

CONTRACT REPORT

93/7

LETTUCE: TIMING OF HERBICIDES

HDC FV118

PART II - ORGANIC SOIL SITE

Annual site report 1993

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Summary

Sixteen herbicide programmes were applied to a crop of lettuce cv. Saladin, for 'Iceberg' presentation, which was transplanted on 10 June 1993 into a loamy peat soil on a commercial holding in Cambridgeshire. The range of products comprised Ramrod Flo (propachlor), Kerb Flo (propyzamide), CIPC (chlorpropham), Tribunil (methabenzthiazuron), and Sovereign (pendimethalin).

None of the herbicide programmes reduced crop vigour, mean head weight or percentages of Iceberg or crisp lettuce.

With very high weed pressure (70 weeds/m² on untreated areas), all herbicides reduced weed populations.

Particularly long-lasting weed control was achieved using either Ramrod Flo @ 6 l/ha post-planting or Kerb Flo @ 3.5 l/ha post-planting or a combination of Sovereign pre-planting followed by a tank-mix of Ramrod Flo + CIPC. Of these, only post-planting Kerb was fully approved.

Inter-row band applications of either Ramrod Flo or CIPC gave safe and effective weed control using a reduced quantity (c. 30% less) of active ingredient per hectare.

Objective

To compare a range of herbicide rates and combinations for a transplanted crop of lettuce on a peaty soil.

(Herbicides on a mineral soil type were also evaluated in project FV118 - refer to the HDC).

Materials and Methods

Site

This experiment was conducted at G S Shropshire and Sons Ltd., Barway, Ely, Cambridgeshire in 1993. The soil type was a loamy peat with approximately 35% organic matter content overlying fen clay.

Treatments

- a. Untreated control (hand-weeded on 30 July)

Single chemical treatments

- b. Ramrod Flo at 6 l/ha pre-planting
- c. Ramrod Flo at 3 l/ha pre-planting
- d. Ramrod Flo at 6 l/ha post-planting
- e. Ramrod Flo at 4 l/ha post-planting
- f. Ramrod Flo at 6 l/ha post-planting as an inter-row band
- g. Ramrod Flo at 3 l/ha pre-planting and 2 l/ha post-planting
- h. Kerb Flo at 3.5 l/ha post-planting
- i. Kerb Flo at 1.8 l/ha post-planting
- j. Kerb Flo at 3.5 l/ha post-planting and irrigated within 3 hours (10 mm)
- k. CIPC at 6 l/ha post-planting
- l. CIPC at 4 l/ha post-planting
- m. CIPC at 6 l/ha post-planting as an inter-row band
- n. Tribunil at 0.5 l/ha pre-planting

Chemical combination treatments

- o. Ramrod Flo at 3 l/ha + Kerb Flo at 1.75 l/ha post-planting
- p. CIPC at 3 l/ha + Kerb Flo at 1.75 l/ha post-planting

- q. Stomp at 5.6 l/ha pre-planting, then Ramrod Flo at 2 l/ha + CIPC at 4 l/ha as a tank mixture post-planting.

Certain treatments were not approved (see Appendix I), and were applied by experimental permit only. Lettuces from these plots were destroyed.

Treatment application

All treatments were applied in 500 l/ha water using an Oxford Precision Sprayer at 2 bar pressure, using 11003 nozzles. The 'band sprayed' treatments were also applied using this equipment (which does not simulate commercial equipment). The herbicides covered the whole bed except 15 cm over each row of lettuce, allowing a 30% reduction in active ingredient used.

Husbandry

Lettuce plants (cv. Saladin) in 38 mm³ peat blocks, supplied by a commercial propagator, were planted by machine into the trial area on 10 June 1993 following the application of a range of pre-planting herbicide treatments (9 June 1993). On 15 June, the post-planting herbicide treatments were applied. The trial was sited within a commercial crop of lettuce and was given the normal husbandry input other than herbicides (Appendix II). The untreated plots were hand-weeded following assessments on 1 July. The trial was harvested on 4 August when the rest of the field was also cut. The lettuces were trimmed to 'Iceberg' standard of presentation, but only sent to market where an approved herbicide regime had been used.

Assessments

Crop vigour was assessed on 1, 14 and 30 July by recording an overall score (0-10) per plot. The total number of each weed species per m² was counted and recorded on 1, 14, 30 July (using three 40 x 50 cm quadrat samples). Assessments of overall percentage of weed cover were made on 1, 14, and 30 July. A single harvest was taken on 4 August, when thirty plants per plot were cut, trimmed and weighed, then graded as either 'Iceberg' (if they weighed at least 300 g and had an attractive round head) or as 'crisp' (still over 300 g and saleable, but either loose or with a slightly poor head shape). Weather data were recorded at ADAS Arthur Rickwood at approximately eight miles away from the trial site (Appendix III).

Design and analysis

The trial design was a randomised block with three replicates. Each plot was a 2.08 m bed width by 6 m in length, with four rows per bed at 41-50-41 cm spacing and an in-row spacing of 27 cm, to give 7.3 plants/m².

The data were transformed if appropriate, then subjected to analyses of variance.

Results

Plant establishment and vigour

There was a full stand of lettuce on each plot and no plant loss occurred before harvest.

The plant vigour scores are shown in Table 1. There were no significant differences between treatments following application of the herbicides.

Table 1. Effects of herbicide treatments on lettuce plant vigour on 1, 14 and 30 July 1993.

Herbicide	Rate l/ha	Timing (pre or post planting)	Vigour scores#		
			1 July	14 July	30 July
a. Untreated			6.7	7.0	7.3
b. Ramrod Flo	6	pre	6.2	6.6	7.5
c. Ramrod Flo	3	pre	7.0	7.3	8.0
d. Ramrod Flo	6	post	6.7	7.2	7.2
e. Ramrod Flo	4	post	6.9	6.8	7.2
f. Ramrod Flo	6	post (inter-row)	6.6	7.1	7.3
g. Ramrod Flo	3+2	pre + post	6.0	6.8	7.5
h. Kerb Flo	3.5	post	6.7	7.2	8.0
i. Kerb Flo	1.8	post	6.7	7.3	6.7
j. Kerb Flo	3.5	post + irrigation	5.7	6.8	7.5
k. CIPC	6	post	6.0	6.8	7.2
l. CIPC	4	post	4.2	7.5	7.3
m. CIPC	6	post (inter-row)	5.7	6.5	6.8
n. Tribunil	0.5	pre	6.3	6.5	7.2
o. Ramrod Flo + Kerb	3+1.75	post	7.2	7.5	7.5
p. CIPC + Kerb	3+1.75	post	6.6	6.9	7.8
q. Stomp, Ramrod + CIPC	5.6, 2+4	pre + post	5.7	7.0	7.3
S.E.D. (25 d.f.)			1.15	0.64	0.49
L.S.D. (5%)			N.S	N.S	N.S

0 = dead, 10 = green, healthy and vigorous

Yield and quality

The mean head weight was 380 g (Table 2). There were no differences between the treatments.

There were no differences between treatments in their total number of Class I (Iceberg) or Class II (crisp) lettuce (Table 2).

Table 2. Effects of herbicides on mean head weight (g), and Class I (Iceberg) and Class II (crisp) lettuce (over 300 g).

Herbicide	Rate l/ha	Timing (pre or post) planting	Mean head weight (g)	% Class I Iceberg	% Class II Crisp
a. Untreated			387	43.3	40.0
b. Ramrod Flo	6	pre	355	37.5	37.3
c. Ramrod Flo	3	pre	378	34.4	48.9
d. Ramrod Flo	6	post	427	52.2	33.3
e. Ramrod Flo	4	post	410	35.4	41.3
f. Ramrod Flo	6	post (inter-row)	426	47.1	49.7
g. Ramrod Flo	3+2	pre + post	351	35.6	40.0
h. Kerb Flo	3.5	post	417	38.9	52.2
i. Kerb Flo	1.8	post	382	35.4	43.0
j. Kerb Flo	3.5	post + irrigation	381	37.8	30.0
k. CIPC	6	post	348	21.1	42.2
l. CIPC	4	post	333	40.8	19.0
m. CIPC	6	post (inter-row)	381	34.4	35.6
n. Tribunil	0.5	pre	372	34.4	35.6
o. Ramrod Flo + Kerb	3+1.75	post	412	50.4	39.6
p. CIPC + Kerb	3+1.75	post	333	27.1	39.7
q. Stomp, Ramrod + CIPC	5.6, 2+4	pre + post	371	44.4	23.3
S.E.D. (25 d.f.)			56.8	13.03	9.07
L.S.D. (5%)			N.S	NS	NS

Lettuce were downgraded from Iceberg standard due to being small, misshapen, or loose (Table 3). There were few rotten lettuce. There were no significant differences between the numbers of small lettuce.

Table 3. Effect of herbicides on percentages of small (<300 g), misshapen and loose lettuce (data in brackets were transformed).

Herbicide	Rate l/ha	Timing (pre or post planting)	Small	% Lettuce Misshapen*	Loose*
a. Untreated			11 (18.8)	2.2	0
b. Ramrod Flo	6	pre	26 (30.2)	0	0.3
c. Ramrod Flo	3	pre	16 (22.9)	1.1	0
d. Ramrod Flo	6	post	14 (17.4)	0	0
e. Ramrod Flo	4	post	19 (23.6)	1.7	1.9
f. Ramrod Flo	6	post (inter- row)	3 (11.2)	0.1	0.1
g. Ramrod Flo	3+2	pre + post	24 (28.9)	0	0
h. Kerb Flo	3.5	post	7 (12.3)	0	2.2
i. Kerb Flo	1.8	post	18 (25.0)	1.7	1.9
j. Kerb Flo	3.5	post + irrigation	30 (31.4)	0	0
k. CIPC	6	post	31 (33.9)	2.2	1.1
l. CIPC	4	post	39 (36.7)	0	1.3
m. CIPC	6	post (inter- row)	29 (30.4)	0	0
n. Tribunil	0.5	pre	28 (29.9)	1.1	0
o. Ramrod Flo + Kerb	3+1.7 5	post	9 (18.1)	0	0.2
p. CIPC + Kerb	3+1.7 5	post	30 (32.7)	1.8	1.8
q. Stomp, Ramrod + CIPC	5.6, 2+4	pre + post	28.9 (31.5)	1.1	1.1
S.E.D. (18 df)			(11.52)	-	-
L.S.D. (5%)			(N.S)	-	-

* data variable, not suitable for analysis of variance.

Weed population

There was intense weed pressure on this site with 70.4 weeds/m² on unweeded, untreated plots on 1 July (Table 4). All treatments, except i (Kerb Flo at 1.8 l/ha post-planting), gave significantly fewer ($P < 0.05$) weeds than the unweeded. There were few weeds (i.e. $< 6/m^2$) on treatment d (Ramrod Flo at 6 l/ha post-planting) and q (Sovereign pre-planting followed by Ramrod Flo + CIPC post-planting). The additional irrigation appeared to improve the activity of Kerb Flo (treatment j) giving few weeds.

Table 4. Effects of herbicides on number of weeds/m².

Herbicide	Rate l/ha	Timing (pre or post planting)	Weeds/m ²		
			1 July	14 July#	30 July#
a. Untreated			70.4*	32.8	23.9
b. Ramrod Flo	6	pre	22.2	32.2	16.9
c. Ramrod Flo	3	pre	35.2	39.4	17.8
d. Ramrod Flo	6	post	5.6	7.2	3.3
e. Ramrod Flo	4	post	28.6	28.1	18.7
f. Ramrod Flo	6	post (inter-row)	15.8	28.9	8.5
g. Ramrod Flo	3+2	pre + post	22.2	21.7	10.6
h. Kerb Flo	3.5	post	35.2	37.2	15.0
i. Kerb Flo	1.8	post	45.3	22.3	14.6
j. Kerb Flo	3.5	post + irrigation	13.0	18.9	9.4
k. CIPC	6	post	37.0	21.7	15.0
l. CIPC	4	post	11.1	13.8	8.6
m. CIPC	6	post (inter-row)	35.2	17.8	12.2
n. Tribunil	0.5	pre	31.5	22.2	11.7
o. Ramrod Flo + Kerb	3+1.75	post	23.1	11.5	15.4
p. CIPC + Kerb	3+1.75	post	54.7	41.4	19.3
q. Stomp, Ramrod + CIPC	5.6, 2+4	pre + post	3.7	3.9	3.3
S.E.D. (25 d.f.)			13.11	7.21	4.86
L.S.D. (5%)			27.01	14.85	10.02

above crop canopy

* untreated plots were hand-weeded after the 1 July assessment

On 14 July, fewer weeds were recorded over all plots due to better competition from the rapidly-growing lettuces. Those treatments which had fewer ($P < 0.05$) weeds than the untreated plots (which were weeded on 1 July) were d (Ramrod Flo at 6 l/ha post-planting), l (CIPC at 4 l/ha post-planting), m (CIPC at 6 l/ha post-planting as an inter-row band), o

(Ramrod Flo + Kerb Flo post-planting) and q (Sovereign pre-planting , followed by Ramrod Flo + CIPC post-planting). On 30 July, several treatments had maintained good weed control.

These were:

- d 6 l/ha Ramrod Flo post-planting
- f 6 l/ha Ramrod Flo as an inter-row spray after planting
- g Ramrod Flo pre- + post-planting
- j 3.5 l/ha Kerb Flo post-planting
- l 4 l/ha CIPC post-planting
- m 6 l/ha CIPC as an inter-row spray post-planting
- n Tribunil
- q Sovereign, followed by CIPC + Ramrod Flo

Weed cover

On 1 July, all treatments had a lower ($P < 0.05$) percentage weed cover than the untreated control (Table 5). Treatments d (6 l/ha Ramrod Flo post-planting) and q (Sovereign, followed by Ramrod Flo + CIPC) had particularly low levels of weed cover.

Table 5. Effects of herbicide treatments on percentage of weed cover and weed vigour.

Herbicide	Rate l/ha	Timing (pre or post planting)	Weeds cover %		Weed vigour#
			1 July	30 July	30 July
a. Untreated			26.7	50.0	9.0
b. Ramrod Flo	6	pre	4.3	60.1	8.6
c. Ramrod Flo	3	pre	12.7	36.7	9.0
d. Ramrod Flo	6	post	1.1	5.3	7.5
e. Ramrod Flo	4	post	9.1	24.0	8.3
f. Ramrod Flo	6	post (inter-row)	7.1	36.0	8.6
g. Ramrod Flo	3+2	pre + post	6.0	30.7	8.5
h. Kerb Flo	3.5	post	16.3	32.3	8.5
i. Kerb Flo	1.8	post	5.1	26.5	8.6
j. Kerb Flo	3.5	post + irrigation	5.1	10.7	8.7
k. CIPC	6	post	8.7	34.0	8.8
l. CIPC	4	post	3.5	20.1	8.4
m. CIPC	6	post (inter-row)	4.0	28.3	8.3
n. Tribunil	0.5	pre	4.7	35.0	9.0
o. Ramrod Flo + Kerb	3+1.75	post	4.1	7.5	8.6
p. CIPC + Kerb	3+1.75	post	13.1	43.5	9.1
q. Stomp, Ramrod + CIPC	5.6, 2+4	pre + post	0.7	4.7	8.3
S.E.D. (25 d.f.)			4.94	14.11	0.40
L.S.D. (5%)			10.18	29.7	N.S

weed vigour score 0 = dead, 9 = green, healthy and vigorous

By 30 July, weed cover had increased. Treatment d (6 l/ha Ramrod Flo post-planting), j (3.5 l/ha Kerb Flo post-planting), l (4 l/ha CIPC post-planting), o (Ramrod Flo + Kerb Flo post-planting) and q (Sovereign pre-planting followed by Ramrod Flo + CIPC post-planting) all gave lower ($P < 0.05$) weed cover percentages.

Weed vigour

Weed vigour was similar for all treatments on 30 July.

Weed species

The main weed species were black-bindweed, chickweed, fat-hen, goose foot, groundsel, mayweed, redshank and red dead nettle (Appendix IV).

The numbers of groundsel weeds were lower (data not analysed) for several treatments on 1 July. By 30 July, groundsel was present on all plots, but at a low level for some herbicide treatments.

Discussion

The peaty soil site provided intense weed pressure which tested the herbicides to a greater extent than in 1992. Most herbicide regimes reduced the number of weeds and percentage cover of weeds during early growth of the lettuce. The low rate of Kerb Flo alone or with CIPC post-planting was less effective at suppressing weeds.

Treatments d (6 l/ha Ramrod Flo post-planting), j (3.5 l/ha Kerb Flo post-planting), l (4 l/ha CIPC post-planting) and q (Sovereign pre-planting, followed by a tank-mix of CIPC + Ramrod Flo post-planting) all gave safe and relatively long-lasting weed control on this soil type. Of these, d, j and q appeared to control groundsel quite well. Of these, only j is currently approved for use on lettuce.

The use of inter-row band applications of either Ramrod Flo or CIPC looked promising in terms of reducing the overall amount of active ingredient applied per hectare by about 30% whilst giving safe and effective weed control.

The additional irrigation after application of Kerb Flo gave much improved early weed control and is worth further investigation.

The application of Ramrod Flo post-planting of the lettuce gave better, longer-lasting weed control than where used before planting.

Lettuces were harvested at a relatively mean low weight, but at the same time that the commercial rig was operating in the field. The herbicide treatments did not affect the mean head weight of the lettuces, nor their quality.

Acknowledgement

The co-operation of staff and provision of the trial site at G S Shropshire and Sons is gratefully acknowledged.

Appendix I

Status of chemicals

- a.
- b. approved (off label)
- c. approved (off label)
- d. not approved
- e. not approved
- f. not approved
- g. not approved
- h. approved
- i. approved
- j. approved
- k. not approved (CIPC at 3 l/ha post-planting is approved)
- l. not approved
- m. not approved
- n. not approved
- o. not approved
- p. approved
- q. not approved (Sovereign has an OLA)

Appendix II

Management of trial site

Site A loamy peat with approximately 35% organic matter content overlaying fen clay

Crop diary

10 June plant lettuce cv. Saladin
30 July hoe trial

Herbicides

9 June pre-planting herbicide treatments applied
15 June post-planting herbicide treatments applied

Insecticides

Ambush, Pirimar, Dipterex and Hostaquick

Fungicides

Zineb, Rovral WP, Favour, Thiram

Fertilisers

Liquid nitrogen at 200 l/ha of 37% N monoammonium phosphate at 50 kg/ha

Irrigation

19 June 37 mm
16 July 37 mm

Harvest

4 August

Appendix III

Temperature (°C) and rainfall (mm) from Friday 11 June to Thursday 5 August 1993 at ADAS Arthur Rickwood (approximately 8 miles from trial site).

Week beginning	Temperature extremes (°C)			Rainfall (mm)
	Air max.	Air min.	Grass min.	
11 June	17.8	11.3	9.8	24.1
18 June	18.9	8.6	6.6	5.7
25 June	22.0	8.3	5.9	1.2
2 July	23.2	9.7	7.3	13.2
9 July	18.1	7.9	5.0	26.2
23 July	21.1	13.5	12.0	18.5
30 July	21.0	10.8	9.1	10.5

Appendix IV

Effects of herbicides on numbers of groundsel (*Senecio vulgaris*) present, and presence of other weeds.

Herbicide	Rate l/ha	Timing (pre or post planting)	Groundsel (plants/m ²)		Other weeds on
			1 July	30 July#	1 July
a. Untreated			16.7	8.3	GF, MW, RS, BBW, RDN
b. Ramrod Flo	6	pre	0	1.7	RS, RDN, MW, FH, GS
c. Ramrod Flo	3	pre	3.7	6.1	MA, RDN, RS
d. Ramrod Flo	6	post	0	2.8	RS, MW
e. Ramrod Flo	4	post	3.7	2.8	RS, GF, RDN
f. Ramrod Flo	6	post (inter-row)	0	2.8	MW, FH, RS
g. Ramrod Flo	3+2	pre + post	0	1.1	RDN, RS, GF, MW
h. Kerb Flo	3.5	post	7.4	6.7	MW, RDN, FH, RS, GF
i. Kerb Flo	1.8	post	3.7	4.4	FH, RDN, RS, GF, MW
j. Kerb Flo	3.5	post + irrigation	3.7	3.9	MW, GS
k. CIPC	6	post	7.4	6.7	MW, FH, BBW, RS, GF
l. CIPC	4	post	9.3	5.0	MW, RDN, FH
m. CIPC	6	post (inter-row)	7.4	5.0	FH, RS, GF, MW, RDN
n. Tribunil	0.5	pre	18.5	7.8	FH, GF, RS, MW, RDN
o. Ramrod Flo + Kerb	3+1.75	post	3.7	2.8	RDN, RS
p. CIPC + Kerb	3+1.75	post	16.7	6.1	CW, MW, FH, RDN, RS, GF
q. Stomp, Ramrod + CIPC	5.6, 2+4	pre + post	3.7	3.3	-

above crop canopy

Key

BBW - black-bindweed - *Bilderdykia convolvulus*

CW - Chickweed - *Stellaria media*

FH - Fat-hen - *Chenopodium album*

GF - Goosefoot - *C. polyspermum*

GS - Groundsel - *Senecio vulgaris*

MW - Mayweed - *Matricaria matricarioides*

RDN - Red deadnettle - *Lamium purpureum*

RS - Redshank - *Polygonum persicaria*