



## **Understanding Light Diffusion**

Light is one of the most important factors for greenhouse production and during the winter, it is often the limiting factor. Striving to give growers the maximum light possible in polyethylene greenhouses is our vital objective. A good understanding of the basis principles involved is essential.

What exactly is diffused light? 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 tail light 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. Remember, PAR light is what the plant sees and 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 a measure of the degree of scatter. Haze is the measurement of wide-angle scattering, and causes a loss of contrast or milkiness. 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 dependant, which means that the farther that the object is being viewed through the film, the object's detail becomes worse.

Consequently, the higher the haze and the lower the clarity, 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.

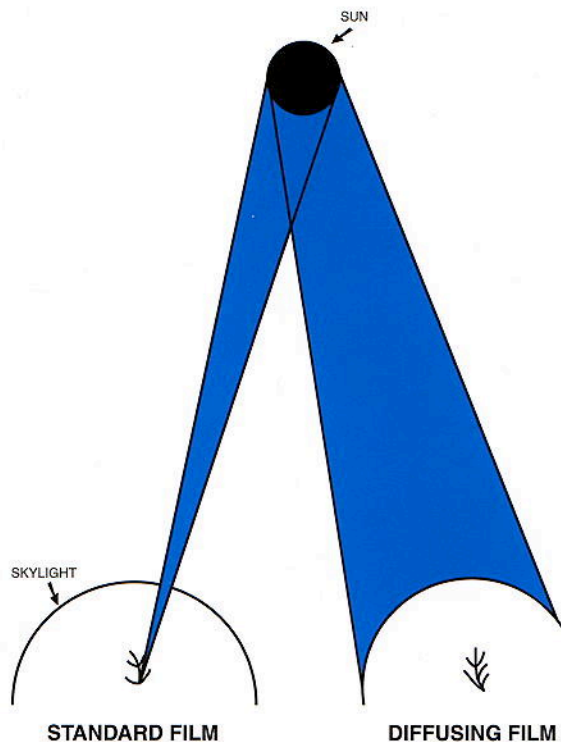


Figure 1 gives an exaggerated view of what happens when a greenhouse film acts as a light diffuser. A leaf under a standard film gets some light from the sky, but most comes from its view of the sun. A leaf under a diffusing film, however, may obtain a larger portion of its light from the bright canopy 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 films is considerably different than standard polyethylene films. This is due to the diffusion (scattering) of light through the film. Plants "see" and 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.