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Comparison of herbicide regimes
for film covered crops
of celery
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COMMERCIAL - IN CONFIDENCE

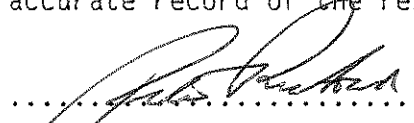
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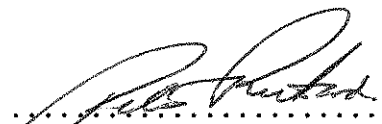
AUTHENTICATION

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.

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CONTENTS

	Page
Summary	1
Objective	2
Introduction	3
Material and Methods	
Site	4
Trial Design	4
Treatments	4
Husbandry	5
Assessments	5
Statistical Analysis	6
Results and Discussion	7
Conclusions	13
Recommendations	14
Acknowledgements	15
Storage of data	16
Appendix I	
I trial plan	17
II crop diary	18
III distribution of heads in each size grade	20

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COMPARISON OF HERBICIDE REGIMES FOR FILM COVERED CROPS OF CELERY

Summary

The earliest production of outdoor celery is obtained from plantings in early April. When these are covered with a film cover they can achieve reliable cropping without bolting from July onwards. The selection and timing of herbicide application in conjunction with the use of the film cover is studied in this trial for an early planted crop of Celebrity grown beneath the fibrous cover material of Agryl P17. The two herbicides used were based on the active ingredients linuron (as Linuron 50) or prometryn (as Gesagard 50WP). The herbicides were applied either at planting or sprayed through at first weed emergence with or without a further application post uncovering in early June. In addition there were two control treatments one hand weeded and one not weeded. The best chemical weed control was achieved when the herbicides were sprayed through the Agryl P17 cover at first weed emergence in early May. This gave excellent control of the dominant weeds redshank (Polygonum persicaria) but did allow the cleavers (Galium aparine) to survive as this species is resistant to both herbicides. There was no observed detrimental effect on crop vigour after spraying through the Agryl P17 using either herbicide. The highest number of marketable heads was obtained either from where the herbicides had been applied through the Agryl P17 or where hand weeding was used.

Objective

To compare application methods of two herbicides on weed control, plant maturity and yield of early planted celery grown under Agryl P17 film covers.



Introduction

Early outdoor celery production has become reliant on the bolting resistant cultivar Celebrity and more recently on the use of a film cover at planting. The film covers provide a favourable microclimate which usually advances weed germination and growth. Weed control is difficult under the film covers and usually necessitates cover removal and hand hoeing followed by re-covering. This is a costly operation and often results in damage to the film cover.

This trial was set up to evaluate the potential of spraying through a certain type of film cover with a high degree of porosity. In this case Agryl P17, which is widely used by celery producers, was chosen. After the scheduled programme a standard herbicide regime was used over the whole trial.



Materials and Methods

Site

The trial was conducted on the Arthur Rickwood EHF on a loamy peat (30-66 cm) over sand and gravel (Adventurers' Shallow).

Trial design

The trial consisted of 3 replicates of each treatment arranged into replicate blocks. Each plot consisted of 70 plants of which 50 were cut and recorded at harvest.

Treatments

1. Herbicide regimes

1. Handweeded up to twice with covers replaced (control)
2. Prometryn at planting, with covering delayed for one day*
3. Linuron at planting, with covering delayed for one day*
4. Prometryn sprayed through covers when weeds first appear
5. Linuron sprayed through covers when weeds first appear
6. 2 + prometryn sprayed after cover removed
7. 3 + linuron sprayed after cover removed
8. 4 + prometryn sprayed after cover removed
9. 5 + linuron sprayed after cover removed
10. Non weeded (control)*

* Note 'treatment changes' detailed below

Rates used.

prometryn - 1.15 kg/ha ai prometryn as 2.3 kg/ha cp Gesagard 50WP
in 600 l/ha water

linuron - 1.1 kg/ha ai linuron as 2.2 kg/ha cp Linuron 50 in
600 l/ha water



Husbandry

Seed of the cultivar Celebrity was sown into Correx trays on January 29 and germinated at 18°C. The seedlings were pricked out at the first true leaf stage on February 22 into Hassy 104 module trays and maintained in a glasshouse with a minimum thermostat setting of 18°C until 5 April when they were placed at 5°C to harden. At planting on 11 April the herbicides were applied according to treatment and the film cover laid onto the appropriate plots immediately or after a 1 day delay where herbicide applications had been made.

The herbicide treatments were applied through the Agryl P17 cover of appropriate plots on 5 May at first seedling emergence.

The Agryl P17 cover were removed from all plots at the end of May and a further herbicide treatment applied where appropriate one week after cover removal. A standard herbicide programme was used for weed control from mid June onwards.

Treatment changes

Due to the extreme weed cover at uncovering for treatments 2 + 3 it was decided to apply linuron to treatment 2 and prometryn to treatment 3 one week post uncovering. Treatment 10 was rotavated in following uncovering once the weeds had been identified.

Assessments

Vigour scores and weed assessments were taken at the end of June. The main harvest was taken on August 8 when the heads were trimmed and recorded for weight and petiole length.

Statistical analysis

All of the data was subjected to an analysis of variance using the ANOVAY program developed by the Computer Development Unit of ADAS at Reading.

Results and Discussion

The trial established well with good uniform growth after planting. The first weeds started to emerge in early May at which point the treatments which involved spraying through the Agryl P17 film cover were applied. The celery was at the 6 true leaf stage at that time.

Assessments of weed growth taken on 20 May showed that the application of herbicides at planting had not had any long-lasting effect on weed development. However, where the linuron or prometryn had been sprayed through the film cover weed control was excellent with no visible detrimental effect on plant vigour.

The weed cover was recorded on 2 June and the results shown in Table 1.



Table 1. Weed cover (%) on 2 June

Treatment	Weed cover	Main species present
1. Hand weeded	0	-
2. Prometryn at planting	100	Red Shank, Field Pansy, Bindweed, Mayweed
3. Linuron at planting	100	Red Shank, Field Pansy, Bindweed
4. Prometryn sprayed through	57	Cleavers
5. Linuron sprayed through	53	Cleavers
6. 2 + prometryn after uncovering	100	Red Shank, Field Pansy, Bindweed, Mayweed
7. 3 + linuron after uncovering	100	Red Shank, Field Pansy, Bindweed, Mayweed
8. 4 + prometryn after uncovering	37	Cleavers
9. 5 + linuron after uncovering	18	Cleavers
10. Non weeded	100	Red Shank, Field Pansy, Bindweed, Mayweed, Hemp Nettle
Mean	67	
SE per plot (18 df)	17	
CV %	26	
SED (18 df) for comparing treatments	13.5	

The best herbicide treatment was where the linuron or prometryn had been sprayed through the Agryl P17 film cover. All other treatments were similar except where the plots had been hand weeded. The dominant weeds were generally red shank (Polygonum persicaria) and black bindweed (Bilderdykia convolvulus) except for the sprayed-through treatments where Cleavers (Galium aparine) was the only dominant weed present.

In late June the trial was assessed for crop vigour and weed cover
Table 2.

Table 2. Crop vigour score and weed cover (% of ground covered) on 28
June

Treatment	Crop vigour (1-10)*	Weed cover (%)
1. Handweeded	7.7	1
2. Prometryn at planting	6.3	6
3. Linuron at planting	4.7	25
4. Prometryn sprayed through	6.7	19
5. Linuron sprayed through	7.3	21
6. 2 + prometryn after uncovering	5.3	15
7. 3 + linuron after uncovering	5.7	3
8. 4 + prometryn after uncovering	6.7	18
9. 5 + linuron after uncovering	7.7	9
Mean	6.4	13

* 1 = poor, 10 = excellent

SE per plot (18 df)	1.57	11.8
CV %	24	90
SED (18 df) for comparing treatments	1.28	9.6

There were only slight differences in crop vigour between the herbicide treatments with the spraying-through film cover treatments (4, 5, 8 + 9) having the least detrimental effect. The treatments where linuron or prometryn had been sprayed at planting (2, 3, 6 + 7) crop vigour had been reduced due primarily to earlier weed competition. There were no significant differences ($P < 0.05$) in weed cover on 28 June between any of



the of the chemical treatments. The higher values for the treatments where the herbicides had been sprayed through (4, 5, 8 + 9) were because of cleavers which are not controlled by either linuron or prometryn post emergence.

Following completion of the herbicide regime treatments the plots were subsequently kept weed free according to commercial practice and the trial harvested on 8 August, Table 3.

Table 3. Number marketable heads (%), mean head weights (g) and petiole length (mm)

Herbicide treatment	Number marketable (%)	Mean head weight (g)	Stick length (mm)
1. Hand weeded	58	491	230
2. Prometryn at planting	36	428	203
3. Linuron at planting	29	413	220
4. Prometryn sprayed through	52	455	213
5. Linuron sprayed through	57	475	223
6. 2 + prometryn after uncovering	28	372	217
7. 3 + linuron after uncovering	18	368	203
8. 4 + prometryn after uncovering	60	497	237
9. 5 + linuron after uncovering	50	473	233
Mean	43	441	220
SE per plot (16 df)	17	63	21
CV %	47	14	10
SED (16 df) for comparing treatments	20.2	51.7	17.4

The mean number of marketable heads was 43% with no significant ($P < 0.05$) differences between the treatments. Taking the harvest in early August demonstrated the benefit of the better weed control regimes. The mean number of marketable heads of all of the 'sprayed-through' treatments (4, 5, 8 and 9) was 55% which was comparable with the hand weeded control at 58%; where as the mean of all the herbicide application 'at planting'



treatments (2, 3, 6 and 7) gave only 28% of marketable heads as most were under weight. There were no significant differences between the mean head weights or stick lengths for any of the treatments.

The proportion of heads in each size grade are given in Appendix III.

Conclusions

1. The prometryn or linuron applied at planting gave very poor control of weeds.
2. Where prometryn or linuron was sprayed through the Agryl P17 at first weed emergence there was good control of most early weeds with no detectable detrimental effect on crop vigour.
3. The dominant weed present where the weed control measures had failed was redshank, but this was successfully controlled by subsequent applications of prometryn and linuron. However, where the herbicides were sprayed-through the Agryl P17 the main weed was cleavers which subsequently proved resistant to both of the herbicides tested.
4. At the 8 August harvest those treatments where early weed control had been good (hand weeded and sprayed-through treatments) showed a tendency to produce a greater number of marketable heads than for those herbicide regimes where early weed control had been poor.

Recommendations

1. The trial should be repeated in 1989 as spraying through the covers looked extremely promising in 1988.
2. The plants should be propagated in peat blocks in order to maximise earliness.
3. The number of replicates should be increased to increase the confidence of the statistical analysis.
4. Herbicides (eg pentanochlor ± chlorpropham) which control cleavers should be included for this weed was a serious problem where the herbicides had been sprayed through the Agryl P17 film cover.
5. A herbicide regime should be developed that enables the Agryl P17 film cover to remain on until harvest, which proved the best removal date in the other HDC celery trial at the same site.

Acknowledgements

The assistance of David Norman (ADAS celery consultant) and the scientific staff at Arthur Rickwood was much appreciated.

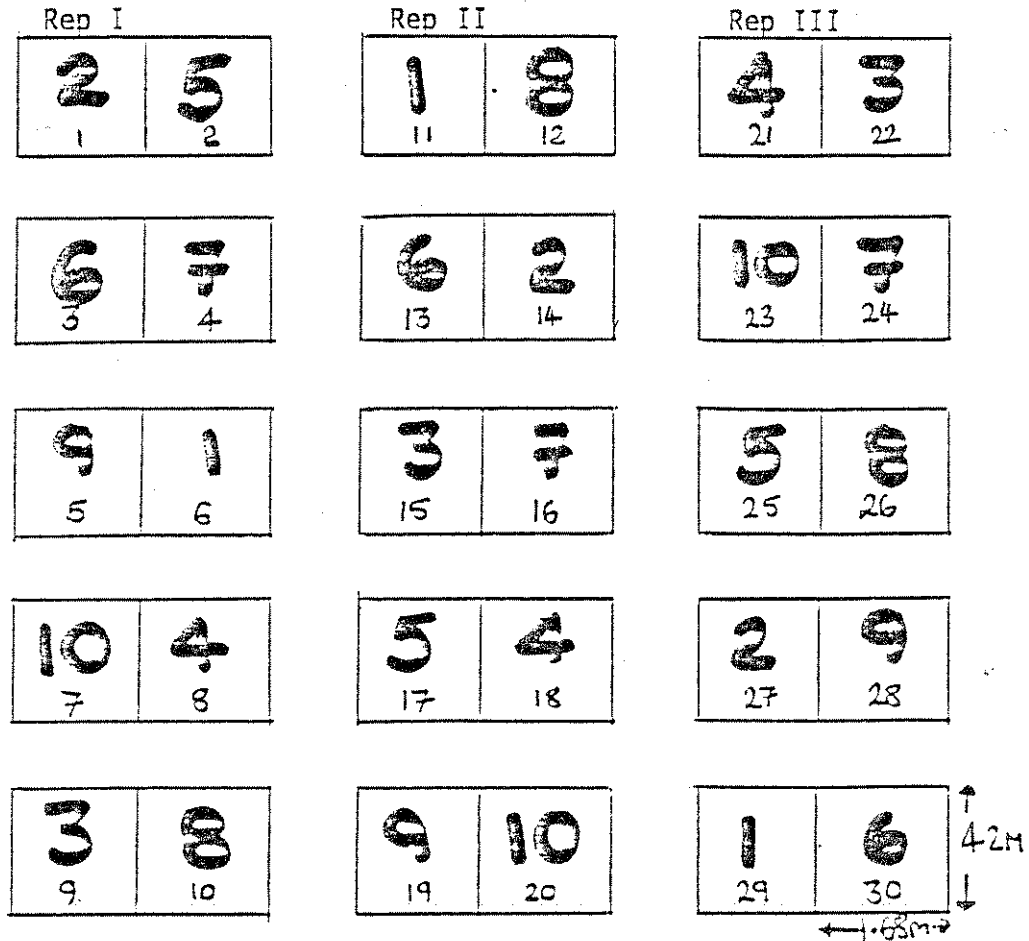


Storage of data

The raw data will be stored by ADAS at Arthur Rickwood EHF, Mepal, Cambs CB6 2BA for a period of 10 years. The Horticultural Development Council will be consulted before disposal of the data.



Comparison of herbicide regimes for film covered crops of celery (Year 1)



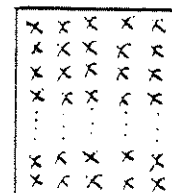
Herbicide Regimes

1. Hand weed up to twice with covers replaced. (control)
2. Prometryn at planting, with covering delayed for one day.
3. Linuron at planting, with covering delayed for one day.
4. Prometryn sprayed through covers when weeds first appear.
5. Linuron sprayed through covers when weeds first appear.
6. 2 above + Prometryn sprayed after cover removed (late May).
7. 3 above + Linuron sprayed after cover removed (late May).
8. 4 above + Prometryn sprayed after cover removed (late May).
9. 5 above + Linuron sprayed after cover removed (late May).
10. Non weeded (control).

Film covering

covered with Agryl P17 from planting (widesheet)

One plot



14 plants

5 rows

Total plants = 70
Harvested = 30
(3 rows x 10 plants)

Spacing

300 mm x 300 mm

Appendix II

Previous cropping	1987	Sugar Beet
	1986	Winter Wheat
	1985	Winter Wheat
Crop diary		
Cultivations	12 January	plough and furrow press
	10 March	rotterra
	5 May	hoed treatment 1
	1 June	hoed treatment 1
Propagation	29 January	seed sown into Correx trays at 18°C
	22 February	pricked out into Hassy 104 trays
Husbandry	5 April	all placed at 5°C to harden
	11 April	planted and covered (except treatments 2 + 3)
	12 April	covered treatments 2 + 3
	25 May	covers removed from treatments 2, 3, 6, 7
	31 May	covers removed from treatments 1, 4, 5, 8 + 9
	29 June	hand weeded to remove cleavers
Insecticides	2 June	1.05 kg/ha ai triazophos as 2.5 l/ha cp Hostathion in 1000 l/ha water
	24 June	140 g/ha ai pirimicarb as 280 g/ha cp Aphox in 400 l/ha water
	18 July	25 g/ha ai cypermethrin as 250 ml/ha cp Ambush in 1000 l/ha water

Herbicides	10 April	800 g/ha paraquat as 4 l/ha cp Gramoxone in 280 l/ha water
	11 April	treatments applied as appropriate
	5 May	treatments applied as appropriate
	17 June	1.65 kg/ha ai chlorpropham + 3.3 kg/ha ai pentanochlor as 11 l/ha cp Herbon Brown in 500 l/ha water
Fertilisers	7 December	157 kg/ha P_2O_5 + 314 kg/ha K_2O
	8 April	120 kg/ha N
	10 June	80 kg/ha N
Trace elements	9 May	9 kg/ha $MnSO_4$ in 200 l/ha water
	20 May	9 kg/ha $MnSO_4$ in 200 l/ha water
	8 June	9 kg/ha $MnSO_4$ in 200 l/ha water
	21 June	9 kg/ha $MnSO_4$ in 200 l/ha water
	11 July	9 kg/ha $MnSO_4$ in 200 l/ha water
Irrigation	11 April	13 mm
	13 April	13 mm
	6 May	10 mm
	25 May	25 mm
	15 June	15 mm
	29 June	15 mm
	4 August	20 mm
Harvest	8 August	overall harvest

APPENDIX III DISTRIBUTION OF HEADS IN EACH SIZE GRADE

