



GrowAir® Greenhouse Air Solutions



KE GrowAir B.V.

located in Strijen, the Netherlands

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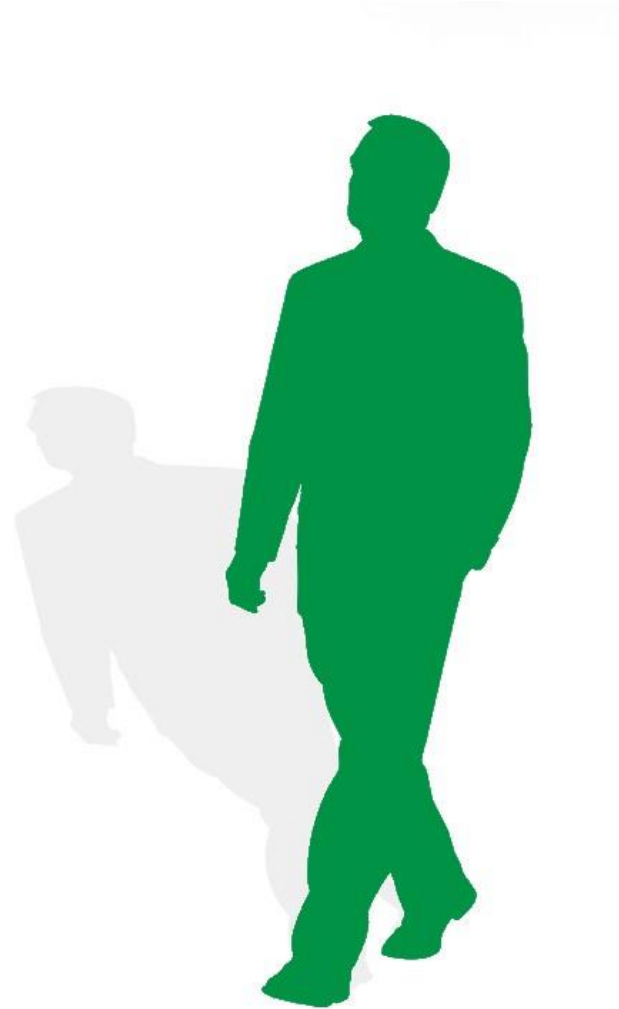
Small personal introduction



Gerjo de Zeeuw

Chief Executive Officer

Overall management
Account management
Business development



Small personal introduction



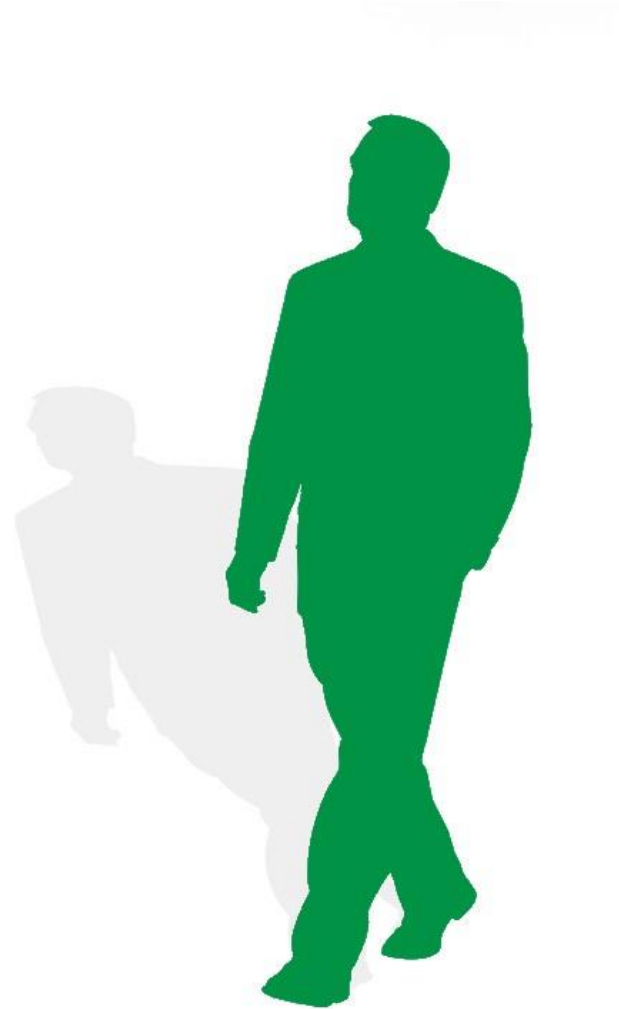
Ronald Groen

Development Engineer

Technical advice

Implementation of projects

Business Development



Horticultural lessons learned

Three types of Air distribution ducts are used in the horticulture:

1. Standard single ducts

- ✓ Brings air into greenhouse
- ✗ Undesirable uneven distribution due entrainment leads to uneven temperatures and uneven humidity in the greenhouse
- ✓ Relative cheap (if looked at the initial investment and not to the operational costs)

2. Double duct

- ✓ Developed by the horticulture sector
- ✓ It creates a more equal and homogenous climate
- ✗ Needs more air pressure and PE materials
- ✗ High initial and unnecessary operational costs

3. GrowAir® duct

- ✓ Developed by the KE Fibertec
- ✓ Balance between dynamic and static pressure
- ✓ Unique calculation software and patented hole pattern
- ✓ The best homogenous air distribution



Patented Diffusion Holes

- Avoid entrainment
- Avoid turbulence
- Uniform air distribution (Horizontal and vertical)
- Uniform temperature (Horizontal and vertical)
- High induction primary en secondary air



We deliver *tailor-made* solution with optimal results

Temp/Absolute Humidity comparison double duct



Data Loggers - DD

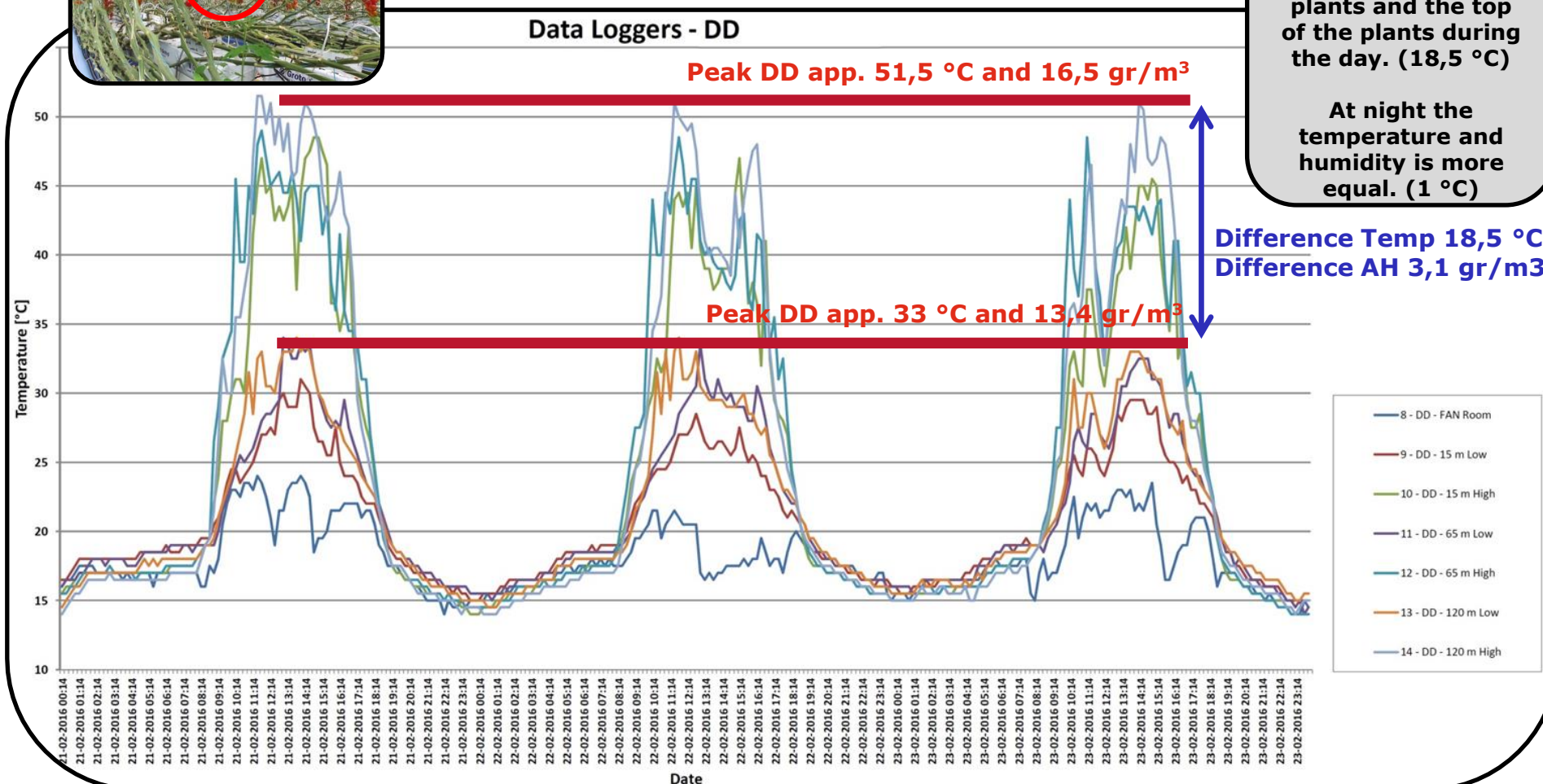
Peak DD app. 51,5 °C and 16,5 gr/m³

Peak DD app. 33 °C and 13,4 gr/m³

There is a big difference between the bottom of the plants and the top of the plants during the day. (18,5 °C)

At night the temperature and humidity is more equal. (1 °C)

Difference Temp 18,5 °C
Difference AH 3,1 gr/m³



Temp/Absolute Humidity comparison GrowAir duct



Data Loggers - GrowAir

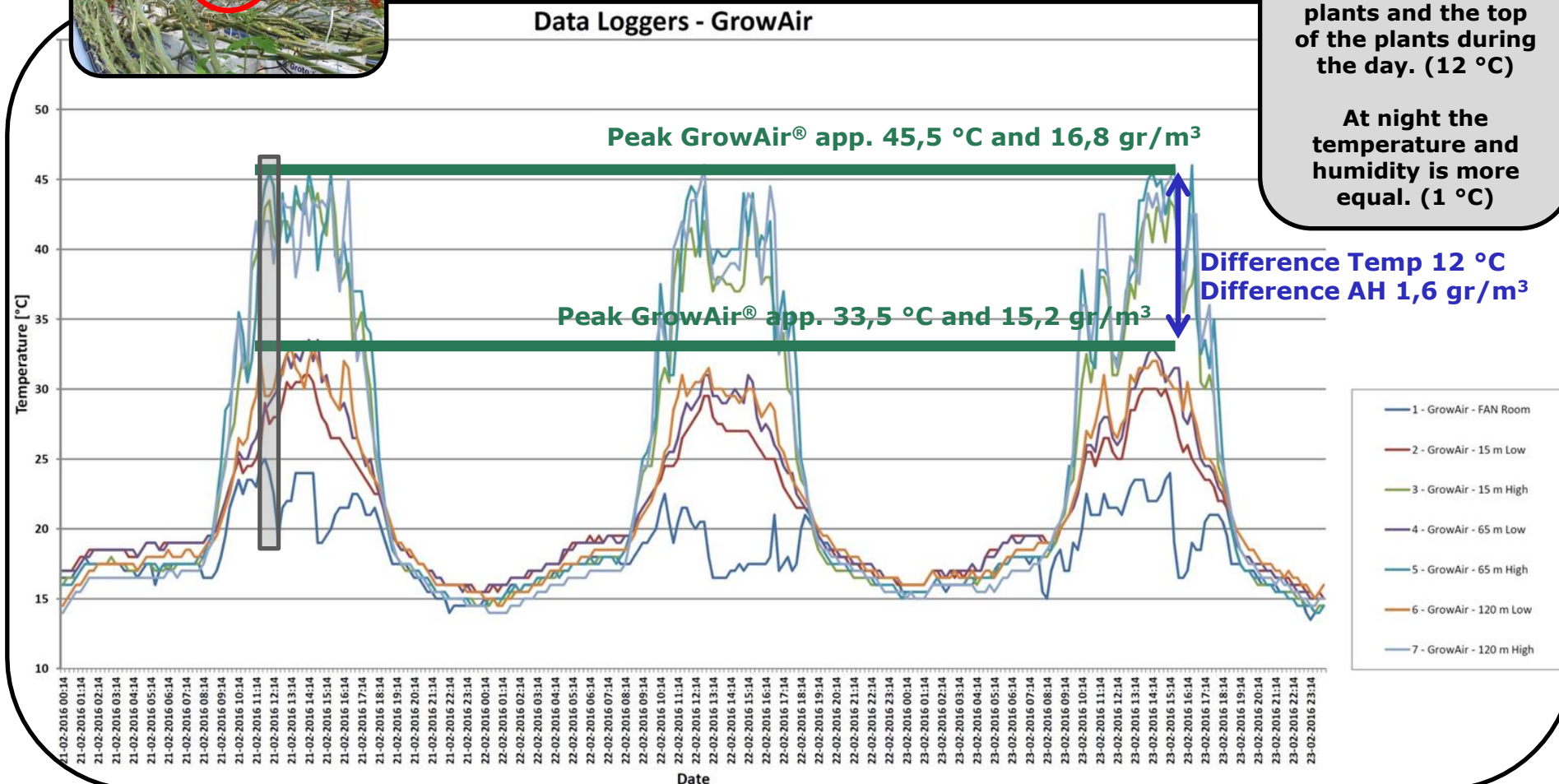
There is a big difference between the bottom of the plants and the top of the plants during the day. (12 °C)

At night the temperature and humidity is more equal. (1 °C)

Peak GrowAir® app. 45,5 °C and 16,8 gr/m³

Peak GrowAir® app. 33,5 °C and 15,2 gr/m³

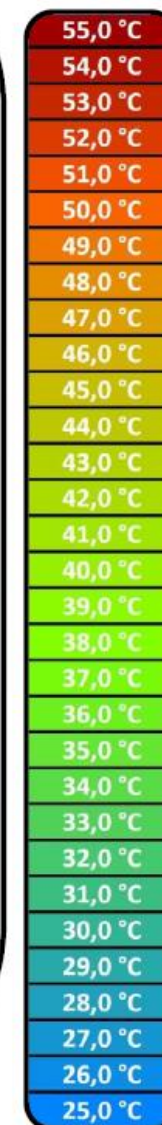
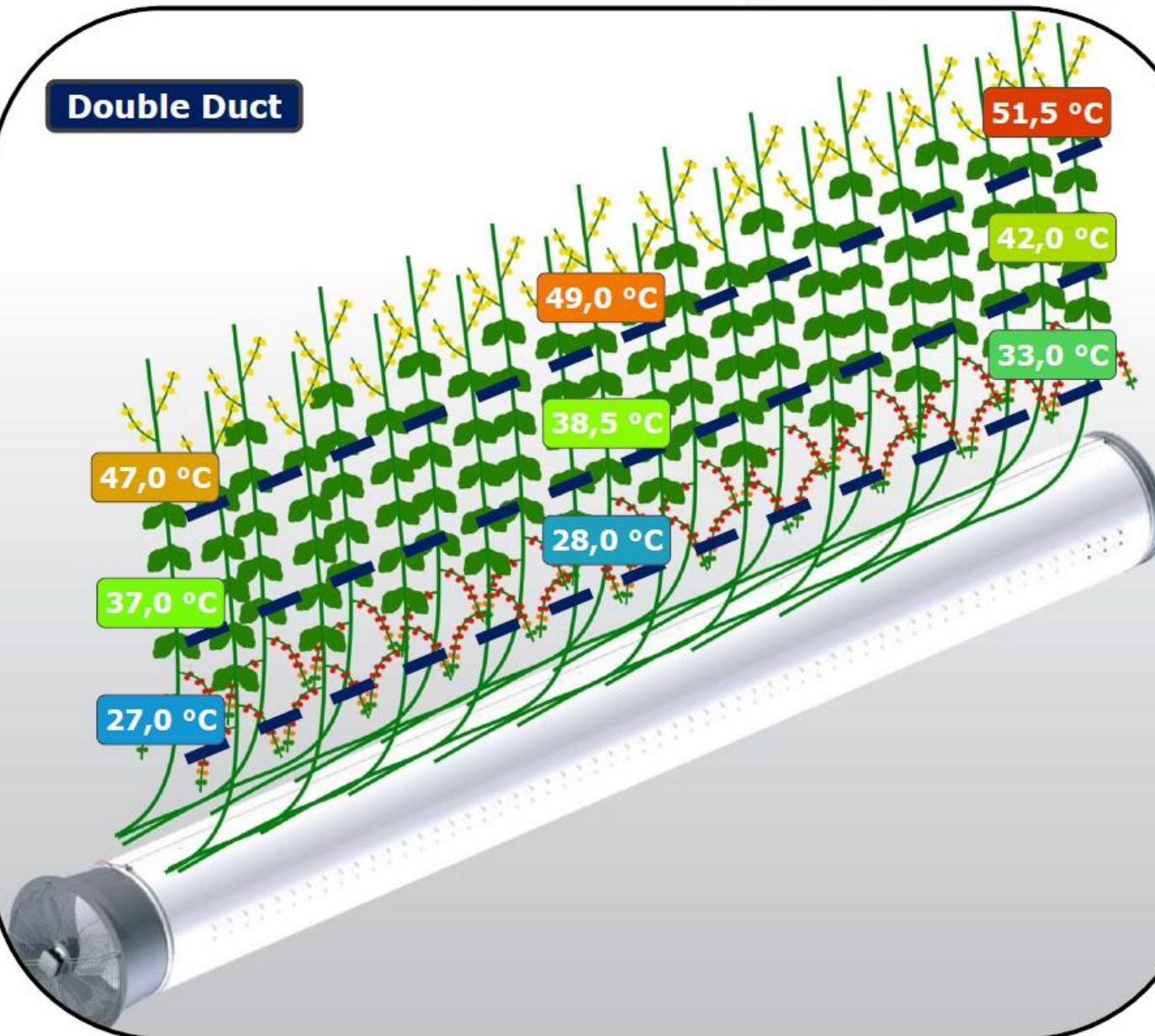
Difference Temp 12 °C
Difference AH 1,6 gr/m³



Horizontal Temperature Gradient



Double Duct



Difference
Top Plant
is 4,5 °C

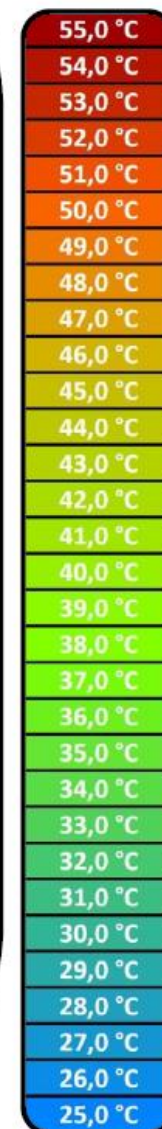
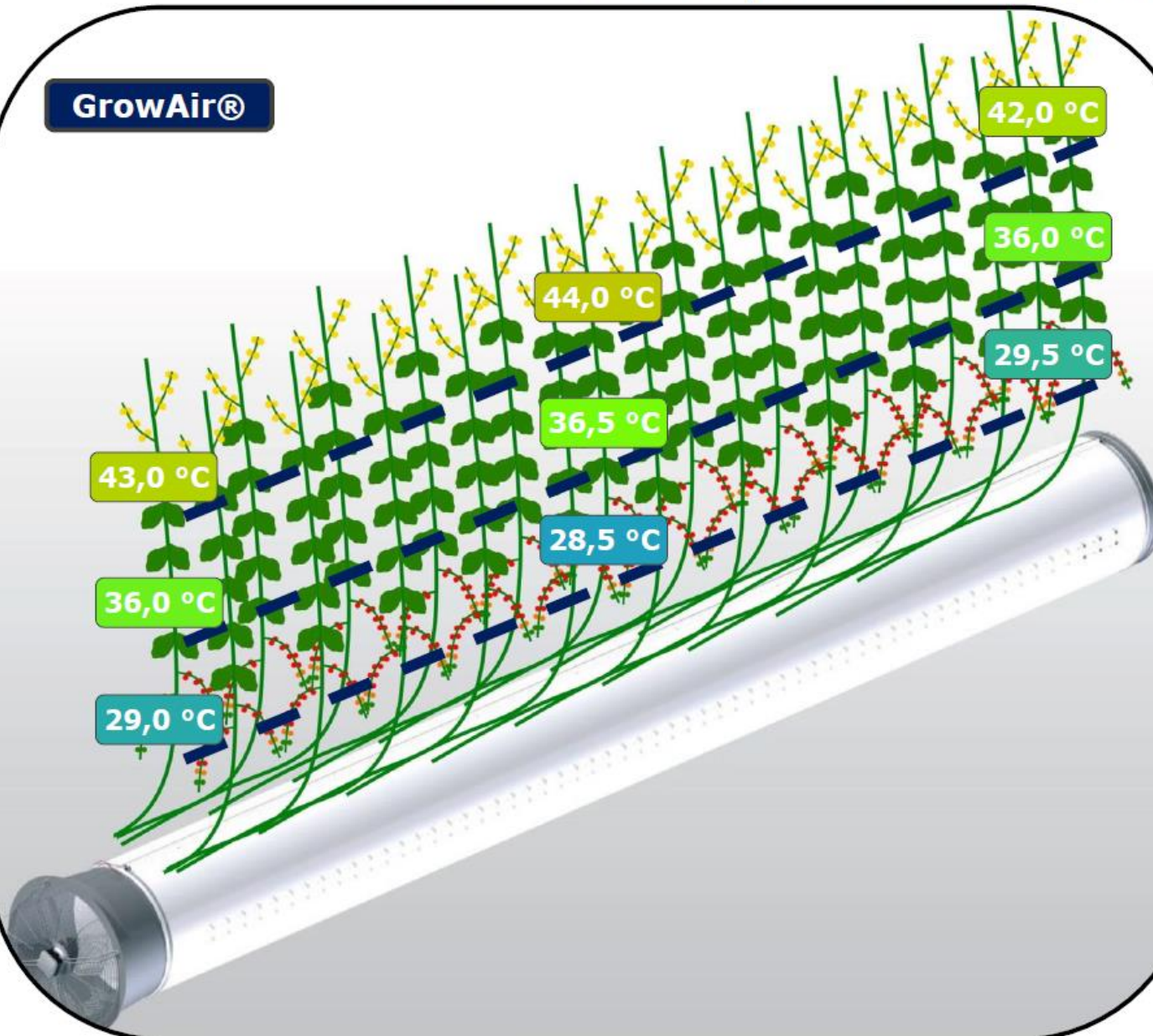
Difference
Middle Plant
is 5 °C

Difference
Bottom Plant
is 6 °C

Horizontal Temperature Gradient



GrowAir®



↕
Difference
Top Plant
is 2 °C

✱
Difference
Middle Plant
is 0,5 °C

✱
Difference
Bottom Plant
is 1 °C

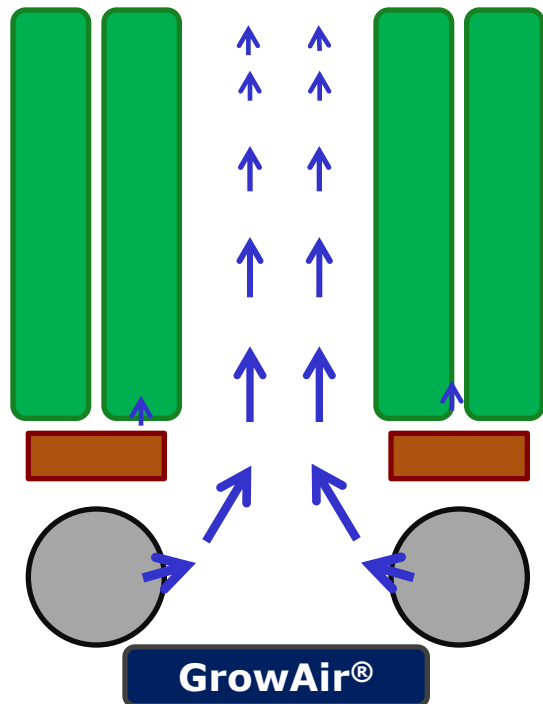
Homogeneous air solution



The GrowAir® patented hole design ensures a uniform air delivery through out the length of the duct and with the same fan speed (*energy consumption*) it provide more air at a higher velocity out of the holes.

This will lead to a higher reach of air compared to the DD-duct.

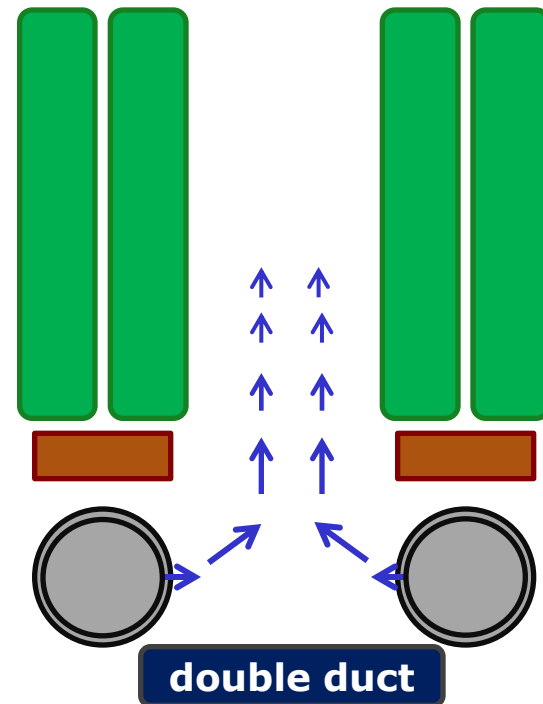
This will be demonstrated below.



Because of the extra pressure loss the DD-duct provides less air and at the same time pushes the air out of the holes with less velocity

This will limited the potential height that the new air can reach.

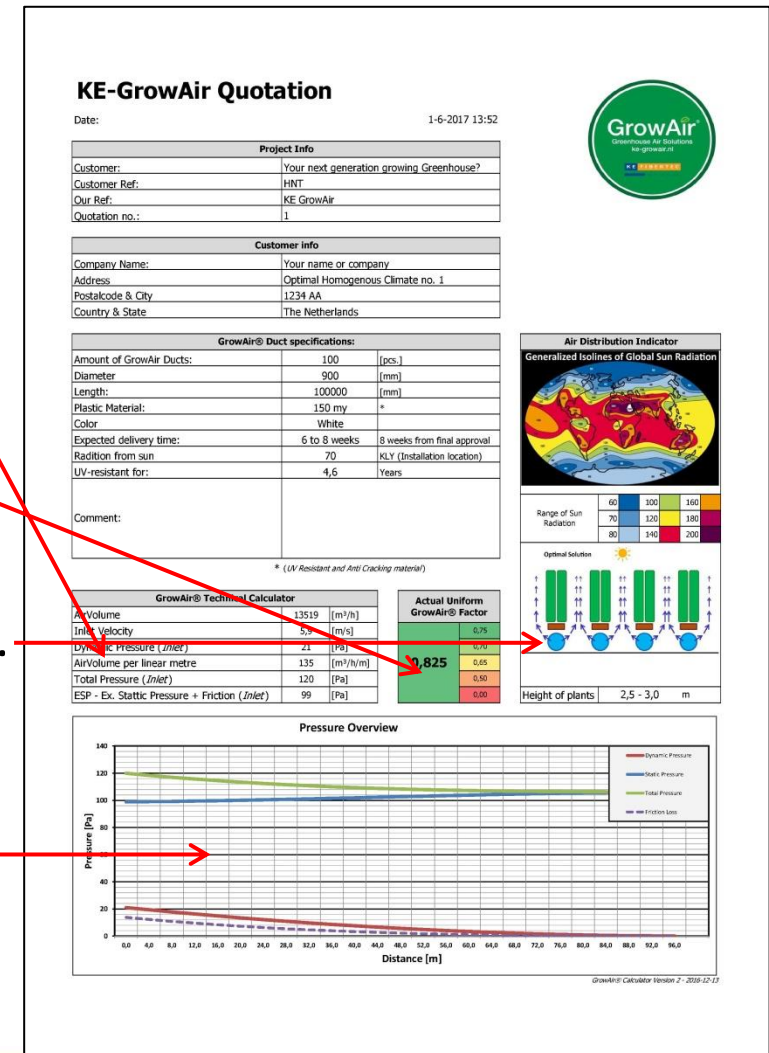
This will be demonstrated below.



GrowAir® Customizing to your needs

The KE GrowAir Quotation shows:

- Unique **Winvent Horti** calculation
- **Uniform GrowAir® Factor** for a homogenous air distribution.
- Ability to mix the **primary air** and **secondary air** up to the top of the crop.
- **Balance** between the **static and dynamic pressure** alongside the duct.



Round up & Next steps



1. Strong organisation
2. Proven products
3. Owned patent KE GrowAir
4. Specific experience in air distribution
5. Experienced KE GrowAir team
6. Support
7. Development
8. Succes for

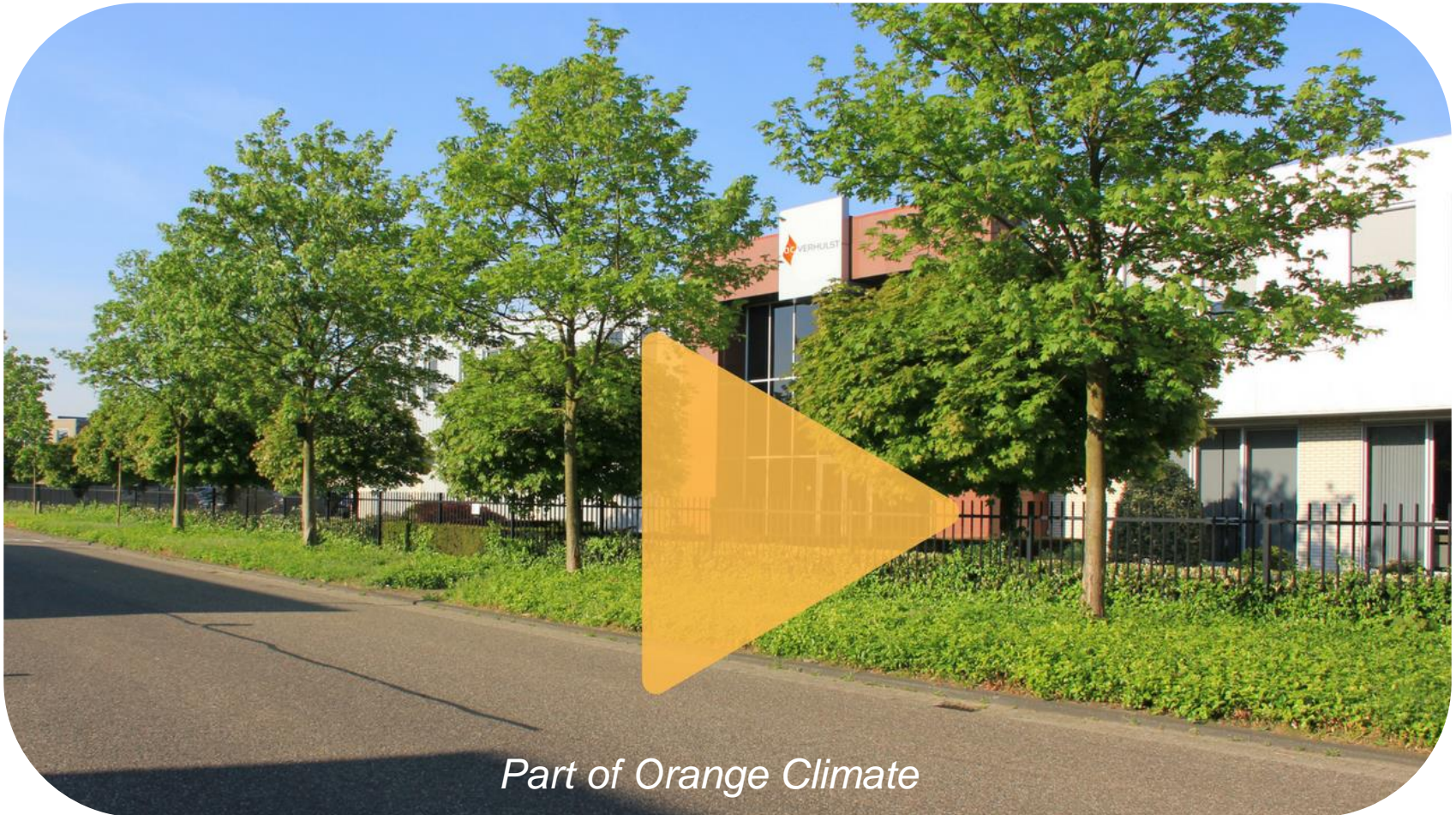


A short introduction

OC Verhulst

- See who we are...
- What we are...
- What we can offer...

Video OC Verhulst



Part of Orange Climate

In short

- Established in 1820 by Johannes Verhulst
- Marketleader Air handling units in the Netherlands
- Part of Orange Climate (2014)
 - Delivery all over the world
 - Agents in over 12 country's
 - Experienced in large projects
- Developer, manufacturer and supplier
- Expert in air handling
- Custom made solutions for divers segments
- Frontrunner Circular Economy in air handling

A few of our customers

HUDSON'S BAY

AmphiA



Radboudumc



Co-create

- 200 years experience
- Use our core quality and expertise
- Co-create with end-users for best solution





Solutions for the horticulture market

Current issues

- High energy usage
- Large amounts of water usage
- Indoor climate effected by outdoor climate
- No optimal air flow or air temperature

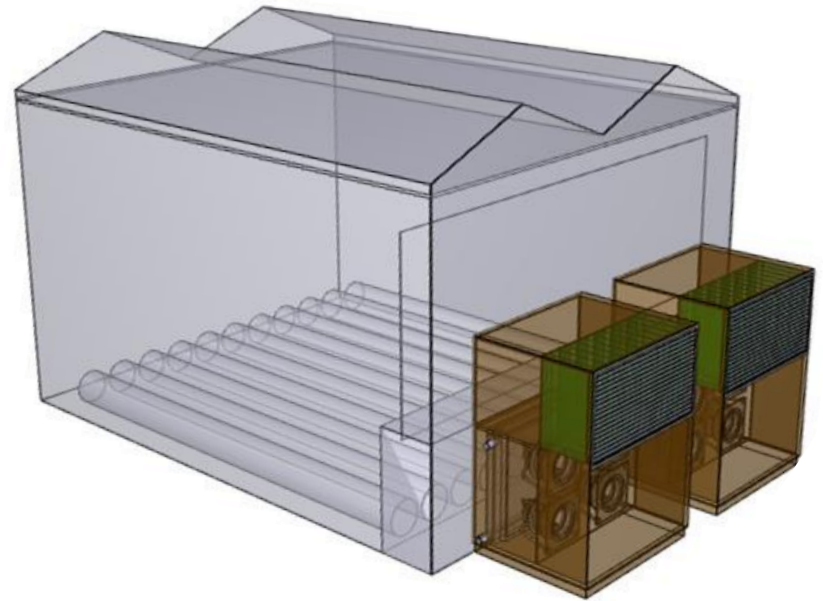
Solutions

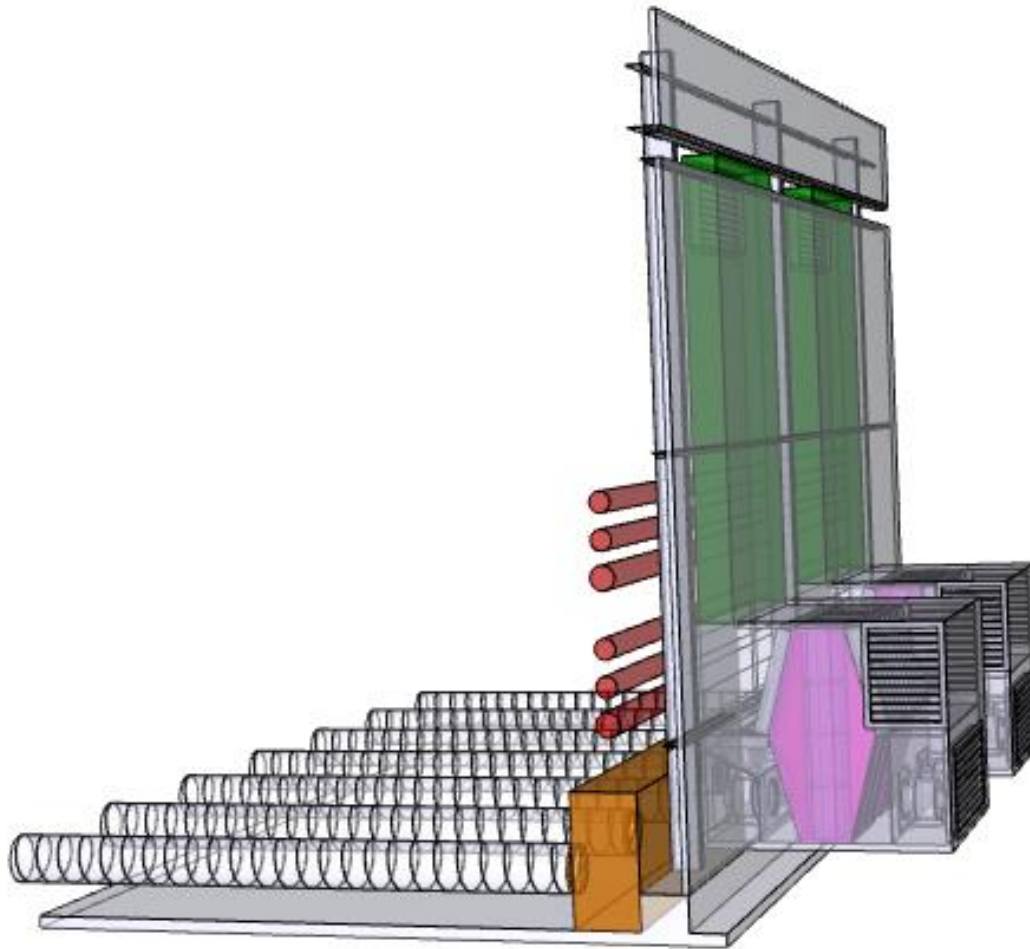
- VA Cool / VA Dessicator
 - Cooling & dehumidify
- VA Grow *energy saver*
 - Lowest energy usage
- VA Grow CO₂
 - Preserve CO₂
- VA Dessicator Green
 - Dehumidify without outside air

VA energy saver

Unique air mixing system

- Special dampers for optimal air mixing
- Optimal, stable grow temperature and humidity for cultivating
- Low energy usage
- Standard units or custom made specs possible





Advantages (1)

- Several operation modes
 - Ventilation with heat recovery
 - Ventilation without heat recovery over the bypass
 - Active recirculation preserving CO₂
- High energy savings
 - Thermal efficiency >90%
- No additional heaters necessary

Advantages (2)

- Improve cultivation
- Improve micro climate around the plants
- Reduce illness
- Grow stronger crops
- Save energy
- Keep lightscreens open longer and windows closed longer
- Dehumidify without mechanical cooling
- Efficient use of indoor- and outdoor conditions
- Heat recovery with $> 90\%$ efficiency

Thank you

Lets meet!

Contact us for a visit at our facility in
Drunen, the Netherlands.

