WHAT SHOULD WE COVER THE GREENHOUSE WITH?

RICHARD WARE

Oaks Road
R.D. 2, Napier

IAN S. FANKHAUSER

Duncan and Davies Nurseries Ltd
P.O. Box 340,
New Plymouth

OAKS ROAD, R.D. 2, NAPIER

Increasing costs in production and demand on our product, the ornamental shrub, has made it necessary to achieve a fast turn around in growing-on-line (G.O.L.) production to maintain any profitability in the industry.

This has meant better structures and, most of all, better coverings. The more efficient the covering the better the product, enabling us to force it along in cold weather, protect it from cold winds, excess rain, hot sun, heavy frost and hail.

For this paper I would like to describe two weatherproof films and one woven fabric that we use in our nursery.

PVC Hyperlyte
Polyethylene woven fabrics.
Knitted polyethylene shade cloth

PVC "Hyperlyte" greenhouse film. "Hyperlyte" greenhouse films are formulated from P.V.C. and have been developed in New Zealand to provide a greenhouse covering of the highest possible strength. They are available in two standard light transmission formulations: the clear formulation, providing 89% transmission of the visible light spectrum; and the white shaded formulation which gives a shade level of 50%. This shaded formulation is particularly suited to propagation house application.

P.V.C. films have very low transmission levels of the long wave radiation (thermal). This feature means that they contain greenhouse heat better than other single skin, flexible cladding materials. They are UV treated.

P.V.C. films are highly resistant to tearing, even in the most severe storm conditions. Small punctures can be readily repaired with solvent-adhered patches.

While standard roll width is only 1350mm, "Hyperlyte" can be supplied as fabricated covers, high frequency welded to any dimension, thus overcoming the problems associated with joints.

Under normal conditions a usable life expectancy of these films would be approximately 5 years. However, considerably longer usage had been experienced under some conditions, but these must be regarded as exceptions.

"Hyperlyte" films are suitable for structures of the tunnel type or for the cladding of houses of the more traditional gable type.

Woven polyethylene. Trade names: "Fabricon," "Solarweave."

Designed especially for the horticultural industry, a UV treated cross-woven fabric that resists ripping and tearing and other operational hazards. Available in three formulations:

Fabricon: One-sided UV polyethylene coating
Solarweave: Natural two-sided UV polyethylene coating
Solarweave: White two-sided UV polyethylene coating
Natural fabric has an 83% light transmission.

In our experience the one-sided materials give a dryer atmosphere or lower humidity. These are ideal for young tubed crops such as *Grevillea, Protea,* or *Leucodendron.*

After the underside of the cover has aged, the woven material does not allow a great amount of condensation to form, thus less dripping occurs.

These materials can be fabricated either by sewing or hot air welding.

Knitted high density, UV-treated polyethylene shadecloth

This material, again developed for the horticultural industry, has strength, longlife, and greater width as its main features.

Knitted cloth has the advantage of being a very stable fabric using carefully monitored levels of UV treatment. It comes in varying shade percentages and colours—clear 10%, white 55%, and black, green and brown with varying percentages.

Another factor we found important was the material's ability to have an inbuilt "memory"—springing back into shape when depressed or bulged.

It is non-running, resistant to ripping, and has an optimum life of 10 to 15 years with the exception of white, with a 20% expected reduction.

DUNCAN AND DAVIES NURSERIES LTD, NEW PLYMOUTH

The range of greenhouse covering materials in New Zealand has increased dramatically over the last 10 years from glass and P.V.C. to fibreglass, twinwall acrylic, polythene, and more in a variety of brands and colours. This poses the perennial problem to the propagator on "what should we cover it with"! The four main factors in helping me to decide are:

The material best suited to one's requirements
Durability and longevity
Cost competitiveness
Service from manufacturer or supplier

I will give an outline of what we use on our nursery, and why.

The covering material for our propagating and growing-on

tunnel houses is polythene. After trialling with various types of P.V.C. and polythene covers we decided to use "Agphane 101" brand. This plastic is polyethylene copolymer, available in 125, 150 and 200 micron (mμ) thickness, in clear and 40% white tint, with a three year warranty on the 200 mμ provided it has the hoops covered with protective felt strips.

These houses have inflated double-skinned 200 mμ covers, the inner being clear and the outer white-tinted. This gives even light spread, but reduces the glare. The double skinning keeps the night temperature up to 5°C. warmer on frosty nights, and 2°C. cooler in the heat of the summer.

Eight years ago we used black shade cloth covers for shading these houses during the summer. While providing adequate shade this also increased the midday temperatures up to 6°C. We then changed to pink glasshouse shading paint of which we applied up to three coats. The disadvantages with this system were that it was time consuming to apply and as the covers become rougher with age the paint becomes increasingly difficult to remove in the winter, especially on P.V.C. Two years ago we began changing to our present system of the outer white-tinted cover, with one coat of pink shading in summer, which to date is working well.

Side vent tunnel houses (cold growing-on houses) are covered with 125 or 200 mμ clear covers—we are gradually changing to all 200 mμ, in the autumn to spring/early summer. Black shade covers are slid over the top if required during sunny periods. We have found the clear covers give better plant growth than tinted ones in this area. These houses are covered with polythene in the winter to encourage plant growth by keeping them warmer with the clear cover and also dryer with our high rainfall (approximately 65 in. per annum). The "side vent" is also important to keep humidity levels down to reduce fungus disease problems. They are also labour-saving because instead of shifting plants we change covers; this is, poly in winter, shade in spring, or when hardening off, then no cover to fully harden off.

Technical information available comparing "Agphane" plastic to other cladding materials is:

(i) The heat retention in double-skinned polythene (not specifically Agphane) heated houses is in the top of the range with only double-skinned P.V.C. being superior.

(ii) Ultraviolet and condensation tests by P. R. Thompson in 1983 (1) found "Agphane 101" was still in good condition and flexible after 3213 hours of continuous testing. This put "Agphane" at the top of the list with these tests against comparable plastics.

(iii) When tested for photosynthetically active radiation and spectral transmissivity 'Agphane 101" was in the same

ranking as horticultural glass, whereas most other plastic covering materials were 10% to 30% lower.

Under test conditions "Agphane" was proven to be the superior plastic. It was also the first to have a three year warranty for the 200mμ grade. These are some of the reasons why we use it, but it also is standing up well to our regular high winds. They are staying flexible with regular removal and storage, not weakening or becoming brittle at folds when stored. It is cheaper for us than other plastics, $100 to $150 per cover depending on size, and 50% cheaper than P.V.C. We also receive prompt service, which was not always the case with other manufacturers.

The other type of propagation house covering material used is twinwall sheeting on a five bay multispan house. The brand is "Qualex" which is extruded from a grade of "Lexan" transparent polycarbonate. A similar material is "Acrylflute", an impact modified acrylic resin, both of which are of the same structure, that is double-skinned sheets reinforced by structural ribs.

In comparison to the "Agphane", "Qualex" transmits 90% of the light of horticultural glass, with better "light scatter"; that is, the light is not as intense but diffused and more evenly spread through the house.

Heat retention, although not as high, is still in the top of the range making this sheeting more efficient than glass, fibreglass, single-skinned polythene, or P.V.C.

It has high ultraviolet stabilizers and is very flexible. It expands and contracts with temperature fluctuations giving a wrinkled effect along walls but it remains flexible and air tight at joints.

In tests for photosynthetically active radiation and spectral transmissivity "Acrylflute" was 10% to 20% lower than horticultural glass depending on density.

"Qualex" is much more costly (up to 4 times dearer) than polythene but expected life is 15 years or more compared to about 4 years for 200 mμ polythene. The extra initial cost balances out over its life span.

Our reason for building this expensive structure (the framing was about 3 times the cost of a tunnel house) was it is a dual purpose export packhouse for 4 months of the year and a propagating house for the balance, rather than having two separate structures. This house is better suited to larger lines of cuttings that require lower humidity than the tunnel houses. It is good with roof-suspended mist lines allowing machinery access for putting in media for plunging grafts into or for establishing newly-potted growing-on lines during quiet propagating periods.

Shade cloth materials used on the nursery have been a 50% black polyester cloth and to a lesser extent Sarlon 50%. These cloths come in 1.8 metre widths which are sewn together into the appropriate size for our houses. The covers are fastened to houses by

ropes through pockets on the ends and nylon cord through clips on the sides.

Both of these cloths are woven and their main drawback is that if they are cut or wear, the cloth continues to fray, unless repaired quickly. They are also available in one width and different percentages of shade.

These covers are used for:

Permanent shade houses

Temporary shade-on-side vent houses

Summer shading to optimize plant growth and hardening crops off from heated houses.

Their life expectancy with us is 10 years in a fixed shadehouse situation or 8 years where they are continually changed on tunnel houses.

We are now changing to "Duranet" shade covers as this knitted material doesn't fray, is available in a range of widths, different percentages of shade and colours and is very favourably priced compared to other cloths. This will solve some of our problems, especially with some natives such as *Corynocarpus* which require heavier shading—we will now be able to put on a denser cover, say 70%, rather than having crops scorching or putting on two covers, which is not easy.

Every nursery has to decide what is best for their requirements as there are many variable factors, such as sunlight levels, weather conditions, types of crops grown and existing nursery structures.

Acknowledgments I. Fankhauser wishes to thank Agplastics, Christchurch, for supplying technical data.

LITERATURE CITED

1. Thompson, P. R. 1983. Ultraviolet—condensation testing of plastics and polyester type shade cloths. Agplastics, Christchurch, New Zealand.