Cladding and membrane light diffusion

Other issues and common grower concerns

TOOLBOX

GREENHOUSE CONSTRUCTION AND SAFE OPERATION

What is diffuse light

Growers can control the greenhouse climate including light levels, temperature and humidity. These variables can impact plant quality, yield and the efficiency of heating and cooling systems. Diffuse light through cladding and membranes plays an important role in increased and uniform productivity.

Light from the sun is composed of a diffuse and direct component. Diffuse light is light scattered by particles, which can be found in clouds or in whitewash, various types of glazing or shades. Diffuse light comes from all directions so shadows are only cast directly underneath objects, while direct light will cause high contrast between dark shadows and brightly illuminated surfaces.

What are the benefits

Most plants can benefit from diffuse light as they use it more efficiently. This is because diffuse light:

- Stimulates greater photosynthesis due to less shading by upper leaves and greater penetration into the canopy
- Promotes better growth due to more even distribution of light horizontally, with less hot and shady areas.

Research has shown that the benefits of diffuse light to the grower can include:

- Improved crop yield
- Higher leaf count
- Lower crop temperature
- Shorter crop time
- Improved quality
- Increased uniformity of plants and fruiting bodies.

These results have been demonstrated in commercial fruit and vegetable crops with a high plant canopy, as well as ornamentals with a small plant canopy. The benefits are greater during the summer.

For example, research in The Netherlands conducted by Hemming et al. (2007) found that cucumber yield and number increased by 4.3% and 7.8% respectively with a diffuse light cover compared to a clear cover protected environment. This was despite the fact that the diffuse cover reduced the total light transmission by 4%.

These benefits have the potential to be much larger in sunnier climates like Australia, compared to cloudier locations like The Netherlands. This is because it's important that the crop still receives the same amount of light, just scattered, rather than reducing absolute light transmission.

KEY MESSAGES

- Diffuse light is light scattered by particles, which can be found in clouds or in whitewash
- Most plants can benefit from diffuse light as they use it more efficiently
- The benefits of diffuse light can include improved crop yield and quality, as well as shorter crop time
- Diffuse light can be provided by installing cladding and membranes in your greenhouse

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How to implement diffuse light on-farm

Diffuse light can be provided by installing cladding and membranes in your greenhouse. These can include curtains, glazing, whitewash, screens and more recently Svensson's white strips. Cladding and membranes can convert direct sunlight into diffuse light without decreasing light transmission to the crop.

However, there are some important considerations when introducing diffuse light. These include, but are not limited to:

- Fixed or semi-permanent cladding or membrane will generally be cheaper, easier to install and operate, but risk losing light transmission, therefore crop growth, when conditions are too dark. For semi-permanent covers like whitewash there is also a significant amount of uncertainty about when is the best time to apply during the season (e.g. spring)
- Moveable cladding or membrane are usually more expensive, more complex to install and operate, but have the benefit of customising the amount of diffuse and direct light in response to the conditions. This means you can maximise crop growth year-round.

The general 'rule of thumb' is only apply diffuse light to the crop when needed. This will usually be during the warmer months when direct light could slow growth or damage the crop.

Directions for further research

While the concept of diffuse light is well understood, there are still many areas for further research to better understand it's impact on commercial crop growth in a protected cropping environment. This includes:

- Effect of diffuse light on crops during different seasons
- Methods for measuring leaf photosynthesis
- Orientation and spacing of crop rows to maximise light reflection
- Crop architecture and the influence on light distribution and absorption
- Correlation between pre-harvest growth conditions and fruit and vegetable quality.

IMPORTANT QUESTIONS TO ASK

- What are the best diffuse light options for my greenhouse? For example, fixed or moveable solutions.
- What have I learnt from implementing diffuse light in the past, or from other growers?
- How do diffuse lighting structures interact with my energy saving measures for heating and cooling?

REFERENCES AND FURTHER READING

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