Smart solutions for greenhouse ornamentals

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Interreg IVb project: GreenGrowing (2011 – 2015)

PCS

Infrastructure

How we work

PCS - Departments

- Nursery stock & green sector
- Azalea & Rhododendron
- Potted plants
- Cut flowers
- Bedding & season plants

PCS - Research

- Water
- Nutrients
- Energy
- Assortment
- Crop protection
- Plant quality
- Culture techniques

PCS - Services

- Observation & warning system for nursery stock
- Advisory services for:
  - Water,
  - crop protection,
  - Nutrients,
  - Climate regulation
- Productdevelopment
- Plantphysiology

PCS - Activities

- Study days
- Courses
- Workshops
- Demonstration
- Symposia
- Grower visits

Sector, Government, Companies

Coordination and technical committees, growers, project groups, suppliers,…

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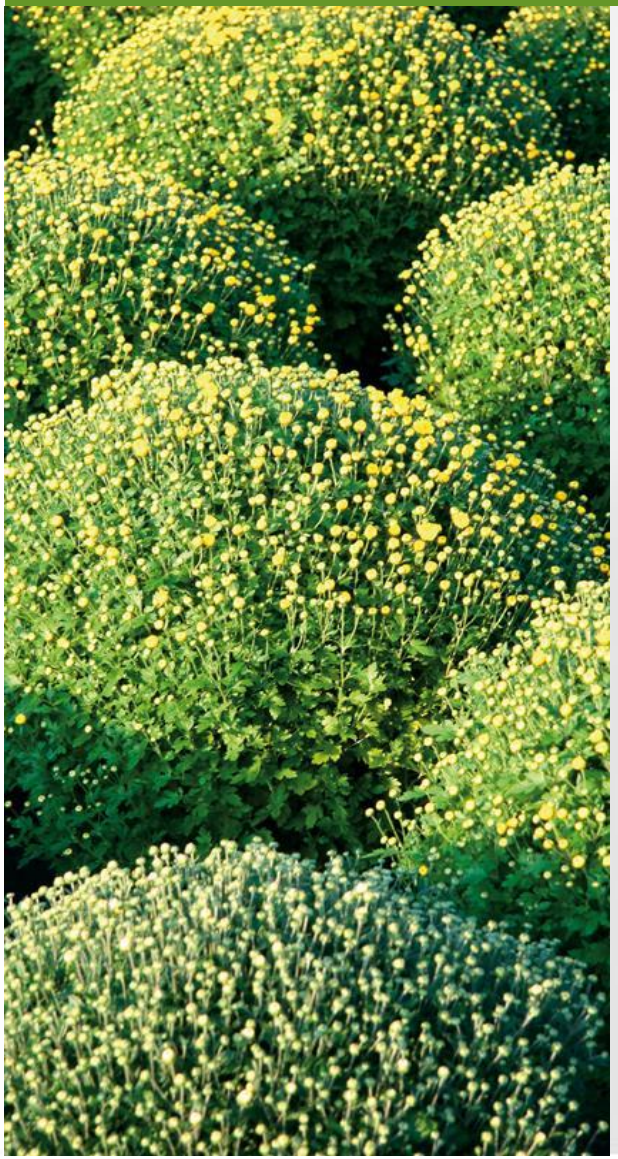
Innovation is being creative with all the existing knowledge

Company

Training and education

Research



New ideas

Research

Validation

Demonstration

Implementation

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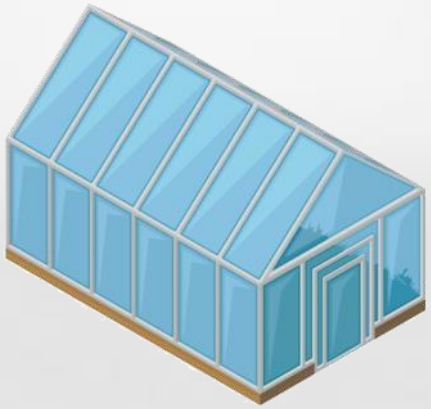
Innovation on all levels

Humidity

Covering materials

Plantmaterial



Plant sensors

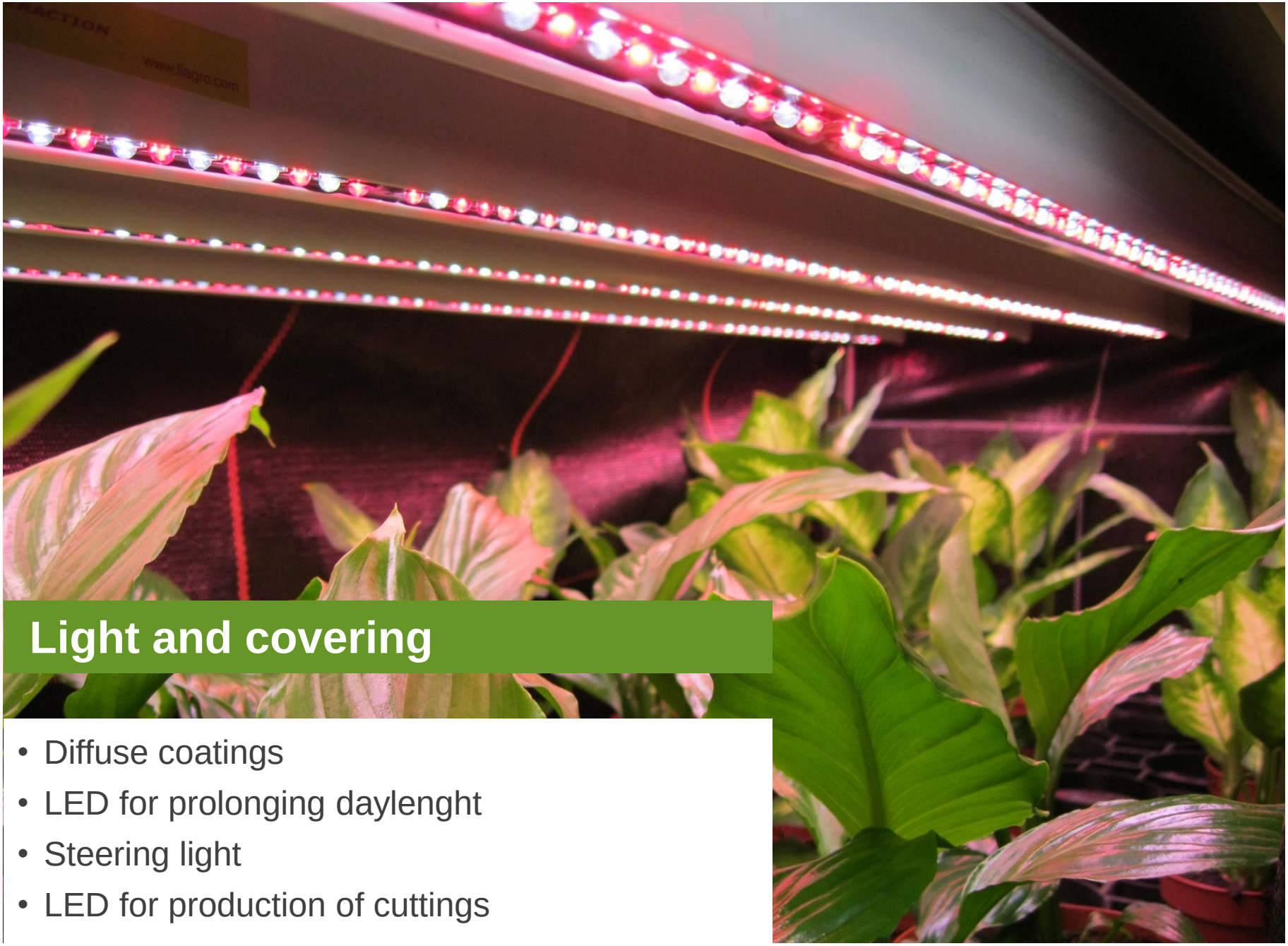
Climate regulation

Screening

Lighting systems

Heating

Ventilation



Light and covering

- Diffuse coatings
- LED for prolonging daylenght
- Steering light
- LED for production of cuttings

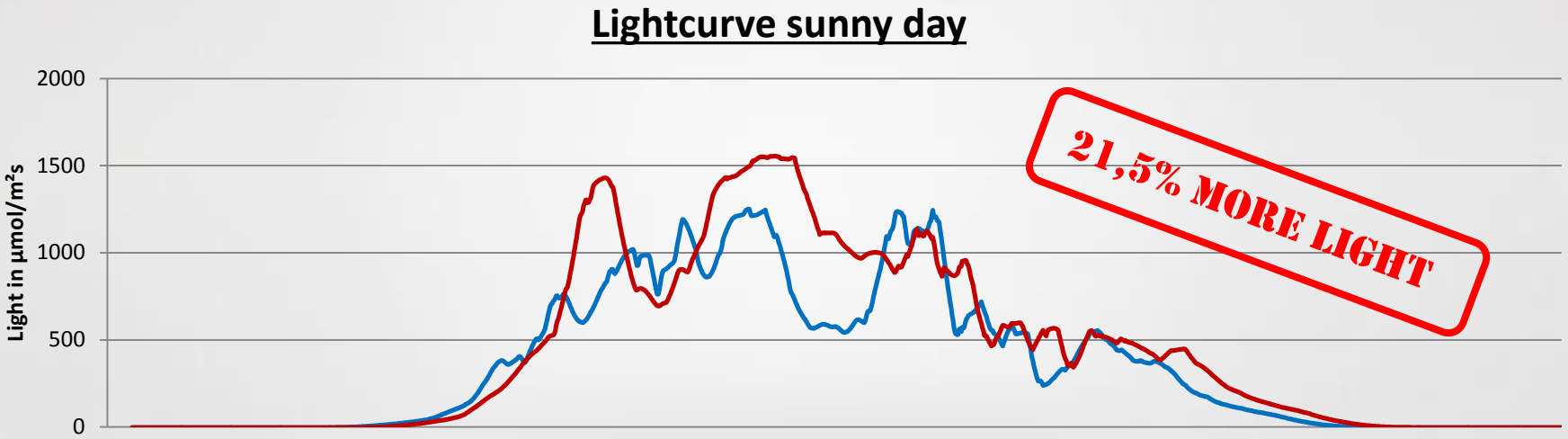
Diffuse or traditional coating?

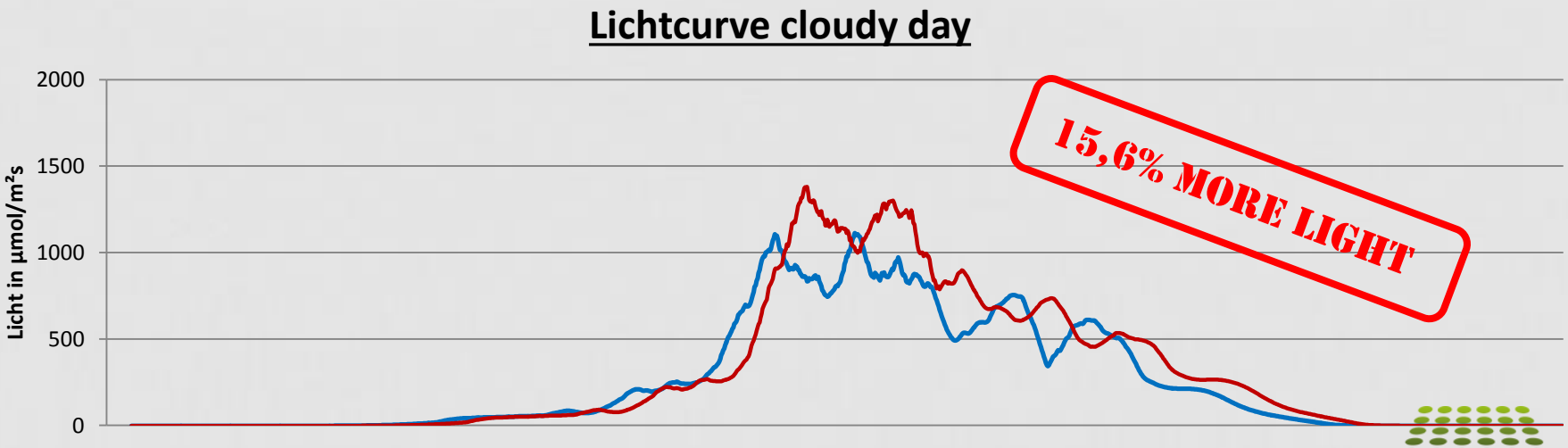
Testing of diffuse coatings **(Carnations)**

Transmission = 77,5% / Haze = 50%

- Lower leaf temperature
- Homogene climate in the canopy
- More light in the greenhouse (scattered)
- No influence on humidity
- No influence on lightspectrum
- Difficult to clean!

Diffuse or traditional coating?





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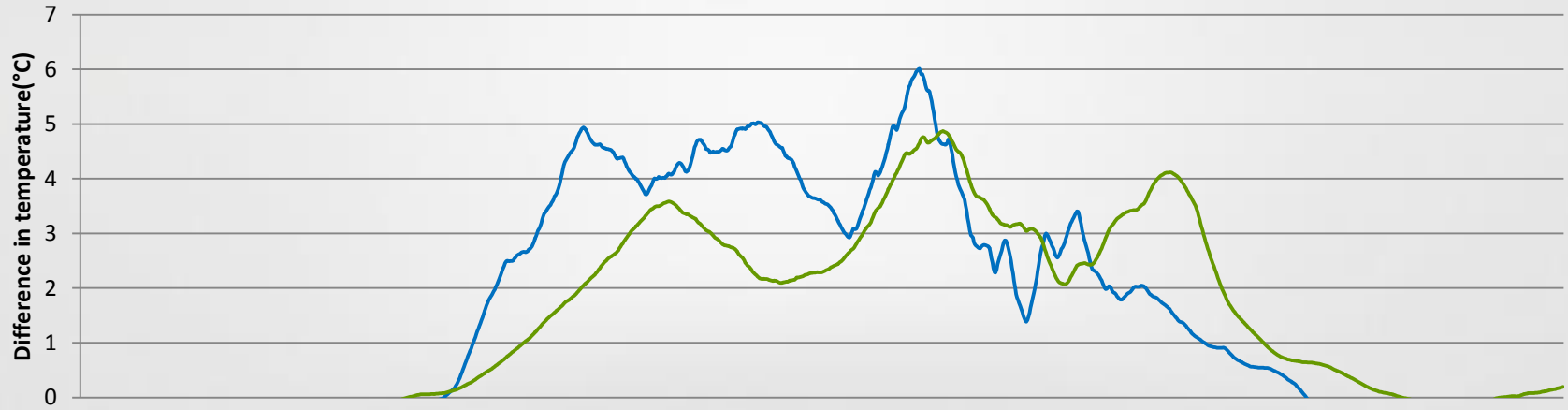
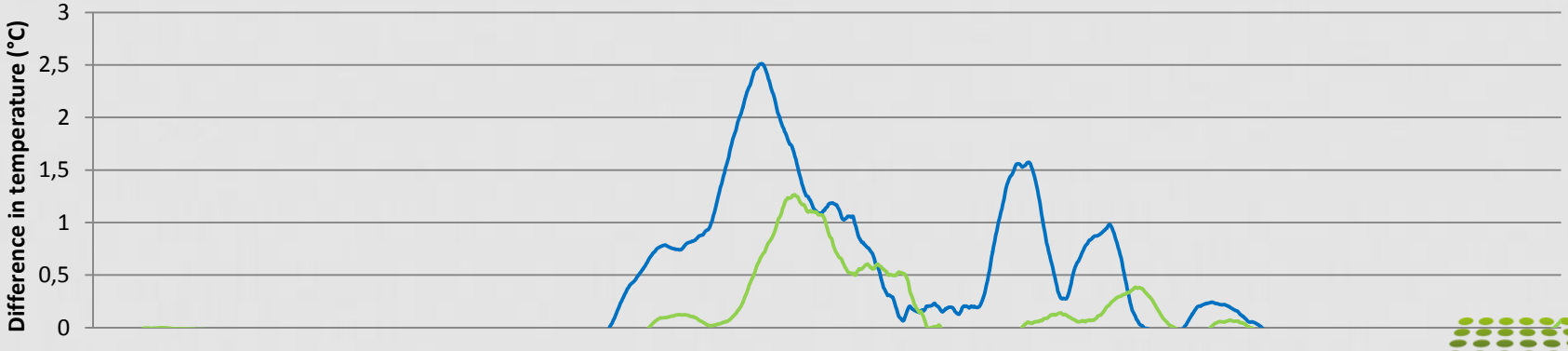
Diffuse or traditional coating?

Temperature differences between upper and lower canopy (sunny day)



Temperature differences between upper and lower canopy (cloudy day)



LED for prolonging day

Alstroemeria: LED for winter production

Goal: Diminish flower abortion with affordable artificial light

- 14h day (LED R/B < 175 W/m²)
- Flexibel system
- Increased robustness of flower branches
- Increased production of marketable branches (70% for some cultivars)
- No influence on bud desiccation

LED for prolonging day

Really extra production?

Cultivar		Total yield	% extra production	Marketable	% extra
'Doris'	LED	72	+ 67%	70,8	+ 45%
	Control	43		48,8	
'Avalange'	LED	124	+ 87%	82,3	+ 9%
	Control	66		75,8	
'Senna'	LED	126	+ 8%	87,3	+ 71%
	Control	117		51,2	
'Irena'	LED	72	+ 11%	94,4	- 3%
	Control	65		96,9	
'Orange Queen'	LED	95	+ 61%	81,2	+ 7%
	Control	59		76,2	

Necrosis, LED to close

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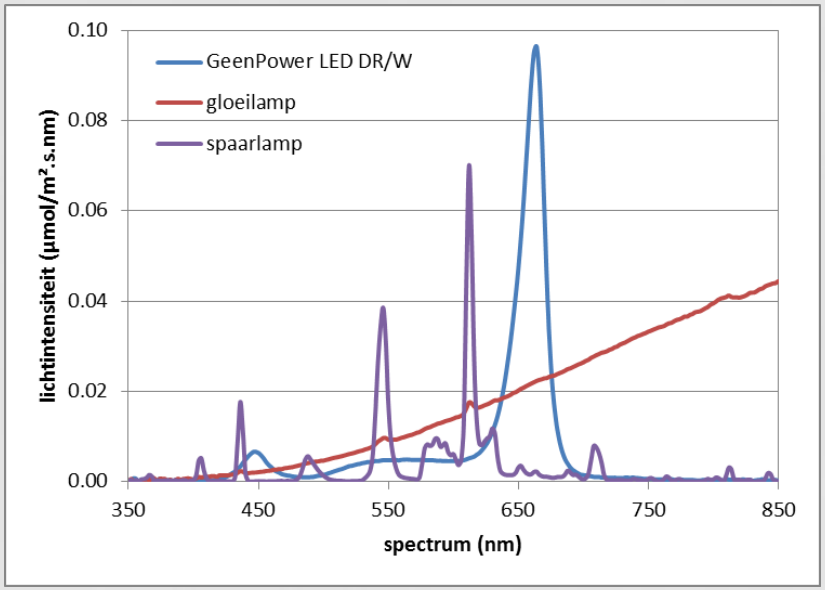
Steering light for bedded plants

- Faster flowering?
- Influence from different wavelengths?
- Energy use?
- *Fuchsia*, *Pelargonium* grandiflorum, *Pelargonium* 'Candy Flower' and *Scaevola*
- 16h daylength



+/- Equal?

Larger after weeks

Second best?

Pelargonium 'Candy Flower'

Temperature effect?

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+/- Equal?

Most flower buds

Fuchsia 'Ernie'

Just for this cultivar!

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Steering light for bedded plants

NOT EARLIER

EFFECT ON FLOWERING

CULTIVAR DEPENDENT

~~FLUORESCENT~~

TEMPERATURE EFFECTS

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Far red concentration

Far red

Far red

Discolouring *Cryptanthus*

Problem: colouring of leaves in winter (UV)

Market demands!

Discolouring *Cryptanthus*

	Red LEDs µmol/m².s	Blue LEDs µmol/m².s	Far red LEDs µmol/m².s	PAR µmol/m².s	Total µmol/m².s	Result end Februari
Recipe 1	42,2	0,0	7,5	42,2	49,7	No red colouring
Recipe 2	42,2	0,0	0,0	42,2	42,2	No red colouring
Recipe 3	42,2	7,5	0,0	49,7	49,7	Red colouring

LED for production of cuttings

Dendranthema grandiflorum

- Production of cuttings without flower buds (photoperiodic lighting)
- 12 cv. and 4 lamp types (experiment is repeated with other light intensities)

Lamptype	W/m²	Under lamp	Between lamps	Between lamps, 75 cm
Incandescent	37,5	20,0	17,0 (85%)	3,0 (15%)
Fluorescent	7,5	3,4	3,3 (97%)	2,5 (74%)
GreenPower LED	4,5	2,3	2,2 (96%)	1,6 (70%)
Oreon Retrofit	0,4	4,4	3,7 (84%)	2,0 (45%)

In µmol/m²s !

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LED for production of cuttings

Light intensity and quality

- Incandescent light = high intensity and low horizontal distribution
- Greenpower LED below minimum requirements at plant level
- Fluorescent lamps = high r/fr ratio

Vegetative growth

- Fluorescent lamp = shorter plants
- No significant difference in fresh / dry weight

Generative growth

- Fluorescent lamp > Greenpower LED > Oreon Retrofit LED = Control

Economics

- Energy consumption decreases with 80-88% with LED
- Cost price LED = 2 X fluorescent lamps

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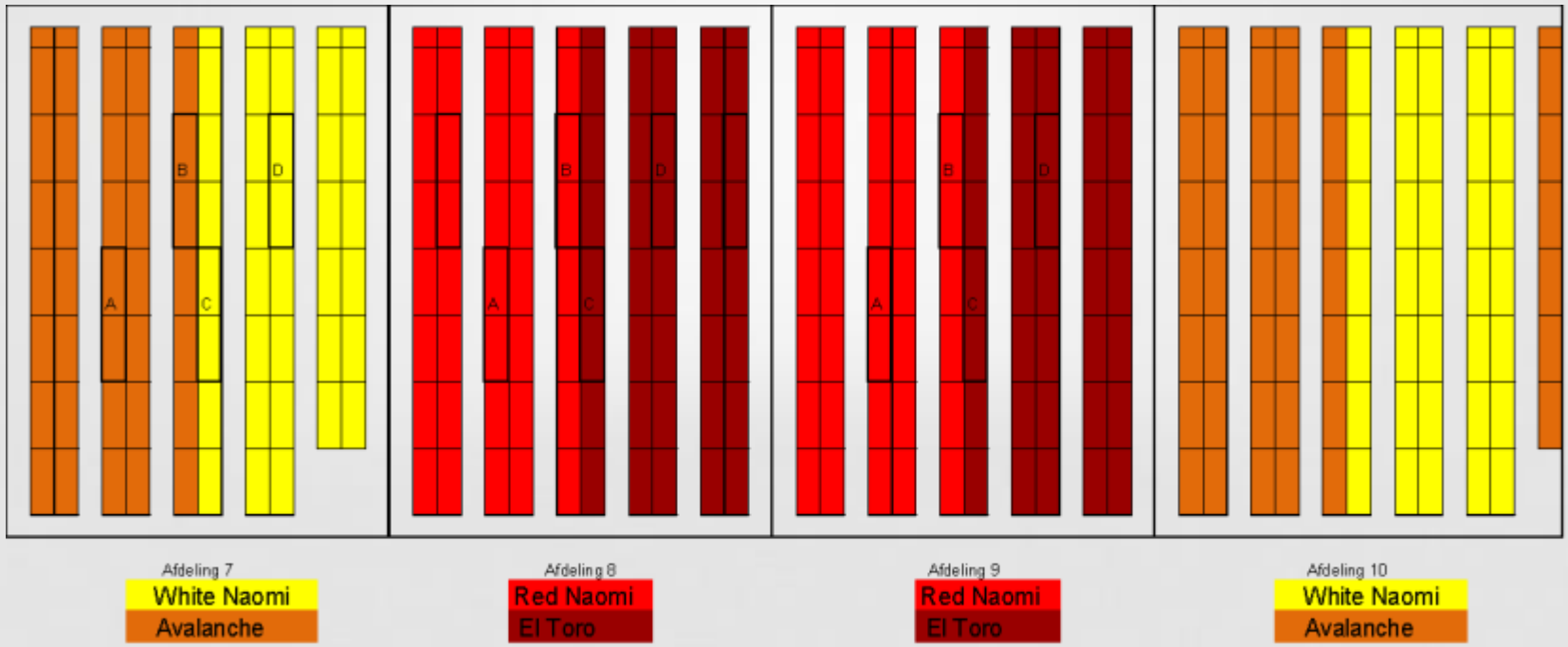
Climate regulation

- Energy efficient cut rose cultivation

Energy efficient cut rose cultivation

- Plantspecies*:*
  - *Rosa hybrida* ‘White Naomi’ and ‘Avalanche’
  - *Rosa hybrida* ‘Red Naomi’ and ‘El Toro’
- Monitoring
  - *Climate differences*
  - *Temperature homogenity in the greenhouse*
  - *Variations on stem diameter*
  - *Production of marketable and non marketable flowers*
  - *Incidence of humidity related disease problems*



1. Test production method with winter break and without artificial light
2. Test a simple and low energy consuming method to passively control humidity under a closed screen
3. Test varieties that perform good in these less favorable production conditions

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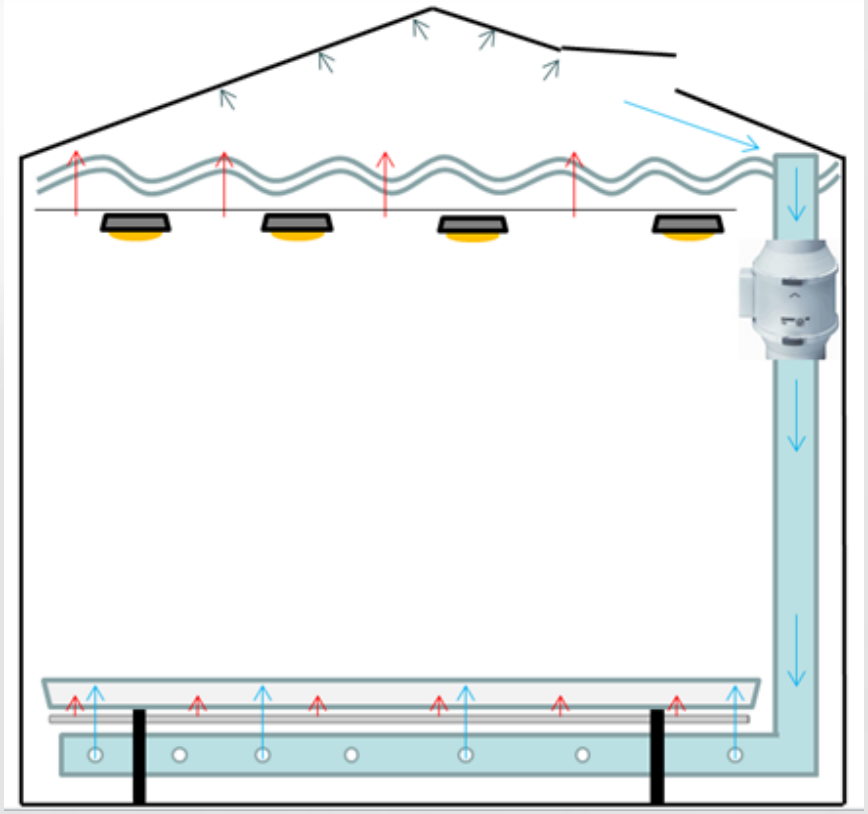
Energy efficient cut rose cultivation

Recirculation system

- Only works when screens are closed
- Slow air flow ➔ air has time to warm up
- Control by temperature above the screen
- Use it to circulate air in the greenhouse



Energy efficient cut rose cultivation

1 month!

RH ↓10%

CLOSED SCREENS

LESS TUBE

NO CONDENS

IRRIGATION!

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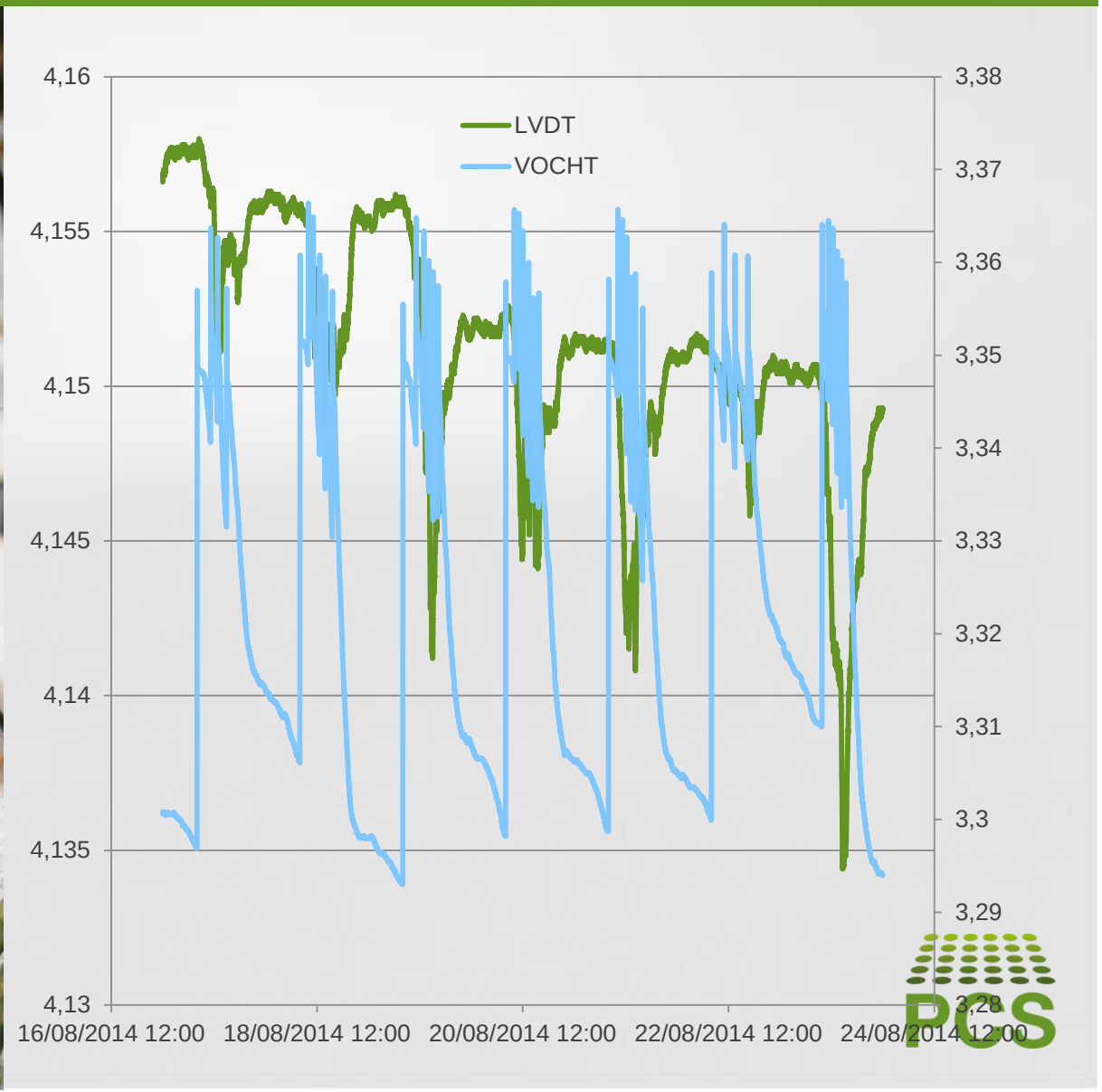
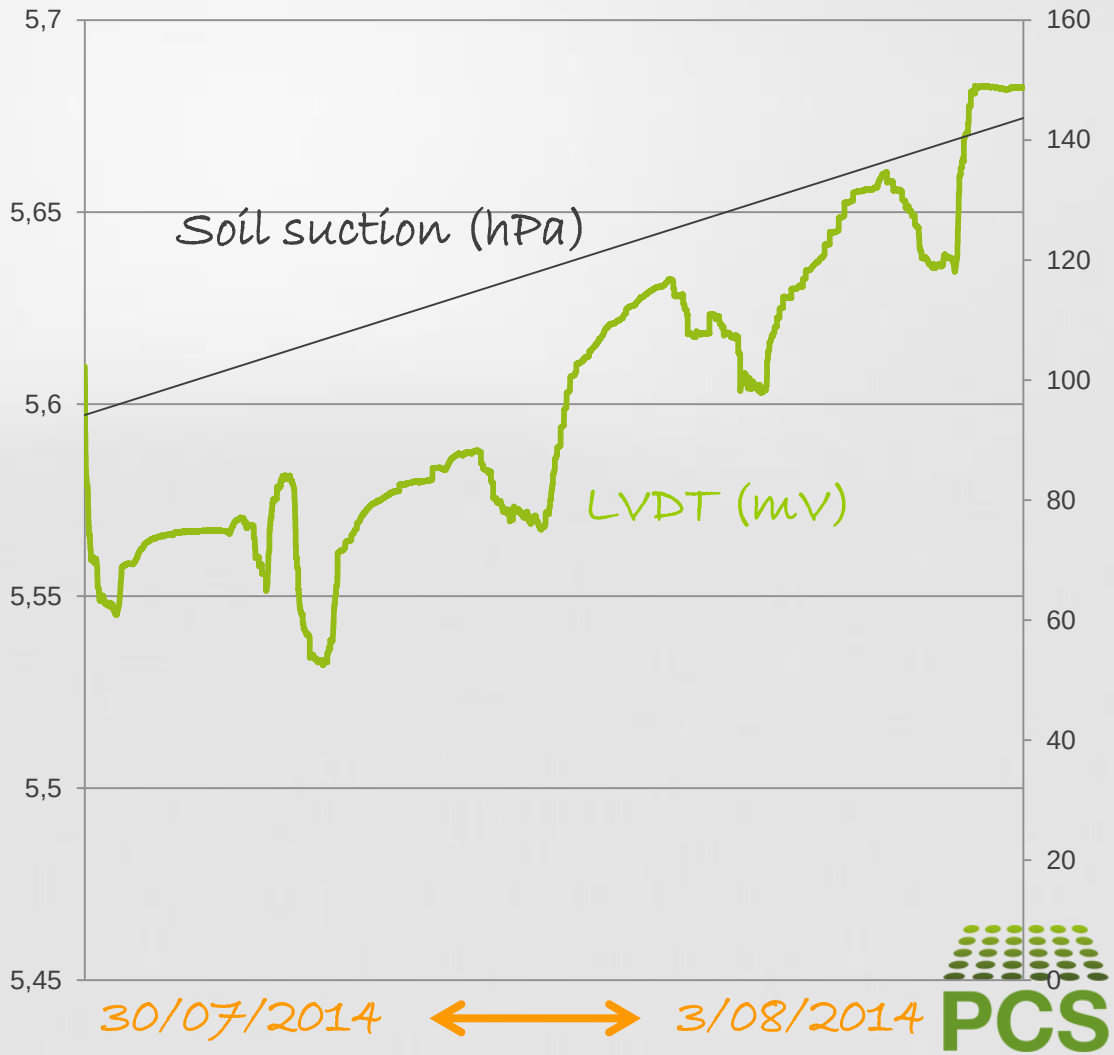
Plant sensors

- Energy efficient cut rose cultivation
- Monitoring growth (*Chrysanthemum*)

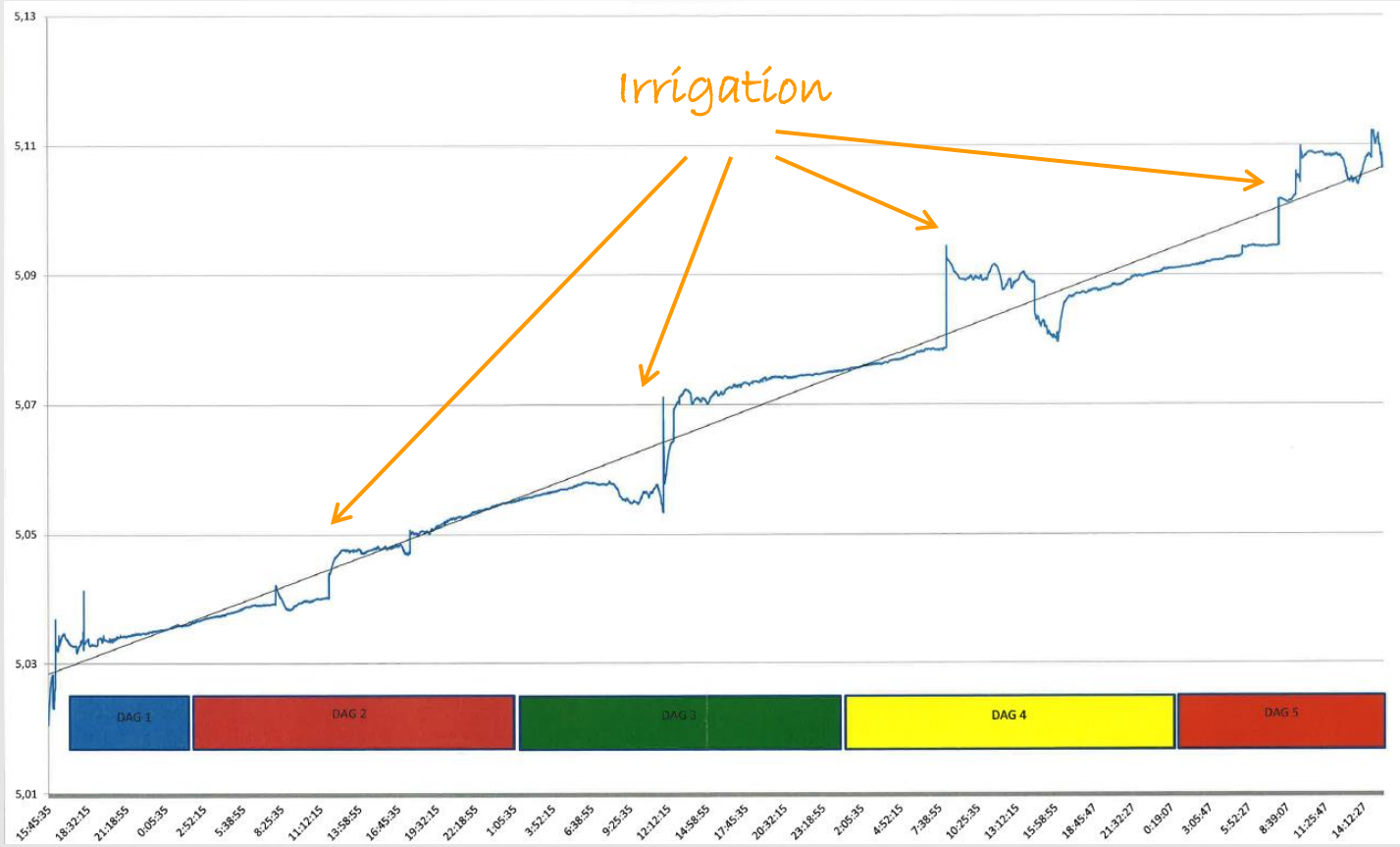
Energy efficient cut rose cultivation

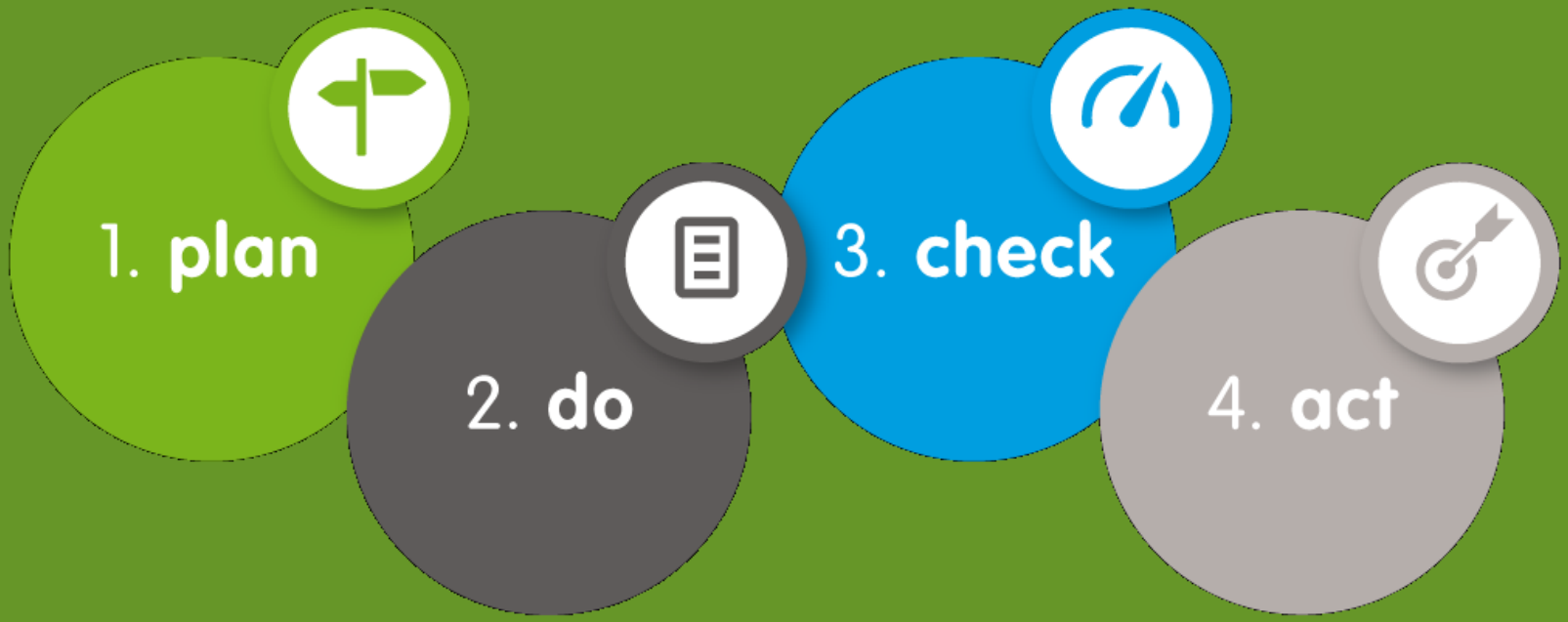


Monitoring growth



LVDT *Chrysanthemum*




1. plan
2. do
3. check
4. act

Heb je nog vragen?

Thank you!

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Bezoek ook www.pcsierteelt.be

Volg jij het PCS al op LinkedIn?

proefcentrum-voor-sierteelt