Spectral light quality

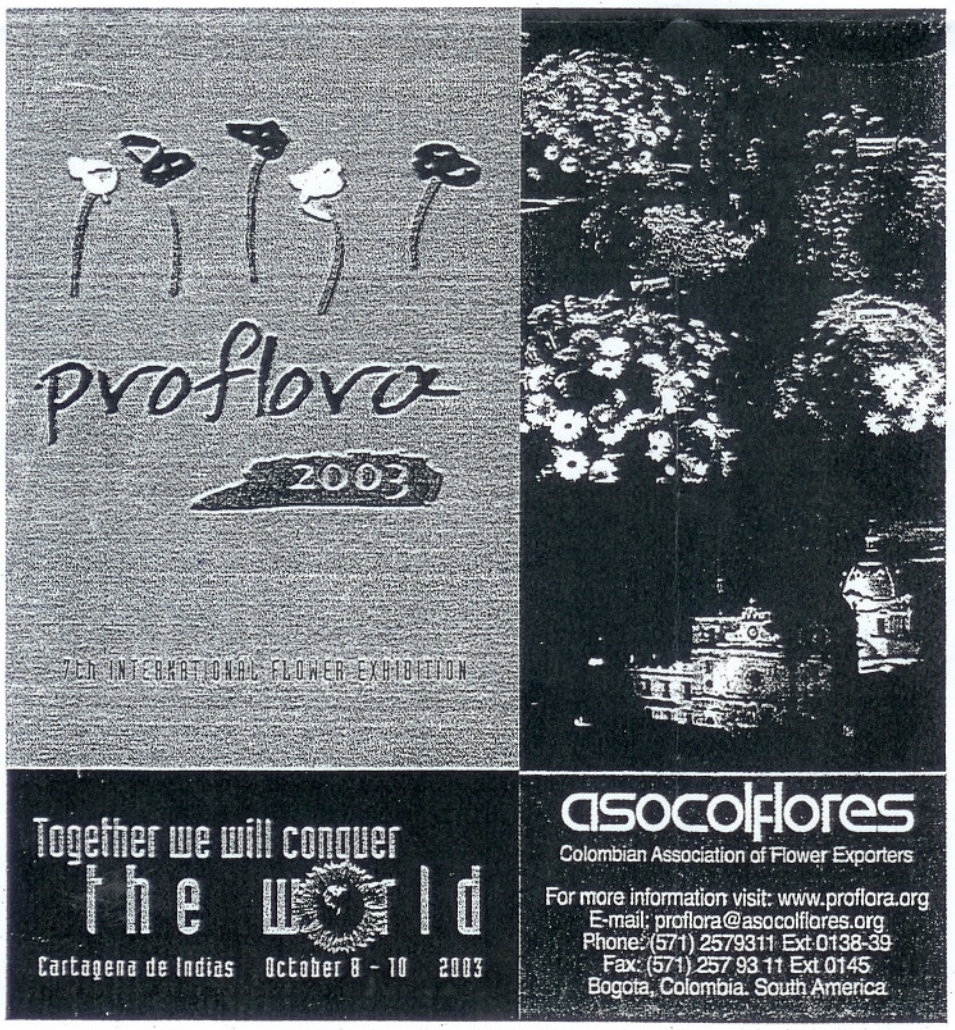
Light can be separated into the different colors of the rainbow, or the light spectrum. Each color represents a different wavelength of light. For example, blue light occurs at 400 to 500 nanometer wavelengths, while red light occurs at 600 to 700 nanometer wavelengths. When plants respond to specific wavelengths in the light spectrum, they are said to respond to the spectral light quality. The most familiar light quality issue of importance to greenhouse growers is the ratio of red light to far red light. Sunlight has a balanced ratio, almost 1:1, of red and far red light. Leaves use red light for photosynthesis, thus leaves readily absorb red light but do not absorb very much far red light.

As a result, far red light reflects off the foliage or passes straight through the leaves. Consequently, the light measured near plants is often low in red light relative to far red light yielding a low red-to-far red light ratio. Plants use this information to determine if neighboring plants are competing for light. If a neighboring plant is shading another plant, then the competing plants will potentially benefit from growing taller. A taller plant will intercept more light than its neighbor, allowing for increased plant growth. Thus, plants in the greenhouse that are spaced close together will elongate very rapidly due to the low red light, high far-red light environment. Shade from shade cloth or clouds does not have the same affect on stem elongation, because these shade sources remove equal amounts of red and far red light. Thus shade cloth and clouds do not have a significant impact on spectral light quality.

Canopy closure is a term used to describe the proximity of neighboring plants. When the leaves of neighboring plants begin to overlap, the red-to-far red ratio begins to be impacted resulting in an increase in stem elongation. Thus, the degree of canopy closure, or leaf overlap, is an indicator of the potential stem elongation to be expected from a crop in the coming weeks. Canopy closure should be factored into the plant growth regulator decision-making process, since a "closed" canopy is more likely to elongate rapidly than an "open" canopy in which the neighboring plants have not yet begun to overlap. Artificial lighting can alter the spectral light quality since electrical lamps can have a different ratio of red and far red light than sunlight. Incandescent lamps provide a large quantity of far red light relative to red light. Consequently, plants grown under incandescent lamps often stretch more than plants grown in sunlight. High-pressure sodium lamps produce more red light than far red light, so stretching does not typically occur on plants grown under these lamps. So, high-pressure sodium lamps are becoming more popular for use in photoperiodic lighting.

Sunlight does not always provide the same red-to-far red light ratio throughout the day. Twilight, or the light at sunrise and sunset, tends to be higher in far red light than red light compared to the sunlight delivered throughout the day. When black cloth is closed over a greenhouse crop in the late afternoon and re-opened after sunrise to provide short day conditions, the plants may actually elongate more slowly than plants grown without black cloth since the plants are not "seeing" the low red light and high far red light provided at twilight. The duration of twilight increases as latitude increases, so twilight is a more important issue for northern growers.

—Dr. Jim Faust, Clemson University, South Carolina, United States, excerpted from the forthcoming 17th Ball Redbook.



Write In No. 007 on Inquiry Card