



Lights in Greenhouse Vegetable production




production: growth and production of tomato under HPS and LED lighting systems

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Experimental design

- Variety: Sunstream
- 4 treatments, equal light intensity, (170 $\mu\text{mol}/\text{m}^2/\text{s}$), optimal growth
 - HPS (100%),
 - LED-top (100%) 88% red, 12% blue)
 - Hybrid (50% HPS, 50% LED-top),
 - Hybrid (50% HPS, 50% LED-interlighting)






Hybrid Interlight LED HPS

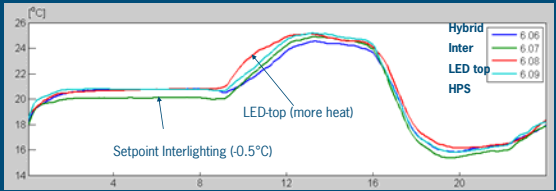



Measurements/observations

- Crop grew well, weekly control growers
- Climate (greenhouse + plant temperature)
- Crop morphology (leaf) length, Leaf Area Index, SLA
- Photosynthesis and transpiration
- Production, truss flowering, setting, split truss, taste, shelf life
- Energy use




Greenhouse climate – mean day




Interlighting acts as minimum pipe (ca. 35°C), thus less heating necessary

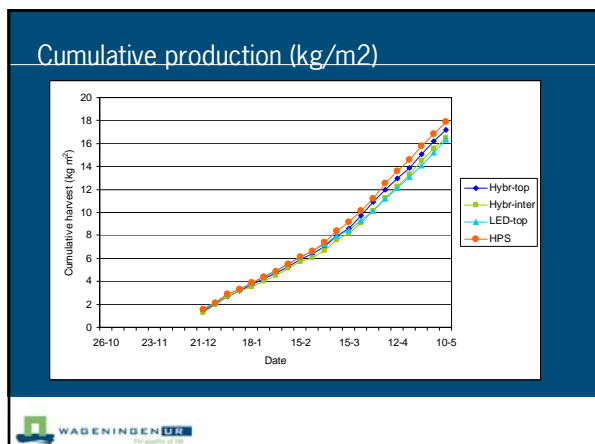
Crop under LED-top too cold in the morning, thus more heating is necessary



Crop parameters to March (destructive)


	Leaf length (cm)	Leaf DS %	LAI (m^2/m^2)	SLA (cm^2/g)
Hybrid	43	9.6	1.8	150
Interlighting	44	9.4	2.2	158
LED-top	44	10.6	1.9	143
HPS	39	9.4	2.1	168






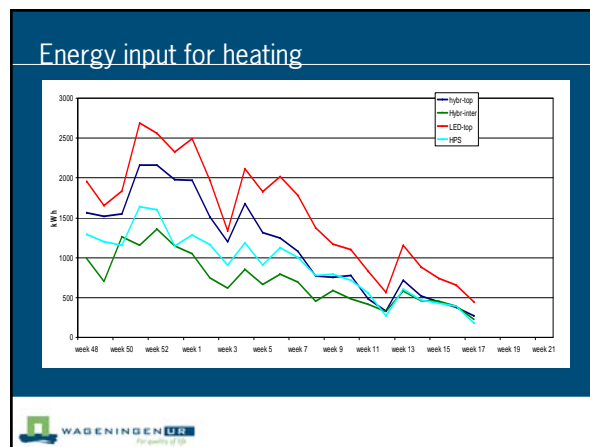
Production until June 21st

	Flowering truss	Total set fruits	Prod. kg/m ²	Prod. %	Split truss %
Hybrid	37.4	1466	25.2	- 2.7	10.5
Inter-lighting	37.3	1433	24.3	- 6.1	11.5
LED-top	36.9	1472	24.5	- 5.1	9.7
HPS	38.1	1498	25.9	-	10.4



Fruit quality


- HPS: slightly higher refraction and % sap
- No clear differences in taste
- No clear differences in % dry matter
- Mean shelf life 16 days

Energy-efficiency (18 nov – 3 mei)

Energy in m³ a.e. natural gas per kg tomato

Hybride	3.87
Interlighting	3.56
LED-top	4.26
SON-T	3.62



- ### Lessons learned
- Each lighting system requires a different heating regime:
 - LED-top: more heating and screening - compensation for lower head temperature compared to HPS
 - Interlighting = 'continuous' minimum pipe
 - Top of crop requires sufficient light for development:
 - Interlighting is hung quite high:
 - At low (sun)light levels, the head requires enough light
 - HPS crop was pushed in its production (higher production, thin leaves)
 - HPS highest production, with LED: Hybrid most promising.