

## SMART Greenhouse Horticulture in Rwanda

Example for emerging farmers

Erik van Os & Anne Elings

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## SMART Horticulture Rwanda

Financed 50% by Netherlands Enterprise Agency

Building Greenhouse

Managing Partner



Project Partners

SMART Horti Business Partners



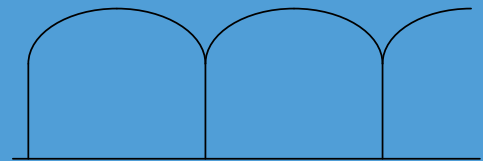
## Aim and Results

- Goal: introducing technologies that are adapted to local circumstances
- Design specific greenhouse
- Building pilots
- Training staff
- Dissemination outside the pilot

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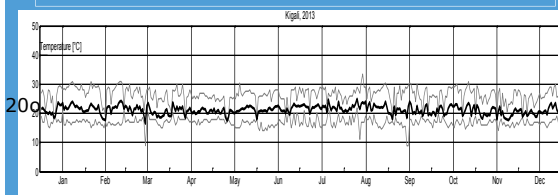
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## Climate



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## Rwanda, Kigali 2013

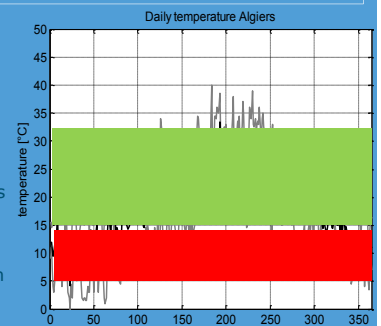


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## Algerian climate - temperatures

Typical:  
- Heating demand in winter

Challenge:  
- High temperatures create need for efficient ventilation  
- Extra cooling measures needed in summer



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## Malaysia: a greenhouse for lowland tropics

Goal: Introduce a greenhouse suitable for lowland tropical climate conditions.

Greenhouse:

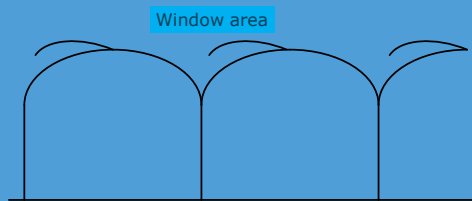
- Natural ventilation
- Insect nets, double-door sluice
- 20 \* 30 m
- Drip irrigation
- Coco fibre substrate
- Computerized fertigation



## Pilot: how to work in the new greenhouse?



## Design factors: shape + ventilation



## Ventilation

**Current tunnels** have ~ 3% window opening  
 $\text{m}^2 \text{ window} / \text{m}^2 \text{ greenhouse} = 0.03$

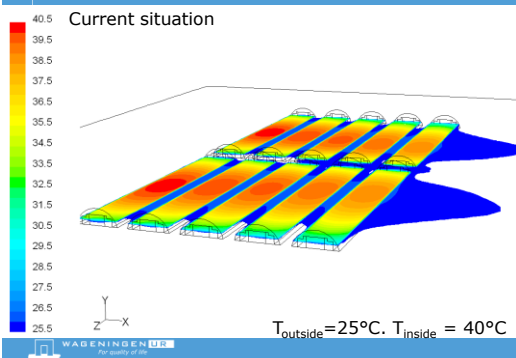


Size: 50 x 8 m  
 Ventilation in front



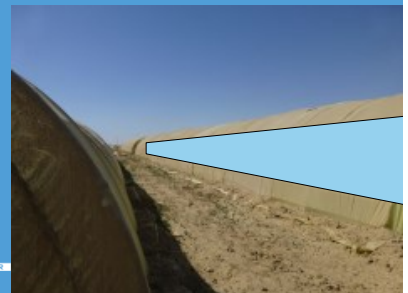
## Temperature in single span tunnels

Current situation



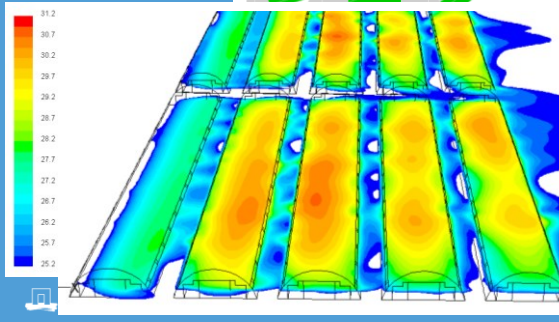
## Ventilation and cooling

30% window opening =  $\text{m}^2 \text{ window} / \text{m}^2 \text{ greenhouse} = 0.3$



Open sides (window fraction 30%)

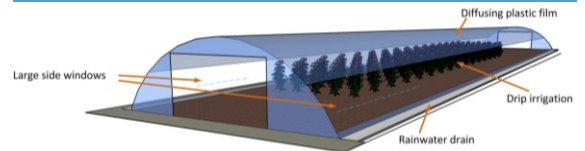
$T_{\text{outside}} = 25^{\circ}\text{C}$ ,  $T_{\text{inside}} = 30^{\circ}\text{C}$



## Final design Algeria

- Ventilation: 30%
  - Doors and side walls
  - Insect netting
- Diffuse film
- Rainwater collection
  - Soilless cultivation
- Manual or mechanised operation needed

TNO:  
calculation of strength



## Cooling – with water

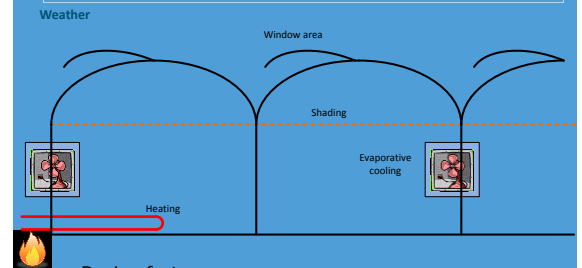


**Adiabatic cooling:**  
Evaporation of water decreases inside temperatures  
(and increases humidity)

- BUT ventilation needed
- NOT working at moments with too high humidity



## Other design factors



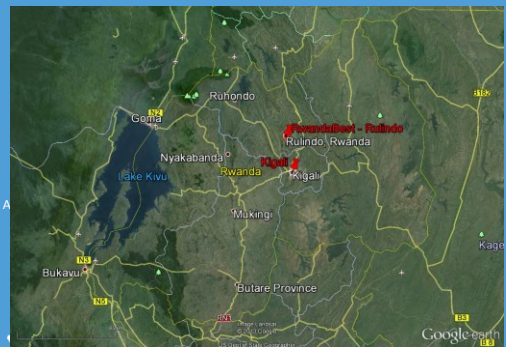
**Design factors:**  
Shape, Ventilation, Shading, Cooling, Heating



## Hilly country in East Africa: Rwanda



## RwandaBest



## Current situation in Rwanda



## RwandaBest



## Expectations RwandaBest

- Own production
- Increased volume
- Stronger market position
- Collaboration with surrounding cooperatives
- Approximately 10 greenhouses, in phases
- Some technology
- Training facilities



## General lines of development

- Pilot with low-tech-plus greenhouse (low-tech plus computerization)
- Training
  - at RwandaBest: **next week**
    - Later: combination with supplying companies
  - of RwandaBest + other producing companies + cooperatives
- Post-harvest value chains
  - Grading, packing, cooling, transport
- Commercial up-scaling of greenhouses to other farms and cooperatives

**Greenport Holland International** Design Bosman, Pilot Greenhouse

**The Greenhouse model:**  
 'EVEREST 8M': with windows permanently opened positioned north south.

50 mesh anti insect nets will be installed at all points of entry to the greenhouse, which reduces the need for pesticides and saves money.

**Resistance:**  
 The structure has been calculated and tested for the worst weather conditions

MODEL EVEREST 8 M		
Standard load and lockers plastic	WIND LOAD	CROP LOAD
ALUMINIUM	150 Km/h	25 KG/M2







## Soilless: against soil-born pathogens



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## Water quality

- Chemical quality
  - Availability good water
  - Additional water
- Effect of salt on yield
  - Too salt, less yield or quality
- Storage and dosing equipment
- Calculation of recipe of nutrient solution

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## Water sources and their contents

- Rainwater
- Tapwater
- Surface water
- Boreholewater

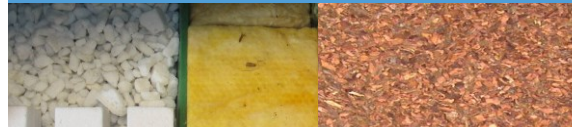
→ Improve with Reverse osmosis



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## SUBSTRATE differs from soil:

- Height of substrate 5-10 cm versus soil >100 cm
- Volume 10-20 litre versus > 500 litre
- Nutrients in irrigation water
- Concentration instead of capacity
- No base dressing / nutrient storage in soil
- Irrigation >20 per day versus 1x per week
- Density, water content, air content



## Training

- Train the trainers
- WUR, private companies
- Subjects:
  - Greenhouse and climate
  - Cultivation in soil and soilless
  - Pest and diseases
  - Organisation of work
  - Chain and post-harvest

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Thank you for  
your attention !



Wageningen UR Summerschool Protected Horticulture  
[www.wageningenacademy.nl/protectedhorticulture](http://www.wageningenacademy.nl/protectedhorticulture)  
 August 24 – September 4, 2015

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