

Agricultural Development and Advisory Service

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CONTRACT REPORT

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Comparison of film cover materials
and removal date for early
production of celery
HDC ref No: FV/29/88
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COMMERCIAL - IN CONFIDENCE



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COMPARISON OF FILM COVER MATERIALS AND REMOVAL DATE FOR EARLY PRODUCTION OF CELERY

Summary

The earliest production of outdoor celery is from plantings in early April which are covered with a film cover in order to achieve reliable cropping without bolting from early July. The selection and management of a range of film cover systems is studied in this experiment. Celery, cv Loret was sown on 27 January, planted on 10 April and immediately covered with either Agryl P17, Agronet, Polycrop Coverall 500, a combination of Polycrop 500 over Agryl P17 (double cover), or left uncovered. An additional treatment whereby plants were planted through a black polythene ground mulch with Agryl P17 cover over the top of them was also used. The single Polycrop Coverall 500 film cover treatment was removed after either 5, 7 or 9 weeks, but when used in the double cover system it was removed after 5 weeks only. The Agryl P17 and Agronet cover treatments were removed after either 7 or 9 weeks or at harvest. The earliest celery matured on 11 July from beneath the Agryl P17 followed by Agronet and Polycrop 500 covers. Generally the earliest harvests were made where the covers remained on for the longest periods. However, despite the early removal of the Polycrop Coverall 500 when used in the double cover combination system severe physiological damage occurred rendering the celery unmarketable. The black polythene mulch successfully controlled most of the weeds whilst not affecting the maturity or quality of the celery.

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A D A S



Objective

To assess the effect of a range of film cover materials and date of cover removal on maturity and yield for an early celery crop.

An



Introduction

Early outdoor celery production has become reliant on the bolting resistant cultivar Celebrity and, more recently, on the use of film cover at planting. Where perforated polythene materials have been used, rapid growth has often been accompanied by physiological damage such that the timing of cover removal has been critical. More recently, fibrous covers have become increasingly used as they allow more flexibility of removal which can even be delayed until crop harvest. The use of double cover combination treatments, whereby a perforated polythene cover overlays a fibrous cover, is under investigation on the continent and is included in this trial which is in its second year.



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

A split plot design was used, with the film cover treatment on the main plots which were split for removal date and split again for harvest date. There were two replicates. Each harvest date sample consisted of 50 plants (5.04 m²) (Appendix I).

Treatments

1. Film cover materials
 - (a) Nil
 - (b) Agryl P17 - a fibrous cover
 - (c) Agronet - a finely netted cover
 - (d) Polycrop Coverall 500 - a perforated polythene film with 500 holes (10 mm) per m²
 - (e) Polycrop Coverall 500 over Agryl P17 (double cover)
 - (f) Agryl P17 with a black polythene ground mulch (38 micron thickness)
2. Cover removal date
 - (a) 5 weeks
 - (b) 7 weeks
 - (c) 9 weeks
 - (d) harvest

Such that (a), (b) and (c) were used for film cover material treatment Polycrop Coverall 500 (1d), with (a) used for the removal of the Polycrop Coverall 500 in the double cover treatment (1e) and (b), (c) and (d) for film cover material treatments using Agryl P17 and Agronet (1b, 1c, 1e and 1f).

Husbandry

Seed of the cultivar Loret (Royal Sluis) was sown on 27 January into Correx trays and germinated at 18°C. When the seedlings were at the first true leaf stage they were pricked out into 4.3 cm peat blocks and maintained at 18°C minimum glasshouse temperature until 6 days before planting when the plants were placed in a glasshouse maintained at a minimum of 5°C.

The trial was planted on 10 April at a spacing of 300 x 300 mm and covered with the appropriate film cover.

The film covers were removed and replaced on two occasions to allow hand weeding. They were removed at the appropriate times (Table 1) and the crop irrigated following uncovering.

Table 1. Date of film cover removal.

Film cover	Cover removal date		
	First	Second	Third
Nil	-	-	-
Agryl P17	25 May	8 June	11 July
Agronet	25 May	8 June	11 July
Polycrop 500	11 May	25 May	8 June
Polycrop 500 + Agryl P17*	11 May + 25 May	11 May + 8 June	11 May + 11 July
Agryl P17 + black polythene	25 May	8 June	11 July

* First date corresponds to Polycrop 500 and the second date refers to Agryl P17.

Note: The 'at harvest' cover removal treatment was standardised at 11 July for all relevant film cover materials treatments.

Assessments

For each removal date of each cover treatment there were two distinct harvest techniques used. The first involved cutting each sub-plot when the majority of the heads on that plot were estimated to have reached a minimum trimmed weight of 450 g. The second technique involved a complete harvest all other sub-plots when the earliest maturity treatments were at their peak maturity.

In each case the whole sub-plot was harvested on a single harvest date.

Statistical analysis

The data was subjected to an analysis of variance test using the computer programs developed by the Biometrics department of IHR - Wellesbourne.

Results and Discussion

The timing of harvest according to treatment maturity is shown in Table 2 with the number of marketable celery from this harvesting technique given in Table 3.

Table 2. Date of harvest according to treatment maturity.

Film cover	Cover removal date		
	First	Second	Third
Nil*	-	-	-
Agryl P17	31 July	20 July	11 July
Agronet	26 July	26 July	20 July
Polycrop 500	31 July	31 July	20 July
Polycrop 500 + Agryl P17*	-	-	-
Agryl P17 + black polythene	20 July	20 July	11 July

* These treatments failed to mature properly but were cut on 7 August.

Table 3. Number of marketable heads (%) at 450 g minimum trimmed weight.

Film cover	Cover removal date			Mean
	First	Second	Third	
Nil	-	-	-	16
Agryl P17	88	80	53	74
Agronet	77	88	87	84
Polycrop 500	58	65	67	63
Polycrop 500 + Agryl P17	0	0	0	0
Agryl P17 + black polythene	88	83	58	76

The earliest maturing treatment combinations were Agryl P17 both with and without the black polythene ground mulch at the third removal date. This was followed within 9 days by the earlier removal of Agryl P17 as well as the last removal dates of both Polycrop Coverall 500 and Agronet. Generally the quality of the earliest maturing treatments was excellent but a delay in maturity which was associated with the early cover removal lowered head quality particularly for the Polycrop Coverall 500 treatment. For the Polycrop Coverall 500 + Agryl P17 combination there was severe physiological damage at all of the uncoverings with none of the heads marketable. The nil cover treatment failed to produce a marketable crop from this early planting date.

The results for the overall harvest where one plot per treatment was harvested at a common date (26 July) are shown in Table 4.



Table 4. Numbers of marketable celery (%) on 26 July (450 g minimum) with angle transformations in brackets for statistical comparisons.

Film cover	Cover removal date			
	First	Second	Third	Mean
Nil				29 (32)
Agryl P17	67 (55)	87 (70)	69 (57)	74 (61)
Agronet	86 (68)	86 (67)	89 (72)	87 (69)
Polycrop 500	27 (31)	47 (55)	80 (70)	51 (52)
Polycrop 500 + Agryl P17	19 (25)	14 (20)	14 (22)	16 (22)
Agryl P17 + black polythene	61 (52)	81 (64)	50 (45)	64 (54)
Mean (where covers used)	52 (46)	63 (55)	60 (53)	
CV %				(16)
SED (5 df) for comparing means of film cover materials				(7.6)
SED (14 df) for comparing means of cover removal date				(6.2)

This 'overall' harvest showed up some interesting differences between the cover treatments. Agryl P17, Agronet, Polycrop Coverall 500 and Agryl P17 with black polythene produced significantly ($P < .05$) higher numbers of marketable heads than the nil and the double cover treatment of Polycrop Coverall 500 + Agryl P17. The results confirmed the benefit of removing Agryl P17, Agronet and Polycrop Coverall 500 later in the life of the crop. The results for the late removal of the Agryl P17 + black

polythene were poorer than had been experienced at the earlier harvest but this may have been due to several weeds which grew through the black mulch and competed with adjacent plants.

From beneath the Agryl P17 (with and without black polythene), Agronet and Polycrop Coverall 500 the heads were significantly ($P < .05$) heavier than the nil and double cover treatments (Table B Appendix V). The quality of heads was better under the Agryl P17 (both with and without black polythene) and Agronet with the sticks significantly ($P < .05$) taller (Table C Appendix VI) than the other treatments. Sticks from under the Polycrop Coverall 500 were slightly shorter and tended to have thicker bases. The number of missing plants was negligible for all treatments except the Polycrop Coverall 500 and Agryl P17 combination where plant loss was on average 37% and caused by physiological damage. For the other treatments the main reason for unmarketability was lack of head weight.

Conclusions

1. The earliest celery was cut on 11 July from beneath Agryl P17 removed at harvest.
2. The black polythene ground mulch successfully controlled most weeds without reducing plant numbers. However, with this system it is important that all of the fertiliser is applied before mulching and that the crop is regularly inspected and any weeds that are present removed early on to prevent competition with the crop.
3. The Polycrop Coverall 500 over Agryl P17 double cover treatment gave poor results due to physiological damage even when the top cover was removed after only 5 weeks. However, where Polycrop Coverall 500 was used on its own early removal was not necessary but generally crop quality was poorer compared to the other types of cover.



Recommendations for future action

Future R & D

1. The work should be continued in 1990 to confirm the results over a typical run of seasonal conditions.
2. The treatment with the double cover of Polycrop Coverall 500 and Agryl P17 should be altered so that the Polycrop Coverall 500 is removed earlier than 5 weeks.
3. Air and soil temperatures should be monitored more regularly under each of the different types of film covers to find the cause of the poor results when using the double cover combination and hence develop a means of overcoming it.



Acknowledgements

The co-operation of Andrew Mead in the Biometrics Department of IHR - Wellesbourne is much appreciated both for advice on planning and analysing the trial.



Storage of Data

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



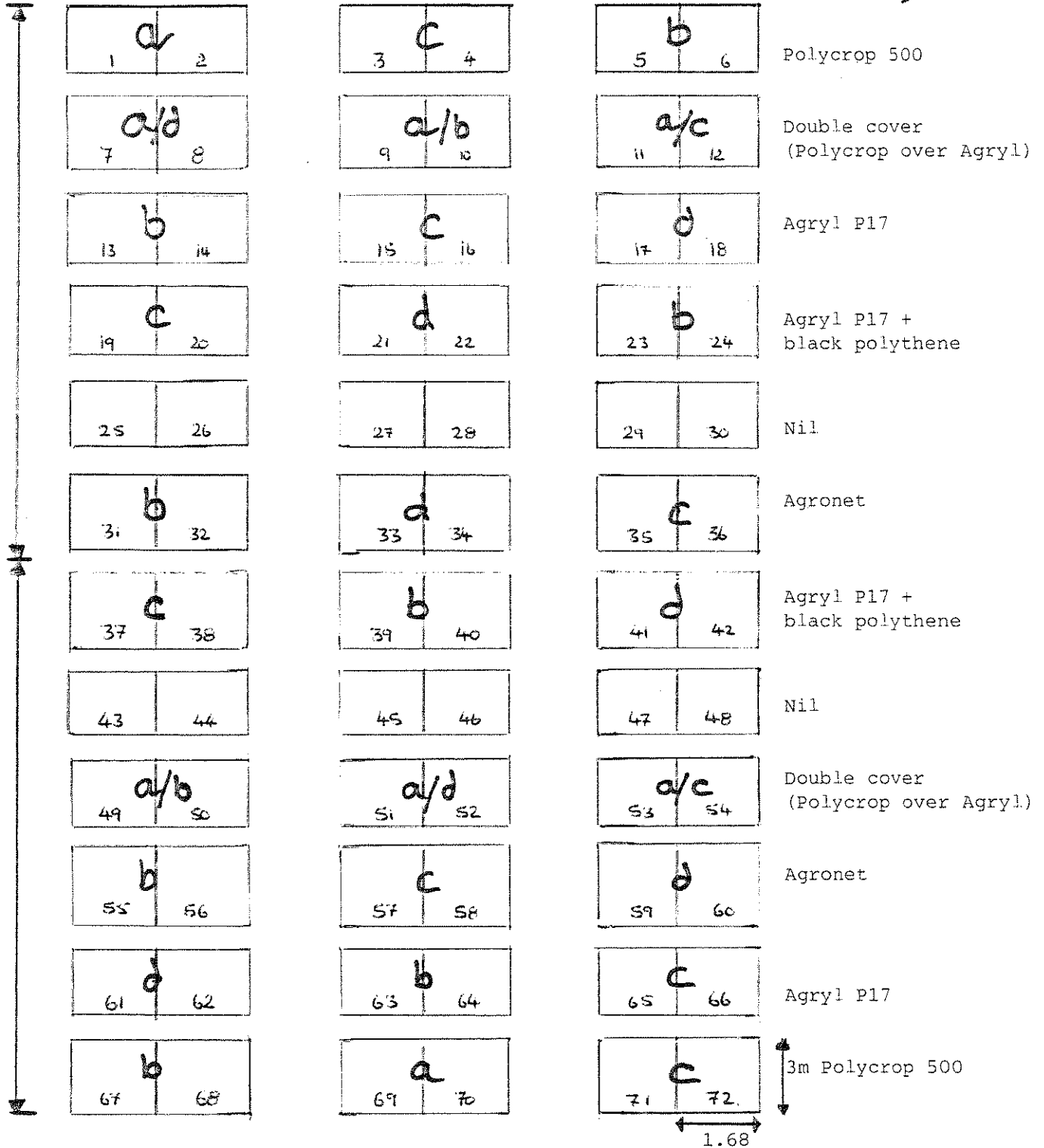
Appendix I

Trial plan



Rep I
(27 M)

Rep II
(27 M)



Removal dates

- a. 5 weeks
- b. 7 weeks
- c. 9 weeks
- d. harvest

Harvest

- 1. as plots mature
- 2. overall harvest (even numbered plots)

Spacing

5 rows @ 300 mm
in-row spacing
300 mm

Harvest

30 plants/plot



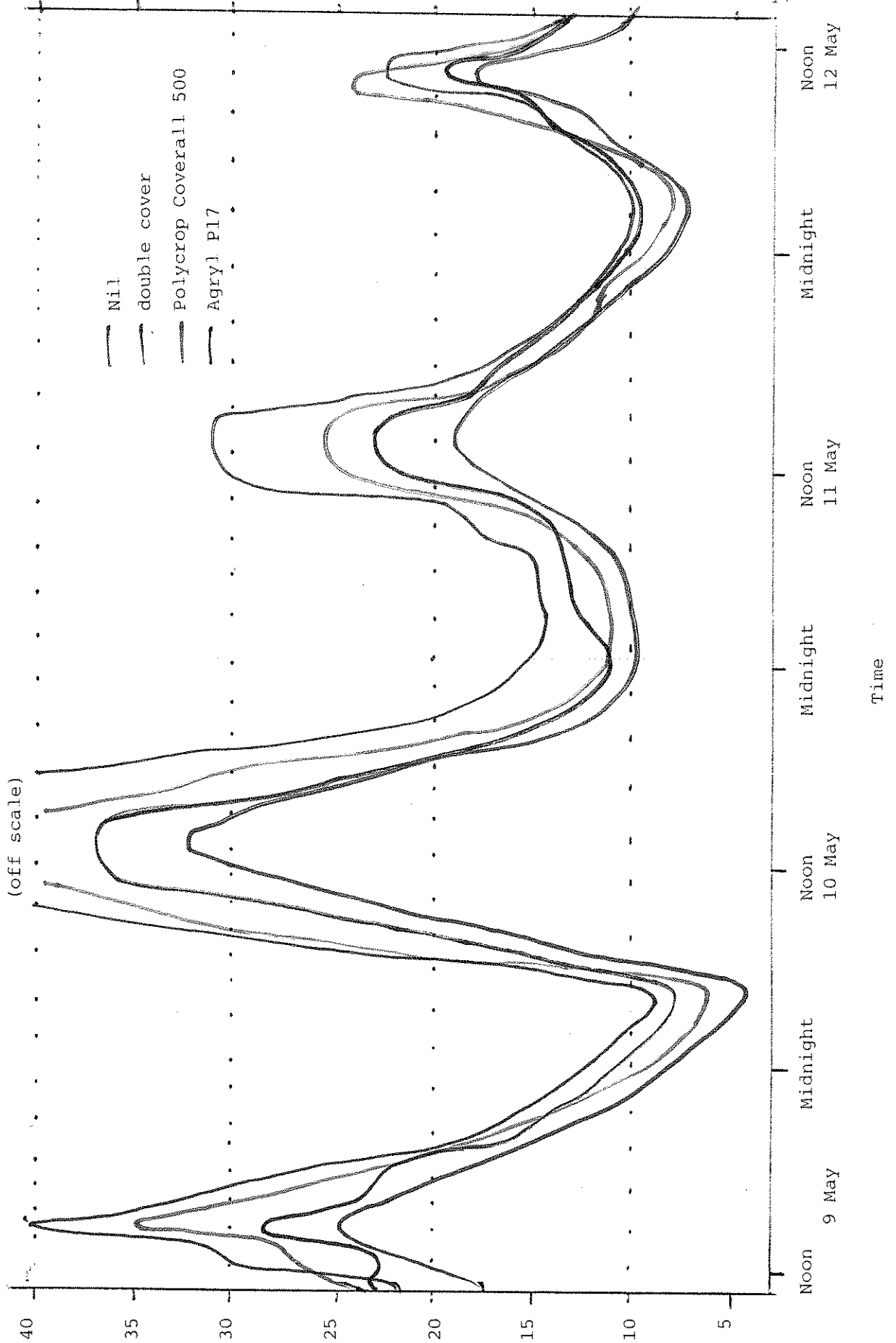
Appendix II

Crop diary

Cultivations	4 January	plough and furrow press
	8 March	rotterra
	3 April	fertiliser rotovated in
	15 May	hoed
	12 June	hoed
Propagation	27 January	seed sown
	28 February	pricked into peat blocks
	4 April	plants moved to 5°C
Husbandry	10 April	planted
Insecticides	24 May	140 g/ha ai pirimicarb as 280 g/ha cp Aphox in 1000 l/ha water (nil and uncovered treatments only)
	20 June	140 g/ha ai pirimicarb as 280 g/ha cp Aphox in 1000 l/ha water (all trial)
Fertilisers	13 December	157 kg/ha P ₂ O ₅ + 314 kg/ha K ₂ O
	3 April	180 kg/ha N (rotavated in)
Trace elements	16 June	9 kg/ha MnSO ₄ in 250 l/ha water
	28 June	9 kg/ha MnSO ₄ in 250 l/ha water
Irrigation	22 April	20 mm
	5 May	20 mm
	11 May	20 mm
	19 May	25 mm
	30 May	25 mm
	15 June	25 mm
	21 June	25 mm
	27 June	25 mm
	3 July	20 mm
	6 July	20 mm
	12 July	20 mm
	19 July	20 mm
	21 July	20 mm
4 August	20 mm	
Harvest	11 July	
	20 July	
	26 July	
	31 July	
	7 August	

Appendix III

Air temperature recorded under the different treatments (9-12 May)



Temp
(°C)



Appendix IV

Table A. Weather data during the trial.

Week commencing	Air temps (°C)			Soil temps (10 cm) Mean	Accumulated day degrees		Rainfall (mm)
	Max	Min	Mean		Current	1988	
10 April	15.7	-0.5	7.9	7.6	20	23	11.3
17 April	12.1	-0.5	9.8	7.2	8	40	23.6
24 April	18.4	-2.3	9.9	6.9	24	13	4.2
1 May	23.0	1.3	11.0	12.1	49	42	0
8 May	18.0	0.4	12.2	11.8	32	46	6.3
15 May	24.7	3.8	12.6	14.1	64	46	0
22 May	28.7	0.9	13.4	16.7	63	47	0.9
29 May	20.3	-0.7	14.6	14.0	28	47	2.7
5 June	24.0	-0.1	15.4	14.5	43	43	12.2
12 June	26.7	8.1	15.5	18.9	88	53	0
19 June	27.1	6.5	16.0	19.6	77	73	0
26 June	22.8	4.3	17.4	15.8	62	75	23.0
3 July	30.2	6.6	17.6	18.8	85	63	20.3
10 July	26.5	7.0	17.0	19.1	83	64	0.1
17 July	34.0	6.1	17.6	21.2	101	82	0.2
24 July	29.1	7.4	20.0	20.9	90	64	18.8
Total					917	821	

1. The air temperatures are measured at 09.00 hrs GMT.
2. The accumulated day degrees are based on a temperature of 6°C and give a useful indication of growing conditions for comparison with other years.

The results show that maximum air temperatures were very favourable in 1989 particularly in early May and this may have caused the severe physiological damage which occurred beneath the double cover treatment.

Appendix V

Table B. Mean weight of all heads (g) on 26 July.

Film cover	Cover removal date			Mean
	First	Second	Third	
Nil				389
Agryl P17	501	571	498	523
Agronet	527	553	584	555
Polycrop 500	367	478	550	465
Polycrop + Agryl P17	437	407	387	410
Agryl P17 with black polythene ground mulch	514	493	438	481
Mean (where covers used)	469	500	491	
CV %				8
SED (5 df) for comparing means of film cover materials				23.7
SED (14 df) for comparing means of cover removal date				20.7
SED (14 df) for interaction between cover and removal date				32.1

There were significant ($P < .05$) differences between the film covers but not between the cover removal dates. There was a significant ($P < .01$) interaction between the film covers and removal dates.

Appendix VI

Table C. Mean stick lengths (mm) on 26 July.

Film cover	Cover removal date			Mean
	First	Second	Third	
Nil				220
Agryl P17	221	224	213	219
Agronet	225	226	230	227
Polycrop 500	209	204	215	209
Polycrop 500 + Agryl P17	183	200	199	194
Agryl P17 with black polythene ground mulch	222	216	236	225
Mean (where covers used)	212	214	219	
CV %				4
SED (5 df) for comparing means of film cover materials				5.6
SED (14 df) for comparing means of cover removal date				4.8

Note: The mean stick length was measured from the base of the head to the first knuckle.


There were significant ($P < .05$) differences between film cover materials but not between the cover removal dates.

PRINCIPAL WORKER

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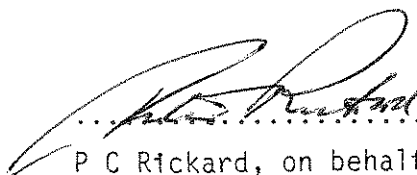
AUTHENTICATION

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.


.....
P C Rickard Contract Manager

Date .. 7 Nov 89

Report authorised by:


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