Plastics on Tunnels for Different Seasons

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Polyethylene plastic has many properties that make it useful as a covering for high tunnels. Its low cost, large sheet size, ease of attachment and good light transmission are properties that have helped to expand the use of tunnels as a means of extending the growing season.

Most polyethylene film is manufactured as a coextrusion of several layers. This allows manufacturers to include additives that enhance its usefulness. The following summary may help you in selecting the right film for your crops.

Life – the life of polyethylene films is limited due to degradation processes induced by sunlight and heat. Co-poly is a low-cost material that is good for one season. This is a better choice on tunnels than construction grade material that has less strength. Greenhouse grade poly is warranted for 4 years or more and costs about double that of co-poly. It contains an ultra-violet (UV) stabilizer that reduces degradation. If additional strength is needed, such as windy locations, a nylon scrim-reinforced material is available from several manufacturers.

Thickness – one-year co-poly film for use on tunnels is available in 3, 4 and 6 mil thickness. Three or four mil film is common for one year use on narrow tunnels. Greenhouse grade material, only available in 6 mil thickness is best for multi-year application.

Condensate control (AC) – also referred to as anti-drip is a wetting agent that reduces surface tension allowing condensation to flow rather than form droplets. This can be sprayed on the film or incorporated in the center layer. Condensation droplets reduce light transmission and can lead to disease problems where they drip onto plants. An anti-fogging additive may be included to prevent early morning and late afternoon fog formation.

Reduced nighttime heat loss (IR) – his is additive that traps the inside radiant heat from escaping. In heated greenhouses, the savings have been measured to total from 10 – 20% depending on whether the sky is cloudy or clear. Research at several universities has been inconclusive as to whether the IR additive slows warming of the tunnel in the morning. In research at Penn State University during October, the tunnels warmed up significantly faster in the morning than outdoor ambient but there was no difference between standard poly and IR poly. During the day, the IR film did not increase the overheating problem as compared to standard clear poly. At night, the tunnels with the IR film retained heat better than the standard poly by 2 - 3ºF but with both types the tunnel was cooler than outdoor ambient. In double layer poly installations, the IR film is always placed as the inner layer to retain nighttime heat.

In the Penn State trials, yield of colored bell peppers was higher with standard poly. On sunflower, there were no significant differences.

Reduced daytime heat gain – in areas with strong sunlight, blocking part of the infrared spectrum can lower inside temperature up to 10ºF. Selective reflective pigments are added to the outside layer. Along with greater diffusion of the light, the advantages include lower cooling costs, greater worker comfort, less irrigation needed, reduced plant stress and improved fruit taste.

Ultra-violet (UV) – bees need UV to navigate. If you are using bees to pollinate plants in the tunnel, purchasing a film that allows some of the UV part of the light energy spectrum to pass through may be important. Otherwise, UV blocking film will reduce whiteflies, thrips, aphids and other insects. It can also control some fungal diseases.

Controlled diffusion – light diffusion is another property that has recently been added by manufacturers. This increases the amount of diffused light that reaches the plants, reducing scorching and increasing light to lower leaves. It is especially important with crops such as tomatoes, cucumbers and peppers. Research has shown that diffused light also reduces fungus spore development and insect propagation.

Light transmission – photosynthetically active radiation (PAR) light transmission varies with the type of additive in the film. Typical values are UV stabilized film – 88 - 91%, IR-AC film – 82 - 87%, IR-AC with diffusion – 77 - 88%. Dust, smog and plastic deterioration can also reduce light transmission. A "rule of thumb" is one percent increase in light equals one percent increase in plant growth. Some growers replace the plastic every year just to get a few percent higher light levels if growing plants during the short days of winter. Some manufacturers make an anti-static film that repels dust, dirt and smog.

Photoselective films – these absorb or reflect specific wavelengths of light. They can enhance plant growth, suppress insects and diseases and affect flower development. Red films such as Dupont IR and Smartlite Red film reduce PAR light and create a shading effect. They have also been shown to improve rose yield and quality.

Single or double layer poly – for normal operation, a single layer is adequate. If you are growing early in the spring or late into the fall and are providing supplemental heat, an inflated double layer may be desirable. It reduces heat loss at night by about 40%. It also reduces the stress at the attachments and the rippling of the plastic on a windy day. Air inflation at ¼" water static pressure is best.

Plastic failure – early failure of poly can be attributed to stress as noted above, abrasion on rough surfaces and sharp edges or heat build up in that area of rafters, purlins and extrusions. Contact with chemicals from pesticides or pressure treated lumber can also affect the life of the plastic. Poly that is left on the tunnel during the winter is subject to cuts from blowing ice especially if there are multiple tunnels adjacent to each other. A scrim reinforce poly may be desirable in this situation.