

LED light for ornamentals – more than fairy lights



LED light for ornamentals

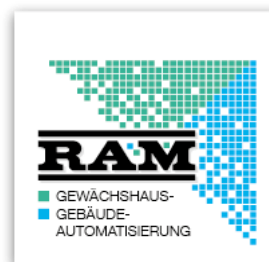
- National project ViSuELL
- LED research with ornamental crops and specific requirements
- Photoperiodical lighting with LED

ViSuELL

Partner:



hempel + rülcker
Gesellschaft für elektronische
Klimaregelsysteme mbH



RAM GmbH
Mess- und Regeltechnik



Funding ViSuELL:



rentenbank
Die Förderung erfolgt aus Mitteln
des Zweckvermögen des Bundes
bei der Landwirtschaftlichen Rentenbank.

Funding SMARTGREEN:

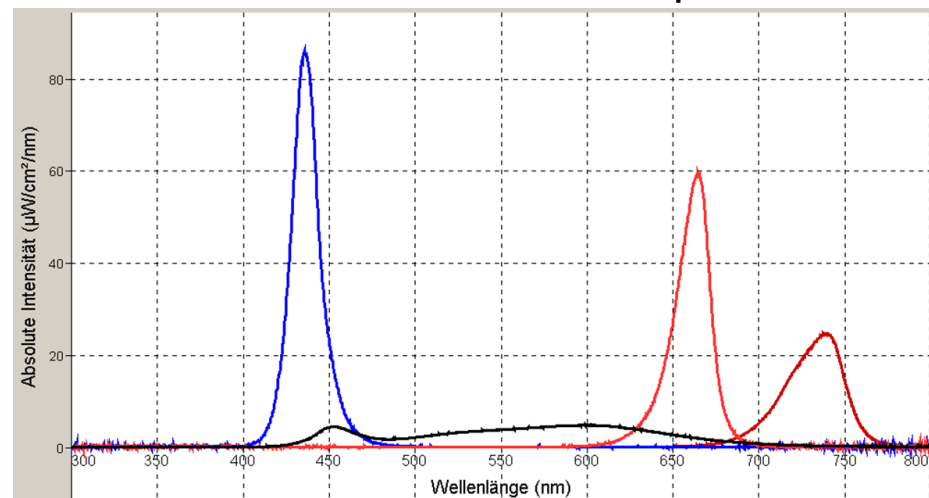


LED Produktionsmodul III



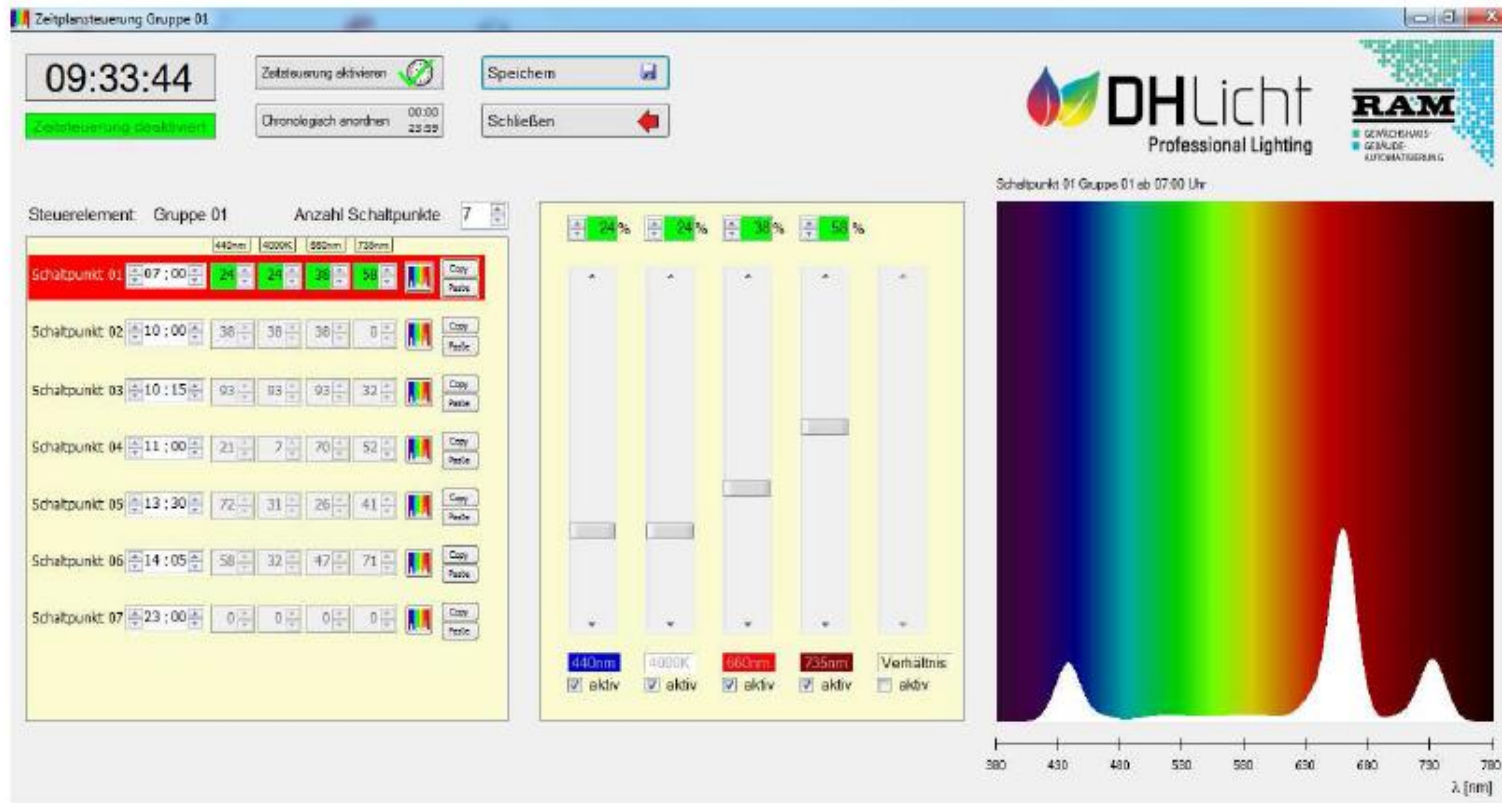
- Material: aluminium
- LED per module: 80
- Capacity per module: total 180 Watt,
40 W per colour

- spectrum:
 - blue (440 nm)
 - white (4000 K)
 - red (660 nm)
 - far red (730 nm)

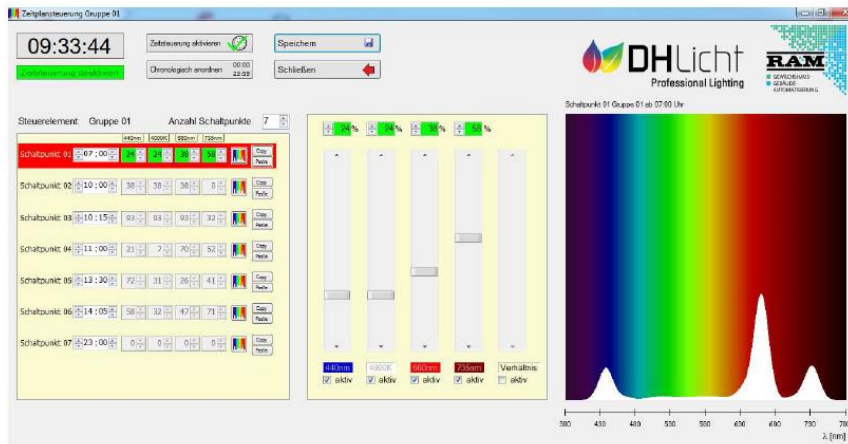


Software: VisuSpectrum (stand-alone or integrated in climate computer)

ViSuELL



VisuSpectrum



ViSuELL



photosynthetic light:
 spezific effects:
 growth retarding:
 photoperiodic:

100 % (all colours)
 50 % (only blue)
 25 % (only red)
 10 % (red/far red)





DE WEEK **IN BEELD**

PLUKKEN ONDER NIEUWE LEDLAMPEN

Bij kwekerij de Haakamp in Brakel worden alstroemeria's geplukt onder de splinternieuwe ledlampen.

Wat is hier bijzonder aan? Ledlicht is toch al vrij normaal?

Leds zijn populair in alstroemeria omdat het gewas het snel te warm heeft. Deze lampen van Unilight-Green zijn bijzonder omdat ze dimbaar zijn en aan een hijsinstallatie hangen.

Waarom dimbaar?

Teler Gert van Daalen wilde met belichting uitbreiden binnen zijn stroomaansluiting. In de ochtend start hij met Son-T en 50% ledlicht. Als er geen warmtevraag meer is, dan schakelt hij de Son-T uit en gaan de leds naar 100%. Het lichtniveau is in beide situaties 130 µmol. Naarmate de instraling toeneemt, lopen de leds terug naar nul. Met een wolk voor de zon gaan ze weer aan. Deze strategie bespaart hem flink wat stroom.

En waarom hijsbaar?

De kas is verdeeld in vier afdelingen met elk een eigen motor om de lamphoogte te regelen. De beste hoogte is 70 cm boven het gewas, vindt Van Daalen. Zo dringt het licht dieper door in het gewas en schijnt het niet op het pad, wat de Son-T lampen wel doen. Bij een jonger gewas kunnen de lampen lager hangen. Tijdens de gewaswisseling worden ze opgetakeld, en dat gebeurt ook als de sprinklers aangaan. „Ze zijn waterdicht, maar ik heb liever niet dat ze nat worden”, zegt de teler. Voor het project heeft hij een bijdrage gekregen van het Regionaal Investerings Fonds van Fruitdelta Rivierenland.

BEELD EN TEKST **Joef Slegers**

Vakblad voor de Bloemist

Vakblad 15/2019

LED light for ornamentals

A summary of results

ViSuELL

Begonia `Peggy`

ca. 60 $\mu\text{mol}/\text{m}^2\text{s}$



LED
80 % red
20 % blue



LED
100 % blue



HPS

HPS

Campanula ,Iris'

LED

50 % red

50 % blue



LED

100 % red



LED

33 % red

33 % blue

33 % white



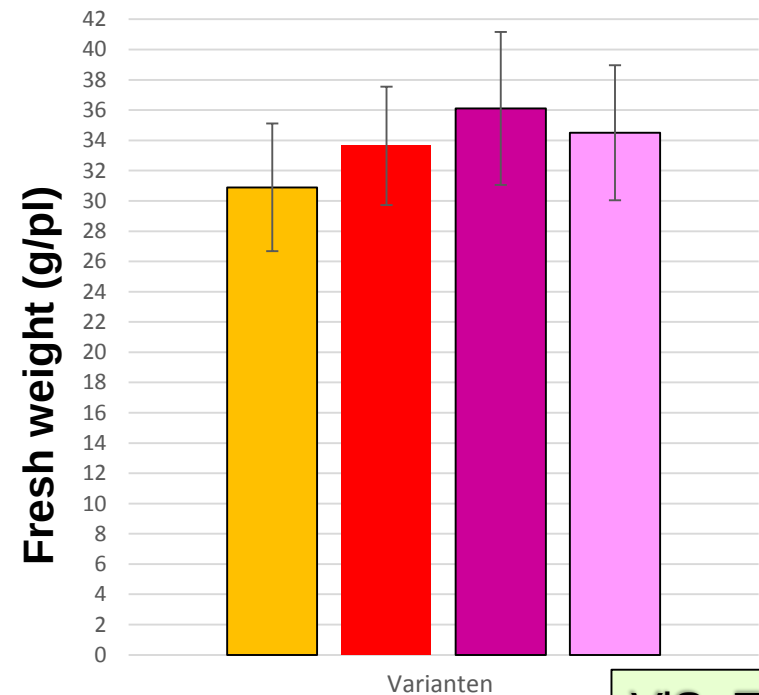
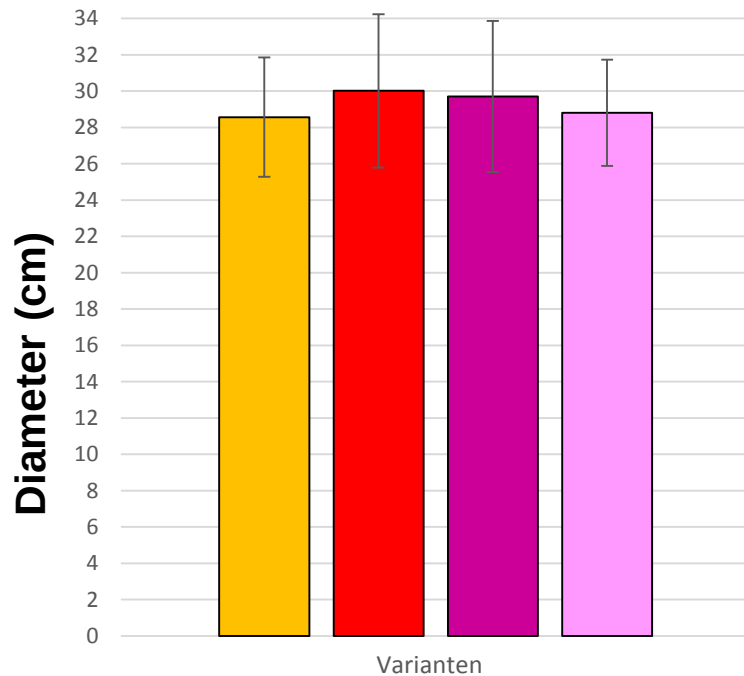
ViSuELL

ca. 65 $\mu\text{mol}/\text{m}^2\text{s}$

Campanula 'Spring Bell Blue'



- HPS
- 100 % red
- 50 % red + 50 % blue
- 33 % red 33 % blue 33 % white



ViSuELL

potrose 'Apache Kordana'

ca. 65 $\mu\text{mol}/\text{m}^2\text{s}$



 **LED**
red

 **LED**
red-blue

 **LED**
red-white

 **HPS**

ViSuELL



HPS



Hedera helix 'Pittsburgh'



LED
red-blue



LED
red



LED
red-blue-white



ViSuELL

● HPS



● LED
red



Hedera helix 'Pittsburgh'

● LED
red-blue



● LED
red-blue-white



ViSuELL

'Lilac Dark Vein'



potted wk 8
lighting: sunrise-sundown

after 4 weeks



without
light



blue



far red

LED



red

ViSuELL

'Red 2016'

potted wk 8
lighting: sunrise-sundown

after 8 weeks



without
light



blue



far red

LED



red

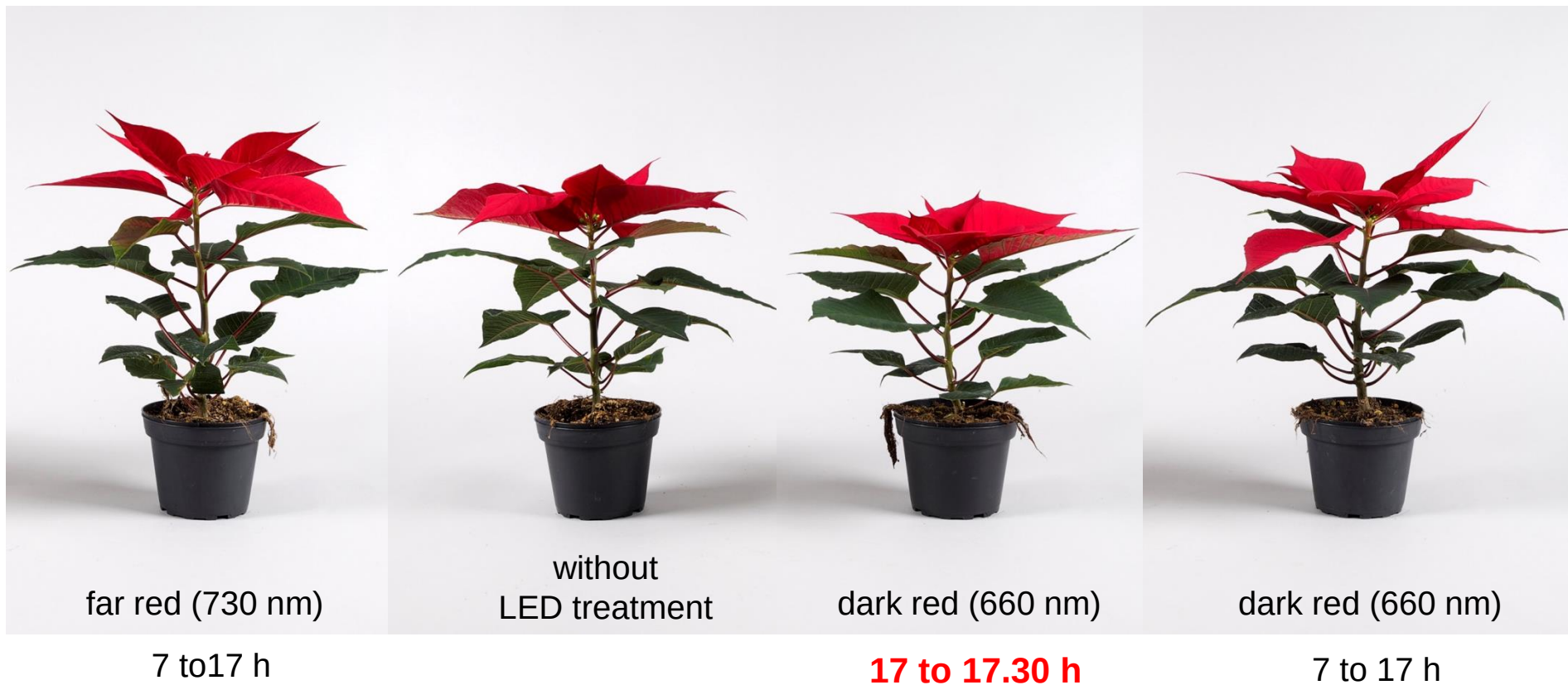
End of day lighting =

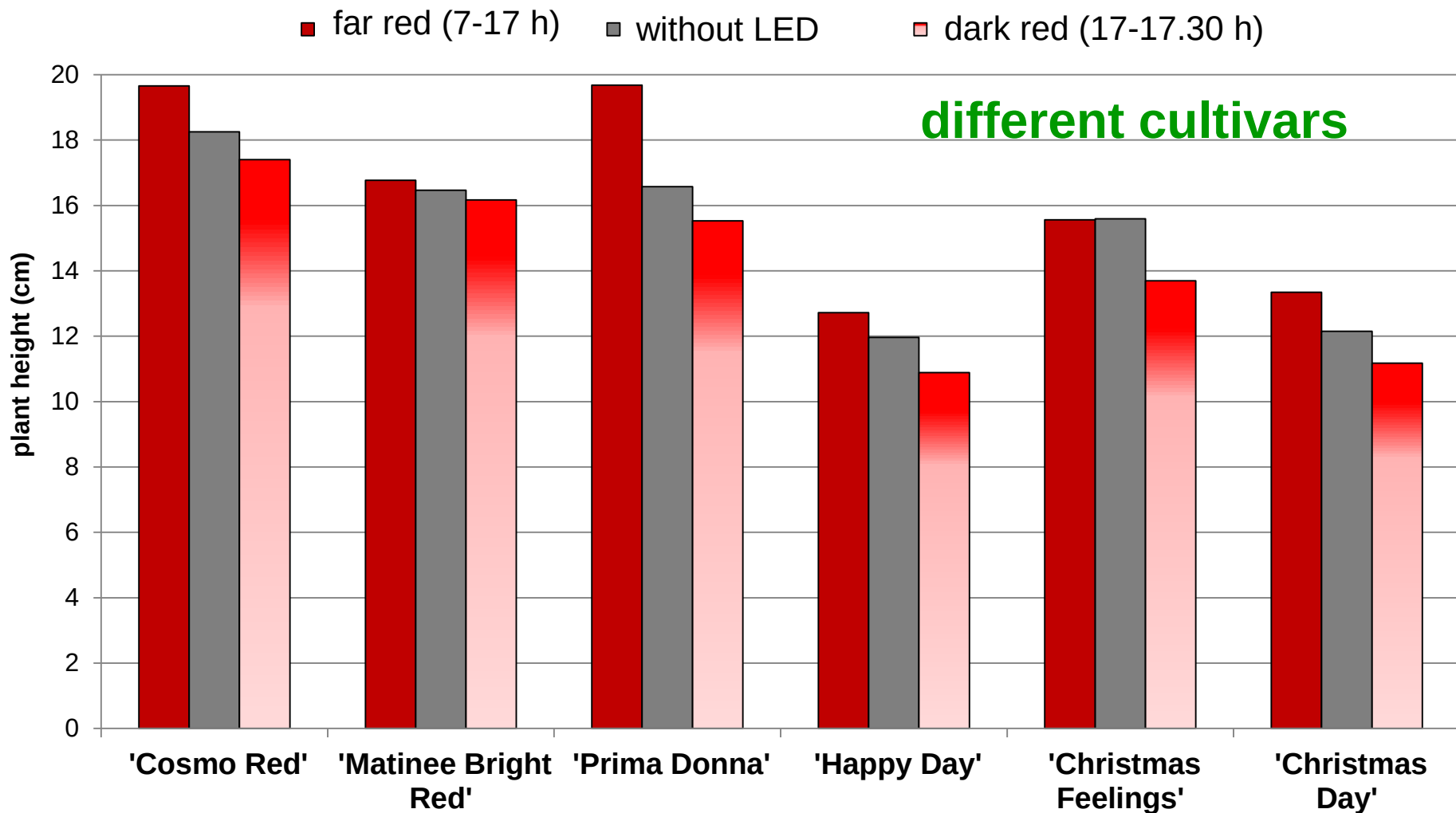
Dark Red (660 nm) after sundown

First experiment in 2015

week no. 36 potted
week no. 44 to 48 light treatment

'Prima Donna'





End of day lighting

'Prima Donna'

Potted wk 30, lighting wk 32 to 38 and 41 to 47



Control
(without LED)



Control
(growth
regulators)



60 min. after
sundown

ViSuELL

End of day lighting

'Prima Donna'

Potted wk 30, lighting wk 32 to 38 and 41 to 47



Control
(without LED)



Control
(growth
regulators)



60 min. after
sundown



120 min. after
sundown

ViSuELL

2017

cultivar: 'Merry White'

week no. 29 potted / week no. 29-38 and 42-48 light treatment



Control
(no LED)
(no PGR)

Control
(no LED)
(growth
regulators)

**60 min. Red
after sundown,
PGR 2x at the
beginning**

**60 min. Red
after sundown
no PGR**

2017

cultivar: 'Venus Hot Pink'

week no. 29 potted / week no. 29-38 and 42-48 light treatment



Control
(no LED)
(no PGR)



Control
(no LED)
(with PGR)



**60 min. Red
after sundown,
PGR 2x at the
beginning**



**60 min. Red
after sundown
no PGR**

Height control with water deficit



**EC-5
Soil Moisture Sensor**



Infinity 2.0



**No
treatments**

- H₂O LD

- H₂O LD+SD

EoD combined with water deficit



**No
treatments**



**- H₂O LD+SD
+ EoD SD**



Infinity 2.0



**Growth
Regulator**



Christmas Break

**No
treatments**

**- H₂O LD+SD
+ EoD SD**

**Growth
Regulator**

Recommendation: EOD lighting poinsettias

Lighting period

- **Start:** 1-2 weeks after pinching
- **End:** 1-2 weeks before sale
- **Break:** 2-3 weeks during flower initiation;
for example wk. 39-41 or 38-40 under natural conditions in
Hannover, adaption to UK conditions

LED light

- **Spectrum:** Dark Red (660 nm)
- **Duration:** 60 minutes after sundown
- **Intensity:** 40-60 $\mu\text{mol}/(\text{m}^2 \cdot \text{s})$

`Chelsey Yellow`

KW 26/2017 getopft, Belichtung ab KW 28

No effect during summertime!



Kontrolle
(ohne LED
ohne
Hemmstoffe)



Kontrolle
(ohne LED
mit Hemmstoff)



60 Min. nach SU
Blau



60 Min. nach SU
Hellrot

LED

LED lights for ornamentals

- National project ViSuELL
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- Photoperiodical lighting with LED

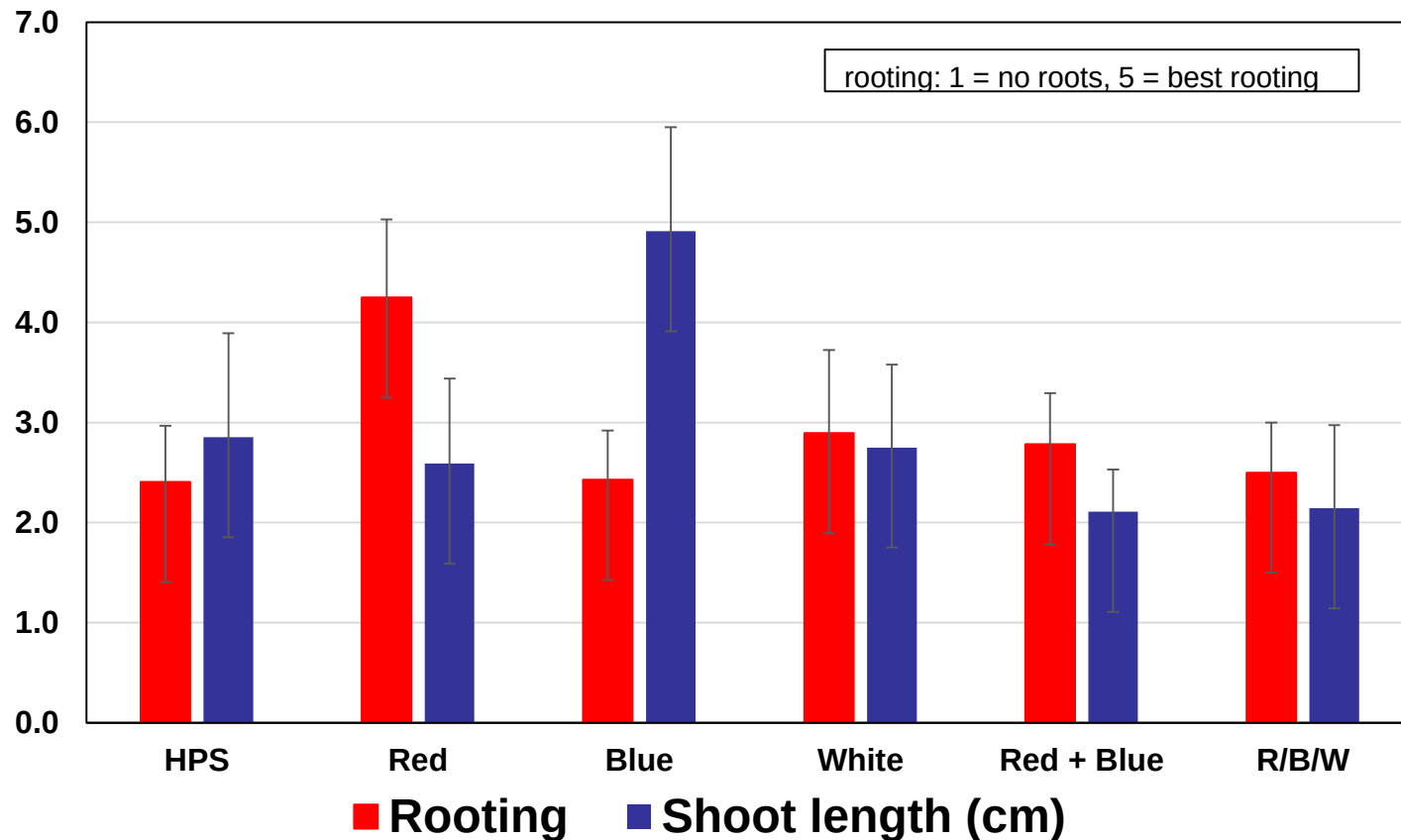
Propagation

Petunia 'Lilac Dark Vein'



Propagation

Petunia 'Lilac Dark Vein'



Propagation

Petunia 'Dark Red'



HPS

red

blue

white

red + blue

**red
+ blue
+ white**

Propagation

Pelargonium 'Linus'



HPS

red

white

blue

greenhouse: 80 $\mu\text{mol}/\text{m}^2\text{s}$, january 2018





`Ospol`

without



**with
PGR**

red

**red+blue
1:1**

blue

HPS

3 weeks after forcing

No. of shoots (> 2 cm) per plant

treatment	without	with PGR
Red	2,0	1,0
Red + Blue	1,2	0,7
Blue	2,1	1,2
HPS	1,9	0,8

Mandevilla Rio Deep Red



LED red

LED blue

HPS with PGR

**Greenhouse:
60 $\mu\text{mol}/\text{m}^2\text{s}$**

Light vs. GA₃...

GA₃ 0,1 g/l 3x

Far red 730 nm
(night)

control

‘Astro Red’



Flowering of hydrangea

'Early Blue'



HPS



LED red



LED red+blue



LED blue

55 $\mu\text{mol}/(\text{m}^2\text{s})$, 16 h/d

Flowering of hydrangea

'Wudu'



HPS



LED red



LED red+blue



LED blue

55 $\mu\text{mol}/(\text{m}^2\text{s})$, 16 h/d

	'Early Blue'		'Schneeball'		'Gräfin Cosel'		'Wudu'	
lighting	Height leaf area (cm)	Total height (cm)	Height leaf area (cm)	Total height (cm)	Height leaf area (cm)	Total height (cm)	Height leaf area (cm)	Total height (cm)
HPS	16,3	27,2	15,8	26,9	14,5	26,2	15,3	23,2
LED red	15,7	22,4	16,5	23,8	16,3	24,4	14,6	21,5
LED red+blue	14,7	22,6	16,4	26,0	15,4	25,0	15,0	22,6
LED blue	16,3	24,1	15,1	25,7	14,5	25,0	14,1	23,0



species	Effect of LED-lighting on		
	Height control	Flowering time	Rooting
Argyranthemum	±	±	0
Azalea (side shoots)	±	±	0
Calibrachoa	±	±	0
Campanula	+	±	0
Chrysanthemum	±	0	0
Begonia	±	±	0
Strawberry	+	+	0
Poinsettia	+	±	±
Hedera helix	+	0	0
Hydrangea	+	+	0
Mandevilla	±	0	0
Pelargonium	0	0	+
Petunia	±	±	+
Potroses	±	±	0

- = negative effect
 + = positive effect
 ± = no effect
 0 = not tested

Compared with HPS lighting

Plant growth of ornamental pot plants (fresh weight, dry matter, leaf formation, ...):

- Mixed light (red/blue/white) in different proportions often seems to be more efficient than specific colours of LED light.

Prospects for morphological control:

- **Red light** (660 nm) often **inhibits** elongational growth and accelerates rooting!
- **Blue light** (440 nm) in some cases **enhances** and in some cases **inhibits** elongational growth!
- **Far red light** (730 nm) **strongly enhances** elongational growth of shoots, leaves and flower stalks!

The exception proves the rule!

LED lights for ornamentals

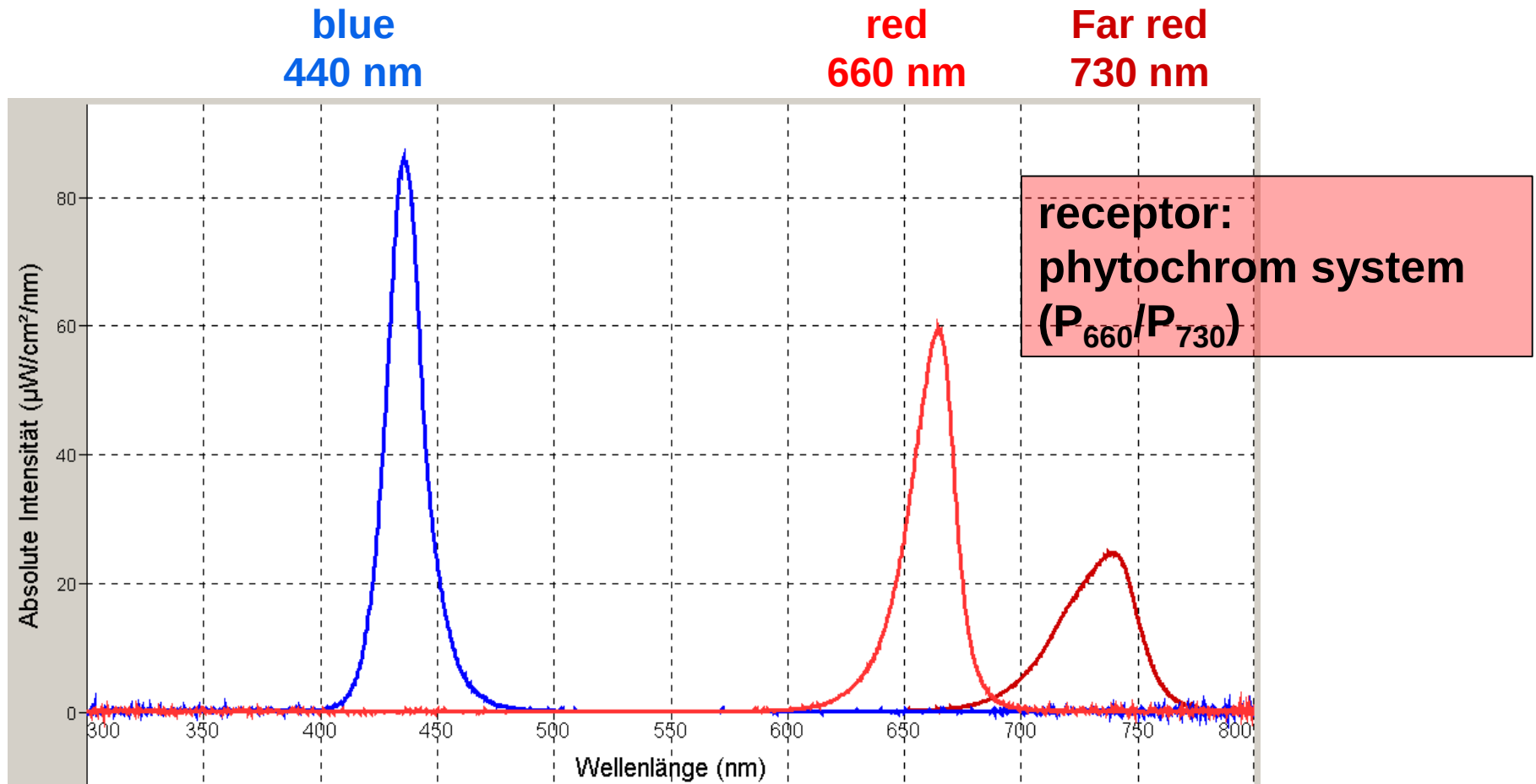
- National project ViSuELL
- LED research with specific ornamental crops and specific requirements
- **Photoperiodical lighting with LED**



LED for photoperiodic lighting



11 h photosynthetic light + 6 h LED
Blue Red Far Red



Replacement for incandescent lamps



„Special LED or simply home light leds (retrofit)?“

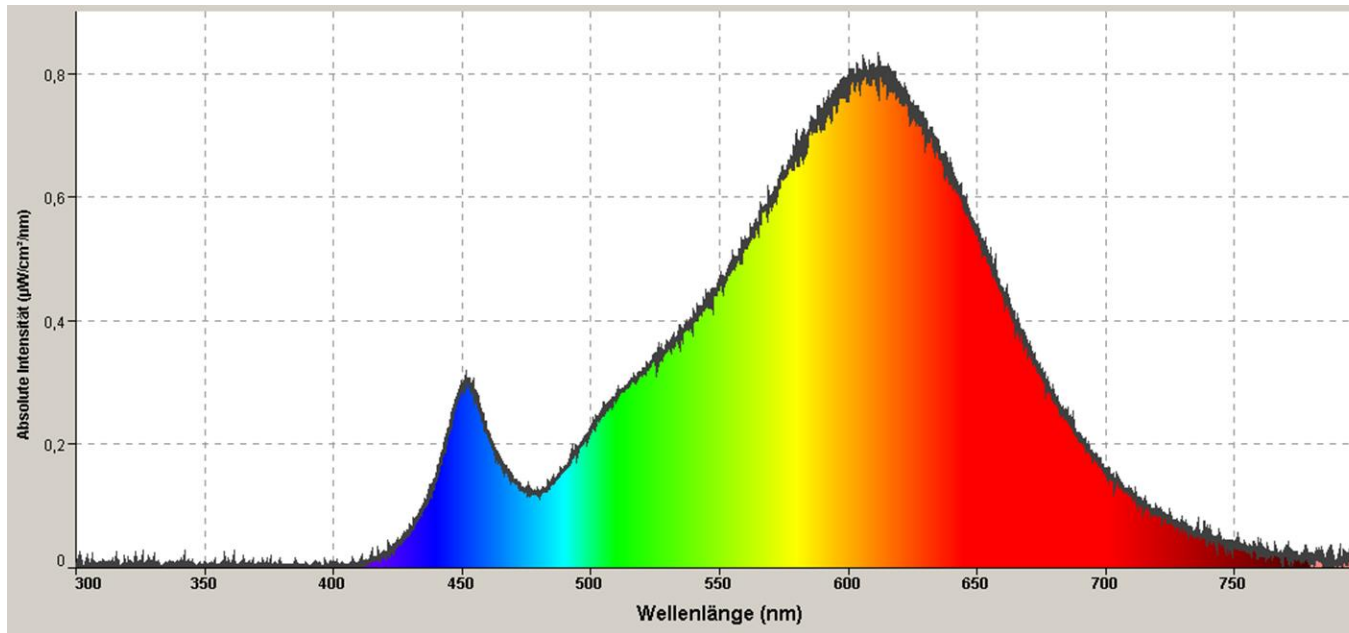


20 – 40 EUR



1 – 15 EUR

LED for living room lighting



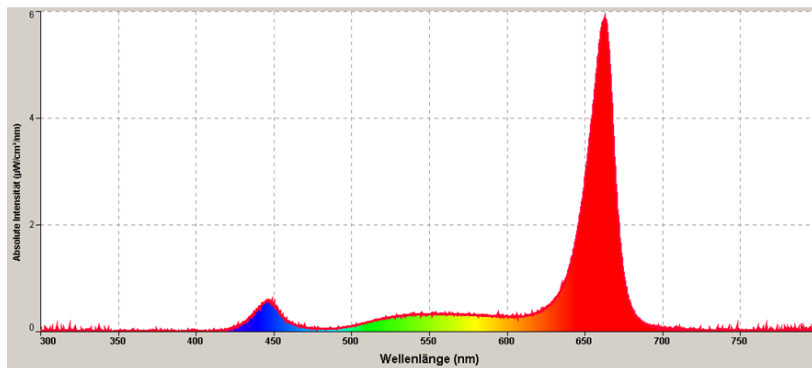
Paulmann 806 Im, 2700 K, 110°, 10 W

Special LED for horticulture

Hersteller: Philips
Bezeichnung: GreenPower Flowering Lamp
Leistung: 18 W
Spektrum: Hellrot (660 nm), Weiß

Intensität (gemessen 1 m unter der LED):

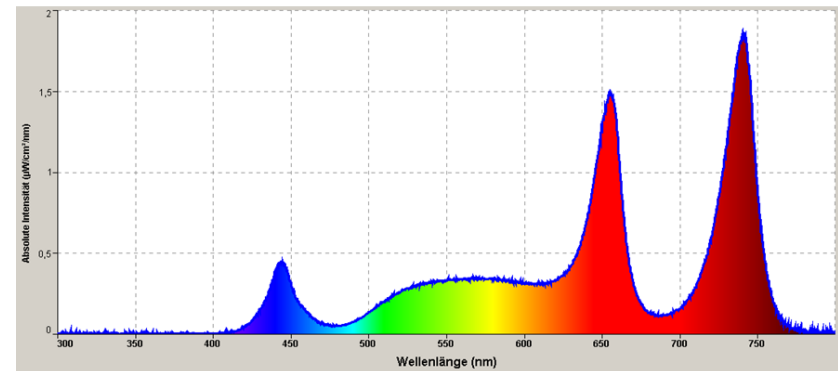
Beleuchtungsstärke: 218 Lux
Photonenstromdichte: 7,9 $\mu\text{mol}/\text{m}^2\text{s}$

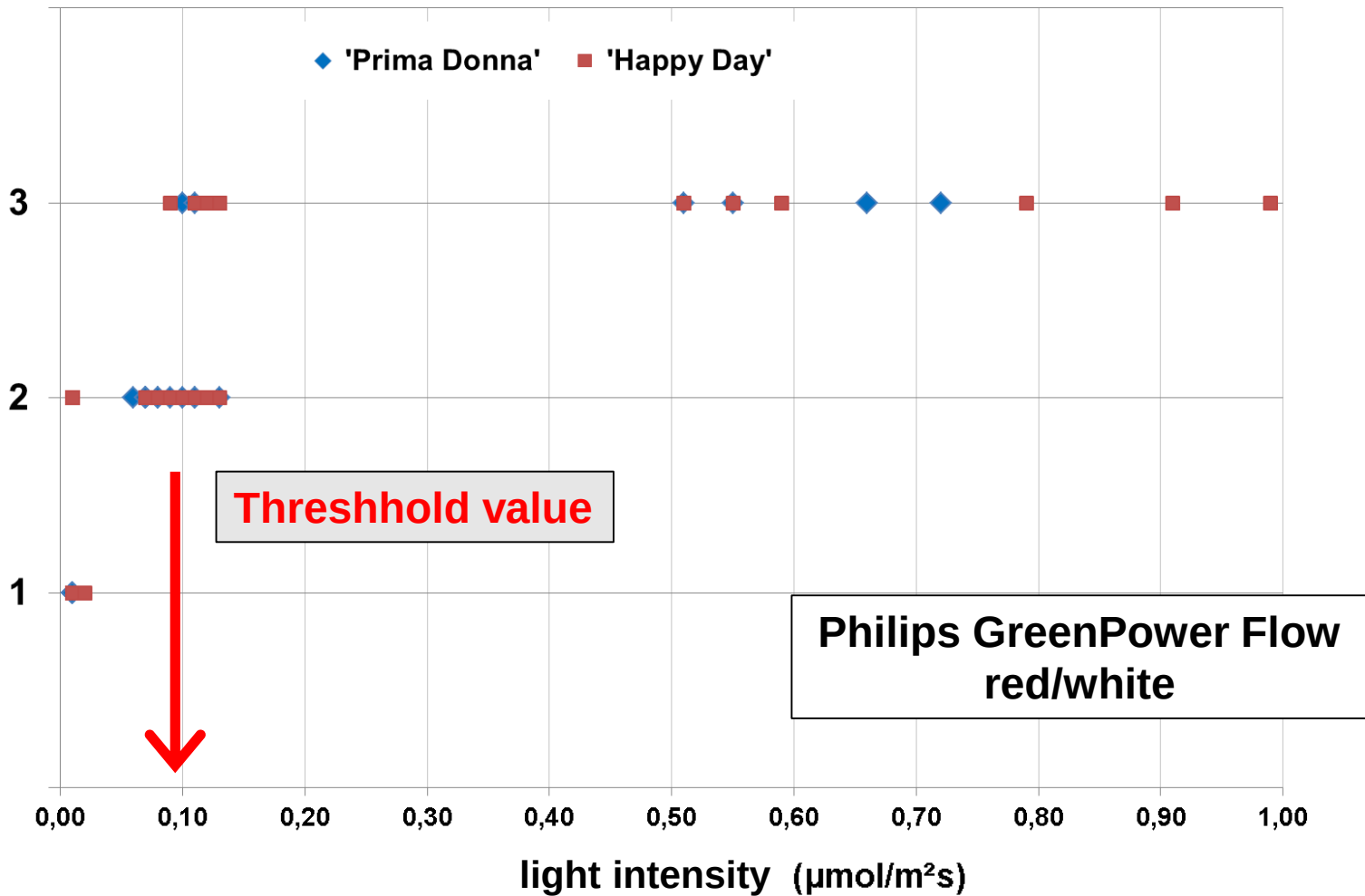


Hersteller: Civilight
Bezeichnung: BR40 Strawberry, 100°
Leistung: 15 W
Spektrum: Hellrot (660 nm), Weiß, Dunkelrot (730 nm)

Intensität (gemessen 1 m unter der LED):

Beleuchtungsstärke: 210 Lux
Photonenstromdichte: 4,6 $\mu\text{mol}/\text{m}^2\text{s}$







Philips GP Flow 18 W

Abstand vom Licht [cm]	Messung [lux]	Messung [μmol]
250	0,03	0,15
200	0,02	0,22
150	0,02	0,46
100	0,00	1,41
50	0,15	6,38
Licht	0,51	17,97
50	0,13	6,11
100	0,00	1,36
150	0,02	0,45
200	0,02	0,20
250	0,03	0,12
300	0,03	0,08
350	0,03	0,06
380	0,03	0,05

Paulmann 110° 10 W

Abstand vom Licht [cm]	Messung [lux]	Messung [μmol]
250	0,02	0,08
200	0,02	0,12
150	0,01	0,26
100	0,02	0,85
50	0,26	4,29
Licht	0,77	10,75
50	0,19	3,25
100	0,01	0,70
150	0,01	0,22
200	0,02	0,10
230	0,02	0,09

Müller Licht 10 W

Abstand vom Licht [cm]	Messung [lux]	Messung [μmol]
250	0,02	0,08
200	0,02	0,12
150	0,01	0,22
100	0,00	0,60
50	0,12	2,19
Licht	0,33	4,84
50	0,12	2,09
100	0,01	0,60
150	0,01	0,22
200	0,02	0,11

Zyurong 15 W

Abstand vom Licht [cm]	Messung [lux]	Messung [μmol]
140	0,02	0,10
100	0,02	0,21
50	0,03	0,81
Licht	0,13	2,08
50	0,03	0,83
100	0,01	0,22
135	0,02	0,11



Messpunkte: Tischmitte ab Leuchte in Abständen von 50 cm
Messhöhe ab Tischoberfläche: 35 cm

LED for living room lighting

LD lighting petunias

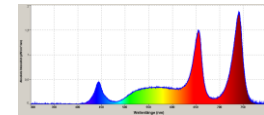
Distance from LED:

6 m

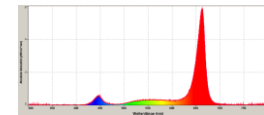
3 m

0,5 m

Civilight BR 40
Strawberry 15 W



Philips Flowering
Lamp DR/W



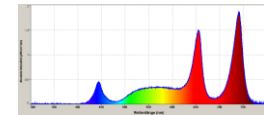
Distance from LED:

6 m

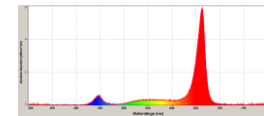
3 m

0,5 m

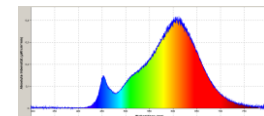
**Civilight BR 40
Strawberry 15 W**



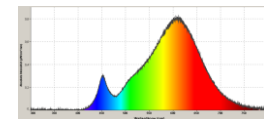
**Philips Flowering
Lamp DR/W**



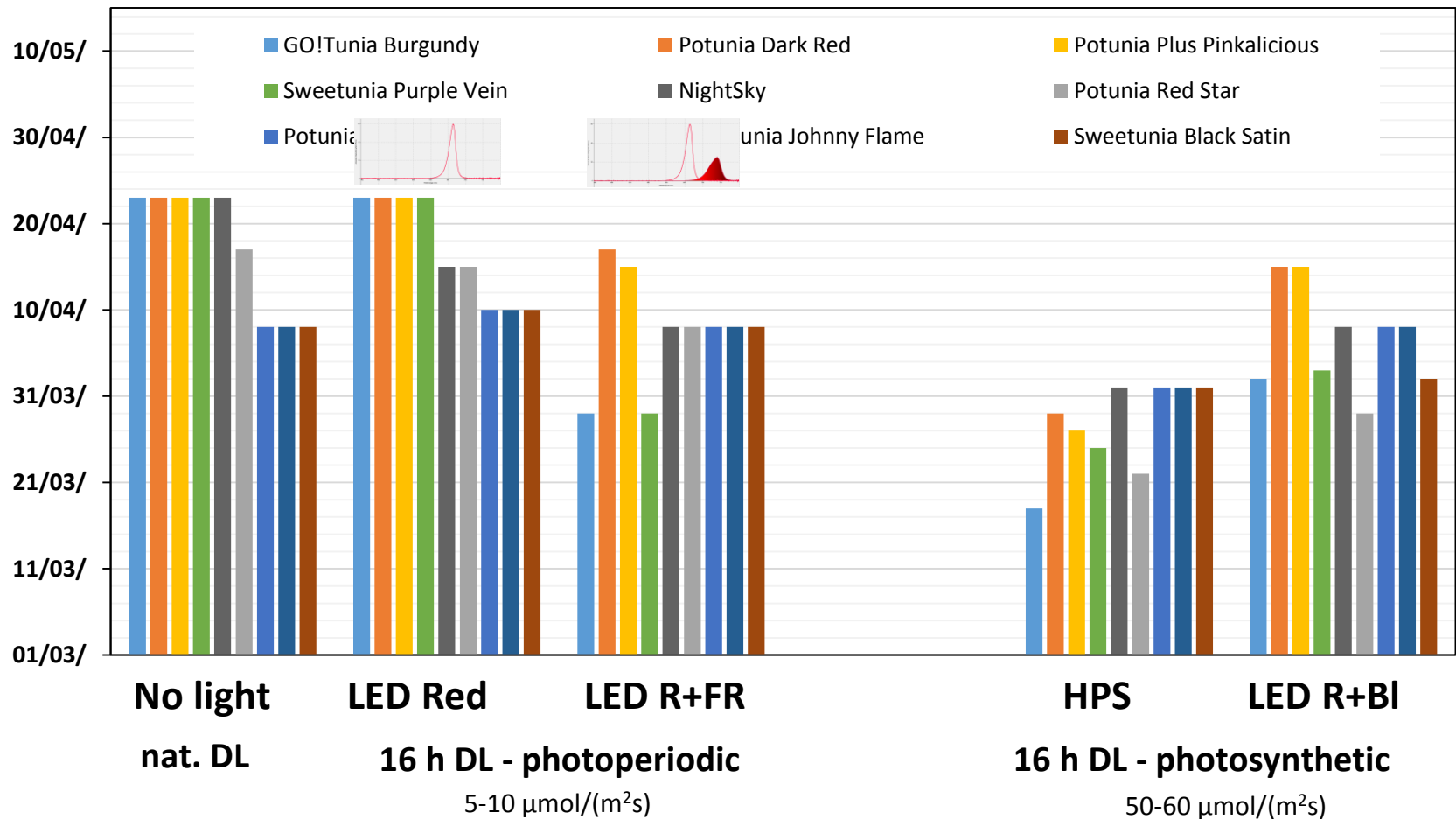
Müller LED 810 lm



Paulmann 806 lm, 110°



Flowering date Petunia





Nat. DL

LED Red

LED Red+FR

LED Retrofit

16 h DL - photoperiodic



LED Red+Blue

HPS

16 h DL - photosynthetic





Nat. DL

LED Red

LED Red+FR

LED Retrofit

LED Red+Blue

HPS

16 h DL - photoperiodic

16 h DL - photosynthetic

daylength

10 h

10 h
+ 4 h SL-R

10 h
+ 4 h LED FR 730 nm

Calynopsis



A hydroponic grow room with multiple levels of plants. The plants are in pots and are illuminated by red and blue LED lights. The text "Thank you!" is overlaid in the center.

Thank you!