Greenhouse Coverings

One of the most important parts of a greenhouse facility is the covering. Since sunlight is generally the limiting factor in wintertime greenhouse production, a covering that transmits maximum sunlight in the plant growth spectrum is essential. Physical durability and optical stability are other critical factors.

Several types of covering materials are presently available. Which one is best, or most economical over the long term, is not easy to state. Glass has been the long-time standard and is still the most stable but other film and rigid plastic materials are offering lower cost coverings but with varying levels of dependability and life.

Table L4.6: Types Of Covering Materials

<table>
<thead>
<tr>
<th>Types</th>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Films</td>
<td>Polyethylene</td>
<td>4 and 6 mil</td>
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<td></td>
<td></td>
<td>Regular</td>
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<td></td>
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<td>UV</td>
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<td></td>
<td>Acrylic/Polyester</td>
<td>&quot;Flexigard&quot;</td>
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<td></td>
<td>Polyester</td>
<td>&quot;Mylar&quot; or equal</td>
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<td></td>
<td>Weatherable</td>
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<td>Rigid Plastics</td>
<td>Fiberglass&quot;</td>
<td>Fiber reinforced</td>
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<tr>
<td></td>
<td></td>
<td>Polyester</td>
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<tr>
<td></td>
<td>Acrylic</td>
<td>&quot;Plexiglass&quot; or equal</td>
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<tr>
<td></td>
<td>Polycarbonate</td>
<td>&quot;Lexan&quot; or equal</td>
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<tr>
<td>Glass</td>
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<td>Regular</td>
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<td></td>
<td>Double Strength</td>
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<td>Low Iron</td>
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General Characteristics and Performance of Coverings
For Greenhouse Use

Polyethylene (Regular and U.V.)

1. Lowest cost covering: regular, 2 cent to 4 cent per square foot; U.V., 6 cent to 8 cent per square foot.

2. Widely available, some manufacturers report recently they have stopped production of this product for greenhouse use. (Thus, be cautious of buying any product of unknown quality for greenhouse use.)

3. Relatively short life in sun: 9 to 11 months for regular, one to three years for U.V.

4. Splits more easily at the folds. Should use unfolded or lay-flat rolls for maximum life.

5. Transmits approximately 85 to 88 percent for solar energy available at the earth’s surface.

6. Transmits all wavelengths of action spectra required for plant growth.

7. Transmits the wavelengths of thermal radiation which allows the house to cool more rapidly at night.

8. The strength of new 4 and 6 mil film is one to two times that of 1/8 inch standard glass.

9. Permits double-layer covering which results in 35 to 40 percent reduction on heat loss, reduced condensation, and only 8 to 10 percent reduction in light due to the second (if clean) layer.

10. Provides a "tighter" house with less air leakage which causes somewhat higher inside humidity conditions.

11. Film most useful for low cost temporary or seasonal coverings.

12. Polyethylene film reinforced with synthetic fibers is also available at a cost four to five times that of regular film but generally this material is not used for greenhouses.

13. Double-layer covering on top side of structure with centrifugal fan developing pressure between the two layers is a way to reduce labor and installation costs. Life equal or better than conventional installation methods.
**Acrylic/Polyester**

1. Combine weatherability of acrylic with high service temperature of polyester.
2. Good transmissivity.
3. Nonreversible, acrylic must be installed to the outside.
4. Susceptible to wind flapping.
5. Only 4 foot width available.
6. Cost is 45 to 70 cents per square foot.
7. Estimated life 10 years plus.

**Polyester**

1. Excellent transmissivity.
2. High service temperature.
3. Only available in 26 and 60" widths
4. Low impact resistance.
5. U.V. degradable unless treated.
6. Cost is 50 cents to $1.00 per square foot.
7. Estimated life 7 to 10 years.

**Polyvinylfluoride**

1. The Tedlar* film has proven to have excellent weatherability but is too costly to compete with existing films as a covering. It is now being used as a surface coating which is molecularly bonded to fiberglass panels to improve their weatherability.

**Plexiglass**

1. An acrylic plastic which has been available for many years but has not been widely used as a greenhouse covering due to high cost except for special Climatic or Conservatory type facilities.
2. It is more resistant to impact than glass.

3. Transmits approximately 90 to 92 percent of available sunlight and is available in UV transmitting and absorbing types.

4. Has long life and weathering resistance comparable to glass.

5. Softer than glass, it is easily scratched and is sensitive to some solvents.

6. Cost appreciably more than glass and other possible covering materials.

7. Flexible enough to be used as curved panels in glasshouses.

8. Strong enough to resist snow and ice loads near gutters of connected houses.

9. Expands and contracts greatly with temperature changes and should not be directly nailed or screwed down, but held under a cover strip with soft mastic sealer to allow movement.

**Fiberglass Reinforced Rigid Plastics (FRP)**

1. Many brands of the basic polyester resin reinforced with fiber glass are available in flat and corrugated forms. Corrugated form adds strength.

2. Made in "weights" from 4 to 8 ounces per square foot, widths up to 51 1/2 inches (48 inch coverage) and lengths pre-cut up to 30 or more feet (special order). Use minimum number of joints and laps to reduce chances of dust and dirt accumulation between panels and also air/water leakage. Use proper clear sealer on laps for tightness.

3. Cost ranges from 85 cents to $1.00 per square foot for 4 to 5 ounce panels, $1.00 to $1.25 for 6 ounce panels, and $1.35 to $1.75 for Tedlar coated panels. Culls (Grade B) and assorted lengths are sometimes as low as 45 cents per square foot but be cautious of the quality and durability of these bargains.

4. Two to four times more resistant to impact and lateral loading than glass. Crazing (not shattering) usually results from impact, but this crazing has no harmful effect unless the panel surface is cracked or broken.

5. The polyester of the panels burns freely and rapidly; entire houses have burned in approximately 10 minutes. Flame retardants and good weatherability have not been successfully used together. Insurance on fiberglass is not easily obtainable.

6. Clear or "frosted" panels of greenhouse quality material transmits approximately 78 to 90 percent of available light when new. Non-greenhouse formulations, especially colored panels, should be avoided.
7. Panels with 15 percent acrylic additive have proven more durable than straight polyester formulations.

8. Acrylic modified polyester panels need cleaning at least annually, and generally re-surfacing with an acrylic liquid sealer every 4 to 5 years to restore weathered surfaces to near-new transmission and surface condition (except Tedlar Coated). The durability of the sealer coat is questionable and undergoing more study at present.

9. Some manufacturer’s guarantees are rather nebulous. Until accurate evaluation procedures and quality standards are established, judge a product more on its performance and company reputation rather than the "guarantee".

10. Proper attachment to the structure and sealing/fastening of lapped joints is essential for resistance to wind forces. (Use fasteners every 8 to 12 inches on ends and sides, or per manufacturers specifications.)

Regular Glass

1. Single strength and small panes not used much on newer designs and constructions. Replacement of panes in existing houses could be double-strength for more resistance to breakage.

Tempered Glass

1. Two or three times stronger than regular glass.

2. Frosted or "hammered" types available for better light diffusion, reduced shadow, and non-see-through properties.

3. Larger pane sizes for reduced structural members, hence less shadows.

4. Requires special structural members and glazing methods to give water and air-tight construction.