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CONTRACT REPORT

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Comparison of film cover materials
and removal date for early
production of red lettuce
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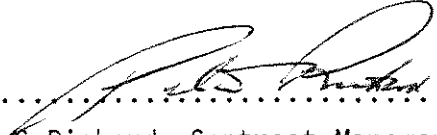
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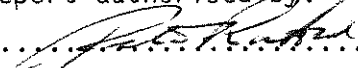
AUTHENTICATION

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 *.19. Oct 88.*.....

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A COMPARISON OF FILM COVER MATERIALS AND REMOVAL DATE FOR EARLY PRODUCTION OF RED LETTUCE

Summary

Four varieties of red lettuce were sown in late January and propagated at either 12 or 18°C minimum glasshouse temperature. At planting on 18 March the plants were either covered with Agryl P17, Polycrop Coverall 500, Polycrop Coverall 500 over Agryl P17 (double cover) or left uncovered. One treatment whereby plants were planted through a black polythene mulch with Agryl P17 film cover over the top of them was also used. The film covers were removed after either 3, 5 or 7 weeks for Polycrop Coverall 500 and either 5, 7 or 9 (at harvest) weeks for the Agryl P17 treatments. The first heads were cut from under the double cover treatment because they were ready a few days earlier than the lettuce from under the single cover treatments, which were about two weeks ahead of the nil covered plants. The best cover removal dates in terms of number of marketable heads were after either 5 or 7 weeks for the Polycrop Coverall 500 and after 7 weeks for the Agryl P17. Retaining the cover of Agryl P17 until harvest caused loose and poorly coloured heads, although after a few days of being uncovered dense and well coloured heads then developed. The black polythene ground mulch controlled weeds very well but did reduce plant stands considerably (up to 30%) as the plants failed to grow through the holes, despite being planted through the mulch. The varieties Quattro Stagioni and Merveille de Quatre Saisons produced excellent heads as did the oakleaf type Kamino. Lollo Rosso only performed well from under the double cover treatment.

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Objective

To assess the effect of temperature during propagation, type of film cover and removal date on maturity and yield using four varieties of red lettuce.

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Introduction

Red lettuce types have been grown by the amateur gardener for many years but it has only been in recent years that they have been produced commercially, mainly in response to the supermarket requirement for an extensive range of salad crops.

The red lettuce group can be broadly divided into three main types - red butterhead, frilly Lollo Rosso and the oakleaf type. The main market for the first two types is the fresh market, whereas the oakleaf types are only really suitable for processing as the large leaf area results in wilting within a short time of harvesting.

At present the husbandry of the crop is based on very limited Dutch information. This trial, in its first year, is aimed at producing the crop as early as possible by evaluating two types of film covers with a range of uncovering dates. The effect on maturity, yield and quality will be assessed using varieties of each type.

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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 four blocks (one variety per block) with combinations of propagation temperature and film covers as main plots. Each main plot was sub-divided into 3 sub-plots for the date of film cover removal. Each sub-plot consisted of 32 plants (5.6m²). (See Appendix I.)

Treatments

1. Film cover materials

- a. Nil
- b. Agryl P17 - a fibrous cover - 17 g/m²
- c. Polycrop Coverall 500 - perforated polythene with 500 holes/m²
- d. Polycrop Coverall 500 over Agryl P17 - double cover
- e. Agryl P17 with a black polythene mulch - 38 micron thick

2. Cover removal date

- a. 3 weeks
- b. 5 weeks
- c. 7 weeks
- d. At harvest when first variety was ready

a-c for film cover material treatments using Polycrop Coverall 500 (1c and 1d).

b-d for film cover material treatments using Agryl P17 (1b, 1d and 1e).

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3. Temperature during propagation

- a. Germination at 18°C followed by 12°C glasshouse minimum
- b. Germination at 18°C followed by 18°C glasshouse minimum

4. Varieties

The trial was based on the varieties Lollo Rosso, Merveilles de Quatre Saisons and Quattro Stagioni of the red butterhead type, and Kamino of the oakleaf type.

Husbandry

The trial was sown into peat blocks (3.7cm) on 29 January and left in a cool environment for 24 hours. After this, all of the blocks were moved to a glasshouse with a minimum thermostat setting of 18°C. Due to poor germination the Quattro Stagioni was resown on 5 February. The propagation treatments were started once the plants had reached the fully expanded cotyledon stage when plants were either kept at 18°C or moved to 12°C, both with ventilation at 21°C. The plants were later placed at a minimum of 5°C with ventilation at 12°C for one week prior to planting.

Base nitrogen at 50 kg/ha nitrogen was incorporated before planting with a pre-planting application of chlorpropham used for weed control except where the black polythene ground mulch was used.

The trial was planted on 18 March at a spacing of 300 x 300mm except for Lollo Rosso where 300 x 250mm was used.

The film covers were removed on the dates as shown in Table 1.

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Table 1. Date of film cover removal.

Film cover	Cover removal date		
	First	Second	Third
Nil	-	-	-
Agryl P17	25 April	6 May	17 May
Polycrop 500	12 April	25 April	6 May
Polycrop 500 + Agryl P17*	12 April + 25 April	25 April + 6 May	6 May + 17 May
Agryl P17 + black polythene	25 April	6 May	17 May

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

Assessments

The plots were harvested as they matured at a minimum trimmed weight of 180g with a maximum of three harvests for each plot.

Statistical analysis

All the data was subjected to an analysis of variance using the Genstat computer program developed by the Statistical Department of Rothamsted Experimental Station.

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Results and Discussion

The trial was planted earlier than had been anticipated due to mild weather in mid March. At planting there were slight differences between the two propagation regimes with those plants raised at 18°C being marginally larger than those grown at 12°C. Establishment was good for all treatments except where the black polythene ground mulch had been used where the plants often failed to find the planting hole.

At the first cover removal date on 12 April the plants were still at a small stage but more advanced than those with nil covering. By 25 April large differences in plant size were noted, with the smaller plants from the earlier uncovering, but these had a more pronounced red coloration. At the final uncovering for the Agryl P17 treatments which was at the first harvest the plants were much larger in size but tended to be loose and generally less red in colour. However, the red leaf coloration increased markedly within a few days of uncovering with the heads also becoming more dense.

The dates of 10% harvest are shown in Table 2, with the dates of 25% harvest given in Table A Appendix III. The variety Kamino has not been included as it was difficult to determine head weight and thus harvested mostly on 23 May and 1 June.

Table 2. Date of 10% harvest meaned across temperatures and varieties (excepting Kamino)

Film cover	Cover removal date		
	First	Second	Third
Nil	2 June	1 June	2 June
Agryl P17	25 May	25 May	21 May
Polycrop 500	23 May	23 May	21 May
Polycrop 500 + Agryl P17	20 May	20 May	21 May
Agryl P17 + black polythene	23 May	23 May	25 May

The earliest harvests were taken on 17 May from the Polycrop Coverall 500 + Agryl P17 double cover treatment with the first heads cut from the second and third uncovering date.

The number of marketable lettuces harvested are given in Table 3.

Table 3. Number of marketable lettuces harvested (%).

Film cover	Cover removal date			Mean
	First	Second	Third	
<u>Propagation temperature 12°C</u>				
Nil	63	49	51	54
Agryl P17	70	66	73	70
Polycrop 500	65	68	77	70
Polycrop 500 + Agryl P17	83	84	65	77
Agryl P17 + black polythene	55	53	42	50
Mean	67	64	62	64
<u>Propagation temperature at 18°C</u>				
Nil	59	56	55	57
Agryl P17	57	61	61	60
Polycrop 500	64	81	78	74
Polycrop 500 + Agryl P17	74	77	67	73
Agryl P17 + black polythene	52	53	50	52
Mean	61	66	62	63
Overall mean	64	65	62	64
SE per plot (60 df)				10.9
CV %				17
SED (60 df) for comparing overall means of cover removal dates				2.4
SED (60 df) for comparing means of film covers				6.5

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The mean number of marketable lettuces harvested was 64%. The film cover treatments nil and Agryl P17 with black polythene were significantly ($P < .01$) lower than the other treatments. The best covering appeared to be the double cover with 75% of lettuces considered marketable. There were no significant ($P < .05$) differences between the cover removal dates or temperature during propagation.

Kamino produced 83% marketable heads, Merveille de Quatre Saisons and Quattro Stagioni similar at 70% whilst Lollo Rosso produced 32% of heads considered marketable.

The main head defects were lack of weight (below 180g), and rotting (Tables 4 and 5). The other main problem was missing plants (Table B Appendix IV).

Table 4. Number of small heads (%) combined for varieties and temperatures.

Film cover	Cover removal date			Mean
	First	Second	Third	
Nil	30	29	35	31
Agryl P17	24	22	24	23
Polycrop 500	24	18	12	18
Polycrop 500 + Agryl P17	16	13	16	15
Agryl P17 + black polythene	16	17	20	18
Mean	22	20	21	21
SE per plot (60 df)				7.4
CV %				37
SED (60 df) for comparing means of cover removal date				1.7
SED (60 df) for comparing means of film covers				5.1

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The mean number of small heads (under 180g) was 21% with the nil covering treatment having significantly ($P < .05$) higher numbers of small heads (31%) than the other treatments. The three cover removal dates gave similar results.

Lollo Rosso produced a high number of underweight heads.

The number of rotten heads is shown in Table 5.

Table 5. Number of rotten heads (%) combined for varieties and temperatures.

Film cover	Cover removal date			Mean
	First	Second	Third	
Nil	0	0	0	0
Agryl P17	1	1	3	2
Polycrop 500	2	1	1	1
Polycrop 500 + Agryl P17	1	2	11	4
Agryl P17 + black polythene	2	2	2	2
Mean	1	1	3	2
SE per plot (60 df)				4.1
CV %				210
SED (60 df) for comparing means of cover removal date				0.9
SED (60 df) for comparing means of film covers				1.8
SED (60 df) for comparing all treatments (interaction)				2.4

The mean number of rotten heads was 2%. The film cover treatments gave similar results although the levels of rotting were higher for the Polycrop Coverall 500 + Agryl P17 treatment (4%). There were significant ($P < .05$) differences between the cover removal dates with the highest levels of rotting recorded from the third uncovering date, most notably for the double cover of Polycrop Coverall 500 + Agryl P17 (with a significant interaction at $P < .05$).

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The treatments varied considerably in the number of missing plants per plot (Appendix IV). There were more missing plants from where the black polythene ground mulch had been used. This was mainly due to the cloddy seedbed which prevented the tight laying of the polythene. This was particularly noted for the smaller framed Lollo Rosso.

The results for the mean head weights were similar (mean 245g) and are given in Appendix V.

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Conclusions

1. The temperature during propagation had no effect on plant growth post planting, and there was no bolting in any treatment.
2. The first heads were cut on 17 May from the double cover of Polycrop Coverall 500 plus Agryl P17, when the Polycrop Coverall 500 was removed after 5 or 7 weeks and the Agryl P17 at 7 or 9 weeks post planting.
3. The single cover treatments matured a few days later than the double covered plants, and two weeks ahead of the nil covered plants.
4. The double cover treatment (Polycrop Coverall 500 + Agryl P17) produced the most marketable heads followed by the single cover treatments of Polycrop Coverall 500 and Agryl P17.
5. Removing the cover at harvest for the Agryl P17 was too late as the heads were 'puffy' and lacked the red coloration. However, after a few days the heads did become dense and well coloured, without being over-mature.
6. The black polythene ground mulch prevented weed growth and the need for hoeing, but many of the plants failed to grow through the planting hole. The ground mulch was successful for Kamino as it kept the leaves clean and thus reduced trimming.
7. The varieties Quattro Stagioni and Merveille de Quatre Saisons produced some good quality heads as did the oakleaf variety Kamino. For Lollo Rosso many of the heads failed to mature.

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Recommendations

1. The work should be continued for at least another season to test the treatments under different spring conditions.
2. The rate of nitrogen fertiliser should also be examined as this may have been the cause of the Lollo Rosso failing to produce marketable heads.
3. Taste assessments should be conducted to determine whether there are any differences between treatments.

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Acknowledgement

The co-operation of the statistical departments of Rothamsted Experimental Station and the Institute of Horticultural Research, Wellesbourne, were much appreciated.

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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.

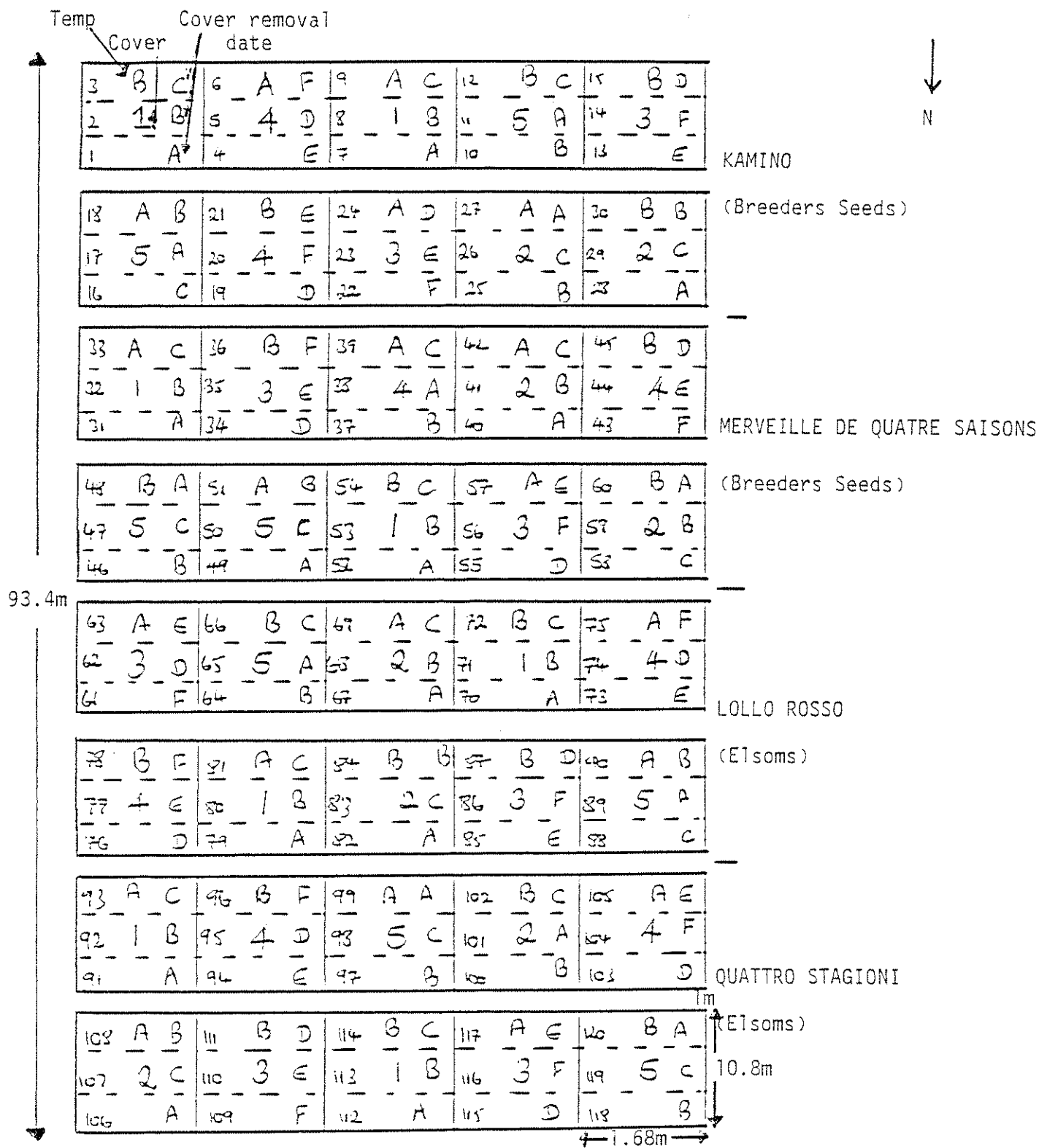
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APPENDIX I



Temp (post emergence)	Film cover	Cover removal date
A. 12°C	1. N11	Film cover 2 + 5
B. 18°C	2. Agryl P17	A. 5 weeks
	3. Polycrop 500 holes/m ²	B. 7 weeks
	4. Polycrop + Agryl P17	C. Harvest
Spacing	5. Agryl + black polythene	Film cover 3 + 4
300 x 300mm		D. 3 weeks
		E. 5 weeks
Harvest		F. 7 weeks

8 plants x 4 rows - 32 plants

APPENDIX II

Crop Diary

Cultivations	12 January	plough and furrow press
	10 March	rotterra
	25 April	hoed
	6 May	hoed nil covered plots only
Propagation	29 January	all seed sown in peat blocks
	30 January	all moved to 18°C
	5 February	Quattro Stagioni re-sown
	6 February	moved to 18°C
	18 February	plants moved to appropriate propagation temperature
	11 March	all placed at 5°C
Husbandry	18 March	planted
	12 April	first removal date of Polycrop Coverall 500
	25 April	second removal date of Polycrop Coverall 500 and first for Agryl P17
	6 May	final removal date of Polycrop Coverall 500 and second for Agryl P17
	17 May	third removal date for Agryl P17
Herbicides	17 March	1.12 kg/ha ai chlorpropham as 2.8 litre/ha cp CIPC in 1000 litre/ha water, except black polythene ground mulch treatment

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Fungicides	18 March	0.55 kg/ha ai benomyl as 1.1 kg/ha cp Benlate in 400 litre/ha water (pre-planting drench)
Fertilisers	7 December 17 March	157 kg/ha P ₂ O ₅ 314 kg/ha K ₂ O 50 kg/ha N
Trace elements	9 May 20 May	9 kg/ha manganese sulphate in 200 litre/ha water 9 kg/ha manganese sulphate in 280 litre/ha water
Irrigation	11 April 22 April 6 May 13 May 25 May	13mm 6mm 15mm 10mm 25mm
Harvests	17 May 23 May 1 June 6 June 10 June 15 June	

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APPENDIX III

Table A. Dates of 25% harvest meaned for temperatures and varieties (except Kamino).

Film cover	Cover removal date		
	First	Second	Third
Nil	2 June	1 June	2 June
Agryl P17	26 May	28 May	23 May
Polycrop 500	28 May	23 May	22 May
Polycrop 500 + Agryl P17	23 May	22 May	23 May
Agryl P17 + black polythene	23 May	23 May	26 May

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APPENDIX IV

Table B. Number of missing plants (%) combined for varieties and temperatures.

Film cover	Cover removal date			Mean
	First	Second	Third	
Nil	10	19	12	14
Agryl P17	10	13	6	9
Polycrop 500	5	5	8	6
Polycrop 500 + Agryl P17	4	5	7	5
Agryl P17 + black polythene	30	27	34	30
Mean	12	14	13	13
SE per plot (60 df)				7.3
CV (%)				56
SED (60 df) for comparing means of cover removal date				1.6
SED (60 df) for comparing means of film covers				6.0

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APPENDIX V

Table C. Mean head weights (g) combined for temperature and varieties

Film cover	Cover removal date			Mean
	First	Second	Third	
Nil	247	251	245	248
Agryl P17	255	254	251	253
Polycrop 500	248	253	267	256
Polycrop 500 + Agryl P17	282	253	256	264
Agryl P17 + black polythene	244	254	243	247
Mean	255	253	252	254
SE per plot (60 df)				20.7
CV %				8
SED (60 df) for comparing means of cover removal date				4.6
SED (60 df) for comparing means of film covers				10.6

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