GROWERTALKS

Features

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Making the Connection Between Climate and Diffuse Light

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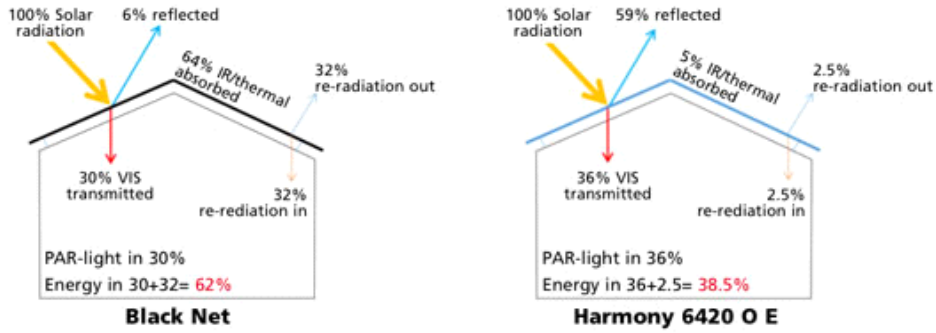
Recent greenhouse trials investigated if it's possible to lower air and leaf temperature and to improve crop quality by using diffusive shade cloths compared to using metallic Aluminet shade. Three shade cloths were included in the trial: new light-diffusing Harmony O E (open exterior) shades at the 30% and 50% shading levels and Aluminet at the 50% shade level. The trial was performed at Brite Leaf Citrus Nursery in Lake Panasoffkee, Florida.

Brite Leaf has independent growing zones where Harmony 3015 O E, Harmony 5120 O E and Aluminet 50 were used. All houses are closed structures with transparent double poly as cover and nets on the gables and sidewalls.



Pictured above: When comparing Harmony 6420 O E and a black net with 70% shade, the energy (= heat) transmitted into the greenhouse is only 39% of the incoming radiation for Harmony 6420 O E, but 62% for a black shading net. This means that the heat load in the greenhouse will be about 60% higher if using a black net compared to Harmony 6420 O E even though the shade level is higher for the black net. (See illustrations.) As a result, the temperatures in a greenhouse can be lowered by using a white, highly reflective shade screen.

Temperature reductions

Data from the Florida trial compared the Harmony zone to a second zone in the same house without a shade

screen. The results found that on a day when the outside temperature is about 86F (30C), the temperature in the greenhouse where shade isn't being used easily exceeds 104F (40C) and can reach a peak temperature of 109F (43C). Under the same outside conditions, but with Harmony 3015 O E used as shade, the temperature inside the greenhouse was no higher than 95F (35C). Peak temperatures were reduced by 7 to 10F (5 to 8C) when using Harmony 3015 O E as outside shade on this particular greenhouse compared to using no shade.

When comparing the 50% light-diffusive Harmony 5120 O E shade to the metallic 50% Aluminet shade, the climate data showed that every single day during June and July, air temperatures were lower in the Harmony house. On average, the air temperatures during these two months were 3 to 5F (2 to 2.5C) lower in the Harmony house compared to the house with Aluminet shade. Differences in peak temperatures close to 6F (4C) show an even bigger gap between the diffusive 50% Harmony shade and 50% metallic Aluminet shade during this period.

During 10 days out of 31 in July, the peak temperatures are 4F to 5F (3.2 to 3.8C) lower in the Harmony house than the Aluminet house. On days with a lot of radiation, the peak temperatures were reduced even more using the Harmony shade. For example, on June 5 and July 6, the peak temperatures were reduced from 104 to 95F (40 to 35C) in the Harmony house.

	Harmony 5120 O E	Harmony 6420 O E	Black Net (70% shade)
Solar	100%	100%	100%
Reflected	46%	59%	6%
PAR transmitted	49%	36%	30%
IR/thermal absorbed	5%	5%	64%
Re-radiation in	2.5%	2.5%	32%
Re-rediation out	2.5%	2.5%	32%
PAR-light in	**49%**	**36%**	**30%**
Energy in	**49+2.5 = 51.5%**	**36+2.5 = 38.5%**	**30+32 = 62%**

Manual readings also indicated leaf and soil temperatures were about 3F (2C) lower in the Harmony house.

Brite Leaf owners Nate and Anna Jameson reported that after a few days of installation it was striking how much the light was spread by the Harmony 50% shade compared to the Aluminet 50% shade. The general feeling was that the climate was more pleasant in the Harmony house and the sun was burning a lot less.

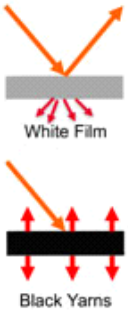
Comparing data from the 50% Harmony house, when shade and no shade is used, shows that with Harmony 5120 O E as a shade screen, temperatures inside the greenhouse can be reduced by roughly 12F (10C) during the hottest part of the day for this particular greenhouse. Temperatures inside the greenhouse were compared during two days with similar outside conditions.

On May 9, when no shade was used, the outside temperatures reached about 91F (33C) and the peak temperatures in the greenhouse were almost 111F (44C). On July 1, when Harmony 5120 O E was used as

shade, temperatures inside the greenhouse were no more than 91 to 93F (33 to 34C) degrees.

The trial shows that diffuse light provides a better climate, which in turn has an impact on the quality and the consistency of the crop. A significant decrease in average and peak temperatures was seen throughout the entire test period. Lower temperatures may potentially lead to less use of water and create a more comfortable climate to work in.

What's so great about white?



Research shows that a diffusive white highly reflective shade material provides a cooler climate compared to a black shading net. The reason: a white shade screen has a much higher shading efficiency than a black shade with the same PAR light transmission.

When solar radiation hits a shade screen, some of the radiation is reflected back into the atmosphere, a part of the radiation is absorbed by the material and a part of the radiation is transmitted through the screen/net into the greenhouse. How much of the solar radiation that's reflected, absorbed or transmitted depends on the properties of the material used in the shade screen/net. The sum of Reflection, Absorption and Transmission is always 100%.

A white shade screen reflects most of the solar radiation due to the high reflection of the white film.
A black net, on the other hand, absorbs most of the solar radiation. This means that black shade will obtain a higher temperature. The absorbed radiation of both the white screen and the black shade screen/net is re-radiated back into the surroundings as heat.

Because the black net obtains a higher temperature due to the high absorption, more heat will be re-radiated from the black shade net into the surroundings. **GT**

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