

## Light Diffusion

### Understanding Light Diffusion

Light is one of the most important factors for greenhouse production, and during the winter, it is often the limiting factor. AT Films provides film that maximizes the amount of light possible in polyethylene greenhouses, using light diffusion. The following provides an overview of the basic principles of light diffusion.

Diffused light is light that is spread out and coming from many sources. A common example of a light-diffusing device is the red plastic taillight on an automobile. Instead of seeing a bright pinpoint of light where the bulb is, you see a fairly even sheet of light.

### Light Transmittance

- **Total Transmittance** can be divided into (a) Direct Transmittance and (b) Diffuse Transmittance. The PAR light value, the value that AT Films reports for all its films, is Total Transmittance within a specified light range. PAR light is what the *plant* utilizes; whereas humans see and utilize a different spectrum of light.
- **Direct Transmittance** is that portion of the light that passes through the film without being scattered or diffused by the irregularities on the surface or the interior of the film.
- **Diffuse Transmittance** is the portion of light that is scattered or diffused by these irregularities. Diffuse Transmittance is a combination of haze and clarity, both measures of the degree of scatter.
- **Haze** is the measurement of wide-angle scattering, and causes a loss of contrast or a milky appearance.
- **Clarity** is the measure of narrow-angle scattering, and causes the detail of an object to be compromised when viewing it through the film. Clarity is also distance-dependent, which means that the farther the object is being viewed through the film, the worse its detail becomes.

The higher the haze and the lower the clarity, the more diffusion is occurring. Although haze and clarity affect how we perceive the film, it is only our perception. **Haze and clarity do not reduce or affect PAR light transmission.**

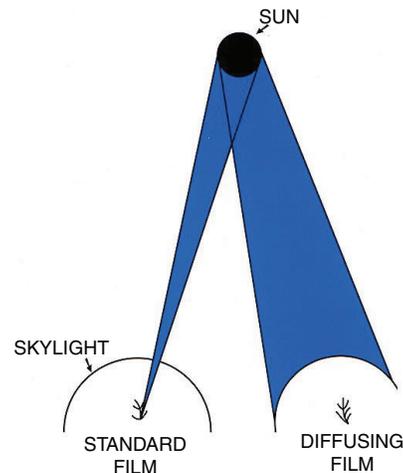


Figure 1

Figure 1 provides an exaggerated view of what happens when a greenhouse film acts as a light diffuser. A leaf under a standard film gets some light from the sky, but most comes from its view of the sun. A leaf under a diffusing film, however, may obtain a larger portion of its light from the bright canopy than from a direct view of the sun.

### Reducing Shadows

Diffusion reduces shadows and allows the plants to receive a more even distribution of light during the day. Although the intensity of light at any one point in time may be lower under a diffused film, the total light transmission is excellent and the plants may actually utilize more PAR light through the course of a day, with less stress. This is due to the more even distribution of light at crop level. By eliminating shadows and spreading available energy more evenly on the leaf surface, there is less stress on the top canopy of the plant and more photosynthesis occurring in the lower canopy.

### Visual Appearance

The appearance of diffused film is considerably different than standard polyethylene film. This is due to the diffusion (scattering) of light through the film. Plants utilize diffuse and parallel light, while our eyes “see” mostly parallel light. This causes a diffused film to look dark and hazy compared to a “clear” film, even though the total light transmission remains the same.

