IMPROVE WINTER GREENHOUSE LIGHT LEVELS

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A general rule of thumb used by many horticulturists and engineers, is that a one percent increase in sunlight in a greenhouse during the winter results in a one percent increase in plant growth.

Many factors affect the amount of solar radiant energy (light) that reaches the plants. These include style and shape of the greenhouse, its orientation, the type of glazing used and the placement of equipment within. The difference between a modern, well-designed structure and an older poorly maintained one can be as much as 30 percent in light transmission. Let's review what can be done to increase light transmission in both an existing greenhouse and in a new one that may be in the planning stages.

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Existing Greenhouse

Clean Glazing - All remnants of shading, dirt and algae should be removed from glass glazing. Use a cleaning compound, bristle brush and water. Spray-on shading is more difficult to remove from film plastic. Plastic also looses one to two percent in light transmission each year from the sun's ultraviolet rays and from smog. Some growers replace the outer layer each year to gain the extra light.

Reflective Surfaces - Keep all structural members clean and painted. Use a high-quality oil or latex paint for wood surfaces and an epoxy paint for metal. White paint will give about 80 percent reflection, whereas aluminum reflects about 60 percent of the light striking it. It also helps to paint bench surfaces and concrete walkways. Tomato and cucumber growers frequently lay white plastic on the floor to increase reflectivity.

Internal Equipment - Unit heaters, pipes, electrical conduit, poly tubes and heat blankets suspended in the air shade the plants. Move as much of this as possible to other areas of the greenhouse.

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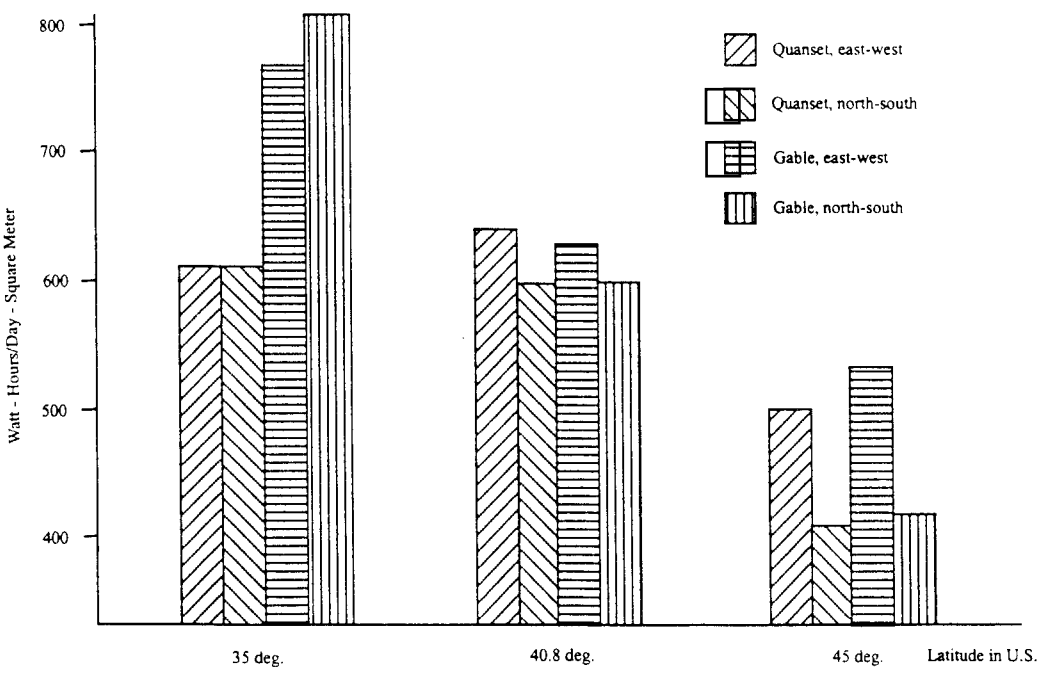

Figure 1. Daily visible solar radiant energy transmitted by quanset and gable greenhouse on December 21.

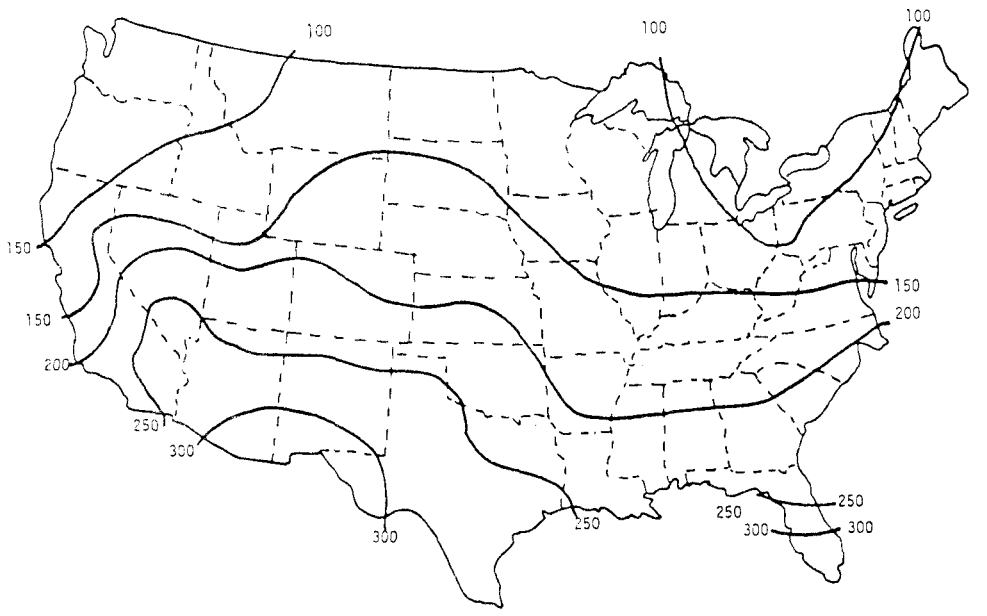

Figure 2. Mean daily solar radiation (Langleys) - December

Outside Obstructions - Accessory buildings, trees and weeds can restrict light transmission, especially at the low sun angle in December and January. Observe the shadows and remove the obstruction if possible.

New Construction

Type of Construction - Generally a single span greenhouse will transmit more solar radiant energy than a ridge and furrow house. This advantage is lost if individual houses are spaced closer together than two-thirds of their height.

The amount of framework also affects light transmission. Structures that are covered with plastic glazing usually have frames spaced four to six feet apart, whereas supports for glass have a normal spacing of two to three feet.

Orientation - The compass direction of the ridge of a greenhouse is known as orientation. The effect of orientation on light transmission is most important during the winter months when the sun angle is low.

Research by Manbeck and Aldrich at Penn State University showed that latitude and orientation had a significant effect on light transmission (Figure 1). Plants in a greenhouse having a north-south orientation will receive more light in latitudes less than 38 degrees. An east-west orientation is generally preferred for northern latitudes. Except for the middle of the U.S., a gable style roof transmits more light.

On sunny days, most of the solar radiant energy enters the greenhouse as direct rays from the sun. In cloudy weather or in areas where high smog levels exist, the sunlight is diffused and enters from all directions. This is particularly true in the northern U.S. during the winter when cloud cover increases. Practices such as insulating the north wall with foam board, although saving on energy costs, will reduce light levels where extensive cloudy conditions exist.

Glazing - There are significant differences in light transmission between the types of glazing and the number of layers used. When comparing light transmission in photosynthetically active radiation (PAR), differences of 15 percent have been recorded between glass and some of the film plastics. Even within different brands of film plastic, a difference of five to 10 percent is possible. Adding a second layer to save energy will lower light levels within the greenhouse by 10 to 15 percent.

Location - As can be seen from Figure 2, a location in the southwestern U.S. can mean twice as much sunlight in December as a northeast or northwest location. In northern climates, a greenhouse receives about 25 percent of the light in the winter as it would get in June or July. In the south, there is a 50 percent reduction. This is why it is important to consider light transmission when designing or maintaining plant production facilities.

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