



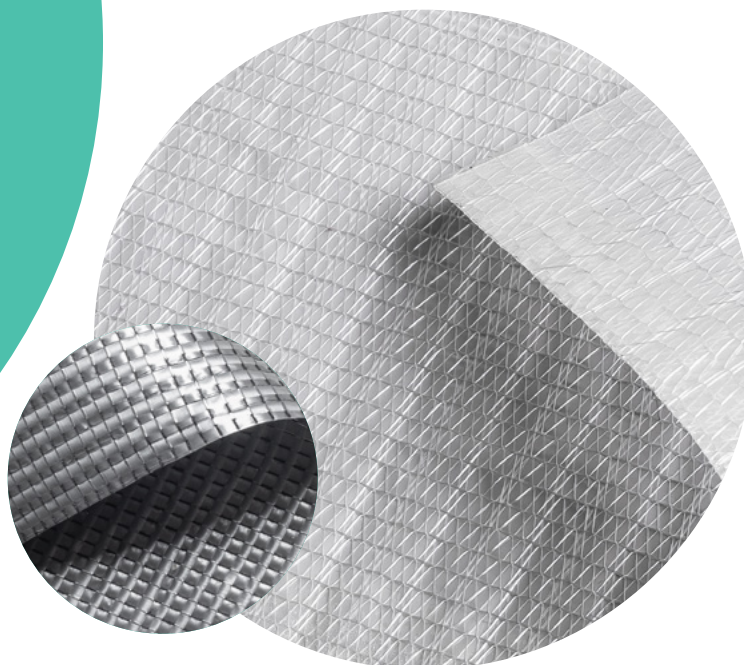
OptiPAR BALANCED PAR. BETTER GROWTH.



Phormium

Supporting growers since 1977

INTRODUCTION



A better greenhouse climate translates into higher crop yields and lower costs. That is why, now more than ever, the greenhouse climate is being closely examined to analyze and optimize it. Climate parameters that are of great importance to crop growth and development include, in addition to temperature, humidity, and CO₂, light quality and quantity.

In greenhouses, the quality and quantity of light are controlled—using screens and coatings when there is an excess of sunlight, and artificial lighting when there is a shortage of sunlight. **This whitepaper takes a closer look at the control options offered by modern screen systems.**

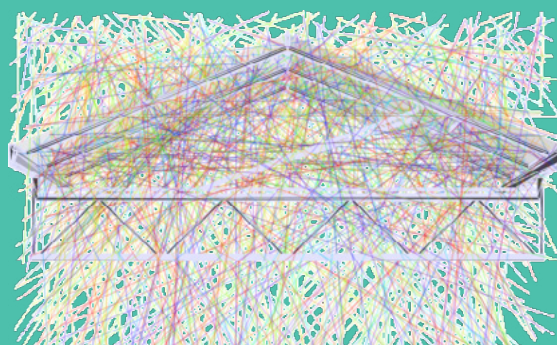
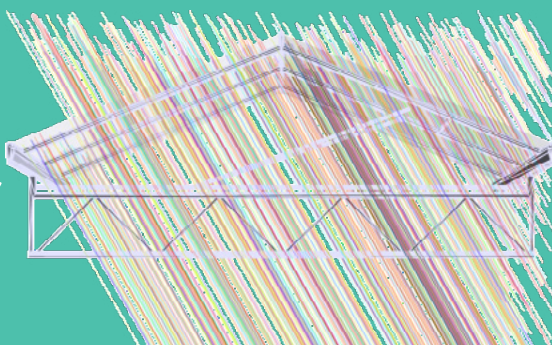
While greenhouses traditionally use shade screens that block a fixed percentage of sunlight, there is an increasing need for a solution that allows growers to block a variable amount of light rather than a fixed amount. Phormium therefore introduces **OptiPAR**, a shading solution that, even more than traditional shades, enables growers to optimize both the quality and quantity of light in the greenhouse.

LIGHT QUALITY

Light quality encompasses characteristics such as colour and the degree of diffusion. A screen affects light quality by influencing these characteristics.

Diffuse light is known to promote crop growth. Unlike direct light, diffuse light rays do not strike the surface in parallel but at many different angles simultaneously. In this way, diffuse light spreads more evenly across the leaf surface of a crop, making photosynthesis more efficient.

Figure 1:
Illustration
of direct (left)
and diffuse
(right)
sunlight
(Kaskieswijzer,
WUR, groen-
kennisnet.nl)



As the variation in the angle of incidence increases, the degree of diffusion increases. Two prominent quantities used to quantify the degree of light diffusion are “haze” and “hortiscatter.” The parameter “hortiscatter” is still relatively new and was first introduced in the NEN 2675 standard. “Haze,” on the other hand, has been in use for quite some time. Although both haze and hortiscatter quantify the degree of light diffusion, hortiscatter is known to be more precise and accurate. **Light diffusion is therefore always expressed in hortiscatter in this whitepaper.**

A higher hortiscatter value (a value between 0 and 100%) corresponds to greater light diffusion. The more even distribution of light across the leaf surface results in lower light intensity per cm² of leaf surface, which leads to more efficient use of light for photosynthesis. This is explained in more detail under “light quantity.” Furthermore, the lower intensity also reduces the risk of crop damage.

In addition to providing better vertical light distribution across the crop’s leaves, a high degree of light diffusion offers another benefit: **improved horizontal light distribution. This ensures that all plants in the greenhouse receive a virtually identical amount of light, resulting in more uniform crop growth.**

LIGHT QUANTITY



Light quantity refers to the amount of light present at a specific moment or over a given period. The amount of light at a specific moment is also called the instantaneous light quantity or light intensity. In horticulture, this is often expressed in $\mu\text{mol}/\text{m}^2/\text{s}$.

When considering the amount of light present over a given period, growers frequently use the daily light integral (DLI). This is expressed in $\text{mol}/\text{m}^2/\text{day}$.

Light intensity indicates how many photons are received by the crop per square meter per second at a given moment. By adding up all the photons received by the crop per square meter throughout the entire day, one obtains the light sum per 24-hour period. This indicates how many photons were received per square meter over the course of the entire day.

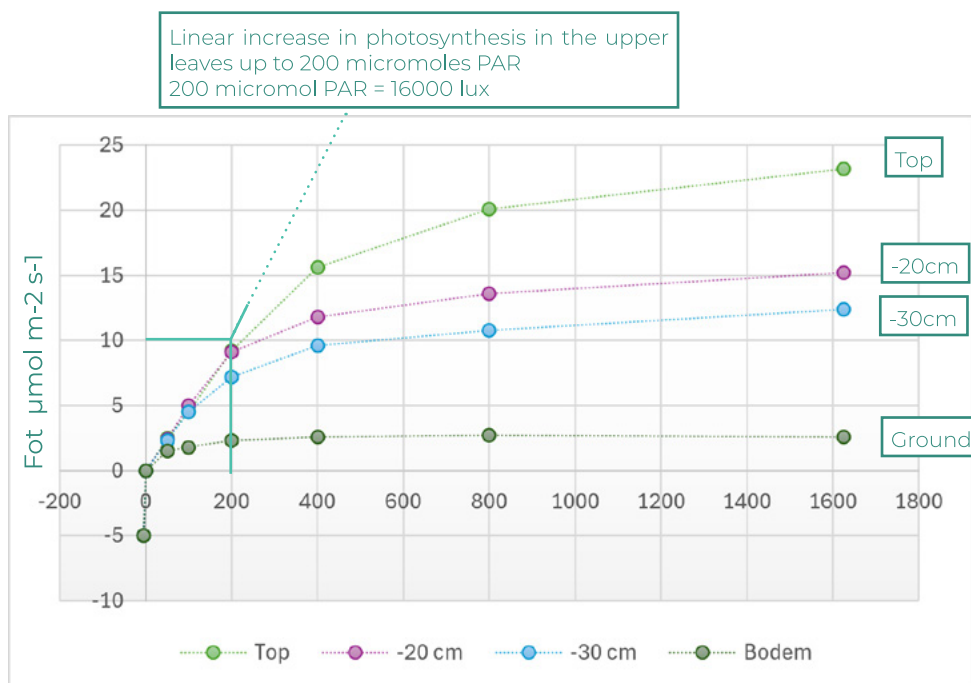
The amount of light a crop receives (light sum) is directly related to the rate of photosynthesis. The higher the light sum, the higher the rate of photosynthesis. However, there is an important limitation to this relationship: as a leaf receives more light, it will become more saturated. Thus, as light intensity increases, the rate of photosynthesis also increases, but the rate of increase in photosynthesis always becomes smaller.

Photosynthesis light-response curve

Figure 2: Relationship between photosynthesis and light intensity in roses, illustrating the general phenomenon of light saturation in crops. Higher light intensities lead to increased photosynthesis. Initially, the increase is linear, but as light intensity continues to rise, the rate of increase in photosynthesis gradually decreases until it levels off. This trend applies to all leaves in the crop.

(Short-cycle lighting in roses, A.H.C.M. Schapendonk)

Because an increase in light does not indefinitely translate into an increase in photosynthesis, it is important to distribute the light as evenly as possible across the crop’s leaves. **Better distribution leads to more efficient use of light by the crop.**



In addition, excessively high light intensities can cause damage to the crop. This is particularly true for certain ornamental plants. **Better light distribution therefore reduces the risk of crop damage. This reduced risk makes it possible to increase the DLI, since higher light intensities can be tolerated as a result of better light distribution.**

The improved light utilization and higher DLI together result in better crop development and higher crop yields.

OptiPAR

BALANCED PAR. BETTER GROWTH.

Traditional shade screens control the quality and quantity of light in greenhouses by blocking a fixed percentage of sunlight (e.g., 50%). When the maximum permitted intensity is exceeded, the shade screen is activated. This allows for the creation of 50% shade. However, more light is often lost than is desirable.

Optimization is possible by installing a second, independently movable screen. If this second screen has a shading factor of 30%, it can be combined with the first screen to create 30%, 50%, and 65% of shade. Whereas a single screen provides only one shading setting (50%), two screens provide three shading settings (30%, 50%, and 65%).



The **OptiPAR** shading system allows for an infinite number of shading settings.

With OptiPAR, you can achieve any desired level of shade between 20% and 100%. This allows you to let exactly the right amount of light reach the crop at any given time. You adjust the shading setting until the desired light intensity is reached. Because light is not wasted unnecessarily—while still ensuring that critical light intensities are not exceeded—higher light sums can be achieved. This benefits crop development and yield.

OptiPAR consists of two screens mounted on two separate wire beds that can move independently of each other. The screen on the lower wire bed is a diffusing screen with a high hortiscatter value. It blocks only a limited amount of light and strongly scatters the incoming light, creating highly diffuse light.

The screen on the upper wire bed has a shading factor between 75% and 100%. Depending on the intensity of the incoming sunlight, this screen closes more or less. It therefore blocks more or less light. The remaining light falls on the diffusing screen, which scatters it and distributes it evenly across the greenhouse. As a result, every plant (horizontal plane) and every leaf (vertical plane) receives almost the same amount of diffuse light—just enough for optimal photosynthesis.

OptiPAR contributes to higher photosynthesis in several ways. The diffuse light provides better light distribution, lower light intensities, and therefore more efficient use of light. The lower risk of crop damage resulting from the high degree of light scattering, combined with the controllable amount of light, enables growers to work with genuinely higher daily light integrals.

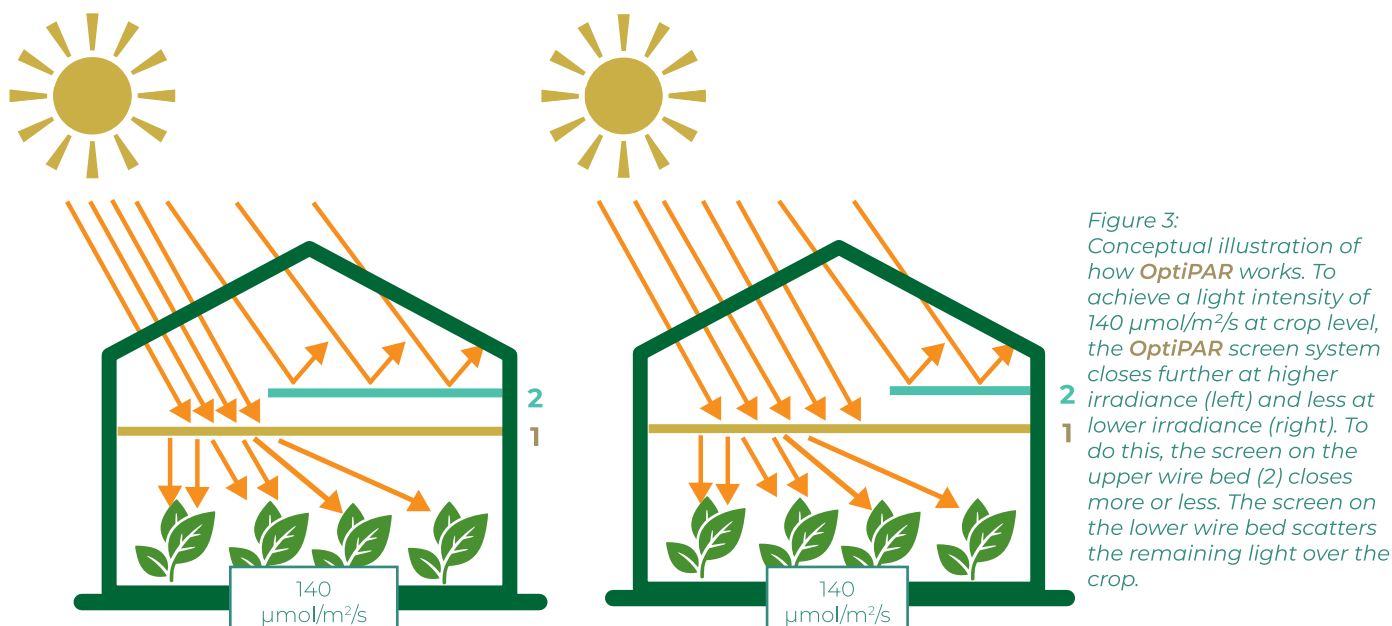


Figure 3:
Conceptual illustration of how **OptiPAR** works. To achieve a light intensity of $140 \mu\text{mol}/\text{m}^2/\text{s}$ at crop level, the **OptiPAR** screen system closes further at higher irradiance (left) and less at lower irradiance (right). To do this, the screen on the upper wire bed (2) closes more or less. The screen on the lower wire bed scatters the remaining light over the crop.

PEARL

Within the **OptiPAR** system, the screen on the lower wire bed is always Pearl. Pearl is a diffuse screen with a hortiscatter value of 83% and a PAR shading factor of 28.5% (NEN 2675). With an energy-saving rating of 47%, the fabric can also be used at night to reduce the greenhouse's energy consumption. Its breathable structure of moisture-wicking yarns helps **Pearl** create a pleasant growing climate for the crop. **Pearl**'s moisture transport value—measured under standardized conditions in the TransHumid device (WUR Lightlab)—is 37.1 g/m²/h. **Pearl** achieves fire class 1 (NTA 8825).

Hortiscatter is a measure of the light scattering caused by a material and is defined in the NEN 2675 standard. The Hortiscatter value is a percentage between 0 and 100 and expresses, as a percentage, the extent to which the light distribution caused by the material in question approximates the ideal Lambertian light distribution.

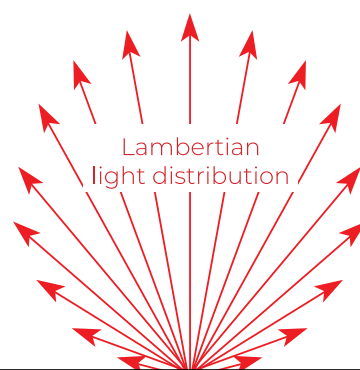


Figure 4 shows the Lambertian light distribution. This forms the basis for calculating a screen's hortiscatter value. The more closely the light distribution caused by a screen approximates the Lambertian distribution, the closer the screen's hortiscatter value will be to 100%.

NOCTIS THERMO

On the upper wire bed, **OptiPAR** includes a screen with a high shading rate. With a shading factor of 99%, **Noctis Thermo** is therefore a suitable candidate. In addition to an appropriate shading factor, **Noctis Thermo** offers other benefits as part of **OptiPAR**. In crops with artificial lighting, it can serve not only as a shading screen but also as a light-emission screen; in unlit crops, it can be used as a highly insulating night screen.

With its 100% aluminized surface, robust woven structure, and high energy-saving rate of 72%, **Noctis Thermo** adds an extra dimension to **OptiPAR**. During the day it is used to control the amount of incoming light; at night it reduces energy consumption more effectively than alternative screens.

MEP™ What makes **Noctis Thermo** special is that it is an affordable aluminum screen. Unlike traditional aluminum screens, **Noctis Thermo** is not manufactured using costly aluminum coatings, but with Phormium's unique MEP™ technology. **Noctis Thermo** also achieves fire class 1 according to NTA 8825 and is covered by an eight-year manufacturer's warranty.



TESTIMONIAL



“The major advantage of a variable screen system such as OptiPAR is that it provides not just one—or, at best, a few—shading levels, but infinitely many.”

Labeau, a plant breeder with sites in Belgium and the Netherlands, grows exotic flowers. In spring 2026, Phormium's **OptiPAR** screen system was installed for Phalaenopsis cultivation at its Lochristi site on the outskirts of Ghent, Belgium.

The **OptiPAR** screen system always consists of two independently controlled screens. At Labeau's Lochristi site, it comprises Phormium's **Noctis Thermo** aluminum night screen on the upper wire bed and the highly diffuse **Pearl** shading screen on the lower wire bed. Amelien Lybaert began using **OptiPAR** and shared her experience.

*The major advantage of a variable screen system such as **OptiPAR** is that it provides not just one—or, at best, a few—shading levels, but infinitely many. “Previously, this compartment had a 65% shading screen and a 75% shading screen. With these screens, we could create three light levels: 65%, 75%, and 91%,” Amelien said. **OptiPAR** makes it possible to achieve any shading level between 20% and 100%.*

The variable shading level offers many benefits. Amelien explains: *“On hot, sunny summer days, we choose to close **Noctis Thermo** by 85% to 90%. This keeps the light intensity, temperature, and humidity in the greenhouse under control. The greenhouse temperature remained manageable even when outdoor temperatures reached 33°C.” On less bright days, **Noctis Thermo** remains open or closes only partially. “This ensures that the crop always receives the required amount of light,” Lybaert summarizes. The screens are not opened and closed manually. Sensors continuously monitor the light level in the greenhouse, and the climate computer controls the screens accordingly.*

The diffuse **Pearl** screen below distributes the remaining light evenly across the crop. The greater degree of light scattering compared with the previous conventional screens is visible to the naked eye. *“There are no longer any cast shadows, and when you walk from one compartment to another, the light is noticeably less dazzling, even though the light intensity is the same in both compartments,”* Amelien notes.

We are very satisfied with the **OptiPAR** system. It allows us to keep heat and light under better control, contributing to an improved greenhouse climate. In addition, because **Pearl** creates such highly diffuse light, we can allow more light to reach the crop than before. This should result in a more vigorous crop.



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