Kas 2030 emissie vrije kas (circulair ?)

Productie vrij van fossiele brandstof, emissie van water en nutriënten en gewasbeschermingsmiddelen

NVTL 11 februari , Wageningen

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GREENHOUSE 2030

SUSTAINABLE PRODUCTION FOR THE FUTURE

WAGENINGEN UNIVERSITY & RESEARCH

Ministerie van Landbouw, Natuur en Voedselkwaliteit

KAS ALS ENERGIEBRON

Energy saving goals in The Netherlands

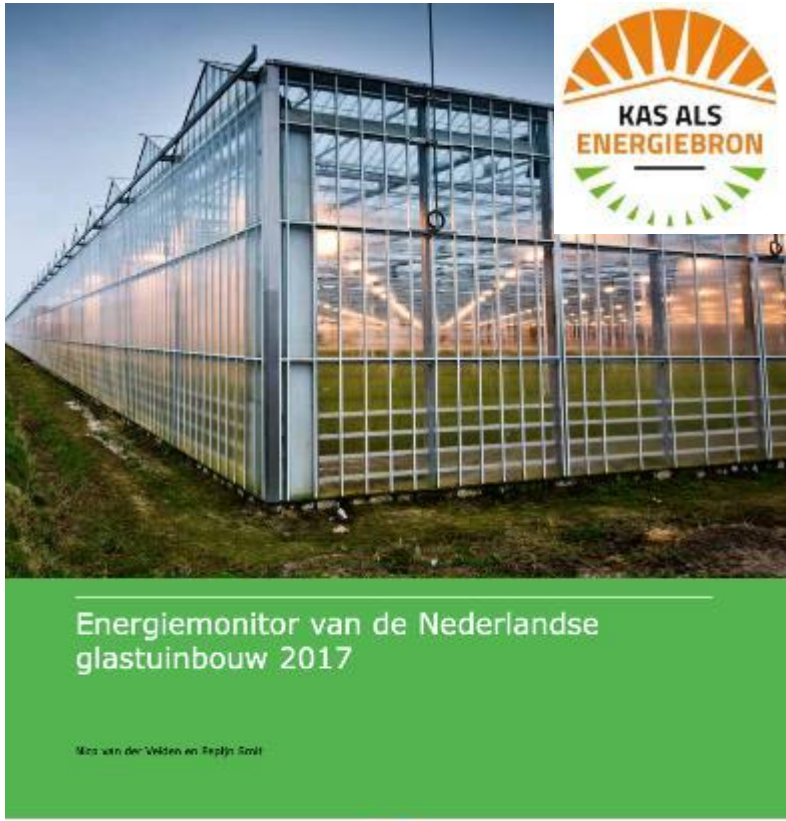
Energy agreement 2014-2020 government and sector

Goals:

- Maximum total CO_2 emission of 4.6 Mt y^{-1} in 2020

Ambition:

- Greenhouse sector completely sustainable in 2050



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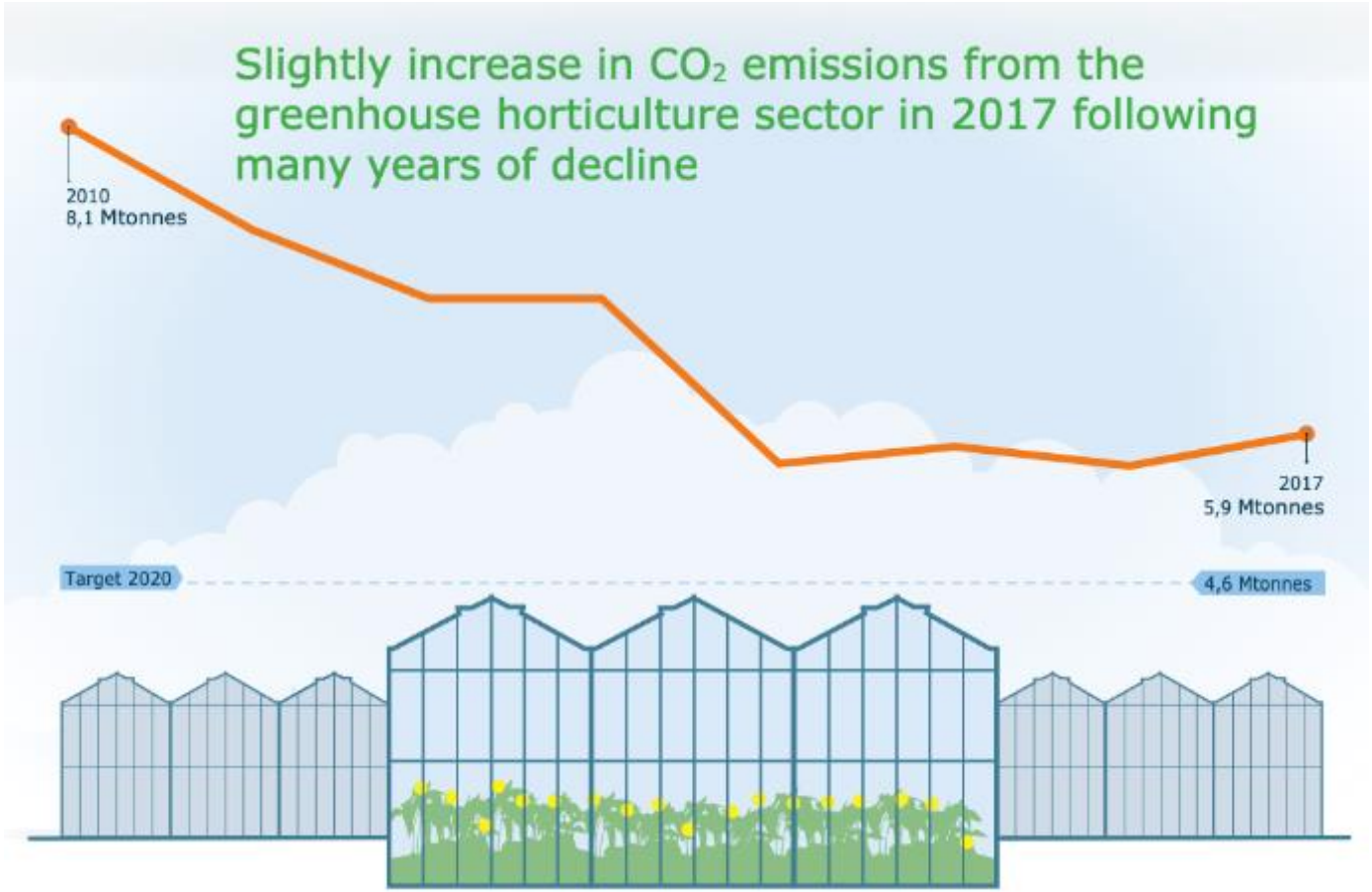
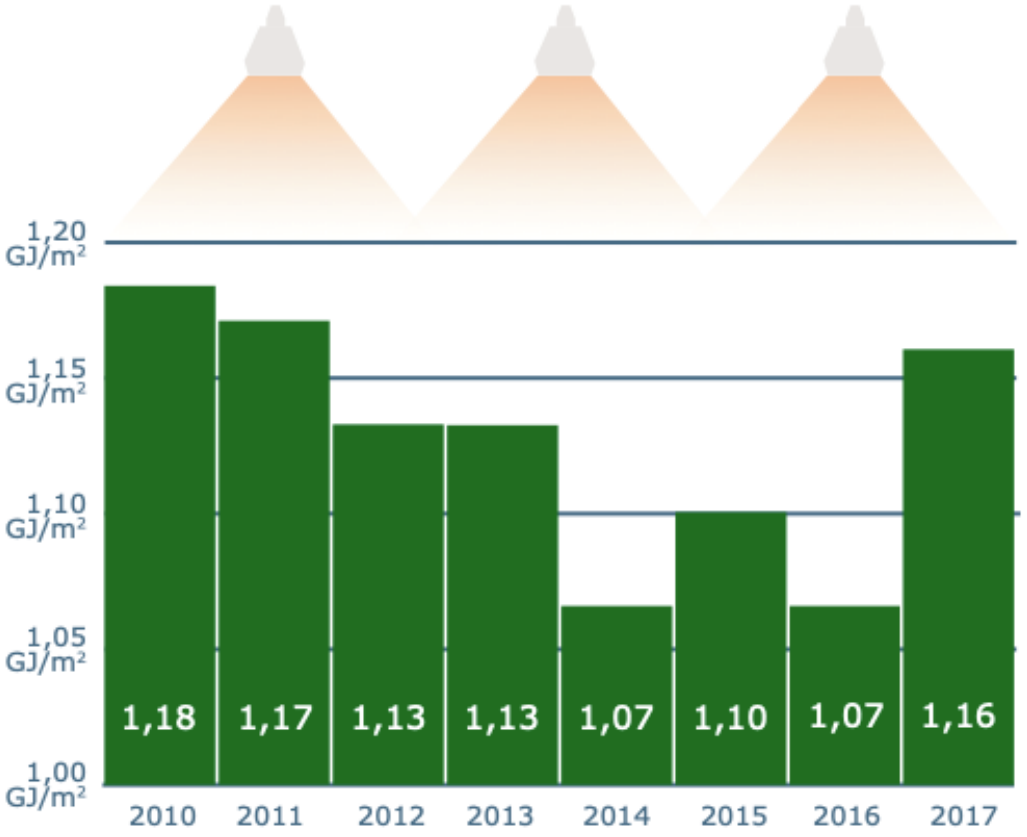
Monitoring CO_2 emissions



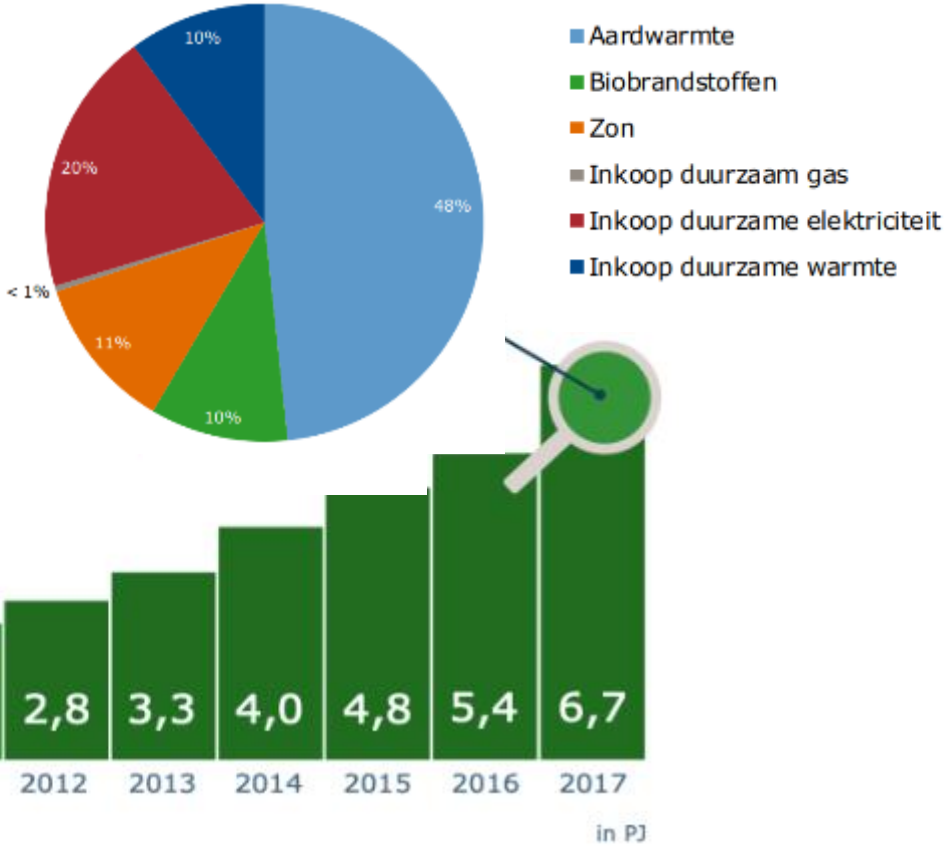
Greenhouse area decreased

2017:
Vegetables: 4992 ha
Flowers: 3592 ha
Fruits, trees: 495 ha

Energy consumption increased



Use of sustainable energy increased



Innovations Greenhouse Horticulture (50 years)

Breeding

Technology innovations

Independence of...

- Environmental conditions (greenhouses, climate control, Next Generation Growing)
- (Fossil) energy (energy saving, fossil free)
- Root zone conditions (substrates, hydroponics, water saving, emission free)
- Chemicals (IPM, biological control)
- Labour (Logistics and robotics)

Entrepreneurship

Logistic chain

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Greenhouse KAS 2030

Research greenhouse facility:

- Fossil free (insulation for less energy and CO_2 losses, sustainable energy sources)
- Emission free (closed water loops, no nutrient losses)
- Pesticide free (maximum biological control)

→integral sustainability

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Greenhouse KAS 2030 How developed?

- Available technique
  - Start of building is NOW so no development of new techniques
- Trend of intensifying crops (crop cycles)
  - more light, higher temperature, more crop
- One afternoon brainstorming with climate & energy, water & nutrients and entomology specialists ended up in this approach
  - Full electric semi closed next generation approach
  - Insect nettings yes or no?
  - Soil grown crops towards substrate
  - Full LED but which spectrum

Greenhouse KAS 2030

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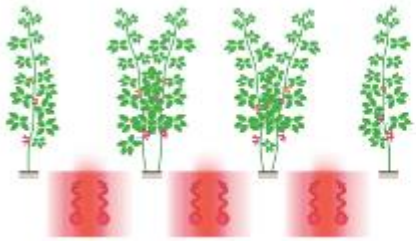
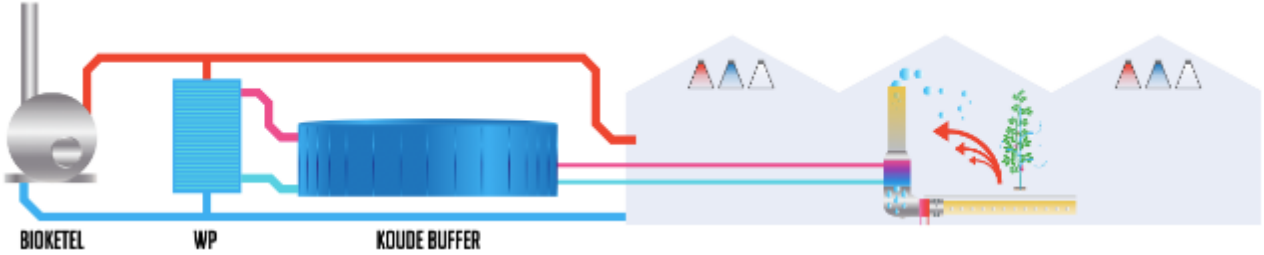


Fossil free energy –
“all electric”

- Insulation, 3 screens
- Diffuse glass
- Heat pump
- Low temperature heating
- Dehumidification
- Peak boiler on biogas/biomassa
- LED
- Green electricity
- CO_2 from industry
- Fogging
- Root cooling (freesia)



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Emission free - 100 % water recycling

- Full water collection of:
  - Condensation
  - Drain
  - Rain collection
- Reverse osmose (start water)
- Ozonation for disinfection

Greenhouse KAS 2030

Towards **pesticide free**

- Biological control,
  start with generalists, add specialists
- Standing army
- Different pollinators
- Use of banker plants

Greenhouse KAS 2030





Optimum crop production

- Light/temperature control
- Use of natural sunlight, diffuse glass with AR
- High intensity LED
- Higher daily temperature
- Improve
  - Yield
  - Quality
  - Timing

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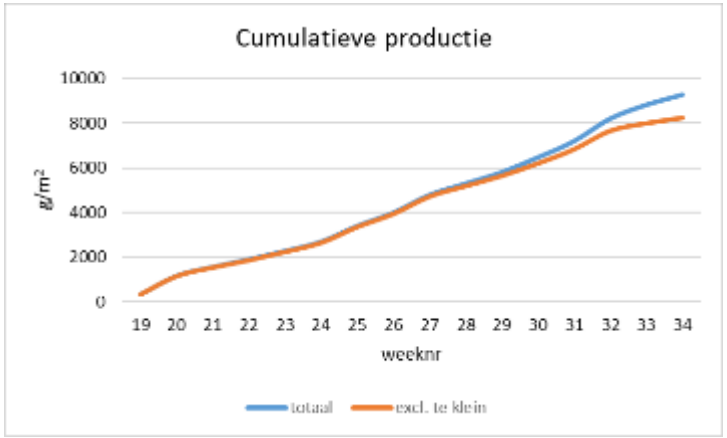
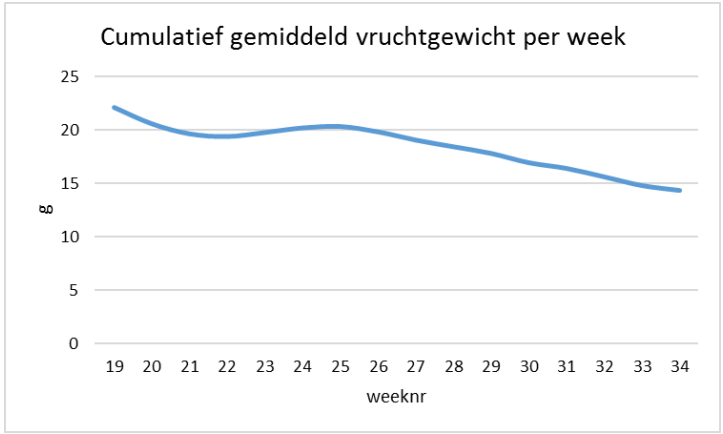
Strawberry

Variety: ‘Favori’ (FlevoBerry)
Plant density: 6.25 pl/m^2
LED: 200 mmol/m^2/s (85%R, 5% B, 10%W), max. 18 h/d, max. 3000 h/y
CO_2: 450-800 ppm, max. 200 kg/ha/h, limit at ventilation >15%
Dehumidification: VPD > 1 g/m^3
Substrate: cocos in trays
Gutter: moveable up/down ➔ 20% more plants in combi with plant density

Production cumulative





Total yield:

1st crop end March-end August: 9.3 kg

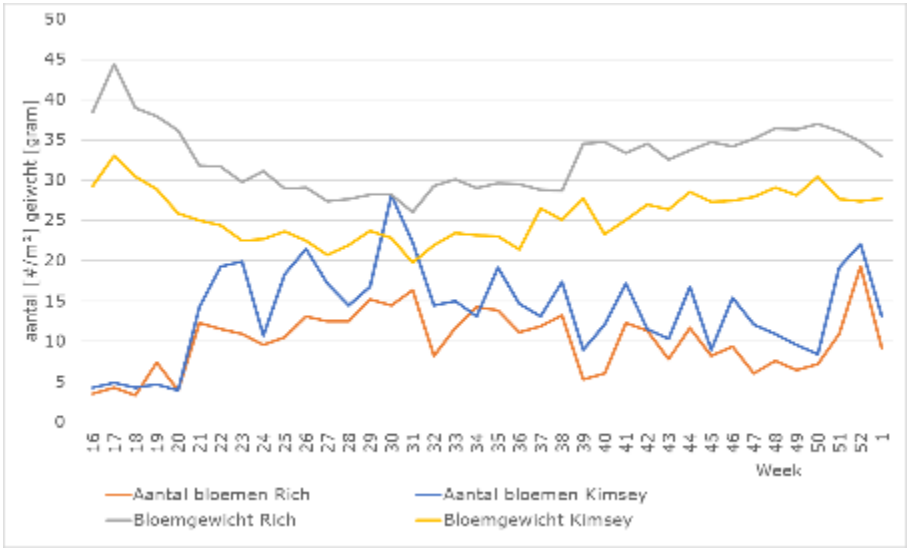
2nd crop end August-now: 10.2 kg

→ Higher than commercial practice due to 20% higher plant density and more light, higher daily temperatures

Gerbera

Varieties: ‘Rich’, ‘Kimsey’
LED: 200 μmol/m²/s (95%R, 5% B), max. 7 mol/d, max. 120 kWh/y
CO_2: 800 ppm, max. 200 kg/ha/h, limit at ventilation >15%
Dehumidification: VPD > 1 g/m³

Production until now

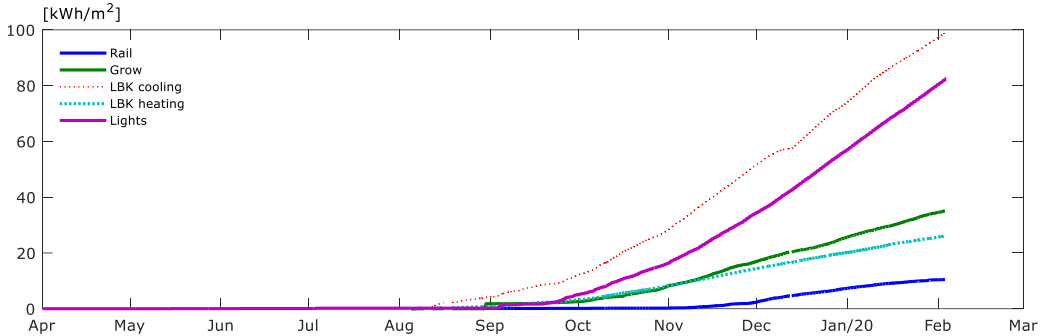


Total yield :

- 'Rich' 384.8 stems/m^2, 'Kimsey' 528.5 stems/m^2
- Start week 12, Still 6 weeks to go

→ Higher yields than in commercial practice (1-2 flowers/m^2/week) due to higher light intensity and higher temperature

Energy use until now



Total energy use: 82.5 kWh/m^2 LED lighting

→ 30% less electricity LED compared to HPS, however, higher intensities installed

98.7 kWh/m^2 air treatment system dehumidification ➔ under investigation

8.1 kWh/m^2 pipe heating ground

27.5 kWh/m^2 crop heating

26.1 kWh/m^2 air treatment system heating

35.6 kWh/m^2 total heating ➔ 4.1 m^3/m^2 gas use → Much lower heating demand, although, higher daily temperatures due to high insulation (screens)

Freesia

8 Varieties, plant density 96 tubers/m^2

LED: 200 µmol/m^2/s (85%R, 5% B, 10%W)

diffuse glass

3 screens

Cooling substrat <16°C

CO_2: 700 ppm, limit at ventilation >15%

Fogging: RH >80%

Dehumidification: RH <95%

Production (1st crop)

	Datum start oogst	aantal stelen/bruto m² kas	totaal geoogst gewicht (kg) / bruto m² bed
Ambassador	6-08	177	4.4
Corvette	26-07	293	5.6
Delta River	8-08	266	5.1
Essence	23-07	261	5.3
Indigo Beach	23-07	207	4.1
Maya	13-08	239	4.7
Soleil	1-08	217	3.5
Volante	5-08	215	3.6

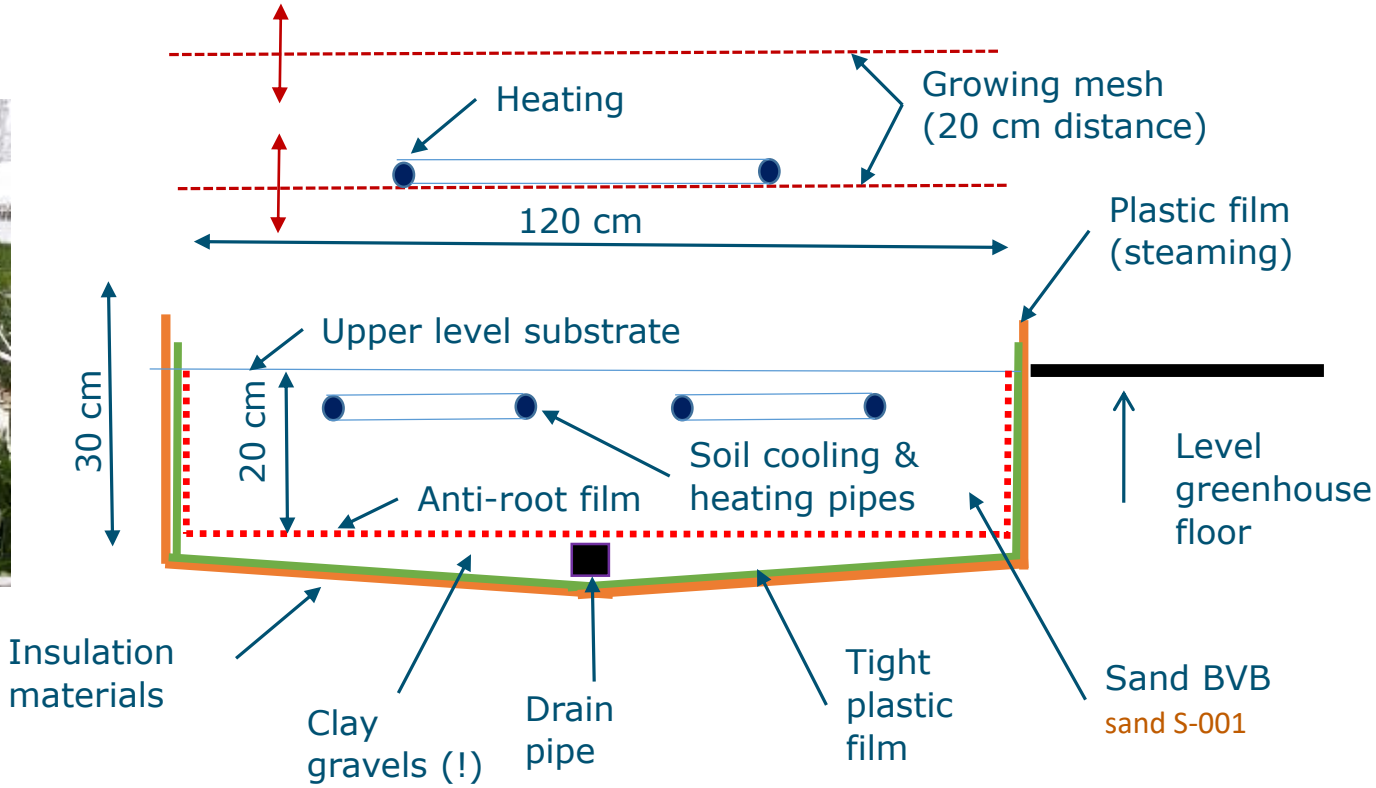
Yield first crop:

Period: end April–end September

Tuber weight at planting ca. 3,4 - 13,7 g/tuber

→ Total production now 6-8 weeks earlier than commercial practice due to very high light intensities and higher temperature

Cropping system in sand beds with recirculation



→ Recirculation drain water and desinfection with ozone

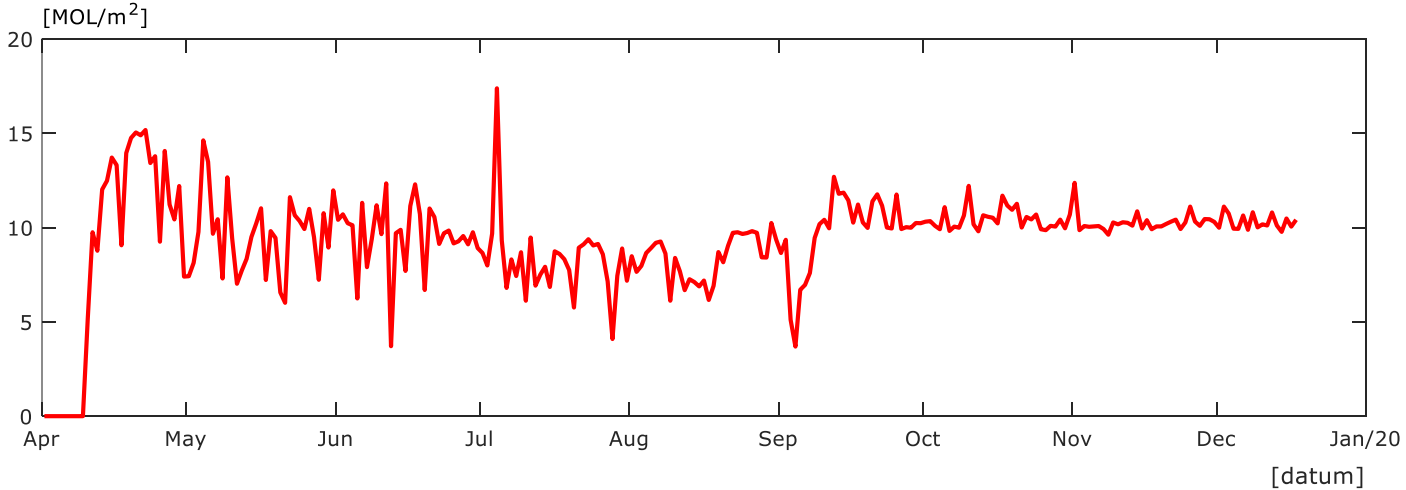
Potanthurium

4 Varieties, plant density 45-30-20-15 plants/m^2
LED: 200 μmol/m^2/s (85%R, 5% B, 10%W)
diffuse glass
3 screens
CO_2: 700 ppm, limit at ventilation >15%
Fogging: RH >80%
Dehumidification: RH <95%

First potanthurium crop under LED

- Goal: 10 mol/m^2/d incl. sunlight
- Use of 3 screens
- Use of 3 groups of LED

→ faster growth, more flowers, higher weight



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- Standing army

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- Yield
- Quality
- Timing

Integral sustainble production system

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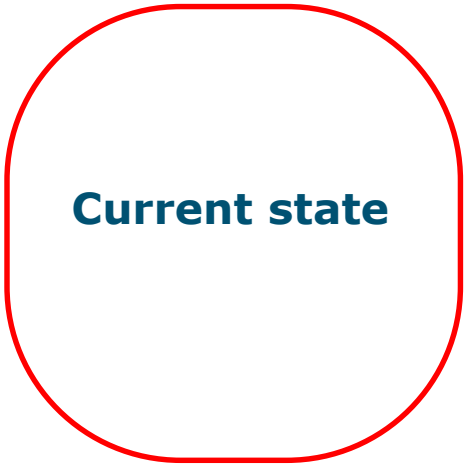
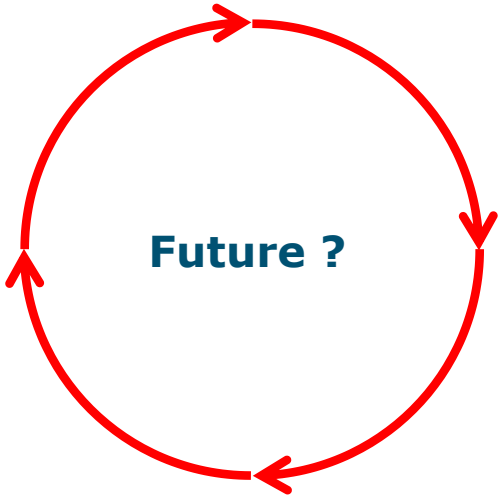
Greenhouse 2030 Circular?





Thank you!

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