

PHOTOBIO LOGIC!

Your new lighting solution

www.horticulture.red

UNDERSTANDING
PHOTOBIOLOGY
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PARC BY RED: DESIGNING
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EXCEEDING YOUR GOALS
WITH THE RED SOLUTION
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LIGHT, TAKING CULTIVATION TO A NEW DIMENSION



Greenhouse cultivation is at the cutting edge in terms of technological innovations. Temperature, irrigation, fertilization... all production parameters are controlled and optimized to the maximum. All except one: lighting. Light is the first element for success. Its complete control has become a real challenge for the future. This means knowing how to provide a quantity and quality of light finely adapted to each crop, each stage and each production objective. But today, your choices are also guided by the energy consumption associated with your growing itinerary. It is now essential to save as much as possible the resources necessary to achieve your agronomic objectives.

Our vision at RED Horticulture is to propose a new way of lighting, which focuses on efficiency rather than power, to help you build a more sustainable agriculture:

- More sustainable for the environment, thanks to the energy savings offered by our technology and the possibility of producing more with the same amount of resources.
- More sustainable for growers, by allowing them to save money but also to generate new added value.

- More sustainable for the industry, by opening up new perspectives for development, food autonomy and response to societal issues.

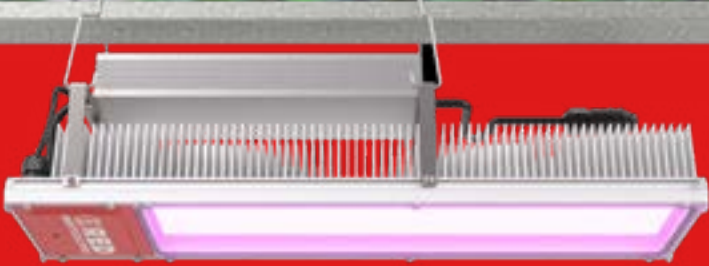
With more than 30 employees, we are leading the way in the field of photobiology in greenhouses throughout Europe and the world. The potential of this science is vast, that's why since our beginnings we advocate and pioneer a new production model. Now, the RED teams and ourselves invite you to join us in defining the next developments of this scientific revolution.

Whether you are a seed, young plant, fruit or vegetable grower, it has become essential to differentiate yourself. Today, it is no longer a question of "just" producing well, but of producing better by activating all the drivers that enable us to generate new added value.

Yassine EL QOMRI & Louis GOLAZ
Founders of RED Horticulture

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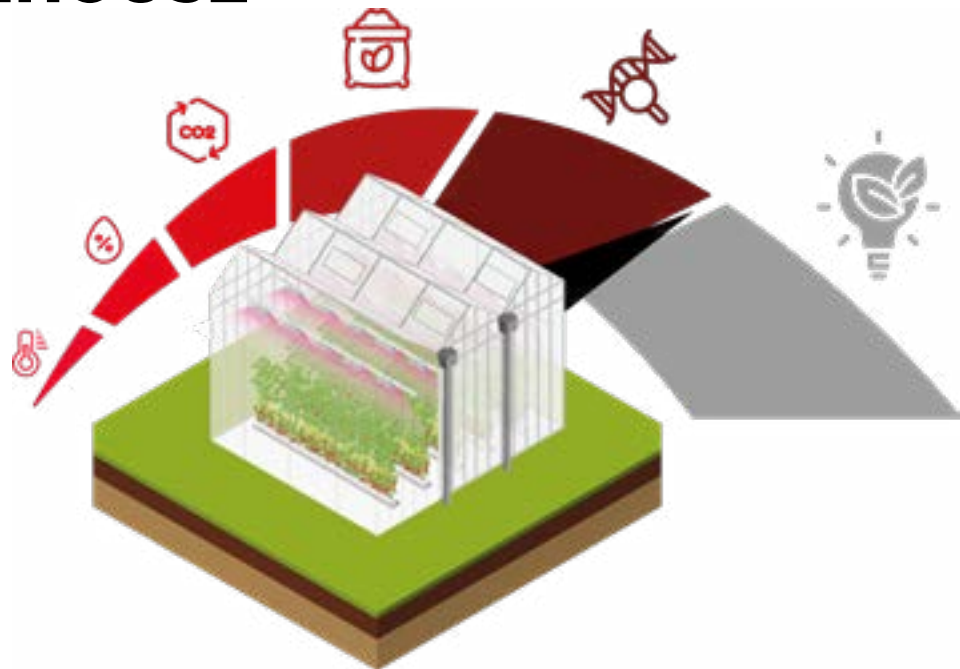
The RED T luminaire flexibility enables you to have the optimum light quality and quantity for all your varieties and stages of development. With MyRED, control all your lighting strategies in an instant.

Thanks to the RED T® lighting solution, its 100% autonomous MyRED® control and its agronomic expertise, RED Horticulture enables its customers to make a difference in their markets. Increased yield, taste quality and energy efficiency.

A lighting project? Let's discuss it!
+33 4 87 91 24 00 — www.horticulture.red



THE LIGHT PARADOX AND THE PRINCIPLES OF PHOTOBIOLOGY IN THE GREENHOUSE



For years you have been controlling and optimizing many parameters in your greenhouse: temperature, CO2, humidity, fertilization Each of these parameters are meticulously defined, all except one: artificial lighting, which remains poorly controlled. Light is the main key factor for the success of your crop as well as the main source of electricity consumption in your operation. It is therefore necessary to better understand the impact of light on plants in order to get the most out of this new value driver: this science is called photobiology.

Photobiology¹ : the right light at the right time



RED is based on this science and more precisely on the impact of light on living beings in the greenhouse: plants, auxiliary insects, pests, pathogens and manpower. This expertise has allowed us to define a unique solution on the market. A method that is only possible through a perfect knowledge of the plant's needs and energy constraints. It is implemented thanks to a unique know-how, the result of years of R&D. From now on, it is the crop itself that controls its lighting needs in order to reconcile agronomic and energy performance.

A few years ago, liquid fertilization was the game changer. Today, it's dynamic lighting that is taking growing to the next level.

— Yassine EL QOMRI
President and Technical Director
RED Horticulture

¹Photobiology: Scientific study of the action of light on living beings.

RED'S VISION

Helping each grower increase the sustainability and profitability of their business through photobiology



Today, agronomic excellence is still necessary but it is no longer sufficient. It must be accompanied by energy efficiency and a real production strategy. Considering how to develop one's activity in a sustainable way is at the heart of all business strategies. Light, through its impact on the energy balance, becomes an essential parameter of your transition.

Energy saving	The LED era has proven that some assumptions about light are wrong. Indeed, 1% more light is no longer equivalent to 1% more production. From now on, it is a question of using the ideal light to reconcile reduced consumption and improved agronomic responses.
Improved yield management	Your development tactics are evolving and you are now confronting them with the associated consumption. More than increasing the yield, it is its management that can offer the greatest potential for growth by planning a reliable production schedule with precise yields.
Increased quality	Photobiology becomes the reference tool to improve the quality of productions, whether it is taste, architecture or vigor and robustness. It is an area that allows you to differentiate yourself from your market and from your competitors in order to always guarantee your customers a head start.

Using data to improve energy efficiency

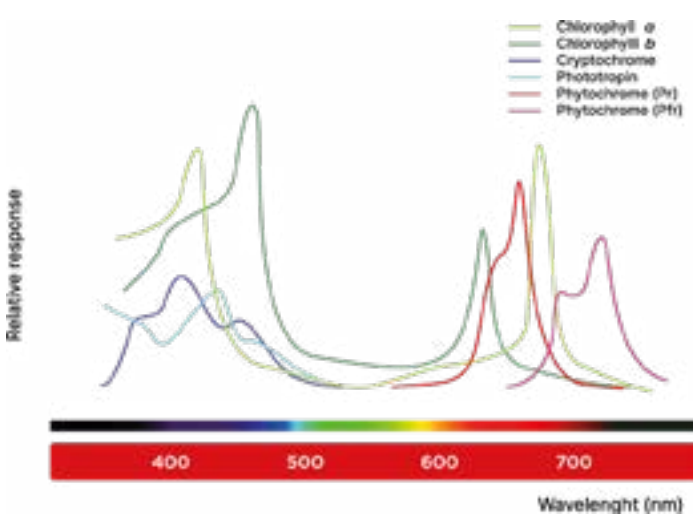
A quarter of a century of digital transformation has led to the advent of the age of data. The previous generation of sensors, although very expensive and few in number, allowed you to know the climatic parameters in your growing environment. Now, new sensor technologies placed directly on the plants give you a perfect agronomic knowledge of the crop: stem diameter, transpiration rate, sap flow, etc ... The last few years have shown us that we are moving from corrective agriculture to predictive agriculture and RED is part of this movement. We are working on integrating innovative technologies and applying them to our photobiological expertise to improve agronomic and energy performance.



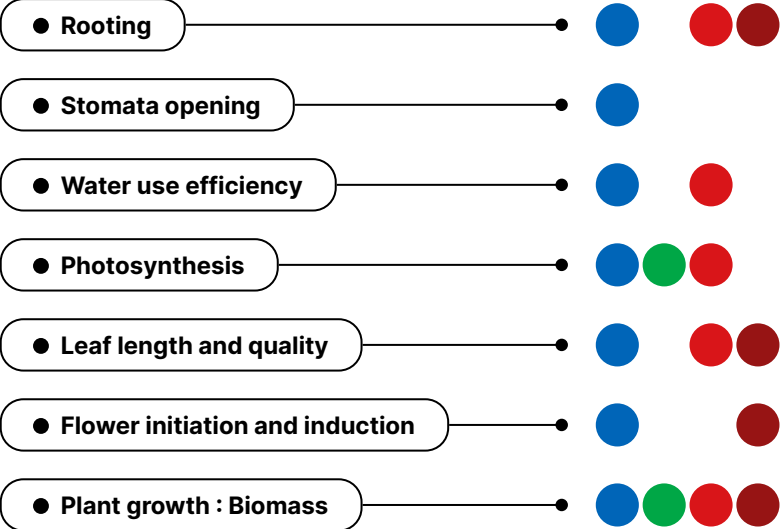
UNDERSTANDING PHOTOBIOLOGY

The photoreceptors

Plants are composed of multiple sensors, those for light are the photoreceptors. Each photoreceptor has its own sensitivity to the different colors of the light spectrum. This sensitivity is dependent on the species, the variety and the stage of development. The photoreceptors are interdependent and connected through communication channels. Each action taken on one of them will influence the whole network and activate a cascade of agronomic responses.



On the right : Some photoreceptors in the PAR and far-red range

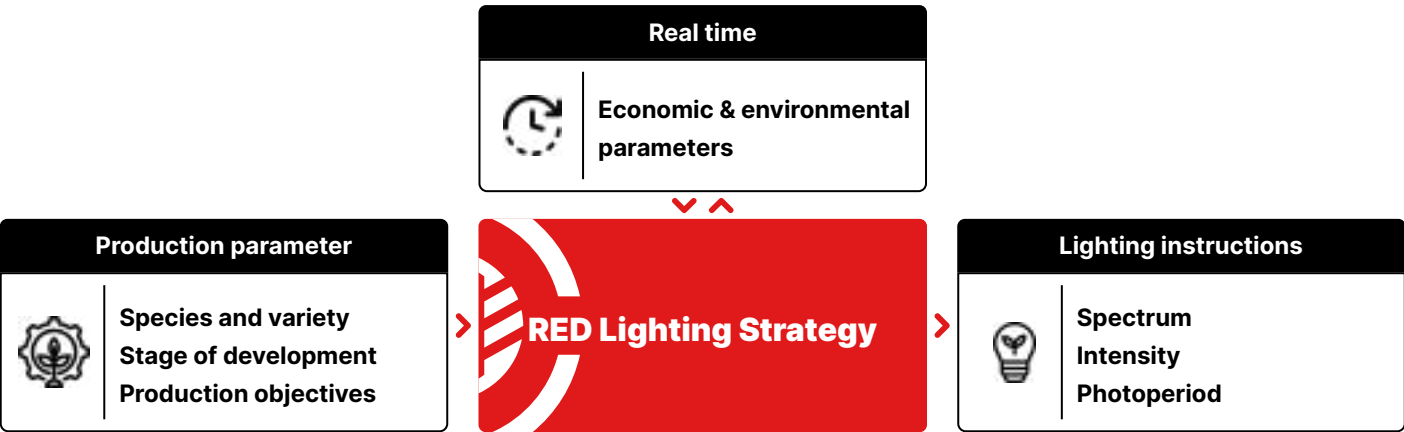


Above : Agronomic responses to light spectrum colors

Key to a lighting strategy: the lighting recipe

Many people talk about spectrum and color ratio when talking about a lighting strategy. However, a strategy does not stop there. Each crop, each variety and each stage of development calls for different needs. To meet these needs, we believe that a lighting strategy must be dynamic and adapt not only to agronomic needs but also to environmental and energy parameters at the time. There is no universal and fixed lighting recipe. It is necessary to continuously combine intensity management and spectrum management to maximize production efficiency.

Providing the right light at the right time



A bank of unique lighting recipes

Today, our strength lies in the exploitation of our proprietary database of field-tested and verified strategies:

+100
PROTECTED LIGHT RECIPES

+10
SPECIES ANALYZED

+15
AGRONOMIC IMPACTS

Energy Efficiency: better production and control of consumption

Your crop production is closely linked to changes in the energy market. You are constantly looking for a balance between your agronomic performance and your energy consumption. RED lighting strategies evolve in real time with the environmental and economic parameters with the objective of efficiency. By combining the best lighting recipes and the high efficiency of RED T dynamic lights, we ensure an agronomic optimization of each kWh.

LUE and EUE: the new essential indicators for measuring performance

The search for efficiency guides our choices in the development of the solutions we offer. To do so, we rely on two specific indicators that reflect the present and future of photobiological performance.

LUE : A performance indicator that shows the agronomic yield for an amount of light received. Allows to compare the agronomic performance of 2 different lighting strategies.

EUE : Performance indicator that indicates the agronomic yield for a given consumption. Allows to calculate the consumption and economic profitability of a lighting strategy.

LUE



Efficiency of the light recipe
(g/mol)

&



Lighting efficiency
(μmol/J)

EUE



Energy efficiency
(g/kWh)

Today, RED solutions provide up to 40% more energy efficiency than a standard fixed spectrum installation.

— Claire GARCIA
Agronomist specialized in photobiology
RED Horticulture

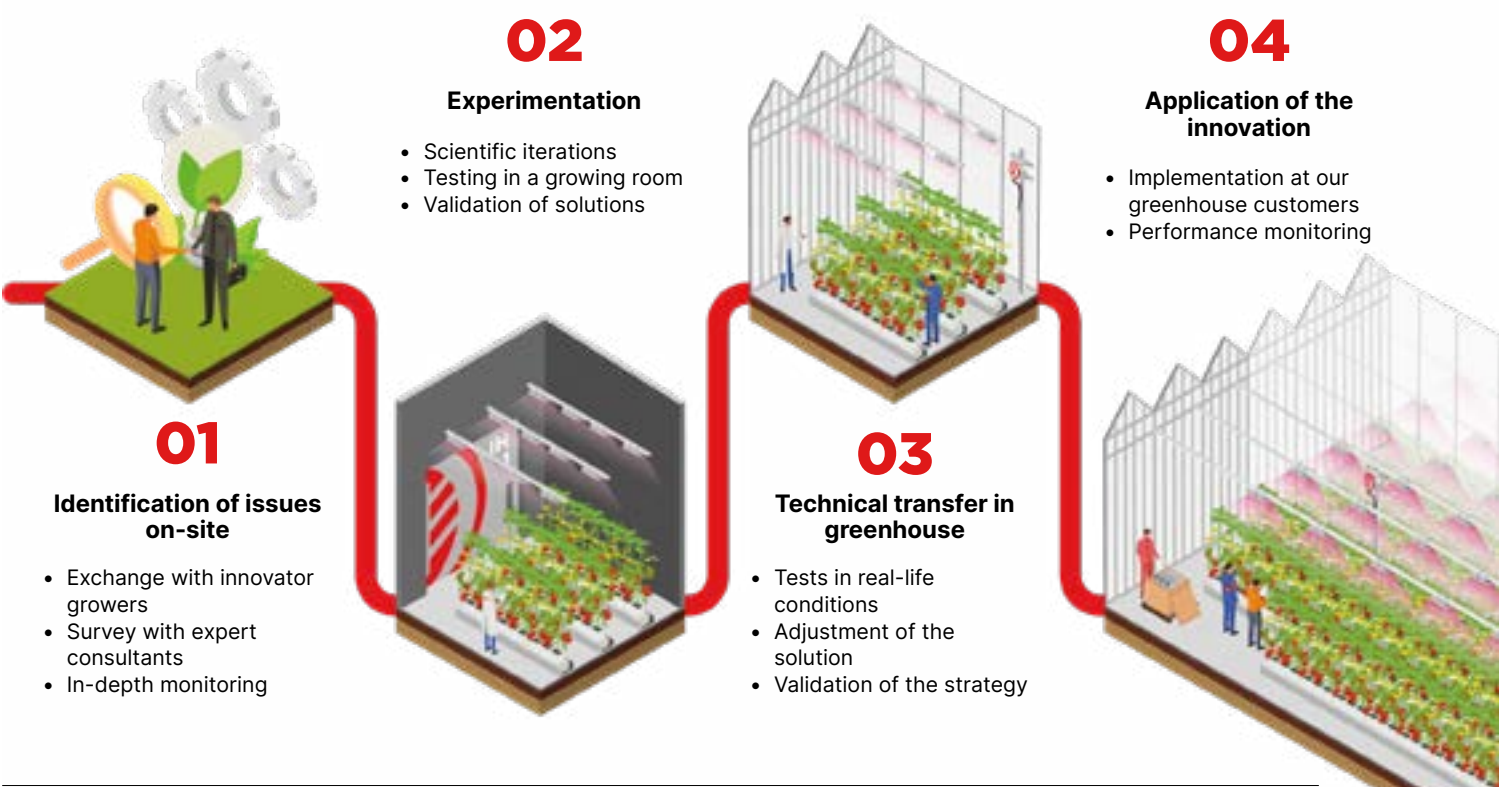


PARC BY RED HORTICULTURE: A UNIQUE LOCATION FOR INNOVATION IN PHOTOBIOLOGY

Food production is one of the major challenges of our century, with needs expected to double by 2050. The industry is always looking for ways to produce more, better and with less resources. The challenge is global and our ambition is to place photobiology as a central element of horticultural and vegetable production. Innovation is in RED Horticulture's DNA. This is why RED has created the Photobiology and Agronomic Research Center (PARC), the only laboratory dedicated to plant photobiology in the world. We invest daily in creating, testing and implementing solutions to meet key challenges.

A global ambition

Working for a more efficient and sustainable horticulture requires that innovation be driven collectively. PARC's doors are open to the scientific community to respond together to common challenges. Producers expect solutions adapted to their fields' needs. This is why the PARC teams work with flexibility to deliver tested, validated and proven innovations.



A forum for discussion and training dedicated to the industry's innovators

At PARC, one of our missions is to train the industry on the light factor, its new measurement units, its control and the innovations applied to it. Training is necessary because we conduct trials in collaboration with the entire vegetable sector: producers, consultants, equipment manufacturers, seed companies, etc. Integrating market players allows us to have a global view of trends and to target priority issues.

Our areas of expertise

SEEDS :
from seed to seed

VEGETABLE CROPS :
from seedling to fruits

SECONDARY METABOLITE CROPS :
taste, nutritional content and quality

A team focused on innovation



PARC brings together experts in plants and light. They work closely with our field agronomists to ensure perfect consistency with the expectations of the industry. The PARC team works to offer producers tangible solutions that meet agronomic, energy and financial challenges. This is why we invite partners, clients and scientific talent to accompany us in the development of strategies that will impact the food supply of future generations.

EXCEEDING YOUR GOALS WITH THE RED SOLUTION

Automate with MyRED™ — p.12

A As the central element of the RED solution, the MyRED computer selects the most suitable light strategy to achieve the defined objectives (yield gain, time gain, energy savings, morphology...). MyRED adapts its instructions according to the data brought back by the sensors, the stage of the crop as well as the price of energy.



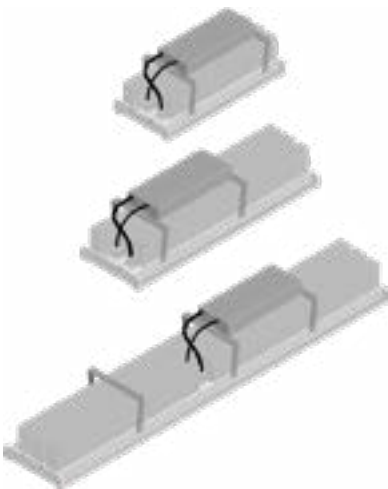
Capture with RED SENSE™ — p.13

B RED sensors allow you to collect all the necessary data (natural sunlight, temperature, humidity, CO2 levels...) to know precisely the state of the crop. They are placed as close as possible to the plants and in several areas to obtain the most reliable data possible.



Illuminate with RED T™ — p.14 & 15

C Autonomously controlled by MyRED, the RED T range supplies your crop with light optimized to its needs. In addition to an efficiency of 3.5umol/J, RED T features 4 independently controllable wavelengths and adjustable intensity. The whole range is compatible with the FIX, DIM and MAX versions to guarantee you an evolution in time.

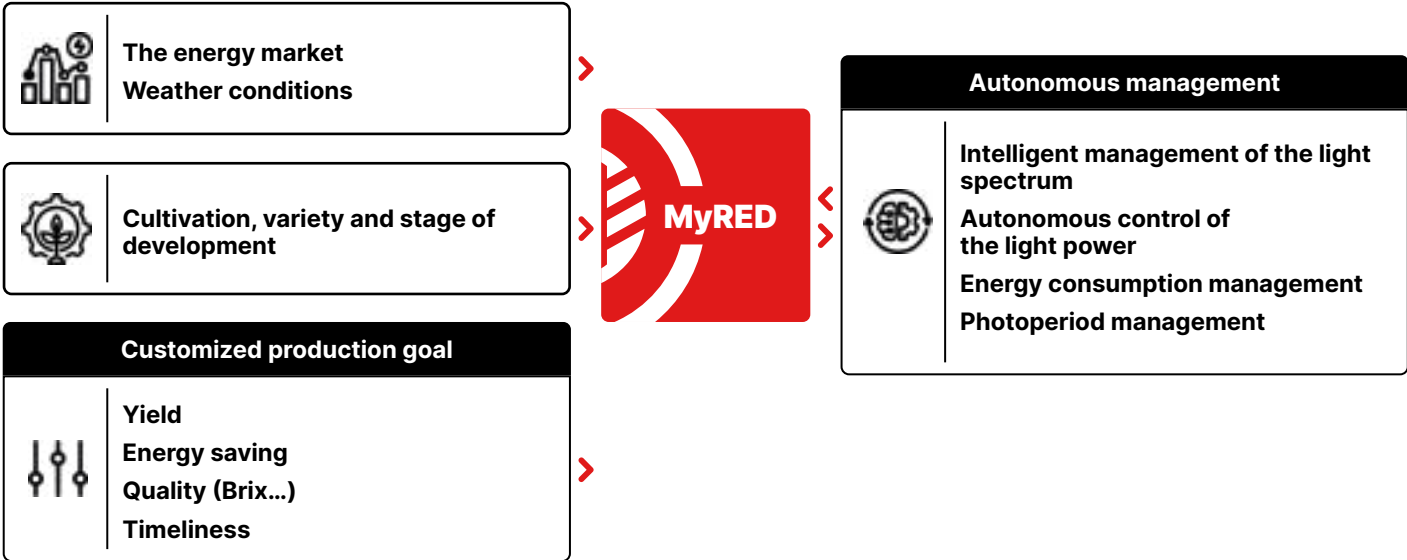


RED Technical Support — p.13

D RED teams will accompany you throughout your project: from the elaboration and deployment of your lighting strategy to its optimization in your growing environment. You will never be left to make decisions for your system on your own.



MYRED : THE INTELLIGENT LIGHT ASSISTANT



MyRED pilots your lighting in real time to optimize your production KPIs such as the EUE. The algorithm is based on our certified innovations and feedback to continuously improve your lighting strategy.

Much more than an autonomous management of lighting control, MyRED also offers many features accessible from any smartphone or computer. This platform dedicated to lighting parameters allows you to view consumption data, DLI, manage your lighting zones, activate the "Observation Mode" and even exchange with a RED agronomist.



Features focused on energy efficiency and visual comfort

- MyRED integrates two key options to improve your profitability:
- **Smart-Dimming** : RED has developed a new generation of dimming, a patented innovation that modulates the intensity of artificial light with respect to natural sun-light and economic factors.
 - **Energy market** : Depending on the specificities of your producer's energy contract (off-peak/peak hours, current rate...), the spectrum and intensity are adapted to promote more economical consumption.

On the left : The "Observation" mode offers you a perfect view on your production thanks to an adapted light spectrum.

RED TECHNICAL SUPPORT: OUR EXPERTS AT YOUR SIDE

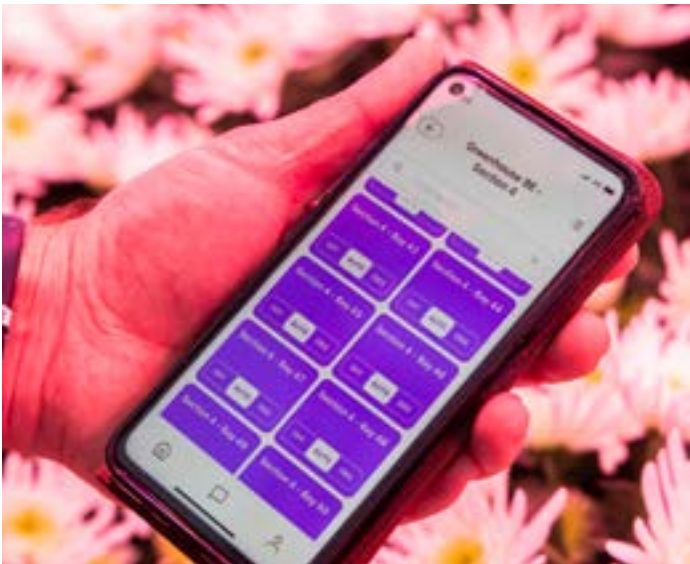
Photobiology applied to the greenhouse is a new element that must be adapted to your existing constraints. Before being specialists in photobiology, our agronomists are experts in the production greenhouse. They will help you optimize your lighting strategy according to your crop itinerary, integrating your climatic and fertilization patterns.

Our teams are driven by our three values "Seek, Share, Smash" that they share with you daily in the field.



MyRED Mobile: Stay in touch with your RED agronomist for a precise and efficient follow-up

MyRED is available in a mobile version and benefits from features adapted to the field such as instant messaging that connects you in real time to RED support.



RED Sense: Capture every essential data in your production environment



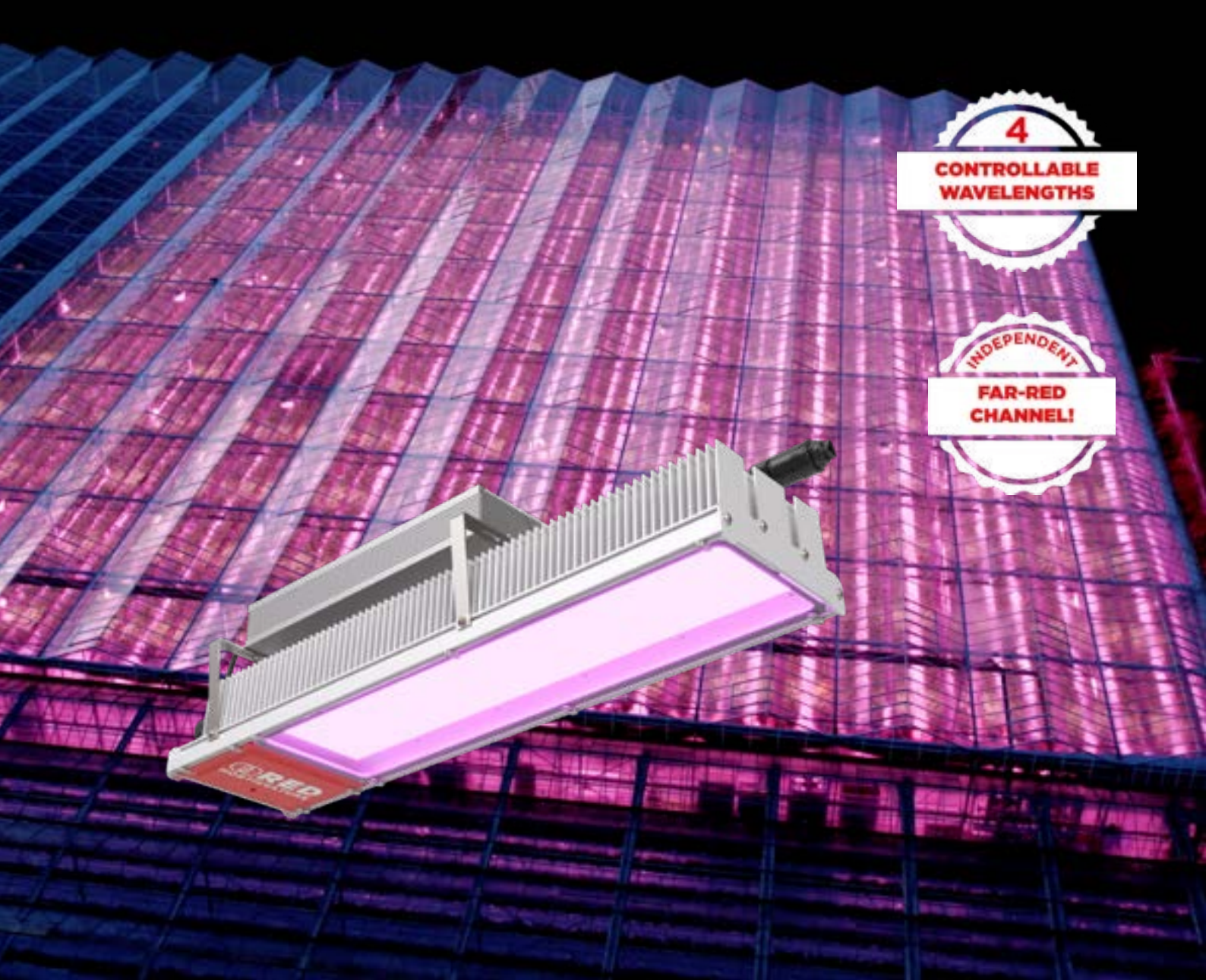
RED SENSE PAR

Benefit from a perfect knowledge of the light actually received by your plants.



RED SENSE AIR

All the climatic information continuously; temperature, humidity, pressure, CO2.



RED T: THE MARKET REFERENCE FOR EFFICIENCY AND FLEXIBILITY

4
POWER
 for a simplified 1:1 HPS retrofit

3,5
UMOL/J
 efficacy

3
CONTROL OPTIONS
 FIX, DIM & MAX

5
YEARS
 warranty

RED T240

RED T320

RED T680

RED T1010

Upgrade your solution gradually

An LED installation represents a significant initial investment. That's why we give you the choice of how much control you want to have over the fixtures. You are therefore free to proceed in several stages in the ability to control the system. A quick and easy conversion that allows you to spread out your investment.

More control... when you want it!

Evolve from a fixed spectrum ON/OFF version to dimming controls all the way to full flexibility.

The 4-point control card:

- Quick and easy conversion
- No modification of the electrical installation required
- Install the card on your own or have it installed by a professional
- Upgrade to MAX to unlock the entire RED solution

	FIX	DIM	MAX
Management of the photoperiod	✓	✓	✓
Management of the light intensity	✗	✓	✓
Autonomous control of the intensity	✗	✓	✓
Far red management	✗	✗	✓
Autonomous control of spectra	✗	✗	✓



RED lighting provides us with energy savings, agronomic quality, more precise production time and a cultivation schedule that is better adapted to our production.

— Nicolas PAUL
 Director
 Groupe Thomas Plants

OUR FULL-LED SOLUTIONS

EARLY&BOOST

STRAWBERRIES

+25%

YIELD

+50%

BRIX LEVEL

+10D

EARLINESS

Control and optimization of crop stages:

- Rooting
- Vegetative development
- Flowering
- Fructification

Your main challenges:

- Bring the production peak forward
- Increase your yields



ECO&BOOST

TOMATOES & CUCUMBERS

+13%

OF WINTER PRODUCTION VS 95/5

+8%

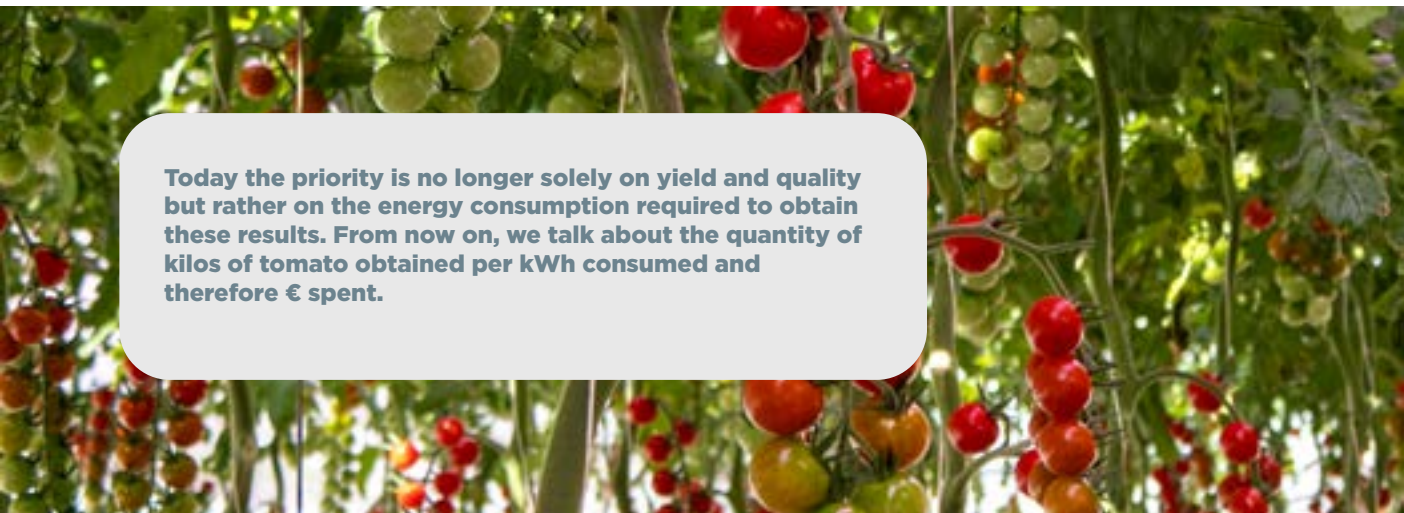
BRIX LEVEL

Control and optimization of crop stages:

- Rooting
- Ramping up
- Maintenance of the balance

Your main challenges:

- Ensure an optimal production quality
- Increase the yield in off-season
- Reduction of electrical consumption during the winter period



ECO&FLEX

YOUNG PLANTS

-60%

LESS POWER CONSUMPTION COMPARED TO HPS

+6

SPECIES GROWN IN THE SAME AREA

Control and optimization of the 4 stages of cultivation:

- Germination
- Rooting
- Vegetative development
- Post-grafting
- Post topping

Your main challenges:

- Reduce energy consumption
- Obtaining high quality young plants
- Flexible equipment to meet the needs of all your species



FLEX&BLOOM

CHRYSANTHEMUMS

+20%

LUE

↗ ↗

QUALITY

Control and optimization of crop stages:

- Rooting
- Vegetative development
- Flowering

Your main challenges:

- Reduce production time
- To have an excellent quality and homogeneity
- Reduce electrical consumption
- Flexible equipment to meet the needs of all your species



OUR FULL-LED SOLUTIONS

EARLY&FLEX
SEEDS

+10%
REDUCTION IN PRODUCTION
CYCLE

↑ ↑ ↑
HOMOGENEITY

↑ ↑
SEED QUALITY

Control and optimization of crop stages:

- Rooting
- Vegetative development
- Flowering

Your main challenges:

- Speed of development
- Speed quality
- Optimizing a strategy for a large number of species and varieties



QUALI&BOOST
CANNABIS

+60%
ENERGY SAVINGS

10
PROVEN LIGHT RECEIPES

Control and optimization of crop stages:

- Parent Plant
- Clone
- Pre-vegetative
- Vegetative
- Flowering
- Maturation

Your main challenges:

- Reducing consumption
- Improve the g/W efficiency
- Homogenize the quality of production all year round




OUR TRANSITION OPTIONS

HYBRID HPS - LED

Your main challenges:


- Ensure a perfect HPS > LED transition
- Use LEDs to the maximum
- Reduce consumption



HYBRID LED - RED

Your main challenges:

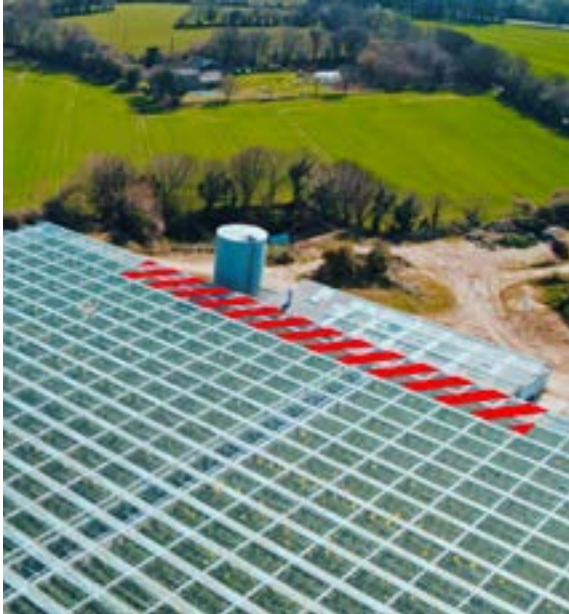
- Completing the ON/OFF
- Improve crop quality



SHADED BAY

Your main challenges:

- To fill the lacks in light of the shaded zone
- To homogenize the performance of all bays





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Top seed-breeding companies as well as young plant, high-wire, leafy greens and medical crops growers are already using RED products and services. Why not you ?

Find out more on: www.horticulture.red/en

Substainbly contributing to the UN SDGs



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