

The plant growth expert



Table des matières

Editorial..... 4

VGD, the European “Grow Lighting” expert..... 5

 A company which is 100% specialized in lighting 5

 An intelligent horticultural lighting system 6

 Why grow lighting? 8

 Multiple benefits..... 8

 High value-added services 9

 A solution which is always tailor-made..... 10

 A 5-step process..... 10

 The use of cutting-edge technology! 11

 Our know-how based in France 11

 Precise lighting..... 12

 A few examples of fixed spectrums 12

 Some targeted advantages 13

Uses which have proved their worth..... 14

 Market Gardening 16

 Horticulture 18

 Berries 20

 Medicinal & Aromatic Plants (MAPs) 22

 Research..... 24

The Vegetal Grow Development offer 26

 The VGD multispectral lights..... 28

 The dynamic multispectral light, a worldwide exclusivity..... 28

 Why multispectral light? 28

 Comparison with other lights on the market 29

 Why switch to LED lights?..... 29

 How much does a LED lighting system cost? 30

 What guarantees do Vegetal Grow Development solutions provide? 30

 Multispectral or fixed spectrum 30

 The sensors..... 31

 LED fixtures or HPS? 32

 More than a service 34

 A light audit for each installation 34

The control boxes 36

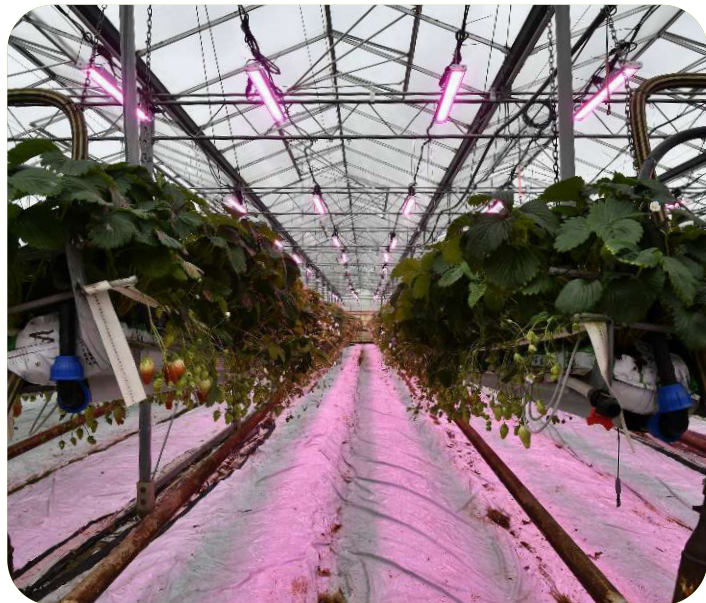
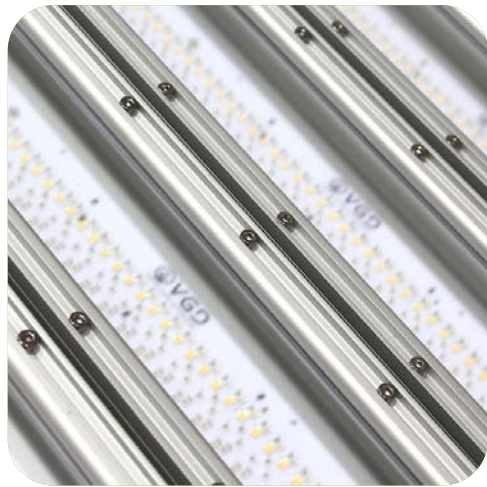
 Control box comparison table 39

 The main functionalities of the control boxes..... 40

 Functionality details..... 42

The VGD management software 44

Glossary 47



Editorial

“ With our experience in color lighting gained in the event industry and having mastered the combination of natural and artificial light in the manufacturing, distribution and tertiary sectors, it was clear to us that these intelligent lighting techniques could also be widely used in the agriculture sector.

The 3 founders of Vegetal Grow Development (VGD) - who combine complementary expertise in plant ecophysiology, engineering and lighting techniques - are able, with their teams, to harness the artificial light necessary in addition to natural light, while respecting the physiology of the plant and the growing conditions.

Our goal is to work alongside the producers, the technical institutions, and the research institutions to take up the challenge of producing more, better, and with a reduced carbon footprint. In doing so, we are meeting society's high expectations for sustainable development and environmental friendliness.

The Vegetal Grow Development lighting therefore positions itself as intelligent and precise: the right dose of light, the right spectrum, and the right wavelength all in the right place and at the right time.

Meanwhile, we are always looking for new lighting solutions. Our Research and Development teams work on potential passive lighting leads, beyond the active techniques which are currently available.

”

Sébastien Deprade

Co-Founders



Sébastien Deprade
General Manager



Guillaume Marie
Technical Manager



Nicolas Chauvin
R&D Manager

VGD, the European “Grow Lighting” expert

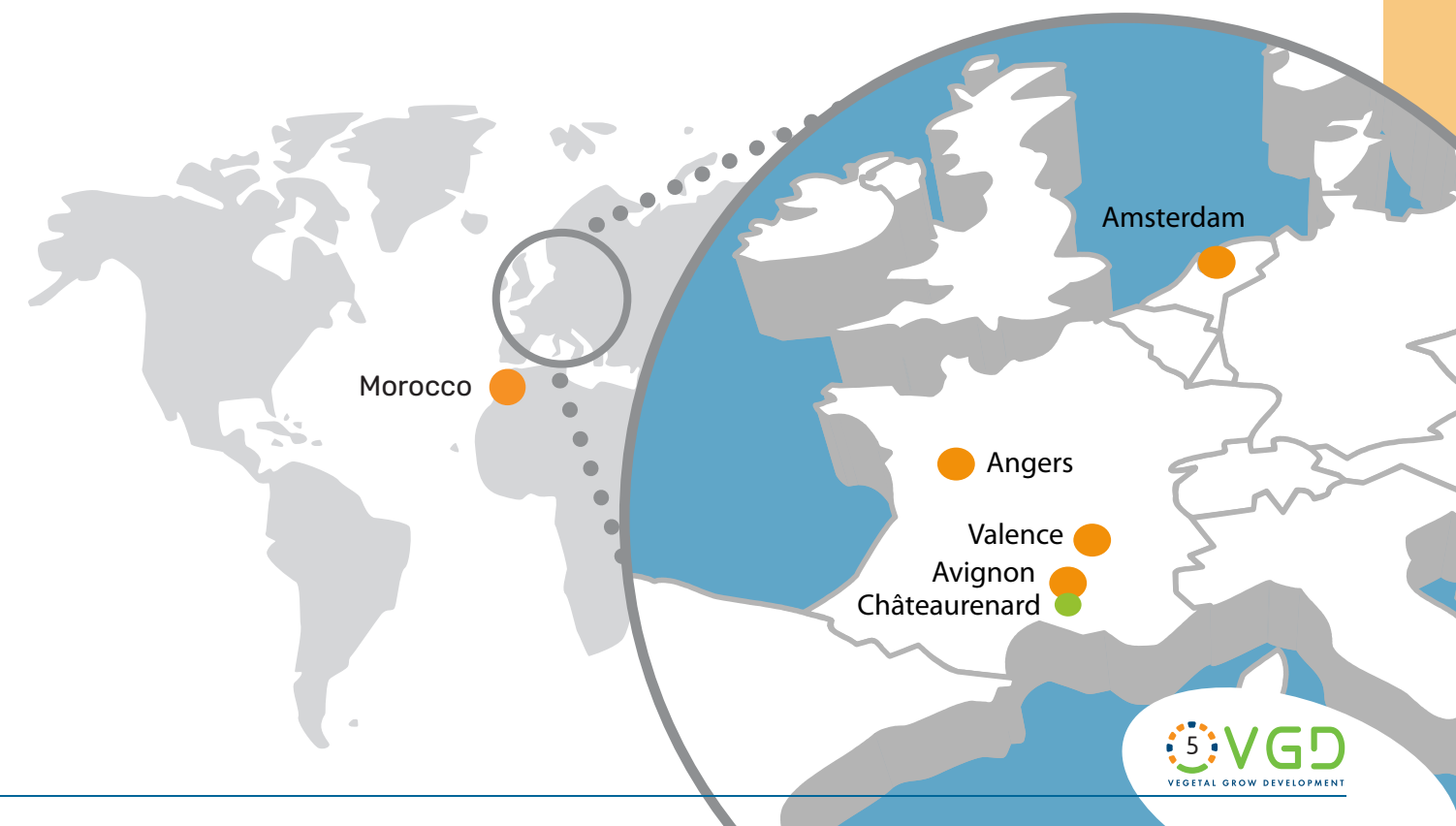
A company which is 100% specialized in lighting

Vegetal Grow Development is owned by the company Light in the Led, a lighting specialist since it was created in 2013, starting out in the event sector, architecture, distribution, the industrial and tertiary sectors and then branching out into the agriculture sector in 2017.

Vegetal Grow Development is the 1st leader of French origin in « Grow Lighting » or intelligent lighting and the 3rd company in terms of French market presence.

The Vegetal Grow Development intelligent horticultural lighting solution has been commercialized since 2018 and is used by leading companies such as: HM Clause, Saveol, Vilmorin, In vivo, Syngenta, the Town Hall of Paris, as well as important independent producers. It also won an award at the SIVAL in 2018 and 2020 when it was launched and then in collaboration with the CTIFL at the SIVAL Innovation competition in the « Services and Software » category. The CTIFL, AKA the « Centre technique interprofessionnel des fruits et légumes » (the interprofessional fruit and vegetable technical center) is a co-development partner which reinforces VGD's expertise in tomato and cucumber cultivation.

Thanks to its network of international partners (installers, greenhouse growers, distributors, technological partners, agroclimatic solution providers, ...), the solutions on offer are available on all five continents.



An intelligent horticultural lighting system

Vegetal Grow Development is offering software, hardware, and service solutions with the aim of improving vegetal growth thanks to **controlled lighting**.

The available **intelligent LED lighting solutions** can integrate:

Management software platform

The **management software platform** which uses Artificial Intelligence (AI) enables real time management, in automatic or manual mode, of the lighting conditions on a computer, a tablet or a smartphone.

Light control box

The **light control boxes** make it possible to precisely and automatically control the light inputs throughout the entire production cycle (intensity, Daily Light Integral, wavelengths, manage per plot, zone, stage of growth, type of plantation, ...).

The VGD intelligent horticultural lighting solution caters perfectly to the controlled lighting needs of:

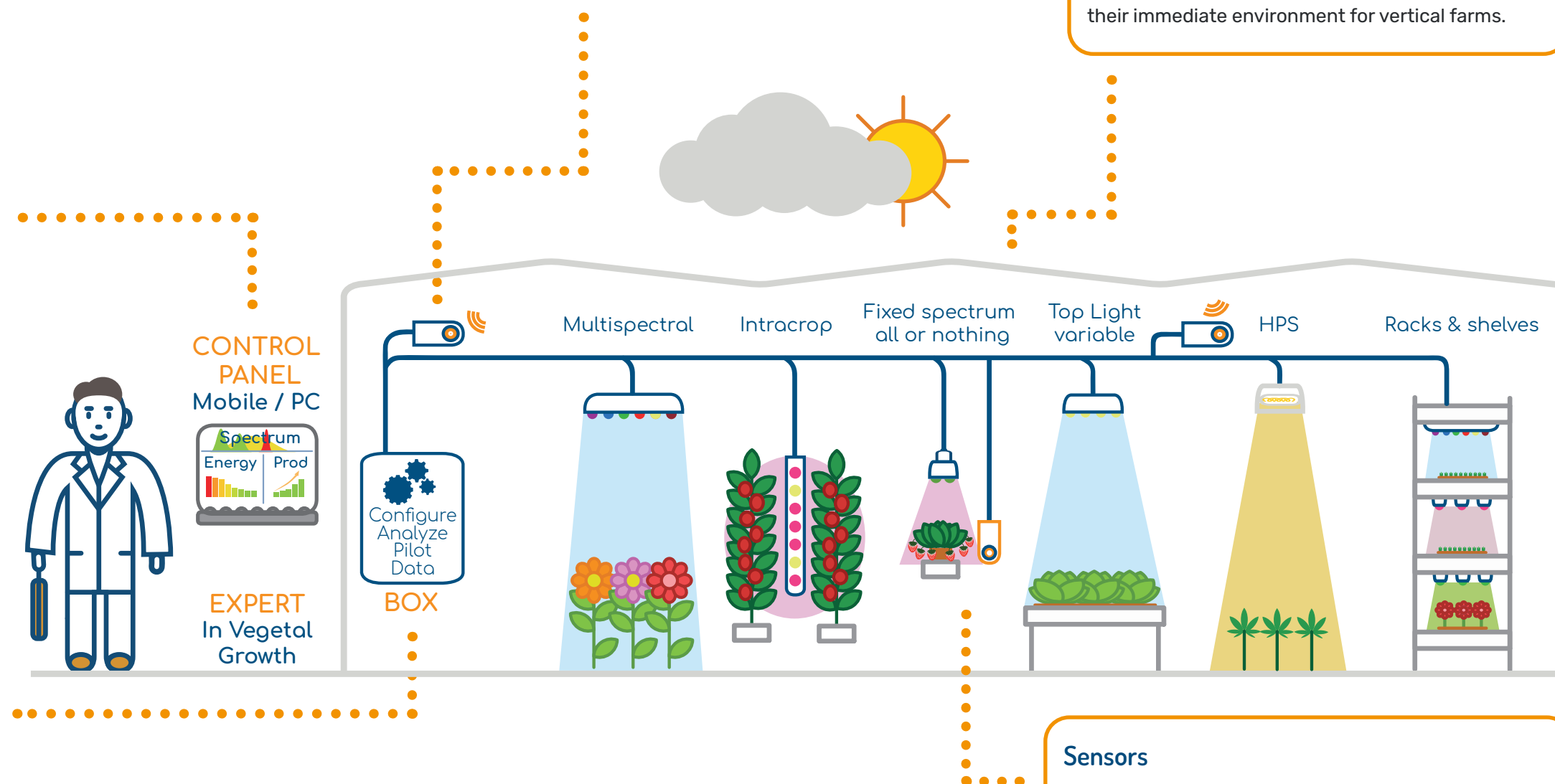
- Market gardeners, horticulturists and nursery workers, producers (of seaweed, red berries, ...) in glass, plastic, or photovoltaic greenhouses
- Seed producers and plant producers in grow rooms
- Private and public research laboratories
- « New generation » urban, vertical, and indoor style farms, ...

Connected spectroradiometer

A **connected spectroradiometer**: it sensors of the light spectrum in real time, enabling the user to measure the delivery and deficiencies of natural light in detail and therefore adapt the lights to cater to needs as efficiently as possible at a given time.

Led lights

The **LED lights** notably cover 6 qualified wavelengths and can be controlled remotely. These lights can be integrated as close as possible to the crops in Top or intra position or adapted to their immediate environment for vertical farms.



Sensors

The **sensors** installed on the production or research site collect, among other things, the temperature, humidity, energy consumption, and plant growth data.



VGD, award winner at the SIVAL INNOVATION 2020 competition

VGD's horticultural lighting platform was an award winner at the SIVAL INNOVATION 2020 competition (Angers – France) in the Services & Software category. SIVAL 2021, The productions of tomorrow, Join us on 12 – 13 – 14 January 2021 in Angers to discover our latest innovations.

Why grow lighting?

Multiple benefits

The Vegetal Grow Development intelligent lighting solutions provide numerous benefits:



Better results

Productivity gains thanks to + 30 to + 300% plant growth, homogeneity, and stability of the production, particularly for sensitive crops.



Healthier

Limited inputs thanks to plants which are healthy and more capable of mobilizing their natural defenses.



Better quality

Improvement of the organoleptic qualities, with among other things, sugar levels reaching up to +15%.



Energy gains

Up to 60% energy savings by combining the benefits of LEDs vs traditional lighting and real time management of the lighting thanks to artificial intelligence.



Reduced carbon

A reduced carbon footprint thanks to the LEDs' lifespan of over 50 000 hours, for example.

The solutions on offer enable, in particular:



Seed producers: to accelerate tests on new varieties being developed or on commercial batches



Plant producers: to propagate the plants faster



Growers: to develop the growth and flowering phases, to amplify and control ripening



Distributors: to improve conservation of the plants (fruit and vegetables, flowers and other plants) in storage platforms or at the point of sale

With its real time management of the quantity of light (which can combine natural and artificial light) as well as the quality of light (spectrum, specific wavelengths), the Vegetal Grow Development intelligent lighting solutions improve the growth and the health of the plants and therefore the quantity and quality of harvests while reducing the carbon footprint.

They improve the profitability of yields and lead to a fast return on investment (ROI) by accumulating increased yields, better management of the crop cycles, reducing the energy bill, eligibility for energy saving funding schemes and research tax credit.

High value-added services

The intelligent horticultural lighting solutions on offer evidently include cutting-edge equipment but they also include high value-added services such as:



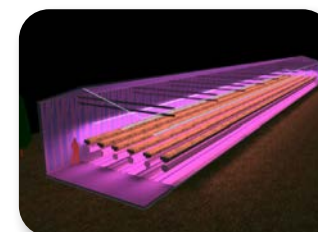
Crop monitoring

Our plant physiology experts accompany producers on-site and/or remotely in order to optimize the lighting for their crop(s). Our offers come with a remote monthly follow-up which enables our clients to capitalize on the hard data related to each of their crops.



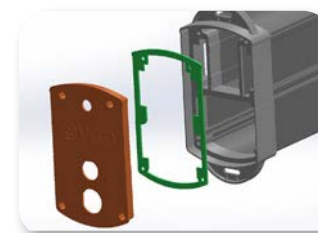
Grow room tests

VGD has a grow room with a controlled atmosphere and a greenhouse with a controlled climate near Avignon to carry out tests for its own account and for its clients. Therefore, it is possible, among other things, to carry out preproduction tests or light spectrum tests. You can also benefit from the network of recognized partners located in every region in order to monitor your tests with qualified teams.



Research department

3D studies of light implantation for improved diffusion and homogeneity, research and simulations in greenhouses based on its geolocation. VGD owns 35 light sensors - which are more precise and reliable than a PAR sensor - spread across Europe to analyze the lighting needs of each of your crop types in detail.



Custom designed lights

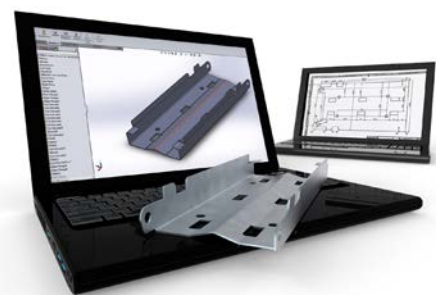
Lights designed from A to Z to suit specific constraints, including the mechanical, ergonomic, and software aspects, as well as electrical aspects. Our suppliers and our tools offer flexibility and reactivity for your projects (cnc laser, 3D printer, silicone, ...).



Personalized advice

The industrial and physiological lighting experts can assist you with your specific light-related project.

A solution which is always tailor-made



Prepared by our research department, the solution offered by Vegetal Grow Development, which is based on the analysis of the existing situation and the possible margin of progress in terms of lighting, is made-to-measure.

It will be specifically tailored to your growing conditions (lights, technologies, location and energy assessments, organoleptic assessment, ...) and to the unique physiological needs of the crop species.

Thanks to its lighting experience in the industrial and tertiary sectors with big groups (Airbus, STX, Daimler, ...), the solutions designed by our teams are based on the know-how and the approved technologies of those sectors and put to use in the horticultural world. Therefore, the principles of lifespan, water-resistance, and easy maintenance are reflected in our proposed lighting solutions.

A 5-step process



Assessment

An optional assessment of your project, from the current energy consumption and the likely energy gains, to the location and quantity of lights to be put in place for increased homogeneity, as well as lighting recommendations and protocols to apply as a consequence, specifically for your crops.



Financing

VGD accompanies you throughout the duration of your project, including the search for financing solutions: Leasing, Renting with an option to buy, Agilor or finance-leasing. Furthermore, we recover your old equipment and give you an eco-responsibility certificate.



Installing the devices

Our « Plug & Play » solutions are designed to make installation easy and save time. Therefore, they can be installed without any particular accreditation or electrical prerequisites. On the other hand, connecting to the power board and network requires the intervention of an accredited installer (yours or one of Vegetal Grow Development's partners) who will guarantee the electrical conformity. VGD can also provide a turnkey solution.



Lighting protocol configuration

The VGD team assists you with setting up the software which enables the precise management of the lighting strategy and the lighting protocols which are adapted to your cultivation (Day Light Intensity, light recipe, PAR, PPFD, wavelengths, ...). Thanks to training courses, you can also gain autonomy in the management of the entire lighting system.



Crop monitoring

VGD can assist you with monitoring growth with the use of connected growth sensors or with occasional on-site support or more regular remote support from a verified physiologist.



The use of cutting-edge technology!

The LED lights provided by Vegetal Grow Development are the only ones on the market which include up to six qualified wavelengths which enable precise real time adaptation to weather conditions and the crops' biological clock.

Furthermore, the software platform which is used relies on Artificial Intelligence (AI). Therefore, the data collected from production sites is analyzed by the central server and then enriches the database of the software package, which continuously improves its performance (« machine learning »).

The Vegetal Grow Development team, made up of 15 people, combines complementary expertise in:



Lighting



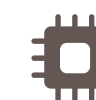
Plant
Physiology



Engineering



Software



Electronics



Artificial
Intelligence

Our know-how based in France

Unique in the sector, the research department - which enables the development of tailor-made solutions - and the Research & Development activities are all based in France, in the south and in the Pays de la Loire region.

Therefore, Vegetal Grow Development participates in the prosperous development of the French industry and invests 30% of its turnover into R&D, constantly innovating on the « Grow lighting » market, the development of French know-how on an international level being one of its values.

Partnerships with prestigious technical and research institutes such as **CTIFL** or **INRAE** and also the competitiveness clusters **Innov'Alliance** (in Avignon), **Vegepolys Valley** (Angers) and **Capenergies** (Aix-en-provence) give access to complementary leading technical and scientific expertise.



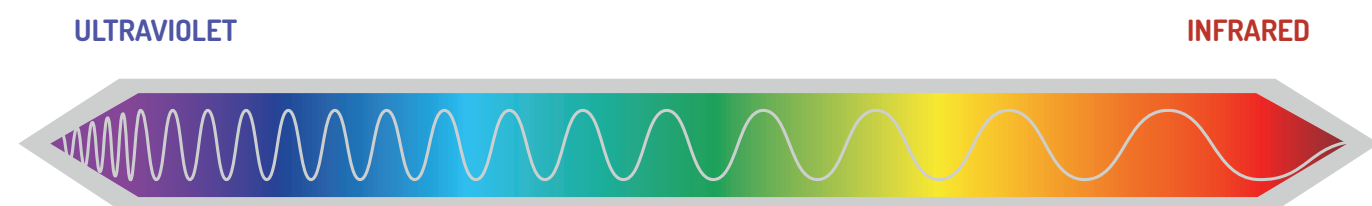


Precise lighting

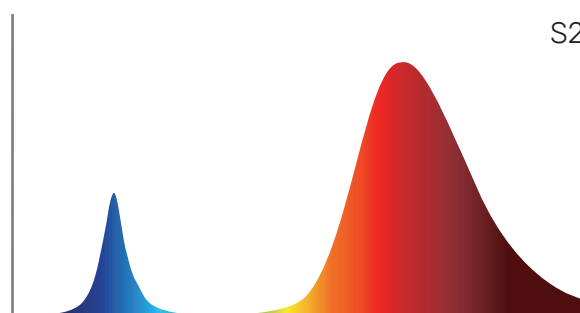
The solutions inevitably vary from one location to another, from one species to another and from one variety to another. It is therefore a question of using the right dose of light, with the right wavelength, at the right place and the right time.

By combining the wavelengths in an optimal manner, it is possible to maximize rooting, enhance uptake at soil level and help with the distribution of resources extracted from the leaves.

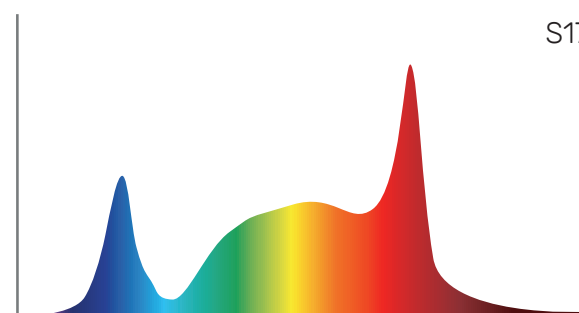
The effects of the different colors and consequently the different wavelengths are specific:



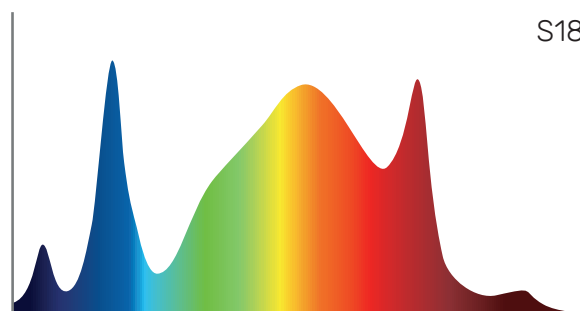
A few examples of fixed spectrums



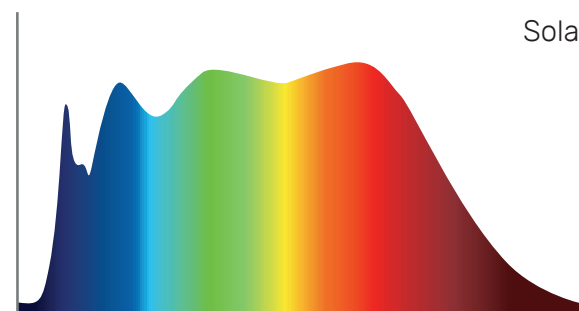
S2



S17

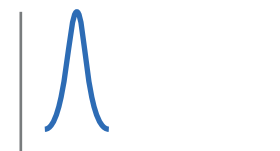


S18



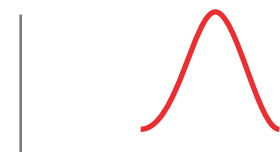
Solar

Some targeted advantages



Impact of Blue

- Enables the activation of cryptochromes. They are involved in photomorphogenesis (reduction of stem elongation, anthocyanin synthesis, maintaining the day/night light cycle among plants);
- Also enables the activation of the phototropins (molecule which bends when subjected to blue light) which cause plants to turn towards light (phototropism) and are responsible for stomatal opening.



Impact of Red

- Enables proper distribution and flow of nutrients from the roots towards the leaves;
- Enables the activation of the phytochromes which control numerous aspects of plant development (seed germination, chlorophyll synthesis, seedling elongation, size, shape and number of leaves, flowering).



Impact of far-red (Infrared)

- Leads to cell elongation which is reflected at the macroscopic level by the elongation of the plant;
- Induces or delays flowering among certain species with the management of the infrared/red ratio.

Vegetal Grow Development also uses other wavelengths (UVA, UVB, UVC, Green, Orange, ...) which have more precise complementary effects (disease resistance, increasing molecule concentration, spectral penetration of the canopy, ...).

The use of the photoperiod also plays a crucial role. It is commonly acknowledged that it is wiser to spread out the photosynthesis process (within the acceptable limits of the crop) than it is to apply high intensity over a short period.

Uses which have proved their worth

- 🍅 Market gardening
- 🍅 Horticulture
- 🍅 Berries
- 🍅 Medicinal & Aromatic Plants
- 🍅 Research





Market gardening in greenhouses is the most widespread type of cultivation in Europe. The scarcity of our resources directly influences production methods. Producing more efficiently and with bigger yields while using less water, electricity and other possible inputs is a mix of producer know-how and innovation. Light is the first natural factor which regulates the living ecosystem. Whether it is natural or complemented artificially, it impacts the yield, the earliness, but also the organoleptic, physicochemical, and sensorial aspects. Depending on the type of infrastructure (glass greenhouses, polytunnels, photovoltaic, double-walled, ...), the light behaves differently, and adapted lighting solutions are available for the vast majority of these market gardening cultivations.



Clients

- ✓ Growers
- ✓ Seed producers
- ✓ Research centers and technical institutes



Crops

Tomatoes, Cucumbers, Bell Peppers, Melons, ...



Aims

- ✓ Increase the yield of tomatoes (kg/m², quantity of fruit)
- ✓ Improve the organoleptic properties (taste, physicochemical properties, visible aspect, ...)
- ✓ Optimize production duration (earliness, late crops, shortening flowering-harvest time, ...)
- ✓ Reduce energy consumption related to lighting
- ✓ Test the impact of different light spectrums in order to define optimal lighting protocols

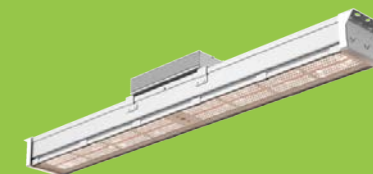
“ I gained production homogeneity throughout the whole season and arrived on the market early. Following the advice of VGD and relying on a managed light supplement gives me the possibility of an easier return on investment. ”

Patrick Roux – Producer

VERTICAL LUMIA

- Innovative vertical inter-crop light
- Lights from the apex to the 3rd bouquet
- Accompanies crops
- Low consumption for formidable efficiency
- 3 ha already installed
- Light and easy to install
- No-glare guarantee
- Harvest or flowering boost mode
- +18% yield for- 30m²

TOP MAX LUMIA



- Above-crop light
- Up to 3,5 μmol/J
- Diffuse and homogeneous light
- Replaces two HPS 600W
- Limit the plants' stress
- Simulates the sun rising and setting

AI BUILDER



- The intelligence of our experts
- 4 years of expertise
- Remote access
- Drastic energy saving
- Controls all lighting solutions
- Easily integrated
- API with agroclimatic management

Results

Tomatoes

3.5 weeks in advance for flowering.
2.5 weeks in advance for the first harvest, shortened flowering-harvest duration,

+ 40% yield
+ 12% vitamin C
+ 15% firmness of the fruit
+ 15% degrees BRIX (sugar level)

+ 33% better taste
+ 40% perceived sugar taste
- 44% water taste



Horticulture



Horticulture covers a wide field of productions where each one has its own cultivation technique. Light plays a key role for the behavior of many species. In production greenhouses and in nurseries, the plants' morphogenesis varies depending on the climate conditions and the location of the cultivation. Natural light or artificially complemented light enables growers to make production cycles shorter, maintain productive mother plants, and obtain strong, dense plants. Thanks to the lighting, signals which are antagonistic to the development of a plant can be used to delay flowering for example.



Clients

- ✓ Horticulturists
- ✓ Nurseries
- ✓ Wholesalers



Crops

Cut flowers and foliage, plants in pots, bedding plants, nursery plants, flower bulbs, ...



Aims

- ✓ Keep mother plants in good growing conditions
- ✓ Obtain homogeneous, strong, compact plants

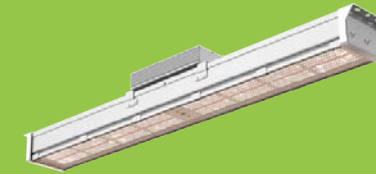
Some examples of compatible solutions

POWER LUMIA



- Above-crop light
- Light and compact
- Homogeneous lighting
- Used at low heights
- Economical €/μmol

TOP MAX LUMIA



- Above-crop light
- Up to 3,5 μmol/J
- Diffuse and homogeneous light
- Replaces two HPS 600W
- Limit the plants' stress
- Simulates the sun rising and setting

VGD BOX



- Cultivation control
- Makes photosynthesis easier and automatic
- Controls your sodium and led installations
- Secures your yields
- Growth monitoring

Results

Multiple species of Mother plants & Cuttings

- The plants obtained under lighting are more robust with a well-developed root system
- The mother plants remained in a vigorous vegetative state



“ Since the fall of 2019, we have been trying out a crop of mother plants and rooting cuttings under VGD led lighting. We see a clear improvement in the rooting quality of our cuttings. For the mother plant side, we are currently deepening our reflections. ”

Pascal Soulard
Senior operating employee - Horticulture
production center - Paris Town Hall

Berries



Cultivation of berries in a controlled environment in a glass or plastic greenhouse and « vertical » cultivation have multiple advantages which make them high-quality and high value-added productions. The consumer notices factors such as the variety, the olfactory aspect and flavor, which sets them apart on the stalls. The quality of the natural or artificially complemented light activates these levers to make a healthy, high-quality product. With physiological mechanisms, it can also favor ascent, homogenize production, increase the yield and even protect against diseases or invasive fungi like mildew.



Clients

- ✓ Growers
- ✓ Seed producers
- ✓ Propagation plantsmen



Crops

Strawberries, Raspberries, Blueberries, ...



Aims

- ✓ Increase production (kg/m², quantity of fruit)
- ✓ Improve the organoleptic properties (taste, physicochemical properties, visual aspect, ...)
- ✓ Optimize production duration
- ✓ Reduce energy consumption related to lighting
- ✓ Use light signals to stimulate and favor ascent
- ✓ Define the most efficient lighting protocols for each species

“ The use of lighting is a factor that's just as important as irrigation, fertilization, and heating. By combining VGD's expertise in the lighting field and my experience as a producer, we work on the development and the optimization of my cultivation technique. Our exchanges are dynamic and interesting, which enables us to evolve from Crop to crop. ”

Philippe Ther – Producer

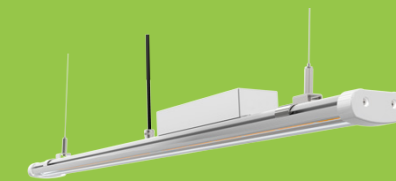
Some examples of compatible solutions

LUCIOLE



- Above-crop light
- Quick and easy installation
- Interchangeable
- 2in1 photoperiodic & photosynthetic
- Simulates the sun rising and setting
- Economic and efficient
- Durable installation guarantee

LINEA LUMIA



- Above-crop light
- Ultra-thin and light
- unbeatable µmol/€
- Homogeneous and diffuse
- Accompanies natural light
- Harvest or flowering boost mode

TOP CONNECT



- Above-crop light
- The fastest and most economical to install
- No targeting required
- No tools needed to install and connect
- Ultra homogeneous
- High yield

Results

For strawberries and raspberries:

- Better acclimatization in production
- Earlier flowering phase (2 weeks gained)
- Earlier harvest (10 days)
- Superior lateral lengths (+ 20%)
- Better production homogeneity
- Increased yield (+ 25%)



Medicinal & Aromatic Plants (MAPs)



The enthusiasm for certain drinks, dishes which are becoming increasingly popular and a rise in consumption related to well-being, make our MAPs top performers on the market. From germinated seed to the growth of a dense and stocky plant, the quality of the light will interact at different levels of the plant's growth process. For germination, cuttings, propagation, breeding, etc. lighting is a key factor for meeting market expectations. Lighting also enables growers to send specific light signals which develop the production of molecules of interest or lead to natural pathogen resistance.



Clients

- ✓ Propagation plantsmen
- ✓ Breeders
- ✓ Producers



Crops

Basil, Mint, Poppy, Lavander, ...



Aims

- ✓ Be able to multiply the production volume by working on the post-germination stages in grow rooms
- ✓ Reinforce and homogenize plants before they go into growing greenhouses

Some examples of compatible solutions

POWER LUMIA



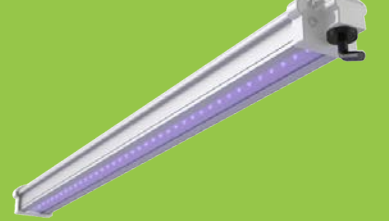
- Above-crop light
- Light and compact
- Homogeneous lighting
- Dwarfs and increases foliage density
- Replaces conventional HPS
- Doesn't heat up
- Economical €/μmol

RACKLIGHT



- Ideal for growing shelves
- Increases the rooting rate
- Plug & Play, installation without tools
- Spectrum adapted to each crop
- Simulate the sun rising and setting
- Guaranteed homogeneity
- Compatible with pathogen testing

UV BAR

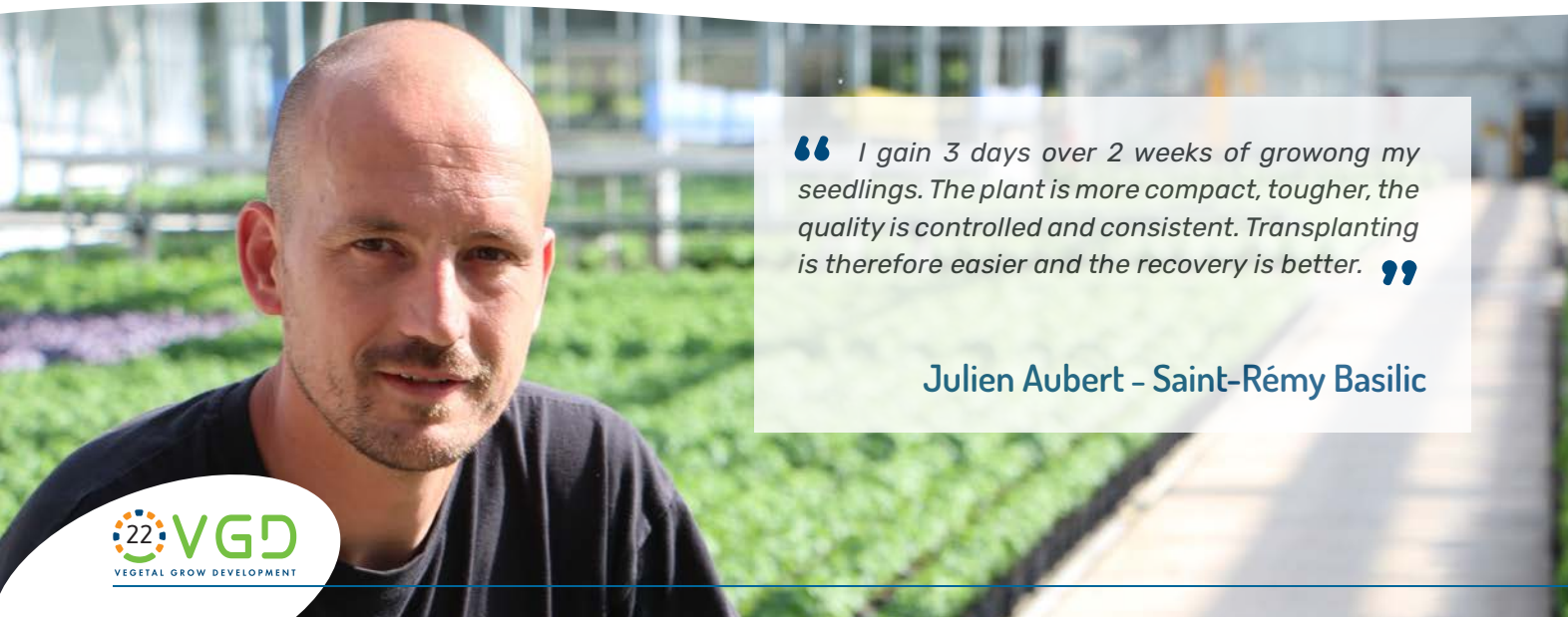


- Ideal for growing shelves
- UV A, B or C
- Helps to defend plants
- Surface deésinfection
- Compliance with security regulation
- Dimensions to suit your needs

Results

Multiple species:

- Production of seedlings was multiplied by 3 over the same surface area
- The plants developed a bigger root system (+ 40%)
- Superior acclimatization in the breeding greenhouse
- 3 days gained over 2 weeks of growing seedlings



“ I gain 3 days over 2 weeks of growong my seedlings. The plant is more compact, tougher, the quality is controlled and consistent. Transplanting is therefore easier and the recovery is better. ”

Julien Aubert - Saint-Rémy Basilic





Whether it's on an economical or a fundamental level, research requires precise tools and know-how in order to overcome technical and scientific obstacles. Technology which is too limited and/or not mastered properly can lead to approximations, errors and sometimes the abortion of research projects due to the limiting factors of the technologies used. That's why our qualified tools and our plant physiology and technical teams in the R&D center are able to accompany you and help you with setting up light tests. The lighting impacts the photosynthetic aspects just as much as the light signal-based messages. The light affects the physiological processes to induce mechanisms inside the plant. It promotes defense, stress, growth stage changes and many other levers.



Clients

- ✓ Seed producers
- ✓ Nurseries
- ✓ Propagation plansmen
- ✓ Vertical farming
- ✓ Independent producers
- ✓ Technical centers and research centers



Crops

MAPs, Tomatoes, Bell Peppers, Seeds, Pathosystems, Strawberries, Spirulina, Seaweed, Lawns, ...



Aims

- ✓ Increase the yield
- ✓ Accelerate the production cycle
- ✓ Control crop reproductibility
- ✓ Test new varieties quickly
- ✓ Increase the production of molecules of interest
- ✓ ...
- ✓ Produce all year round
- ✓ Increase quality
- ✓ Speed breeding
- ✓ Crop homogeneity
- ✓ Improve postharvest conservation

Some examples of compatible solutions

HIGH RACK 6 CHANNELS



- Overcomes obstacles
- Accelerates the cycles
- The only multispectral light that can shine from a distance of 1000 to 100mm with perfect homogeneity
- Programmable from channel to channel
- The only limit to its uses is your imagination
- High performance and guarantee

VF BOX



- Manage your existing solutions
- Indispensable to simulate all of the world's solstices
- Plug & Play
- Make your cultivation environments intelligent and interactive
- Data log and monitoring

μWAVE



- Simple yet efficace
- Calibrated according to your installation
- Mobile and adapted to those with little experience
- Controls all VGD technology within reach
- Economical and reliable

Results

- Definition of the optimal light spectrum, adapted to various types of crops with lighting standard industrialization
- Replacement of the fluorescent tubes in grow rooms with an optimized spectrum
- Seed production cycle for bell peppers reduced to 18 days
- Optimization of crop management for raspberries, tomatoes, and strawberries
- Definition of light signals to end dormancy
- Definition of light signals to reach a precise stage of development in order to increase vitamin C concentrations
- Observation of different pathosystems (hosts – pathogens)
- ...



“ As a service provider in the cellular biology and phytopathology fields, we at Vegenov were looking for a tool which would enable us to test an unlimited number of light recipes for our experimentations in greenhouses and in grow rooms. We therefore purchased a VGD « High Rack 6 channels » led lighting system. This equipment now enables us to offer our seed producer and agrochemist clients the possibility of studying the impact of lighting on the metabolism and the growth of the plants as well as on the development of plant microorganisms. ”

Mickaël Euzen
R&D cellular biology engineer - Vegenov



The Vegetal Grow Development offer

- The VGD multispectral lights
- Comparison with other lights on the market
- Cost and Guarantees of a LED device
- The sensors

The VGD multispectral lights

The dynamic multispectral light, a worldwide exclusivity

Resulting from discussions with growers, seed producers and research centers in 2017, Vegetal Grow Development developed a management system linked to a multispectral LED based electronic circuit.

This system makes it possible to regulate natural spectral deficiencies related to weather conditions. Unique on the market, this system, based on the independent management of 6 wavelengths, enabled Vegetal Grow Development to build its own database, which puts it ahead of the curve with regard to the interaction between plants and light.



Why multispectral light?

With just one light, it is possible to adapt the spectrum to suit your requirements, constraints, and goals:

- No longer necessary to disassemble lights to change the spectrum
- A constantly optimal light spectrum which adapts to usage conditions according to the parameters which are pre-set by the user
- Bigger energy savings due to its modularity over six independent spectral channels
- Spectrum optimization for each stage of vegetal growth
- Step by step management: each light is independent and can receive different instructions
- Standard 6 bands or custom-made up to 32 bands, the wavelengths are customizable
- 32 tested and qualified wavelengths to suit plant requirements

The technology introduced by Vegetal Grow Development adapts to your needs in greenhouses and grow rooms.

Comparison with other lights on the market

	Multispectral VGD Lights	Standard LED Lights	Sodium / HPS Lights
Management of multiple light spectrums	🌱🌱🌱	🌱	
Lighting control	🌱🌱🌱	🌱🌱	
Investment	€ to €€€	€ to €€€	€
Cost of running	€	€€	€€€€
Management of the light at each growth stage	🌱🌱🌱	🌱	
Energy consumption monitoring	🌱🌱🌱	🌱	🌱
Compatibility with agroclimatic software	🌱🌱	🌱	
Intensity management	🌱🌱🌱	🌱🌱	
Zone management	🌱🌱🌱	🌱	
Multi-crop management	🌱🌱🌱	🌱	

Why switch to LED lights?

LED (light-emitting diode) technology is an alternative to the current horticulture lighting leader known as “HPS” (High pressure sodium). While the purchase price is higher, the lifespan of a high-quality LED system varies between 40 000 and 100 000 hours depending on the environment in which it is used, i.e. 4 to 10 times longer than alternative solutions. After use, LED lights are recyclable.

Furthermore, horticulture LED lighting uses 2 to 6 times less energy than traditional lighting, which is a clear economical advantage.

Additionally, Vegetal Grow Development’s horticulture LED lighting technology adapts the intensity in real time and for 32 different wavelengths depending on the type of plant and its stage of growth.

Lastly, 85% of a LED system is converted into photosynthetic light. In addition to this, its low heat emission enables the optimization of the climate regulation in the production environment.

How much does a LED lighting system cost?

The economic equation is a determining factor in a horticulture lighting project. We always suggest a return on investment within 3 years, equipment and energy consumption included.



Therefore, our controlled lighting solutions are available for as low as 15 €/ m² for crops which are lacking seasonal light or as an occasional light supplement. For more demanding cultivations like molecular extraction or for plants which demand a high quantity of daily light, the price can reach up to 150 €/m². To help you to easily forecast the optimization of your cultivations, our commercial engineers can accompany you with a free assessment of your project. You can also seek assistance from an approved agro-equipment supplier.

What guarantees do Vegetal Grow Development solutions provide?

All of our solutions are qualified and tested on our trial sites in real-life conditions prior to their commercialization.

The standard guarantees for our solutions range between 3 to 7 years and vary depending on conditions of use.



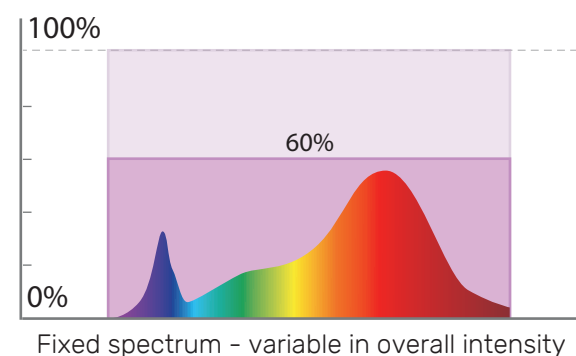
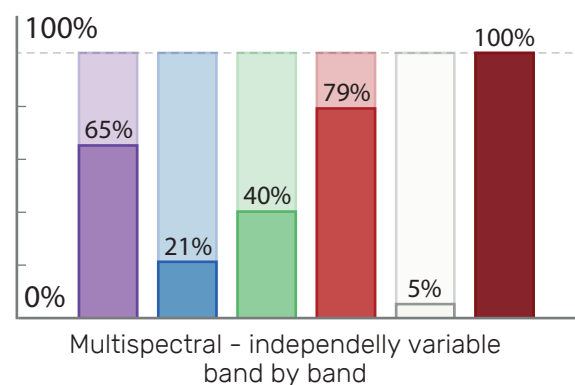
Multispectral or fixed spectrum

Vegetal Grow Development also has the ability to offer and install standard lights with fixed spectrums in order to reduce the cost.

Roughly 30% less expensive than multispectral lighting, this choice is adapted for monocrops for example and if you're sure that you're not going to change them within the next 5 to 7 years.

It is nonetheless possible to just modulate the intensity of the lighting thanks to Vegetal Grow Development control systems.

If you switch to a different type of crop, the Vegetal Grow Development «buy-back» financial solution would enable you to adapt to the new production.



The sensors

The sensors installed inside greenhouses or grow rooms collect a large amount of data in real time.

Here are the main types of sensors on offer:

Spectro

A connected spectrometer type of light sensor which senses the decomposition of the indoor light spectrum in real time, making it possible to rectify the natural light deficiencies.

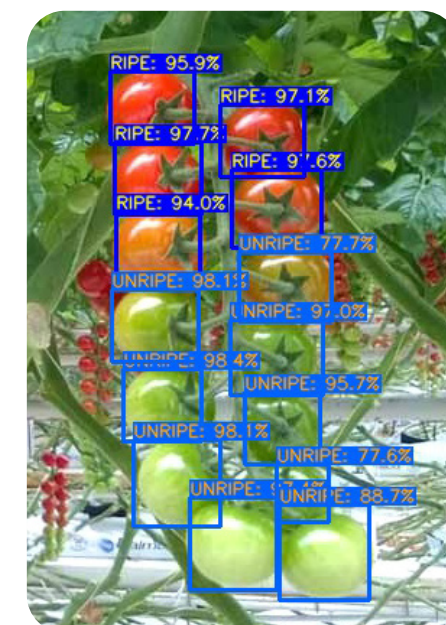


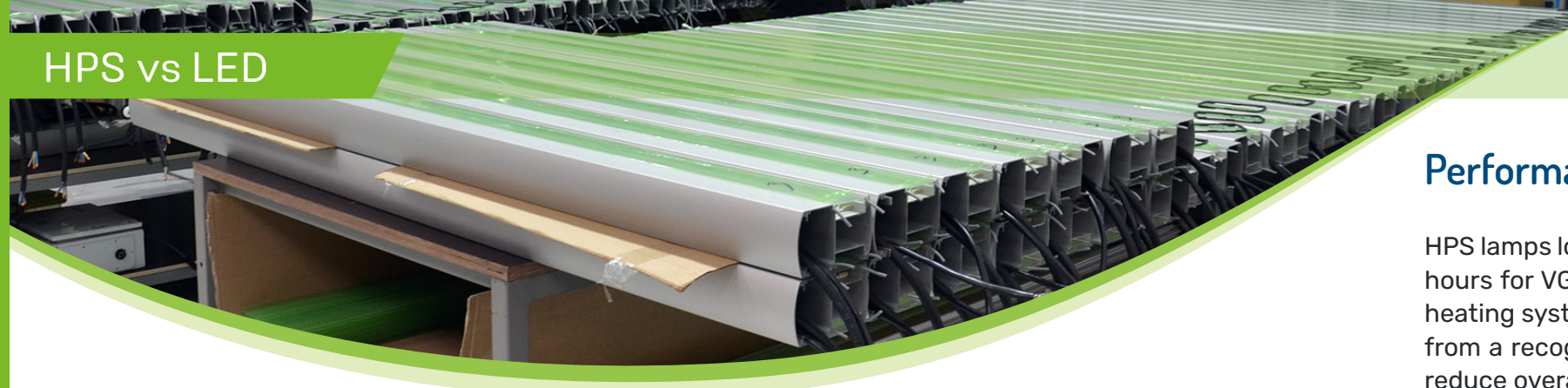
Growth

Growth and state of health sensor (cameras) which make it possible to monitor the growth of crops in real time throughout their whole life cycle.

Interfacings with other sensors or agroclimatic software are also possible:

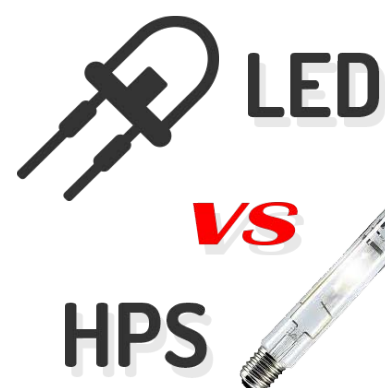
- interfacing possible with certain agroclimatic software to completely integrate the management of your crops ;
- interfacing possible with other sensors for specific requirements (temperature, CO₂, ...).





LED fixtures or HPS?

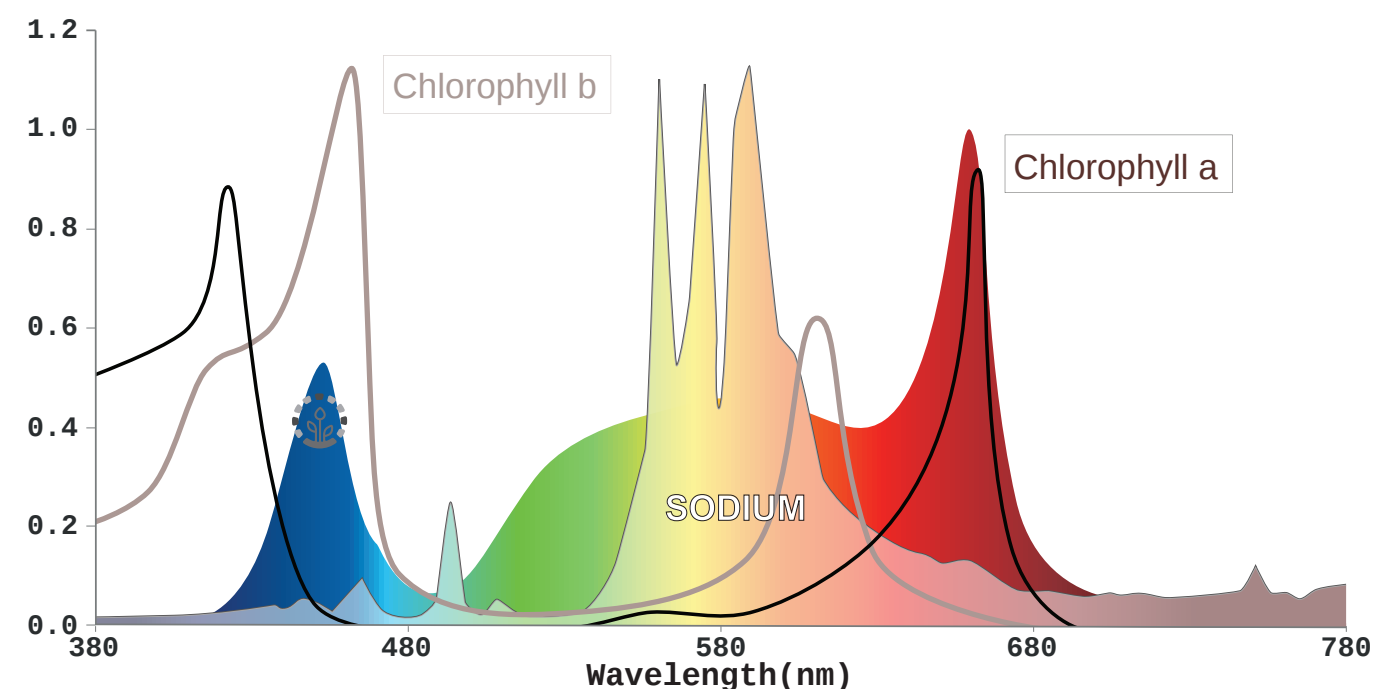
Vegetal Grow Development has a unique control solution for all of the market's LED and HPS (High Pressure Sodium) luminaires, preventing energy waste and light pollution. This solution in no way affects agronomic performance and guarantees savings of 5 to 16% on overall annual consumption without any modification to the electrical installation.



One of the main arguments of LED lighting is its consumption two to three times less than that of HPS and the additional benefits are multiple: intensity, efficiency, spectrum, thermal, variation, ...

HPS lamps mainly emit in an area between 550nm and 630nm (corresponding to the yellow-orange area of the visible spectrum) with a very low emission in the blue, which is however involved in the photosynthesis process but also in the activation of the main photoreceptors. The red content in HPS lamps is also weak, although some intensity peaks are present. A partial activation of phytochromes (red and far red photoreceptors) is therefore obtained, as is the process of photosynthesis.

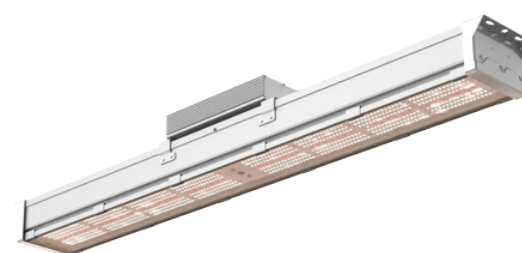
In a VGD LED fixtures, it is possible to choose the spectral wavelengths used. This allows mechanisms to be activated in plants when desired: use of specific wavelengths for rooting, germination, flowering and other stages of growth.



Performance

HPS lamps lose on average 30% of their intensity after 3000 hours of operation compared to 50,000 hours for VGD LED fixtures. The thermal delta is large enough to be compensated by more efficient heating systems (Watts/Joule). It is a bad idea to keep HPS lights as a substitute for heating. A study from a recognised Dutch university mentions that the use of LED lighting in tomatoes crops would reduce overall electricity consumption by 15%.

By reducing the number of HPS lamps in a greenhouse, thanks to the performance of TOP MAX LUMIA LED fixtures, the shadow cast by HPS lamps can be reduced by 6%. Thus, the performance of current LED technology allows today to replace HPS luminaires simply.



TOP MAX LUMIA
580 W



HPS
1000 W

50,000h lifetime	✓	✗	30% loss after 3000h
20 to 40% more flow	✓	✗	2x higher consumption than LEDs
Factory adaptable spectrum	✓	✗	Standard and non-adaptable spectrum
Economy of scale in the number of light points	✓	✗	Long start and high temperature

Conclusion

For the same intensity ($\mu\text{mol}/\text{m}^2/\text{s}$ or lux) captured by a plant, HPS lamps consume more, are less efficient with a spectrum less optimised for photosynthesis. LED fixtures inevitably have more positive points compared to HPS lamps. Eco-responsibility is at the heart of our challenges and VGD solutions accelerate this vital transition.

Find the full article on our website : <https://vgd-led.com/comparatif-hps-et-led/>



More than a service ...

Light is naturally appreciated by humans and, in many cases, too often trivialised. VGD is in constant contact with producers, seed companies, experimenters, and has detected a real need in the characterisation of the light in a growing environments. This service has become essential to optimise producer performance. VGD provides its know-how through its equipment, its recognised light platform, our plant database and our experts offer you the opportunity to quantify and characterise the light influence in your crops.

A light audit for each installation



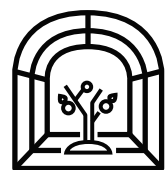
Indoor
vertical
farming



Greenhouse



Photovoltaic
Greenhouse



Plastic
Greenhouse



Nursery



Custom
Projects



Clients

- ✓ Closed environment producers
- ✓ Greenhouse growers of all types
- ✓ Specific producers

- ✓ Arborists
- ✓ Algae producers
- ✓ Field crop producers



Aims

- ✓ Characterise the existing material
- ✓ Characterise the production system
- ✓ Measure the light perceived by the plant
- ✓ Analyse the interest of a lighting system
- ✓ Valorise natural light
- ✓ Appreciate the filtration level
- ✓ Better understand its photosynthesis
- ...

Our expertise

- ✓ Specialised tools for measuring the light absorbed by the plant
- ✓ Standard and custom protocols
- ✓ Formatting and analysis of results
- ✓ Discussions with our plant specialist teams
- ✓ Measures adapted to your problems
- ✓ Proposal and sizing of your lighting project based on production capacity

Vertical farming



- Spectral characterisation
- Spectrum analysis
- Light enhancement
- Distribution mapping of the light
- Protocol recommendation
- Facilitate light penetration
- Homogenise the light
- Advice on changing fluorescent tubes

Greenhouse



- Characterisation of natural light
- Light assessment at the top of the plant
- Impact of whitening
- Investment for protector screens
- Diffusing power of the glass
- Greenhouse light filtration
- Identification of gray areas
- Climate control tools
- Bright strategy
- Limit the investment risk

Custom



- Process evaluation
- Dispersion of light in specific environment
- Industrialisation aid
- Tailor-made solution adapted to the constraints of the culture
- Action in innovative vertical farming, algocultures, aquaponics, arboriculture, sports ground



Light is the fundamental factor naturally governing all climatic factors in a growing environment. The current appreciation of light by PAR or other sensors leaves room for an optimization of 30 to 60%.



From 1 day to 12 months, together we characterise the audit that corresponds to your needs in order to convert the different axes of optimization for your crops.

Do not wait any longer!

Do you want to renew an installation, but you are afraid about the question on your experiments or interfere with the pathogen host relationships studied ? The identification of your systems will allow you to renew in complete safety as close as possible to the old existing one.

Do you want to use the light lever to improve your performance, but want to better understand the advantage and inconvenient ? With our continuous audit, we offer you real support in setting up your project, by answering all your questions clearly and precisely.



The control boxes

The Vegetal Grow Development Box control solution is an intelligent connected box which enables management of lighting in real time to cater to the specific requirements of the agriculture sector and monitor plant growth.

The system's strength is its capacity to take decisions which are adapted to the crop, based on variables which are sent to it in real time (natural light, DLI, wavelengths, temperature, CO2, hygrometry...) for each independent zone, plot and/or for different growth stages of the crops.

The parameters are adapted to each type of cultivation but also, and most importantly, they are compatible with the main lighting technologies which are currently available on the market (sodium/HPS, competing LED, multispectral VGD LED).



The control boxes

Various types of control boxes are on offer, depending on the conditions of use:



Grow room box

Developed to offer maximum spectrum flexibility and modularity, this box makes it possible to benefit from all of the advantages of VGD technology in a closed, confined environment without natural light. This box can be used, for example, to control a light with the creation of infinite spectrums or to manage lights separately in order to create different zones. It is therefore possible to imagine and compose various spectral recipes and test them in the same climate conditions.



Greenhouse box

This tool makes your production easier. It effectively guarantees the right light at the right moment by following a set of ambient parameters and by continuously decomposing the natural light spectrum. Suitable for use in a research center or for production in a greenhouse, it is compatible with all of the lights on the market. This box manages zones and crops independently from each other based on their needs. It is easily integrated into your ecosystem without the slightest modification.



Integrator box

This box has a larger amount of functions and represents the latest generation of VGD boxes. It combines all of the power of the VGD software suite to make one unit with the climate regulation systems. It is easily and simply integrated into the climatic cabinet. Additionally, it enables the collection of and secure analysis of the production data (light spectrum, growth...) to create optimization scenarios for crop yields and organoleptic properties.

µWave control

This sampler enables the use of VGD multi-wavelength technology intermittently without a control box, i.e. without a smartphone, tablet, or computer. It is generally used for tests to define the unique light spectrum of one or more lights which is adapted to each cultivation.



Control box comparison table

	GROW ROOM	GREENHOUSE	INTEGRATORS / AI	R&D (µWave)
	VF Box (Vertical Farming Box)	Greenhouse production (venlo, polytunnel, photovoltaic)	VGD technological building block for agroclimatic systems	Manual light spectrum control box
SPECTRUM Light spectrum management	3 icons	3 icons	3 icons	1 icon
LIGHTS Lighting management (plot configuration, Led and/or HPS management, ...)	3 icons	3 icons	3 icons	
MONITORING Management and monitoring software (spectrum, energy consumption, growth, managing sensors, ...)	2 icons	3 icons	3 icons	
AGROCLIMATIC Compatibility with market agroclimatic software	2 icons	2 icons	3 icons	
SENSORS Connected sensors (light spectrum, growth / disease, ...)	1 icon	3 icons	3 icons	
DATA Collection & visualization of crop data	2 icons	3 icons	3 icons	
SPECTRAL ABUNDANCE Light spectrum variations (spectrum intensity, colors, wavelength, ...)	3 icons	3 icons	3 icons	2 icons
	AUTO	AUTO	AUTO	MANUAL

The main functionalities of the control boxes

MONITORING

You discover how light is propagated and evolves in your greenhouse or cultivation environment. With the VGD system, light becomes a new production optimization factor!

CONTROLLED LIGHTS

VGD positions itself as an expert platform at the disposal of others, that's why the system can control and manage all lights on the market which use standardized management protocols (Signify, Hortilux, HPS, ...).

DATA CENTRALIZATION

The data generated by the VGD system is processed according to production requirements for efficient agronomical and physiological use.

AGROCLIMATIC INTEGRATION

All of the light expertise is one control unit. VGD is an innovation building block which seamlessly integrates agroclimatic management software. Simply increase precision and efficiency with one simple API.

SENSORS

The sensors used by VGD are currently the most precise ones on the market. VGD has developed two sensors which enable the analysis of light and plant growth.

NATURAL LIGHT

The sun is the first natural element that governs most photosynthetic processes. The VGD system analyzes its entire spectrum in real time in order to make the best decisions at the right time.

MULTISPECTRAL MANAGEMENT

Pioneer in its field, VGD has the only real time control system which is capable of modulating multiple spectral bands simultaneously. The result of 3 years of R&D, this innovation, which is currently being used on more than 2 ha, offers the highest flexibility for most cultivations.

AUTONOMY

Reliable, robust, and independent are the best adjectives to describe the VGD system. With or without an internet connection, the decision making remains inseparably integrated in the cultivation environment. Completely autonomous, it guarantees a good production no matter the circumstances.

ENERGY MANAGEMENT

The VGD system balances the physiological needs of your plants and the regulation of your contractual electricity consumption. Energy demand management is no longer a source of stress for producers or their crops.

PLANT EXPERTISE

For different types of crops, the quantity of light, the spectral quality and the duration of exposure, correlated with market objectives are among the answers provided by the VGD system. A quick and simple configuration with our experts makes it possible to adapt the right light management to suit the producer's interests.

Functionality details

Light is easily assessed visually by humans. Nonetheless, it remains a physical complexity for which imprecision is unforgiving. The Vegetal Grow Development solution holds all of the tools and expertise necessary to control, qualify and characterize all of the parameters required for the optimal growth of living organisms.

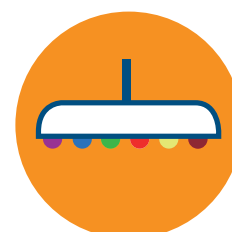


MONITORING

The user-friendly software makes it possible to define the cultivation parameters in advance, as well as the light location, lighting scenarios for each crop and stage of growth and visualize the data collected by the sensors (light spectrum, energy consumption, growth sensors, ...) in real time.

Here are the details of the main parameters which can be customized:

- Configuration of the light spectrum components by plot or by group of lights
- Management of the lighting scenarios for each type of crop
- Management of the lighting scenarios for each stage of growth
- Management of the lighting scenarios to suit the production targets and the climatic variations (weather)
- Configuration of the DLI / PAR parameters
- Energy consumption statistics and optimization
- Visualization of the indoor light spectrum in real
- Visualization and analysis of the data
- Configuration of the management mode (automatic or manual)



MULTISPECTRAL MANAGEMENT

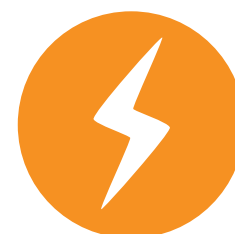
- Management of the light intensity and DLI (Daily Light Integral)
- Management of the percentage distribution of the light spectrum for each color (up to 32 wavelengths)
- Management of the light spectrum for each stage of growth (germination, rooting, vegetative growth, flowering, harvest, ...)
- Management of the spectrum based on the crop and location and control of each plot from 1 to 300 000 m²
- Management of the light signals and the end of dormancy
- Management of the main functions in integrated software mode or with a simple remote control to avoid using the software and to make the operators' jobs easier



CONTROLLING LIGHTS

VGD, a true multidisciplinary platform, enables users to control different lights, individually, by group of lights, or by crop, in a simple ON/OFF mode or in integrated remote control mode (via a smartphone, a tablet or a computer) depending on the capacities of the lights:

- Vegetal Grow Development LED lights
- Competing LED lights (depending on the control capacities)
- HPS Sodium lights



ENERGY MANAGEMENT

- Management the balance between electricity consumption and the light provided according to the producer's priorities
- Managing the hours of reduced consumption based on the type of contract, with the possibility of connecting to the electricity network's ICT output
- 40% reduction of a crop's lighting related consumption thanks to light intensity modulation, while maintaining the same agronomical results
- Management and recording of the measured energy consumption directly on the network via a metering system approved by the operators



DATA CENTRALIZATION

The crop data is visible throughout the whole cycle, right up to the harvest in the form of a history report, in real time or in comparative mode between the different data sets.

- History / current situation comparison
- Key Performance Indicator (KPI) tables
- Analysis of correlations between light and other cultivation parameters
- Potential annual consumption forecast

The collection and flow of cultivation data is strategic and Vegetal Grow Development understands that well.

That is why different solutions are made available in order to guarantee the security of the data and its transit within the greenhouse and outwards.

Therefore, the following types of systems are on offer:

- Cabled / fiber optic
- Wifi
- 4G / 5G
- Secure remote access for the producer and/or VGD

The VGD management software

The Vegetal Grow Development software enables users to set parameters in advance for lights and crops for each plot and to program the luminosity levels and the lighting objectives for a given period on an ergonomic interface.

It also enables real time monitoring of the light spectrum decomposition and energy consumption.

The photosynthetic light analysis software can be a very pertinent influence for taking action on the other agronomical factors in a more precise manner.

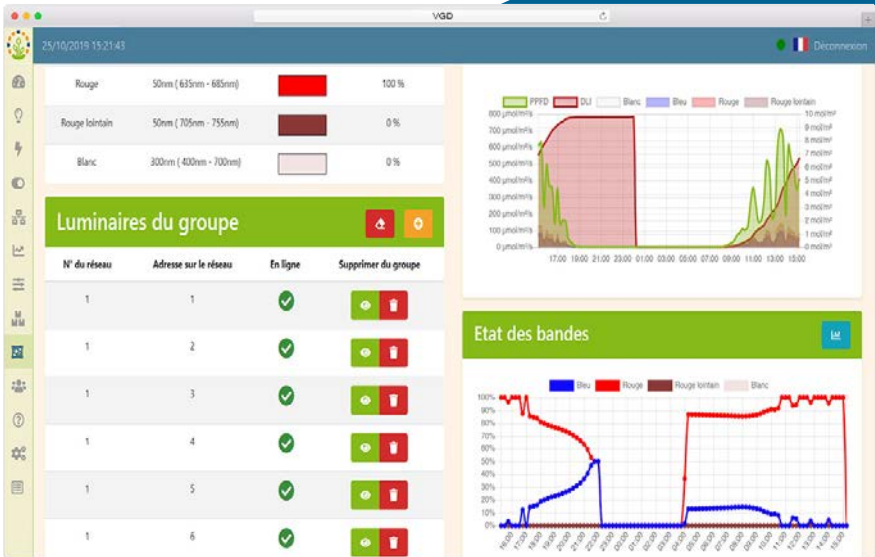
MANAGING DIFFERENTS ZONES

The platform enables the creation and management of different growing surfaces. Each command can be different to suit the planting timetable, the varieties being grown and the production objectives (earliness, yield, production leveling...). With just one click, you can supervise every modality and properly monitor each zone which is being cultivated differently.



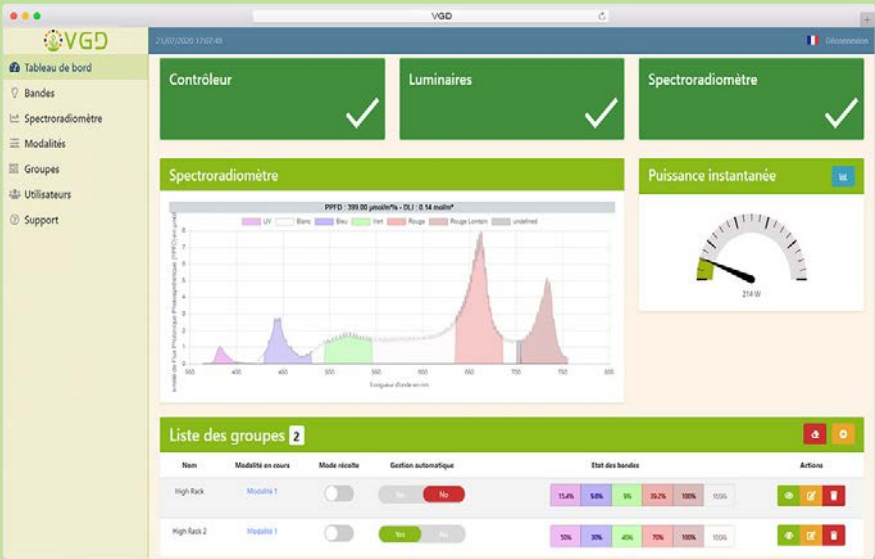
DETAILED STATISTICS

All of the data is processed and analyzed by our experts with our own algorithms. Visualization of the statistics is completely customizable; the use and exportation operate in just one window to simplify agronomic and physiologic decisions. Our experts will know how to guide you.



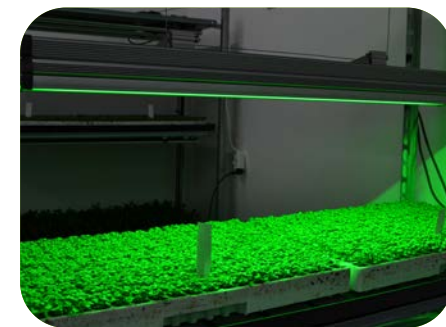
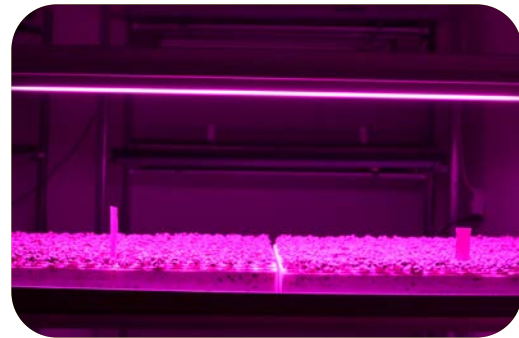
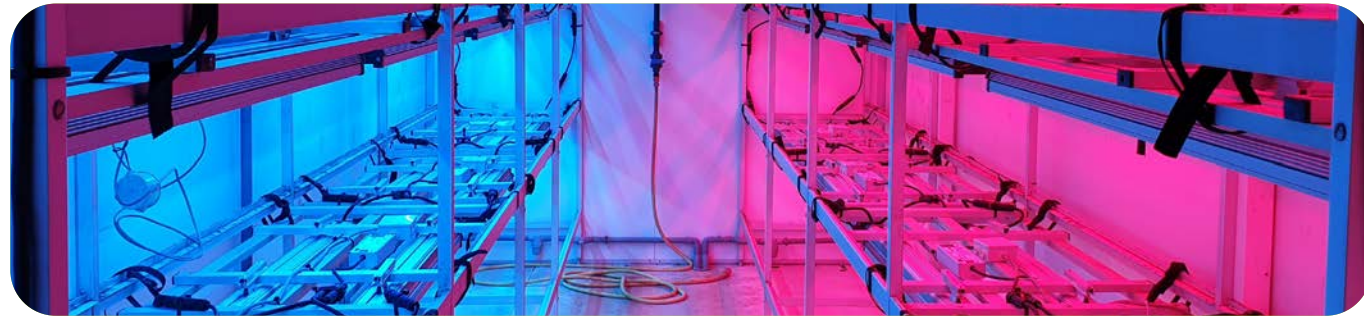
DASHBOARD

With one glance, the operator can visualize all of information required to assess the behavior of the light, the smooth functioning of photosynthetic control, consumption, the parameters which are operating... This window interfaces with the agroclimatic management, making the overall supervision of the operation easier.



A SPECIAL FOCUS ON THE QUALITY OF THE LIGHT

Light is a crucial factor for cultivations. The VGD software uploads and processes the most precise data on the market. Why such precision? Because photonics is a precise science, not an approximative one. VGD correlates the amount of natural and/or artificial light with the DLI. VGD positions itself as being twice as precise as the other systems on the market and this precision is reflected in the cultivation quality and the energy savings.



Glossary

Chlorophyll

Main photosynthetic pigment (green) found in chloroplasts inside plant cells. It mainly absorbs red and blue lights.

DLI

Daily Light Integral. Quantity of photosynthetic active radiation (PAR) received each day depending on the intensity and the duration of light exposure. It is expressed in mol/m²/day.

HPS

High Pressure Sodium. Type of High Intensity Discharge (HID) lamp which contains a sealed ceramic arc filled with sodium, mercury, and xenon gases. These gases are lit up to produce a light which has a yellow, red, and orange colored spectrum.

LED

Light emitting diode. A solid-state device which creates light by making electricity pass through a chemical compound to excite it and make it light up. No filament needs to be heated up. LEDs which are used as growing lights are very efficient because they produce more power per watt than other light sources and generate less heat while they are functioning.

Nursery

Area used for the propagation and cultivation of plants until they reach a stage where they can be transplanted or commercialized. It also refers to plots upon which annual plants (particularly vegetables and flowers) are sown and grown until they reach a stage where they can be transplanted to their final location. There are 2 main types: ones for propagation and ones for growing.

Organoleptic properties

Properties capable of stimulating a sensory receptor (appearance, smell, taste, texture, consistency).

PAR

Photosynthetic active radiation. The wavelengths in light in the visible range from 400 to 700 nanometers (nm) which lead to photosynthesis.

Photoperiod

Ratio between the length of the day and the length of the night.

Photosynthesis

Synthesis of carbohydrates by plants using energy from the sun captured by chlorophyll pigments.

Physicochemical properties

Physical properties (firmness, texture, colorimetry,...) and chemical (acids, sugars,...).

Phytotron

Grow room used for studying plant biology. Unlike greenhouses, they are often blinded rooms in which all environmental parameters (humidity, temperature, irrigation, lighting, ...) are controlled.

Plant physiology

Study of the functioning of plant organs and tissues and the nature of the mechanisms which are responsible for the organs performing their functions.

PPE

Photosynthetic photon efficacy. It is the unit used to measure the efficiency of lighting. It is obtained by dividing the PPF (μmol/s) by the entry power (W). It is measured in μmol/J (because 1W = 1J/s).

PPF

Photosynthetic photon flux. It measures the total quantity of PAR produced by a lighting system every second. It is measured in μmol/s.

PPFD

Photosynthetic photon flux density. It measures the quantity of PAR that effectively reaches the plant, temporarily in a specific location. It is measured in μmol /m²/s.

Secondary metabolites

Chemical compounds synthesized by plants which perform non-essential functions. Unlike primary metabolites, their absence is not lethal for the organism. Nonetheless, they are involved in ecological interactions between the plant and its environment.

Spectroradiometer

Tool which can be used to measure the power of electromagnetic radiation fluxes based on the wavelength.

Spectrum

The wavelengths produced by a source of light.

Speed breeding

Cultivation technique which makes it possible to harvest quicker by increasing photosynthesis and accelerating plant growth.

Stomata

Pore found on stems or leaves which enables the plant to breath and exchange with the atmosphere (water vapor, carbon dioxide, oxygen). The pore can open or close depending on exterior conditions. It is similar to pores on human skin.

Vertical farming

Practice which consists of growing vertically in order to increase the production capacity per square meter.

Wavelength

A physical quantity. Each color of light is characterized by a wavelength range in nm.

Follow-us

@VGDLED



@VGD-LED



@VGD_Led



VGD-LED



+33 (0)4 84 98 00 35

contact@vgd-led.com

**1241 chemin du mas de Grichaud
13160 Châteaurenard, FRANCE**

www.vgd-led.com