at 4 or 6 l/ha had been used.

3. The use of Ramrod Flo both pre and post-planting did not appear to affect crop vigour or the quality at harvest but gave poorer control of Chickweed.

4. The use of CIPC pre-planting followed by Ramrod Flo at 2 l/ha post-planting enhanced the control of Groundsel and Mayweed compared to the use of CIPC alone, with no adverse affect on crop quality.

5. The post-planting use of Ramrod Flo at 3 l/ha and Kerb at 1.1 kg/ha appeared safe to the crop, provided good weed control and a high quality crop at harvest

6. Tribunil at 0.5 or 1 kg/ha had no detrimental affect on crop quality but gave poor control of Common Chickweed and Groundsel.

7. The use of Ramrod Flo plus Treflan and Sovereign applied post-planting adversely affected early crop vigour and reduced crop quality at harvest although these treatments did provide superior control of most weeds, particularly Chickweed.

8. The pre-planting use of Sovereign plus Ramrod Flo post-planting gave extremely good weed control whilst also producing a high quality crop.

Recommendations

1. The trial has been undertaken for two years but with inconsistent results. Ramrod Flo applied post-planting did not provide the high level of weed control which had been observed in 1992.

2. The combination of reduced rates of herbicides applied early post-planting and repeated after 10 or 14 days requires study to determine its effect on the longevity of weed control and crop quality at harvest. At present weed control can be inadequate in the last two weeks prior to harvest.

3. A full report containing the results from both sites in the two years will be written and presented to the HDC by January 1994.

APPENDIX I: CROP DIARY (Field A4)

21 April	Saladin sown in 37 mm peat blocks (B2).
17 May	150 kg/ha N; 50 kg/ha P_2O_5; 150 kg/ha K_2O.
20 May	Fertiliser incorporated. Irrigation (15 mm) to Replicates I and IV.
24 May	Pre-planting herbicides applied.
26 May	Trial planted.
28 May	Post-planting herbicides applied.
7 June	Irrigated 20 mm.
8 June	Pirimor @ 500 g/1000 l/ha water.
15 June	Rovral @ 380 g/760 l/ha water.
28 June	Pirimor @ 500 g/1000 l/ha water.
1 July	Irrigated 15 mm.
2 July	Metasystox @ 420 g/1000 l/ha water.
6 July	Control plots handweeded.
7 July	Favour @ 3 l/600 l/ha water, Pirimor @ 500 g + Ambush @ 250 ml/1000 l/ha water.
8 July	Irrigated 15 mm.
12 July	Pirimor @ 500 g/1000 l/ha water.
19 July	Harvest
20 July	Harvest
26 July	Harvest
30 July	Harvest

APPENDIX II:

Table A: Ground cover by weeds (%) on 29 June and 12 July.

Treatment		Weed Cover (%) 29 June	12 July
1.	Control	9.3	1.1
2.	Ramrod 6 l pre-planting	2.9	37.0
3.	Ramrod 6 l + Treflan pre-planting	0.1	0.8
4.	Ramrod 2 l post-planting	2.9	28.8
5.	Ramrod 4 l post-planting	2.5	16.2
6.	Ramrod 6 l post-planting	3.5	13.3
7.	CIPC pre-planting	1.5	8.8
8.	CIPC pre-planting + Ramrod 2 l post-planting	1.8	8.0
9.	Ramrod 3 l + Kerb 1.1 kg post-planting	3.4	9.5
10.	Ramrod 3 l pre + 2 l post-planting	4.7	28.8
11.	Ramrod 6 l band post-planting	4.1	20.7
12.	Tribunil 0.5 kg pre-planting	0.8	21.2
13.	Tribunil 1.0 kg pre-planting	1.3	7.5
14.	Sovereign 4 l pre + Ramrod Flo 2 l post-planting	0.3	3.2
15.	Sovereign 4 l pre + Ramrod Flo 4 l post-planting	0.2	2.5
16.	Sovereign 4 l post-planting	0.9	2.2

APPENDIX III:

Table B: Number of Chickweed plants per plot (11 m^2).

Treatment		Number of Chickweed Plants Replicate I	II	III	IV
1.	Control	64	84	126	75
2.	Ramrod 6 l pre-planting	33	25	53	37
3.	Ramrod 6 l + Treflan pre-planting	2	0	3	0
4.	Ramrod 2 l post-planting	31	35	51	45
5.	Ramrod 4 l post-planting	53	34	21	16
6.	Ramrod 6 l post-planting	53	21	10	17
7.	CIPC pre-planting	21	6	8	2
8.	CIPC pre-planting + Ramrod 2 l post-planting	14	5	7	5
9.	Ramrod 3 l + Kerb 1.1 kg post-planting	32	5	7	5
10.	Ramrod 3 l pre + 2 l post-planting	38	29	29	14
11.	Ramrod 6 l band post-planting	46	34	36	35
12.	Tribunil 0.5 kg pre-planting	44	27	47	38
13.	Tribunil 1.0 kg pre-planting	19	14	51	8
14.	Sovereign 4 l pre + Ramrod Flo 2 l post-planting	2	8	4	0
15.	Sovereign 4 l pre + Ramrod Flo 4 l post-planting	9	1	0	1
16.	Sovereign 4 l post-planting	9	0	1	2

Note: Irrigation (15 mm) was applied on 20 May to Replicates I and IV only.

APPENDIX IV:

Table C: Percentage of heads in each quality grade based on the number planted (angle transform).

Treatment		Class I	Class II	Marketable
1.	Control	61	20	70
2.	Ramrod 6 l pre-planting	55	26	70
3.	Ramrod 6 l + Treflan pre-planting	55	14	59
4.	Ramrod 2 l post-planting	55	26	70
5.	Ramrod 4 l post-planting	64	21	78
6.	Ramrod 6 l post-planting	65	12	70
7.	CIPC pre-planting	65	12	70
8.	CIPC pre-planting + Ramrod 2 l post-planting	59	23	71
9.	Ramrod 3 l + Kerb 1.1 kg post-planting	67	14	73
10.	Ramrod 3 l pre + 2 l post-planting	62	15	70
11.	Ramrod 6 l band post-planting	65	20	75
12.	Tribunil 0.5 kg pre-planting	60	23	72
13.	Tribunil 1.0 kg pre-planting	57	25	70
14.	Sovereign 4 l pre + Ramrod Flo 2 l post-planting	60	18	68
15.	Sovereign 4 l pre + Ramrod Flo 4 l post-planting	64	18	72
16.	Sovereign 4 l post-planting	43	16	48
SED (45 df) to compare all treatments		4.1	4.3	4.4
LSD (5%)		8.2	8.6	8.8

Note: The figures quoted in Table C are angle transforms to allow for statistical comparisons to be made between treatments.

APPENDIX V:

Table D: Mean head weight (g) and number of Class I heads over 600 (g) - angle transform (actual percentage in brackets).

Treatment		Mean Head Weight (g)	Class I Heads (over 600 g) (%)
1.	Control	620	48 (55)
2.	Ramrod 6 l pre-planting	663	50 (59)
3.	Ramrod 6 l + Treflan pre-planting	608	45 (50)
4.	Ramrod 2 l post-planting	645	46 (51)
5.	Ramrod 4 l post-planting	662	52 (63)
6.	Ramrod 6 l post-planting	657	54 (65)
7.	CIPC pre-planting	650	51 (60)
8.	CIPC pre-planting + Ramrod 2 l post-planting	670	51 (61)
9.	Ramrod 3 l + Kerb 1.1 kg post-planting	661	53 (64)
10.	Ramrod 3 l pre + 2 l post-planting	652	51 (60)
11.	Ramrod 6 l band post-planting	667	55 (68)
12.	Tribunil 0.5 kg pre-planting	651	52 (62)
13.	Tribunil 1.0 kg pre-planting	667	50 (58)
14.	Sovereign 4 l pre + Ramrod Flo 2 l post-planting	657	51 (60)
15.	Sovereign 4 l pre + Ramrod Flo 4 l post-planting	650	48 (55)
16.	Sovereign 4 l post-planting	515	34 (32)
SED (45 df) to compare all treatments		24.0	4.0
LSD (5%)		50	8.2