HORTICULTURE RESEARCH INTERNATIONAL

STOCKBRIDGE HOUSE

A REPORT TO THE HORTICULTURAL DEVELOPMENT COUNCIL,
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EVALUATION OF NONWOVEN CROP COVERS

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Summary

Six commercially available nonwoven crop covers were evaluated and compared with a perforated polyethylene crop cover and no crop cover. They all gave some frost protection. Temperatures, strength and the amount of plant distortion at crop cover removal varied. There were also differences in maturity, yield and quality. No one product was outstanding or gave a significant advantage.

Introduction

For several years there has been a limited number of products used for nonwoven crop covers, but in 1990 many more manufacturers started to offer nonwoven materials for crop covers while established firms produced new and improved versions. With the gradual expansion in the use of nonwoven crop covers it is becoming more important for growers to have impartial data on each product so that an objective assessment of each can be made.

Objective

To evaluate commercially available products for use as nonwoven crop covers and provide guidelines for their suitability for use on field vegetable crops.

Materials and Methods

Location

HRI Stockbridge House

Site

A fine sandy loam of the Quorndon Series.

Treatments

Test Crops: Cauliflower and Marrow

A. No cover (control)

B. Polyethylene (as Coverall) (500 x 10 mm holes/m^2)
- Polycrop Growing Systems

C. Polypropylene (known as nonwoven) Materials:

Product	Manufacturer	Main UK Agent*
Agryl P17 Plus	Sodoca	Polycrop Growing Systems
Base UK 17	Newberger Spa	Lows of Dundee
Lutrasil P17	Freudenberg	Nursery Supplies (Bourne) Ltd
Envirofleece	Rudolf Schachtrupp (German agent)	Agralan Ltd
Gro-Shield	Dun and Low Nonwovens Ltd	Gromax Plasticulture Ltd
Covertan-Pro	Corovin Gmbh	Corovin

* See Appendix I for addresses

Experimental Design

Two replicates in a randomised block design. Each plot 4 x 1.83 m beds wide, 8 m long. 90 recordable plants of cauliflower, 40 recordable plants of marrows.

Culture and Diary

Cauliflower

Sown:	30 January in Hassy 308. Propagation as standard practice.
Base Fertiliser:	3 April; Applied to ploughed site 215:48:200 kg/ha NPK.
Planted:	4 April; Planted into a 100 mm deep furrow. All plots given standard weed control after planting of propachlor (as Ramrod flo at 9 l/ha) plus chlorthal-dimethyl (as Dacthal at 6 kg/ha).
Spacing:	Three rows per bed, 60 cm between rows, 45 cm within rows.
Crop Covers Laid:	16 April
Crop Cover Removal:	6 June Perforated polyethylene 19 June All nonwovens
First Harvest:	20 June

Marrows

Sown:	28 March in Hassy 104. Propagation as standard practice.
Base Fertiliser:	3 April; Applied to ploughed site 120:48:200 kg/ha NPK.
Planted:	16 April; After cultivating site to a tilth. Planted into a 100 mm deep depression to prevent crop cover lying on young plants. Diphenamind (as Enide 50 W at 7 kg/ha) applied for weed control immediately after planting. Crop covers laid as appropriate.
Spacing:	Two rows per bed, 75 cm between rows, 75 cm within rows.
Crop Cover Removal:	14 June
First Harvest:	27 June

Records

Marketable yield
Growth assessments
Frost damage assessments
Strength tests on materials
Temperature data

Data subject to statistical analysis as appropriate.

Results

Table 1: Growth* and Distortion+ Assessments

	Cauliflower			Marrows		
	Growth		Distortion		Growth	
	15 May	5 Jun	6 June	15 May	29 May	17 Jun
No Cover (control)	3	4	0	1	1	1
Agryl P17	7	7	3	5	7	6
Base UV 17	7	8	4	6	6	6
Lutrasil P17	7	7	4	7	7	8
Envirofleece	6	7	5	5	5	6
Gro-Shield	6	7	4	6	6	6
Covertan-Pro	6	7	4	7	8	9
Perforated Polythene	7	8	0	4	4	5

* Refers to speed of growth and does not reflect quality or vigour (Score 1-9; 9 = best)

\+ Distortion refers to plants at crop cover removal (Score 0-5; 5 = most distortion)

Cauliflower

The growth scores showed that plants under all the crop covers grew quicker than the control (no cover) at both assessments. At the second assessment the plants under nonwoven covers, except Base UV 17, were slightly less advanced than those under perforated polythene, but all were more advanced than those without crop cover.

Distortion of growth and especially edge effect when crops covers were removed was most severe on plants covered with Envirofleece, Lutrasil and Gro-Shield. Some plants in the outside rows did not produce marketable heads from these treatments. Less edge effect was caused by Agryl, Base UV and Covertan. The perforated polyethylene crop cover was removed early enough for plants to recover from any distortion.

Marrow

All crop covers gave higher growth scores than no crop cover (control). Nonwoven crop covers gave higher scores than perforated polythene. Lutrasil and Covertan tended to give higher scores than the other nonwoven materials.

Table 2: Marrows: Frost Damage Assessment (Score 0-3; 3 = severe damage) and Mean Number of Open Flowers per Plot (80 plants/plot)

	Frost Damage[+]			Open Flowers[*]
	23 Apr	30 Apr	5 Jun	14 - 20 June
No Crop Cover (control)	3	3	3	0
Agryl P17	2	2	0	24
Base UV 17	1	2	1	27
Lutrasil P17	1	2	0	34
Envirofleece	1	2	0	25
Gro-Shield	1	1	0	21
Covertan-Pro	1	1	1	38
Perforated Polythene	1	2	2	27

[+] Minimum ground temperatures (° C) immediately before assessments were 22/23 April - 3.0; 27/28 April - 4.5; 1/2 June - 2.6 and 4/5 June - 2.1

[*] Mean of three counts taken on 14, 17 and 20 June during the first main flush of flowering after uncovering.

Cold spells occurred in late April and early June. All covers gave protection to the plants, while plants with no crop cover were virtually all killed. The few plants that survived without a crop cover did not provide a viable stand. At the two assessments in April the plants were small and there was an air gap between the leaves and the crop cover, in June the leaves were pressing on the crop covers. The most severe frost was - 4.5 °C at the end of April when Gro-Shield and Covertan-Pro showed less damage than other treatments. The plants under perforated polyethylene were scorched after the frost in June.

After crop cover removal on 14 June Covertan-Pro followed by Lutrasil P17 had the most plants in flower. Gro-Shield, Agryl P17 and Envirofleece were the least advanced.

Table 3: Cauliflower: Maturity, Yield (crates/ha), Class I (as % of total marketable) and Deep Curds (as % of number planted) actual ()

	Mean Cut Date	Total Marketable Yield	% Class I	% Deep Curds
No Crop Cover (control)	3 July	2179	85	62 (78)
Agryl P17	23 June	2365	82	55 (68)
Base UV 17	22 June	2277	69	53 (63)
Lutrasil P17	22 June	2336	81	56 (68)
Envirofleece	23 June	2361	83	62 (78)
Gro-Shield	23 June	2205	86	59 (73)
Covertan-Pro	21 June	2361	69	50 (58)
Perforated Polythene	23 June	2084	87	54 (65)
SED (9 df)	0.7	76.4	4.9	2.7

Maturity

Plants grown under all types of crop covers were earlier than plants with no crop cover. Of the nonwoven crop covers, (left on until harvest), Covertan-Pro was significantly earlier than Envirofleece, Gro-Shield, Agryl and perforated polythene.

Marketable Yield

Plants grown under Agryl, Lutrasil, Envirofleece and Covertan-Pro gave higher yields than no crop cover. Perforated polythene gave the lowest yield but the difference was not significant over Gro-Shield and Base UV.

Quality

Of the nonwoven crop covers Gro-Shield gave the highest percentage Class I followed by Envirofleece, Agryl and Lutrasil. Base UV and Covertan-Pro both gave low percentages of Class I. Perforated polythene gave the highest percentage of Class I but this was only significant over the two lowest figures (Covertan Pro and Base UV 17). The control (no crop cover) also gave good quality, however only Envirofleece was able to match the control for deep curds which were better than Agryl, Base UV, Lutrasil, Covertan-Pro and perforated polythene. Covertan-Pro gave a particularly low number of deep curds.

Table 4: Cauliflower: Head Characteristics (as a % of the number planted) (angle transformation) actual ()

	Size 4 (11-12.9 cm)	Size 5 (13-14.9 cm)	Size 6/7 (>15 cm)	Loose
No Crop Cover (control)	23 (15)	34 (31)	40 (41)	23 (15)
Agryl P17	18 (10)	43 (46)	38 (38)	27 (20)
Base UV 17	23 (15)	39 (39)	38 (38)	32 (28)
Lutrasil P17	17 (8)	38 (38)	42 (44)	28 (27)
Envirofleece	15 (7)	40 (41)	41 (43)	27 (20)
Gro-Shield	25 (18)	42 (45)	33 (30)	24 (17)
Covertan-Pro	21 (13)	40 (41)	40 (41)	34 (31)
Perforated Polythene	26 (20)	40 (41)	32 (28)	23 (15)
SED (9 df)	4.0	1.5	2.0	2.6

All crop covers produced higher percentages in Size 5 than no crop cover, Base UV and Lutrasil gave the lowest of the crop covers. Plants without crop cover gave a high percentage of large heads (Size 6 and 7) which was matched by Lutrasil, Envirofleece and Covertan-Pro. Gro-Shield and perforated polythene gave less large heads.

Covertan-Pro gave significantly more loose heads than any other treatment except Base UV which was significantly higher than no crop cover, Gro-shield and perforated polythene.

Assessments of other characteristics were made, but there were no treatment effects for length of cut, discoloured heads, immature heads or pollen beetle damage, levels of which were generally low.

Table 5: Marrows: Maturity and Fruit Weight

	Date to First Fruit per Plant	Number of Fruit to 22 July	Mean Fruit Weight (kg) (to 1 Aug)
No Crop Cover (control)	**No harvest, plants did not survive frost**		
Agryl P17	5 July	2.3	1.10
Base UV 17	2 July	2.6	1.03
Lutrasil P17	2 July	2.6	1.13
Envirofleece	2 July	2.7	1.08
Gro-Shield	4 July	2.5	1.17
Covertan-Pro	3 July	2.6	1.12
Perforated Polythene	5 July	2.2	1.20
SED (6 df)	1.6	0.30	0.049

Envirofleece, Base UV17 and Lutrasil P17 were three days earlier than Agral P17 and perforated polythene but the difference was not significant. However these small differences were maintained throughout the successional harvest period. Agryl and perforated polythene gave slightly fewer fruit per plant by late July. Fruit from Base UV 17 plots tended to be smaller than average, but differences were only statistically significant when compared with Gro-Shield and perforated polythene.

Table 6: Strength Tests for Nonwoven Crop Covers (Newtons (N) 1 kg = 9.8 N)

	Along the Sheet	Across the Sheet	Diagonal	Mean	6 mm Probe
Agryl P17	19.6	16.2	16.8	17.5	26.0
Base UV 17	25.9	11.1	11.7	16.2	21.8
Lutrasil P17	14.0	9.1	10.4	11.2	16.3
Envirofleece	12.0	5.9	8.9	9.0	14.6
Gro-Shield	11.6	15.8	14.2	13.9	15.5
Covertan-Pro	17.0	10.8	12.1	13.3	22.4

Method

Each sample was 25 mm wide and stretched to breaking point by a tensile strength machine. For the 6 mm diameter probe test samples were laid over a 30 mm diameter hole and the probe pushed against the material to breaking point.

Base UV was strong lengthways but weaker crossways. Agryl gave the best all round strength. However in the field conditions all brands withstood the crop pressing on the underside and all weather conditions without tearing or disintegration.

Table 7: Marrows: Weekly Maximum 50 mm Soil Temperatures (°C) from Laying Crop Covers Until Removal (17 April - 11 June)

Week Ending	23/4	30/4	7/5	14/5	21/5	28/5	4/6	11/6
No Crop Cover (control)	11	15	14	16	19	19	17	20
Agryl P17	14	18	16	19	22	22	17	21
Base UV 17	13	17	15	18	22	22	18	22
Lutrasil P17	15	19	17	19	22	22	18	22
Envirofleece	14	19	17	19	23	23	17	21
Gro-Shield	14	19	16	19	23	22	19	21
Covertan-Pro	15	19	16	19	22	22	18	19
Perforated Polythene	-	-	15	17	21	20	16	21

Soil maximum temperatures were generally similar for each crop cover and 2-4 °C higher than no crop cover.

Table 8: Marrows: Weekly Minimum 50 mm Soil Temperatures (°C) from Laying Crop Covers Until Removal (17 April - 11 June)

Week Ending	23/4	30/4	7/5	14/5	21/5	28/5	4/6	11/6
No Crop Cover (control)	2	6	4	7	9	10	7	7
Agryl P17	5	7	7	10	11	13	11	10
Base UV 17	5	8	7	10	11	13	10	10
Lutrasil P17	5	8	7	10	11	13	11	10
Envirofleece	5	8	6	10	11	13	11	10
Gro-Shield	5	9	6	10	11	13	10	10
Covertan-Pro	6	9	7	10	12	13	10	11
Perforated Polythene			7	9	11	14	7	10

Minimum soil temperatures were similar for each crop cover and generally 2-3 °C higher than no crop cover.

Table 9: Marrows: Number of Accumulated Day Degrees (above 6 °C) from Laying Crop Covers Until Removal (17 April - 15 June)

	Soil (Depth 50 mm)
No Crop Cover (control)	305
Agryl P17	396
Base UV 17	398
Lutrasil P17	416
Envirofleece	412
Gro-Shield	410
Covertan-Pro	413
Perforated Polythene	369

All crop covers gave more accumulated day degrees than no crop cover. Perforated polythene gave a lower number of 50 mm soil day degrees than nonwoven crop covers. Differences between nonwoven crop covers were small, the highest was Lutrasil P17 at 416 compared with Agryl P17 at 396.

Discussion

This was the first year of a trial comparing different nonwoven materials for crop covers. Therefore results should be treated with caution. Since the trial was carried out some of the manufacturers have made alterations to the specifications for 1992.

The cool spring, with particularly cold spells in late April and early June, with frost at night, favoured the use of nonwoven crop covers, especially over marrows. The marrow plants without crop covers did not survive the ground frosts in sufficient numbers to produce a viable crop. All of the nonwoven crop covers protected the plants that were in furrows on the coldest night of - 4.5 °C. Although the biggest leaves of some plants were scorched on some plots (depending on how much they were pressing on the cover) all plants recovered well. Although differences on both crops between the various materials were generally small, there were some significant effects that are important when deciding which materials to use.

Although the strength test showed considerable variations in the materials all performed satisfactorily when used in the trial. No product showed undue problems of tearing or disintegration. Some materials stretched more than others resulting in plants being less distorted at uncovering.

Observations/Comments of Performance of Materials Used in the Trial

Agryl P17 Plus

Gave average growth for both crops with some scorching on marrows after the most severe frost. High yield of cauliflower, average mean weight of marrows. Good strength. Little crop distortion of plants at uncovering. Gave low number of day degrees.

Base UV 17

Good growth for cauliflower, but only average for marrows, with scorching after most severe frost. Average yield on cauliflower, low percentage of Class I, low mean weight of marrows. Good strength lengthways, but less crossways. Average crop distortion at uncovering. Gave low number of day degrees.

Lutrasil P17

Average growth for cauliflower, good growth on marrows. Only slight leaf scorch after hardest frost. High yield and % Class I of cauliflower and good size heads. Highest mean head weight of marrows. Average strength but slightly above average distortion of plants. Gave highest number of day degrees.

Envirofleece*

Slightly below average growth for both crops. Some leaf scorching on marrows after most severe frost. High yield, % Class I and % deep curds of cauliflower with good size. Low mean weight of marrows but early. Lowest strength and highest distortion assessment. Gave average number of day degrees.

* It should be noted that since the trial began the specification of Envirofleece has been changed by the manufacturers and the new material is available for 1992.

Gro-Shield

Average growth for both crops. Only slight frost damage. Average yield of cauliflower with high % of Class I, of medium sized heads. Marrows later than average with above average fruit weight. Below average strength and plants with above average distortion. Gave average number number of day degrees.

Covertan-Pro

Good growth, especially for marrows, with only slight leaf scorch after frost. High early yield of cauliflower, but low % Class I. Average weight for marrows. Good strength with average distortion. Gave slightly above average number of day degrees.

Price of each brand is an important factor when growers decide which one to choose. Prices are deliberately not quoted because individual contracts between growers and agents will vary depending on quantity, locality and discounts negotiated. However on the one year of results obtained in 1991 no product could claim sufficient advantage to justify a premium in price.

Conclusions

In a cool, rather cloudy late spring nonwoven crop covers, especially Agryl P17, Lutrasil P17 and Envirofleece, matched perforated polythene for yield and quality of cauliflower and were easier to manage when the weather became warmer but there was no advantage of earliness over perforated polythene which remains £300-£500/ha cheaper.

Nonwoven crop covers, especially Covertan-Pro, gave advantages of frost protection for the marrows. Because there was less check after frost most showed a slight advantage of earliness over perforated polythene. A successful early crop of marrows was not possible to achieve without crop covers in 1991.

Future R & D Work

New nonwoven products and improved specifications of established materials continue to be offered to the horticultural industry. It is important that the testing and evaluation of materials continues. Most manufacturers claim that 17 g/m^2 nonwoven crop covers can be used more than once. Products were stored from the 1991 trial to test them on a second crop.

The results are from only one experiment and they need to be substantiated in order to produce firm guidelines.

APPENDIX I: ADDRESSES OF MAIN UK AGENTS

Polycrop Growing Systems
Farthing Road
Ipswich
Suffolk
IP1 5AP (0473) 240890

Lows of Dundee
PO Box 300
Marrbank House
6 Paradise Road
Dundee
DD1 9JZ
Scotland (0382) 29251

Nursery Supplies (Bourne) Ltd
Exeter Street
Bourne
Lincolnshire
PE10 9NJ (0778) 424141

Agralan Ltd
The Old Brickyard
Ashton Keynes
Swindon
Wilts
SN6 6QR (0285) 860015

Gromax Plasticulture Ltd
Garden House
Church Road
Baltisford
Stowmarket
Suffolk
IP14 2HF (0449) 721211

Corovin
The White House
9/11 Ack Lane East
Bramhall
Cheshire
SK7 2BE (0614) 40009