CONTRACT REPORT

FV145a

Early Production of Carrots using Polythene Covers

Commercial-in-Confidence

Report to:	Horticultural Development Council 18 Lavant Street Petersfield Hants GU32 3EW
ADAS Contract Manager:	J E Birkenshaw ADAS Horticulture 24 Willington Road Kirton Boston Lincs PE20 1EJ
Period Covered:	1993/94

PRINCIPAL WORKER

J E Birkenshaw ADAS Vegetable Team Kirton

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.

.... Date: 22/11/94..............................

J E Birkenshaw - Contract Manager

Report Authorised by:

.... 22.11.94.

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RELEVANCE TO GROWERS AND PRACTICAL APPLICATION

Objectives of Project

On an early crop of carrots sown in February 1994:

* To quantify the benefit of using infra-red (IR) reflecting polythene, ventilated at 200 holes per sq m, (holes put in by manufacturer).

* To confirm the benefits of managed ventilation of solid polythene, ventilated at 200 holes per sq m, in mid-March followed by a further 200 holes in mid-April (holes put in manually).

* To quantify the benefits of polythene with 200 holes/sq m placed between rows of carrots, (holes put in by the manufacturer).

Key Results

Infra-red reflecting polythene (with low or high rate of IR filler) increased soil temperature, encouraged early crop growth, and increased by more than 20% yield on 13 June 1994 compared to the control - current commercial practice.

There was no advantage in using higher rate of IR filler, which is a more costly product.

Solid polythene, manually ventilated, also increased soil temperature, encouraged early crop growth and produced a 20% increase in yield on 13 June 1994 compared to control - current commercial practice.

Polythene with 200 holes/sq m placed between carrot rows also increased soil temperature, encouraged early growth but the yield was not significantly better than the control.

Opportunity for Application

Infra-red reflecting polythene is currently more expensive than polythene used commercially but prices should reduce if more is used. If a yield increase of 20% or more is achieved in commercial practice this will more than offset the higher cost of IR polythene.

A system using solid polythene progressively ventilated in the field can be applied commercially and would be cheaper than IR polythene. However a more precise system of mechanically ventilating polythene on a field scale is required.

A system using polythene with holes placed between carrot rows is likely to be the easiest and cheapest for growers to adopt but row spacing and hole spacing needs to be matched precisely to achieve the benefits obtained in this trial. This technique has not yet proved better than current commercial systems.

SUMMARY

The current commercial practice of early carrot production using polythene with 200 holes/sq m spaced uniformly across rows of carrots was compared with three new techniques. These comprised IR polythene (infra-red reflecting polythene) with 10% or 20% IR filler and solid polythene `progressively` ventilated to 200 holes/sq m in mid-March and 400 holes in mid-April and polythene with 200 holes placed between rows of carrots. These treatments were imposed on a commercial crop of February drilled carrots.

Soil temperature and rate of plant emergence were significantly increased by all the experimental treatments when compared to the control, there were no other significant differences between experimental treatments.

All experimental treatments produced a significant increase in yield between 3.46 and 5.52 t/ha (20-33%) compared to the control from a harvest date on 13 June 1994.

INTRODUCTION

The carrot industry currently grows some 800 hectares of early carrots under polythene. The technique used is well established and reliable. However, 35,000 tons of carrots are still imported into the UK from Spain and France during April, May and June.

The current commercial technique uses polythene with 200 holes/sq m, sowing in January or February and removing the film in late April or early May. Earlier crops can be grown by sowing in October or December but these are more prone to bolt and are more risky to grow. Maintaining a higher temperature under the polythene could reduce this risk of bolting but later in the season more ventilation will be required when temperatures are warmer. Polythene without holes warms the soil more but ventilation is required later in the season (HDC project FV145, 1993).

New types of polythene which trap infra-red radiation have been available for walk-in polytunnels for several years and this type of material produced earlier carrots in 1993 - HDC project FV145. British Visqueen currently manufactures an 80 micron infrared or `thermic` film for export to France. This is not widely used in the UK but provided the opportunity to test the thermal properties on carrots in 1993 (HDC project FV145).

For 1994, Brithene films Ltd produced 2 IR reflecting films, one with 10% and the other with 20% infra-red `filler`. Brithene films also provided polythene (not IR reflecting) with holes placed in such a way that there were no holes immediately above the rows of carrots which are drilled in 2cm deep gullies. Ventilation took place only after the carrots grew sufficiently tall that the polythene was lifted off the soil surface.

These polythene films provided the following experimental treatments which were compared with current commercial practice:

Experimental treatments

a. Control, current commercial practice, 200 holes/sq m.

b. IR polythene, 10% filler, 200 holes/sq m.

c. Polythene with 200 holes/sq m placed between carrot rows.

d. IR polythene, 20% filler, 200 holes/sq m.

e. Polythene without holes, progressively ventilated.

Crop drilled 18/2/94 and covers placed immediately after drilling.

Treatment e. was progressively ventilated by manually putting 200 holes/sq m in on 18/3/94 and a further 200 holes/sq m on 19/4/94. Polythene was removed from all treatments on 7/5/94 when carrots had reached the 6 true leaf stage.

MATERIALS AND METHOD

A site was selected in a commercial crop sown for early production (covered with polythene). After drilling and herbicide application, polythene treatments were machine laid within the commercial crop. Apart from ventilation treatments all other cultural operations were the same as for the commercial crop being grown on the site.

Ventilation (treatment e.) was applied manually using 1 cm diameter steel rods pushed through the polythene.

Soil temperature under each type of polythene was recorded at 10 cm depth using a squirrel data logger.

Polythene was removed from all treatments on 7/5/94, when plants reached 6 true leaves.

Experimental treatments were harvested at the same time or within one or two days of the commercial crop. 2 m of bed (4 rows) were lifted and roots graded - less than 20 mm or greater than 20 mm diameter then counted and weighed. Numbers of fanged roots, bolters and splits were also recorded although levels were low, less than 1% on all treatments.

CROP DIARY

Variety	Primo
Mean Final Plant Population	74 per sq m
Sowing Date	18/2/94
200 holes per sq m treatment applied	18/3/94
400 holes per sq m treatment applied	19/4/94
Polythene removal date	17/5/94
Irrigation	25 mm applied 1/6/94
Harvest Date	13/6/94

RESULTS

1. Soil temperature

Figure 1 shows the day time soil temperature for February, March and April recorded hourly at 10 cm depth. During February there was no real difference between treatments, probably due to wet overcast weather conditions.

During March and April the control treatment was cooler than polythene with holes placed between carrot rows, both IR polythene treatments and polythene which had been progressively ventilated.

Figure 2 shows the mean soil temperature at night (20.00 hours - 08.00 hours) for the same period. During February differences between treatments were negligible but during March and April the control treatment was appreciably cooler than all other treatments.

2. Plant Stand Counts

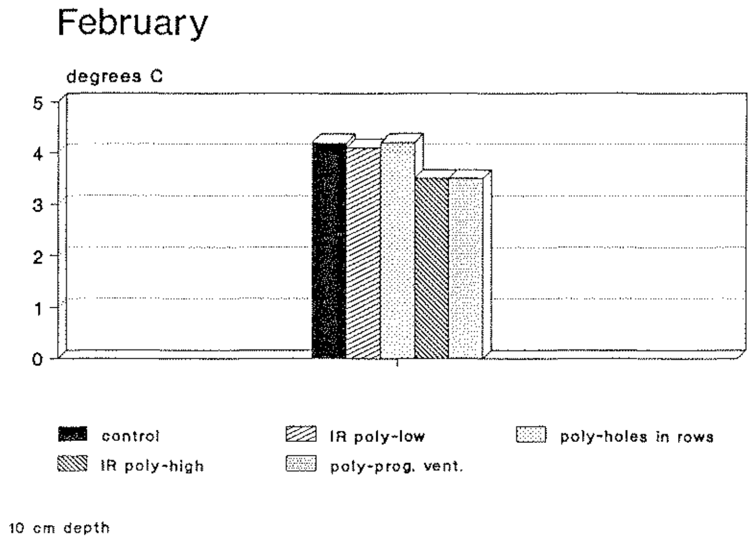
Plant stand counts were recorded at 2 week intervals from sowing until May. Figure 3 shows the number per metre of row for each treatment and sowing date.

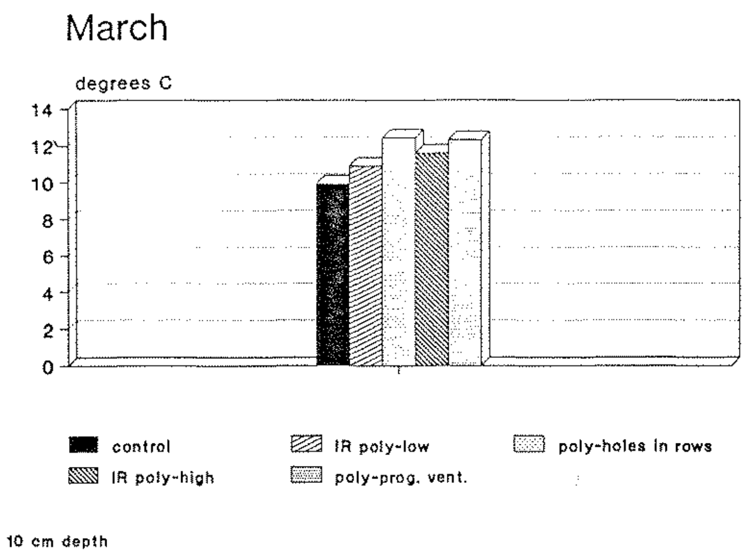
Normal polythene, initially without holes, and both types of IR polythene gave significantly more rapid plant emergence than the commercial control. The polythene with holes placed between carrot rows produced a slower rate emergence in spite of higher soil temperature. This was probably due to soil disturbance when laying this treatment and the problem of ensuring accurate alignment with rows of carrots.

Figure 1

Mean soil temperature

day
8.00 - 20.00 hours





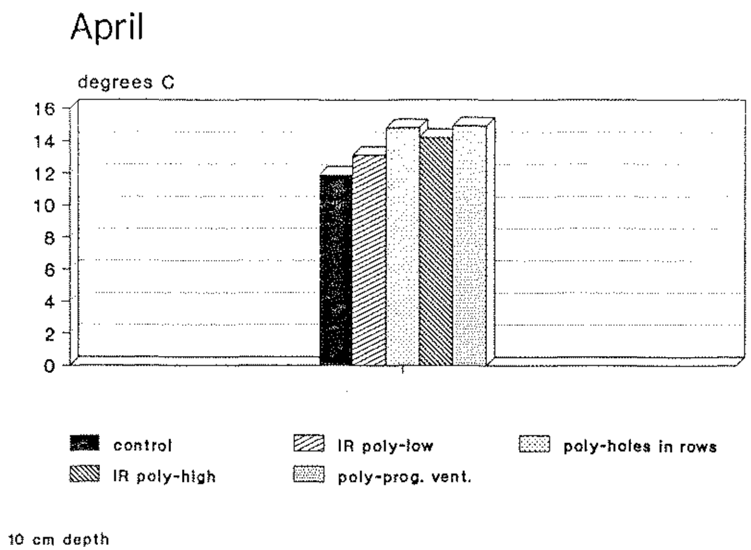
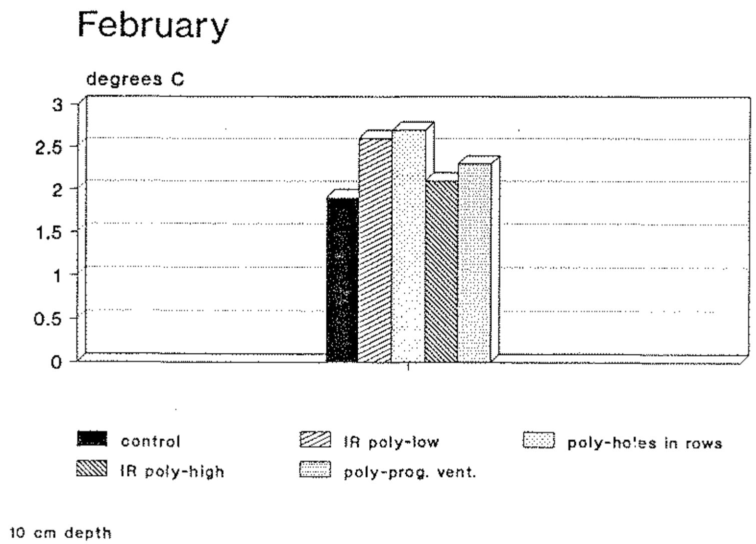
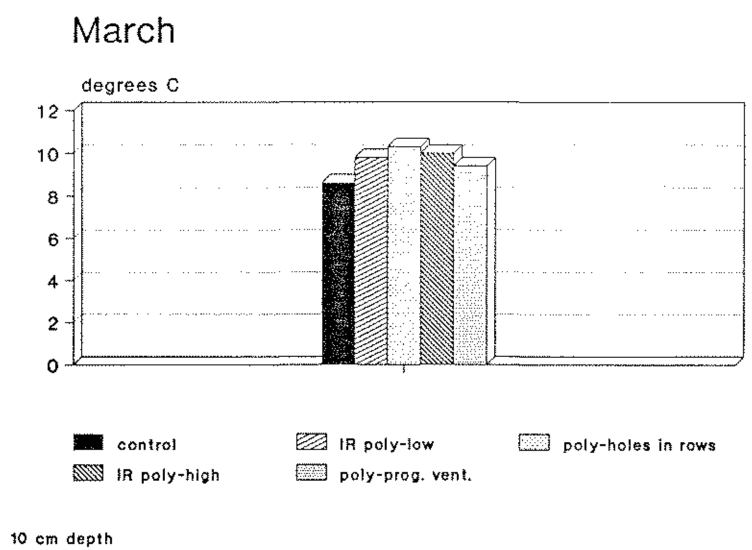


Figure 2

Mean soil temperature

Night
20.00 - 8.00 hours





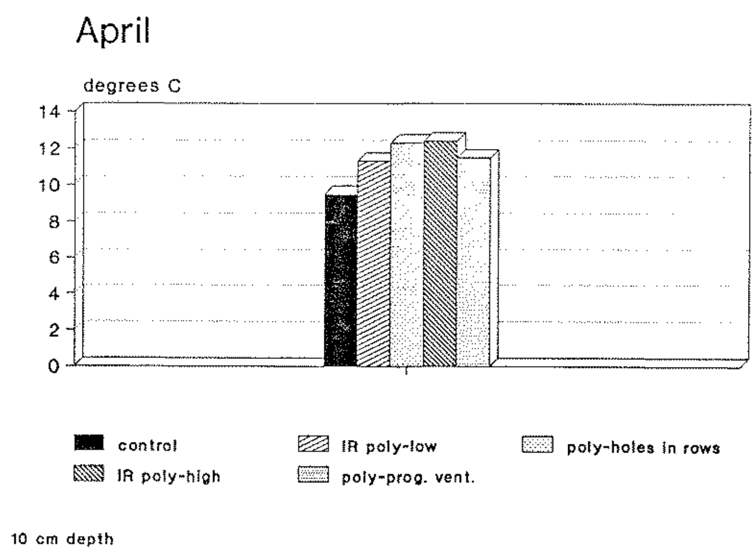
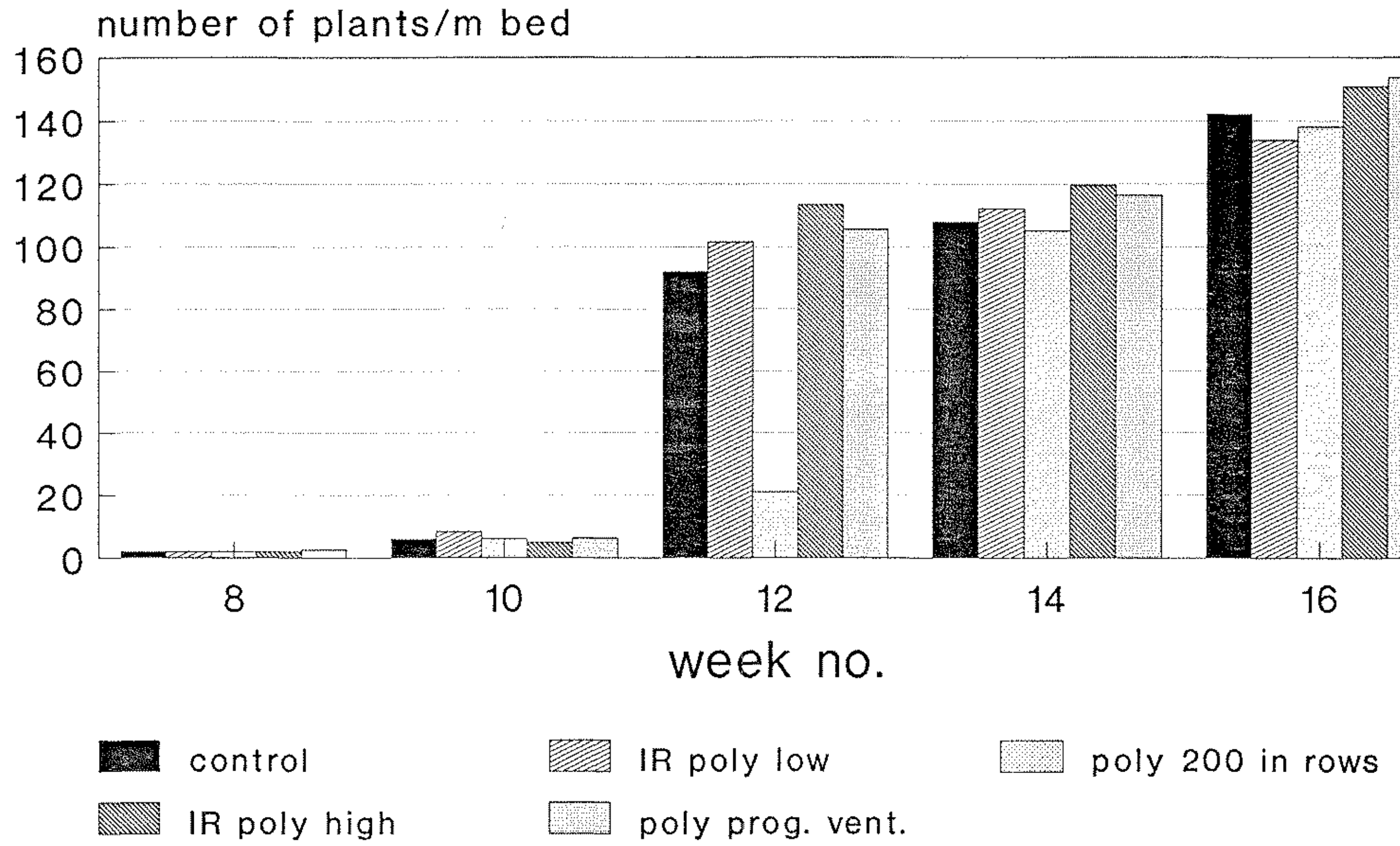


Figure 3
Plant stand counts



sed = 4.55

3. Yield

Table 1 shows yield, weight and number of roots, graded < and > 20 mm diameter.

Except for the treatment with 200 holes/sq m in rows all experimental treatments produced a significantly greater yield (3.46 to 5.52 t/ha) than the control, current commercial practice.

TABLE 1

Mean of 4 replicates

Number and weight/4 sq m

Treatment	< 20 mm		> 20 mm		
	No	Wt/kg	No	Wt/Kg	Wt t/ha
Control, with 200 holes/sq m	101.5	1.425	182.8	6.74	16.85
IR polythene with 200 holes/sq m 10% `filler`	73.0	1.138	195.0	8.95	22.37
Polythene with 200 holes/sq m in rows	71.7	1.163	206.8	8.13	20.31
IR Polythene with 200 holes/sq m 20% `filler`	82.0	1.325	219.8	8.76	21.91
Polythene with no holes progressively ventilated	76.7	1.152	230.5	8.93	22.32
Mean	81.0	1.240	206.9	8.30	20.75
LSD	31.57	0.4232	53.52	1.86	4.66

4. **Field Observations**

Normal polythene without holes (progressively ventilated) did not "pond" during heavy rainfall which ran off into the wheelings. However, this treatment was more susceptible to wind damage than the polythene used commercially.

IR polythene was strong but "stretchy" and must be laid the right way up.

Polythene with holes placed between rows of carrots needs particular precision when being laid or some of the holes will be over the row and cause `premature` ventilation.

DISCUSSION

IR Polythene

Soil temperatures, plant stand counts and yield results show that IR polythene was warmer than polythene with 200 holes per sq m currently used commercially.

There were no significant differences between the 10% and 20% rates of infra-red filler but the lower rate of filler is likely to be cheaper to buy. This material will be easy for growers to adopt.

Solid Polythene

Soil temperatures, plant stand counts and yield results show that polythene without holes and progressively ventilated was warmer than polythene with 200 holes per sq m currently used commercially but no better than the other treatments. Since this treatment was more susceptible to wind damage and requires machinery to be developed for ventilating in the field, this is the most difficult for growers to adopt but this type of polythene is cheapest to buy.

Polythene with holes placed between rows of carrots

This treatment also produced warmer soil, more rapid plant emergence but the yield was not significantly greater than the control treatment. Extra precision is required when laying this type of polythene and when rows of carrots are closer than 450 mm it may not be possible to place 200 holes/sq m without significantly reducing the strength of the polythene.

This type of polythene is likely to cost the same as that currently used commercially.

CONCLUSIONS

1. IR Polythene

Soil temperature, rate of plant emergence and yield was significantly increased by both low and high rates of IR `filler` compared to control, current commercial practice. However this was at one site and further work is required to confirm the benefit of this type of polythene.

2. Ventilation and solid polythene

Solid polythene without holes and progressively ventilated in the field also increased soil temperature, rate of plant emergence and yield. This confirms the benefits obtained in 1993 but a mechanical system of ventilating in the field needs to be developed before this can be adopted by the industry.

3. Polythene with holes placed between rows of carrots.

This treatment also increased soil temperature, but not rate of plant emergence or yield compared to the control, current commercial practice. The cost of this type of polythene is likely to be the same as that in current use but extra precision will be required when laying.

Recommendations

1. IR polythene has potential for producing earlier carrot crops from a February sowing. This needs confirming in one more season and the potential for October sown crops assessed.

2. Normal polythene progressively ventilated gave an increase in yield and a system of ventilating polythene on a field scale is required to realise the commercial advantage. This should be further developed.

3. Other crops, where there is a premium for earliness, should be trialled with these polythene treatments. If similar benefits apply then the cost of IR polythene is likely to be less if its use is widespread.

ACKNOWLEDGEMENTS

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