

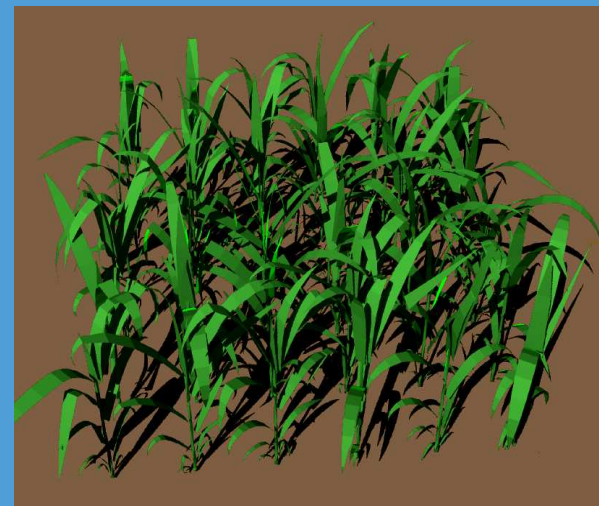
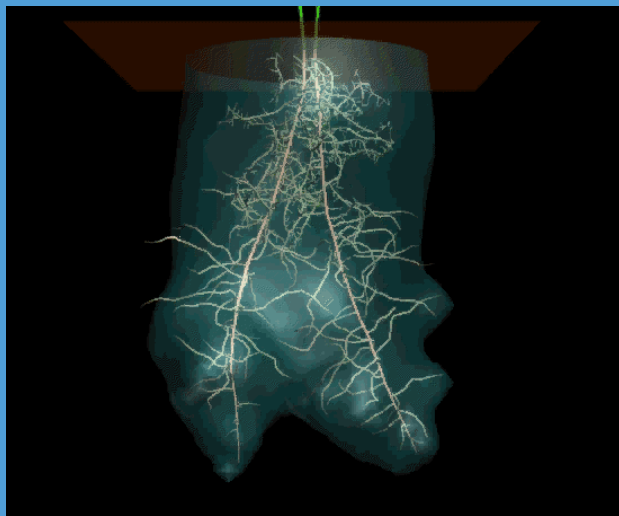
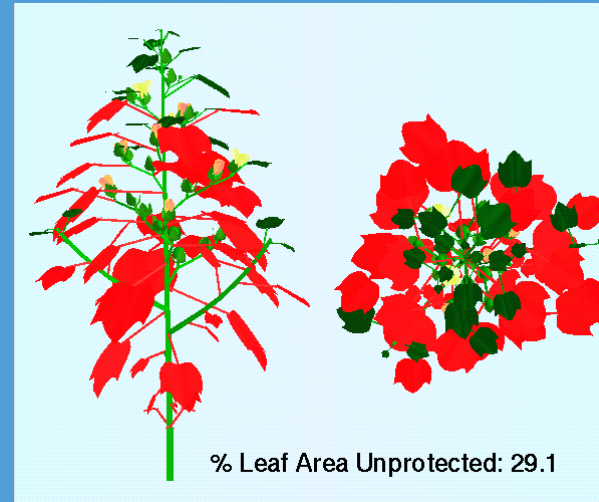
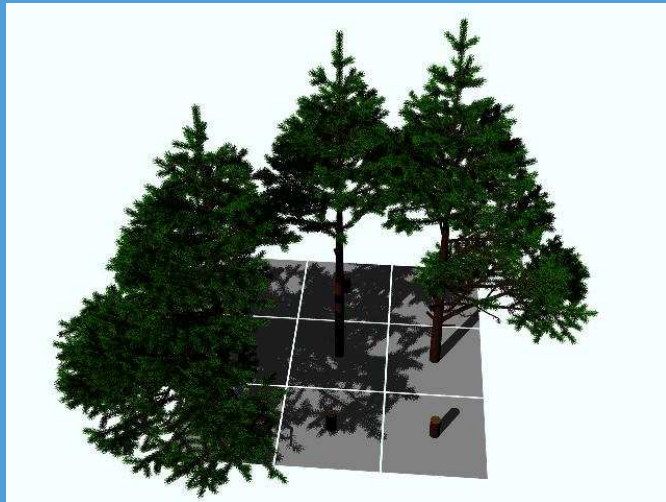
# 3D modellering van gewassen

(3D, wat kan je er mee?)

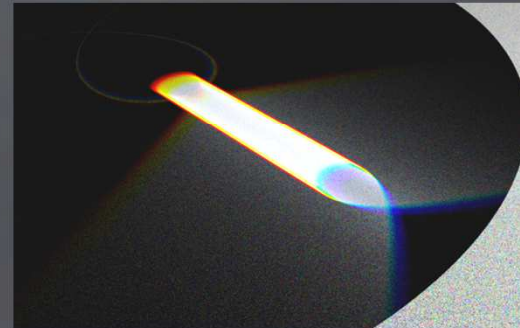
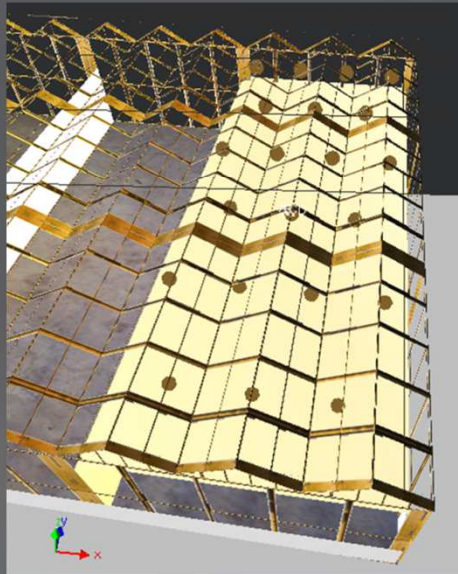
Pieter de Visser  
WUR Glastuinbouw



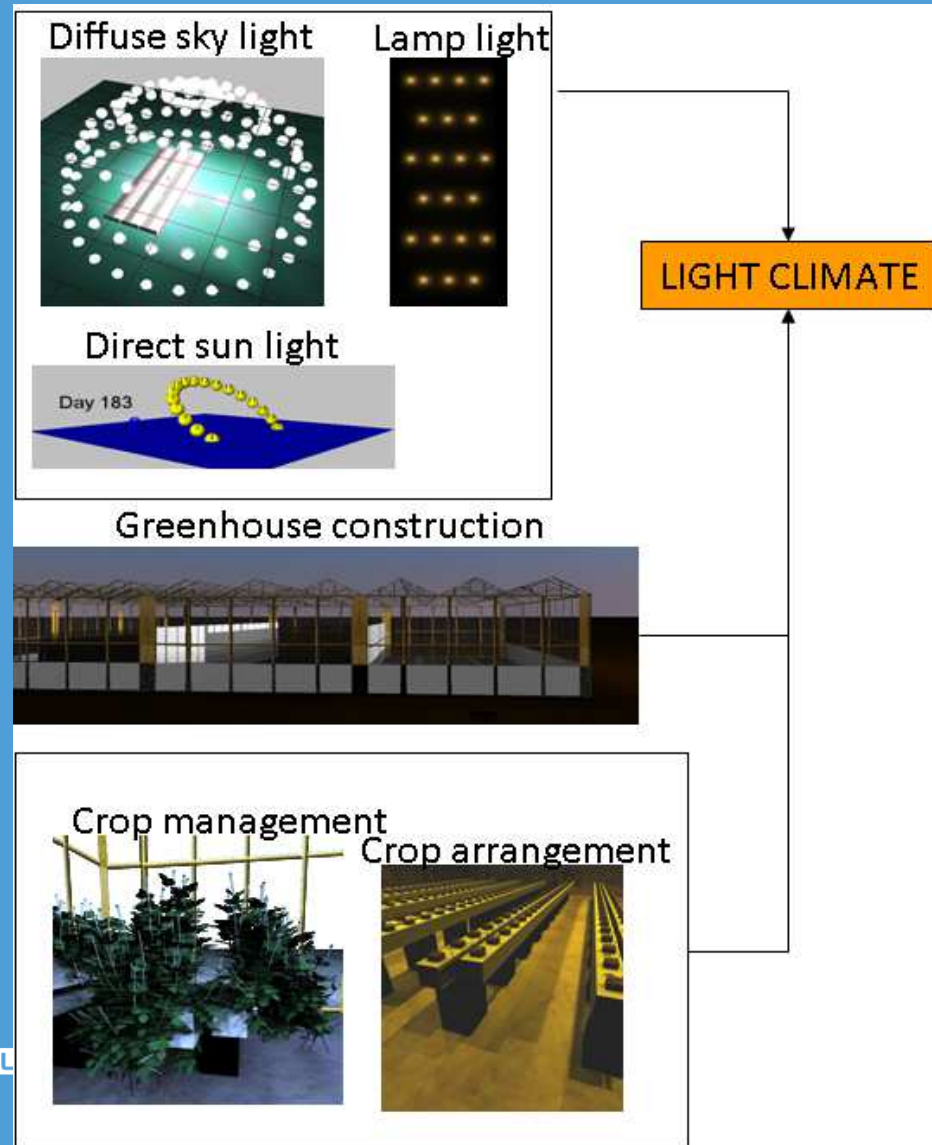
# 3D plant modelling startte in jaren '90



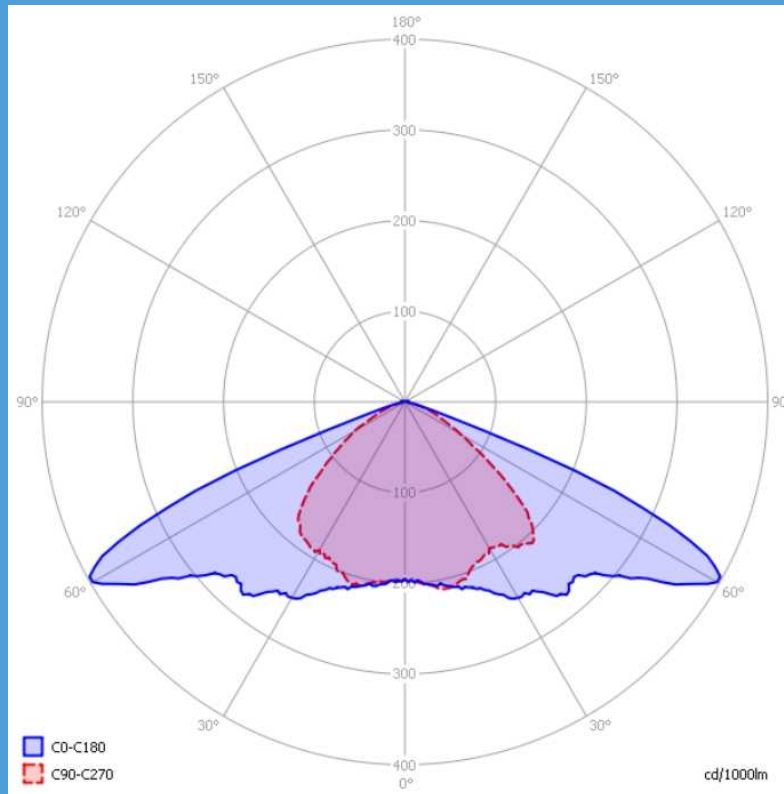
# Voor glastuinbouw: kas structuur; hele spectrum; lichtbreking



# Licht: zon, plaatsing lampen, planten, etc.

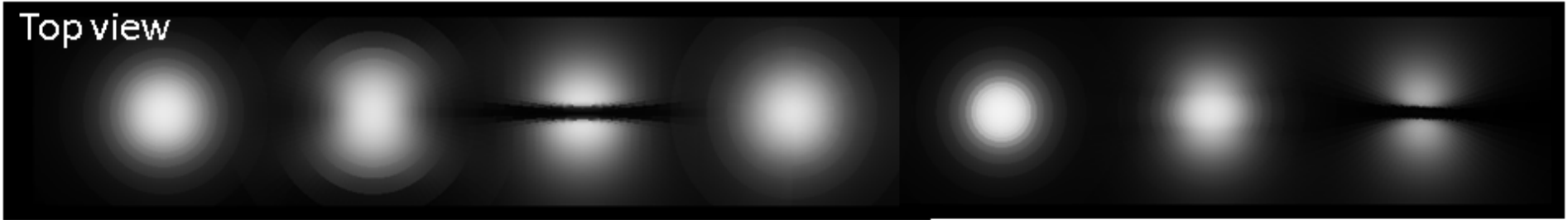


# Stralingspatroon lampen --> model

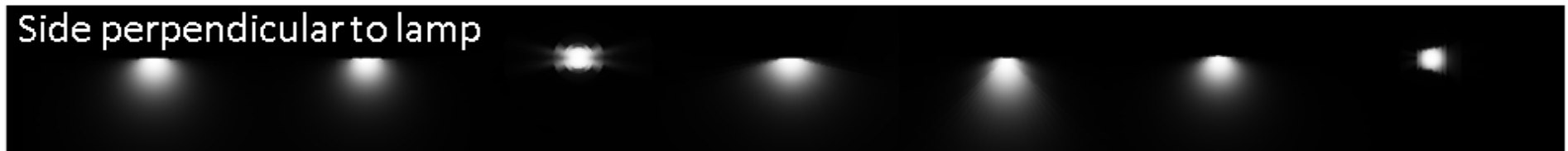


# LEDs: vele stralingspatronen mogelijk

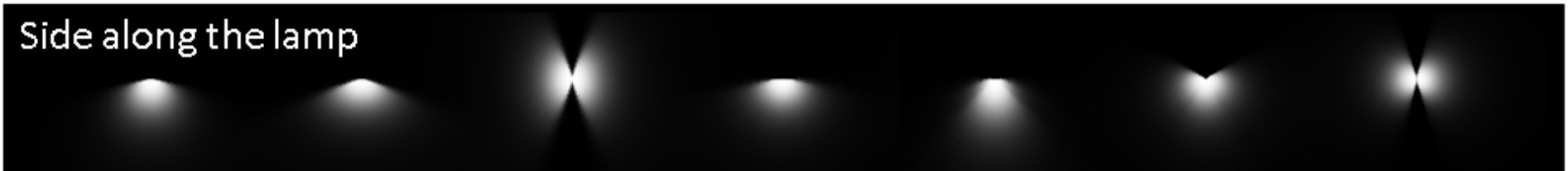
Top view



Side perpendicular to lamp



Side along the lamp



In EU-ClimateKIC-project "Carbon LED" i.s.m. Philips, Bayer en INRA (Fr.)



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# Van 'wireframe' naar ...

The screenshot displays the GroIMP software interface. The main window shows a 3D wireframe model of a greenhouse structure with several red wireframe plants inside. The interface includes a menu bar (File, Edit, Objects, Panels, Net, Help, OpenGroIMP), a toolbar with buttons like 'Reset', 'Stop', 'testLight2', etc., and a 'View' panel with 'View', 'Camera', 'Fit', and 'Render View' options. On the right, there is a console window titled 'XL Console' showing simulation data.

```
Light response curve Flat Object Inspector jEdit - Tomato2010.rgg XL Console
filter on SONT-lamps (filter): no
Power of SONT-lamps: 0.0
Current scenario for greenhouse texture (scenario): 1
Daily total global radiation computed for day 180: 42.351414 MJ m-2
Daily total radiation measured on day 180: 15.059098 MJ m-2
Average atmospheric transmissivity on day 180: 0.35557488
Power of diffuse sky light: 236.37679 micromol PAR m-2
Power of direct sun light: 458.13235 micromol PAR m-2
*****CHECK THE FLAGS!!*****
All plants considered: no
Enclosing box for calib. lamp (CALIBRATE_LIGHT): yes
LED lamps on: no
Lateral LED panel on: no
Photosynthesis based on SONT lamps (PSSONT): yes
Shading screen closed (screen): no
Measuring stick visible (stick): no
Filter on SONT-lamps (filter): no
Power of SONT-lamps: 0.0
Current scenario for greenhouse texture (scenario): 1
Daily total global radiation computed for day 180: 42.351414 MJ m-2
Daily total radiation measured on day 180: 15.059098 MJ m-2
Average atmospheric transmissivity on day 180: 0.35557488
Power of diffuse sky light: 236.37679 micromol PAR m-2
Power of direct sun light: 458.13235 micromol PAR m-2
Number of organs: 84
  step 1 done after 5 ms
  memory 125323
Number of organs: 86
  step 2 done after 5 ms
  memory 125798
Number of organs: 173
  step 3 done after 5 ms
  memory 130463
Number of organs: 228
  step 4 done after 5 ms
  memory 122611
```

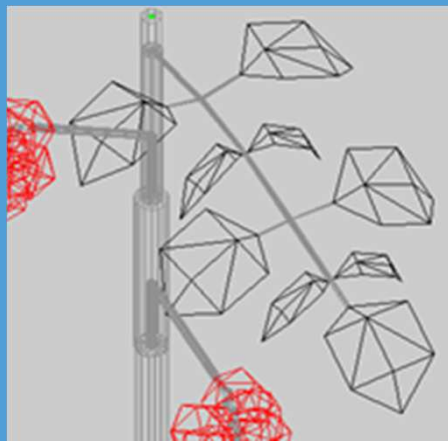
Done

EN 100% 15:06 9-5-2012

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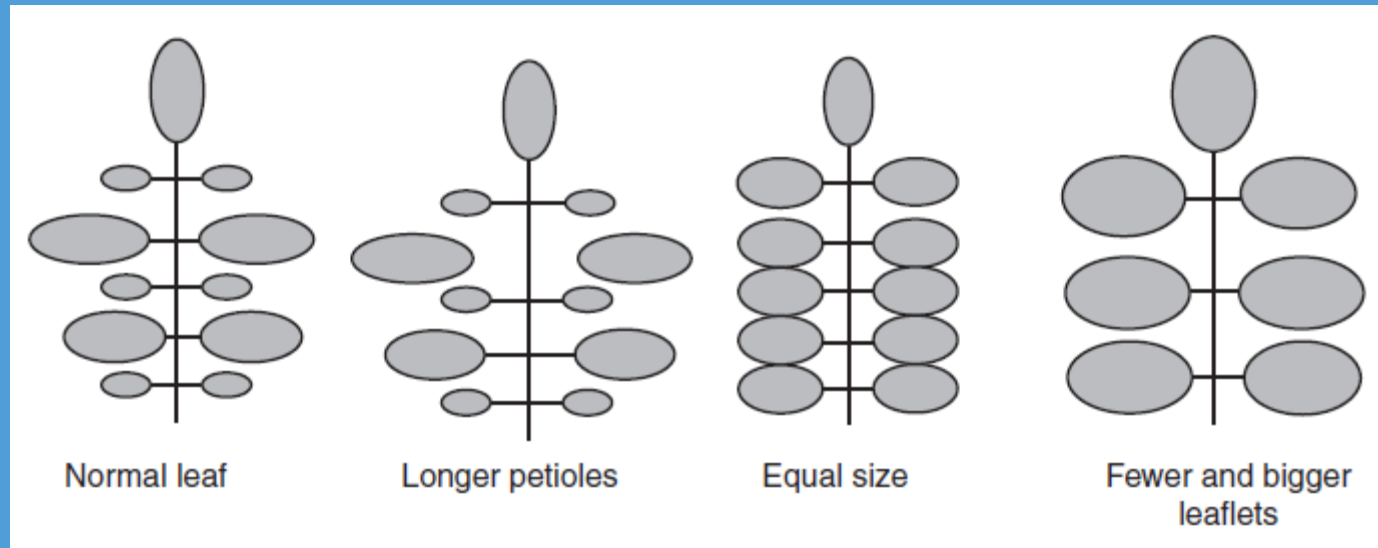
# 3D structuur van plant

- Ras 1, 2, etc.





# Bladvorm en fotosynthese



42.0

39.4

39.3

41.8

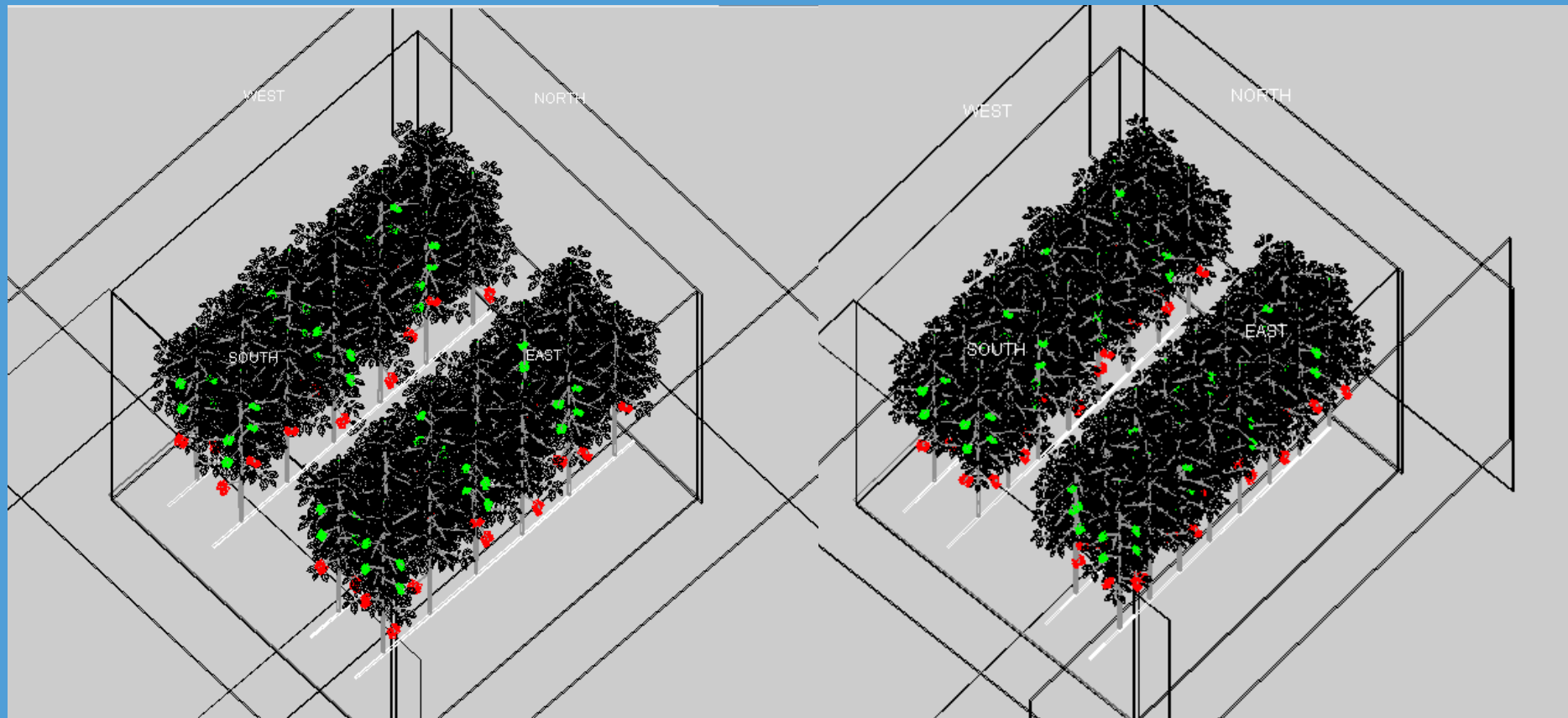
Fotosynthese (zomer,  $\text{g CH}_2\text{O m}^{-2} \text{d}^{-1}$ )(Sarlikioti et al, 2011)



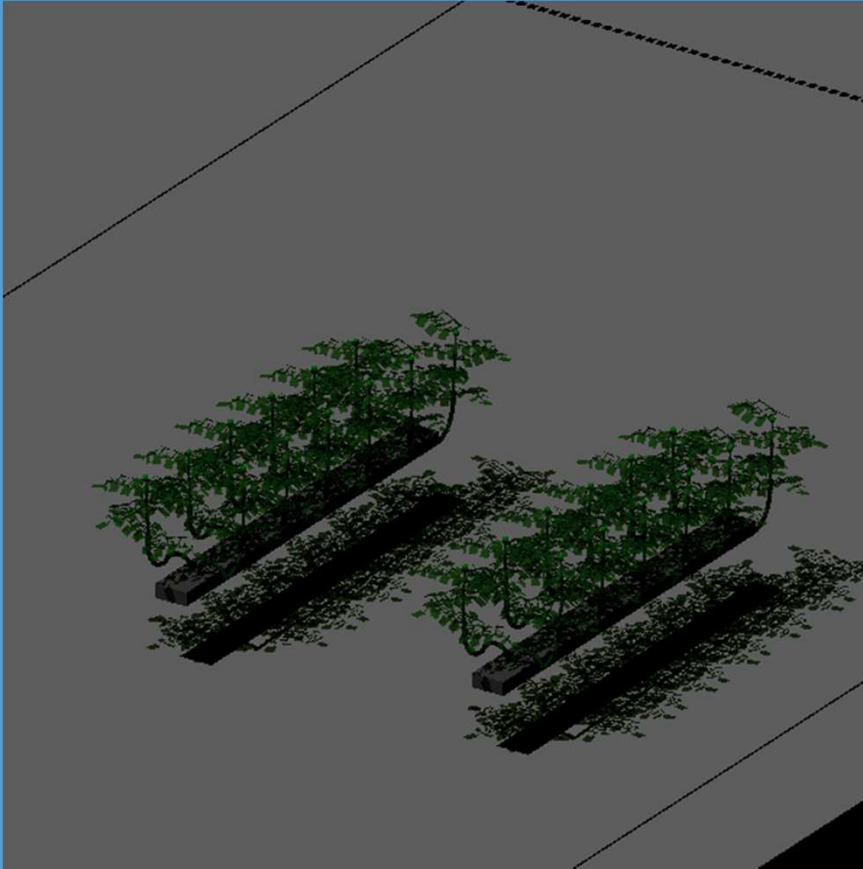
# Verhoging stengeldichtheid: zelfde LAI, smaller blad: lichtopvang hoger? Nee.

2.5

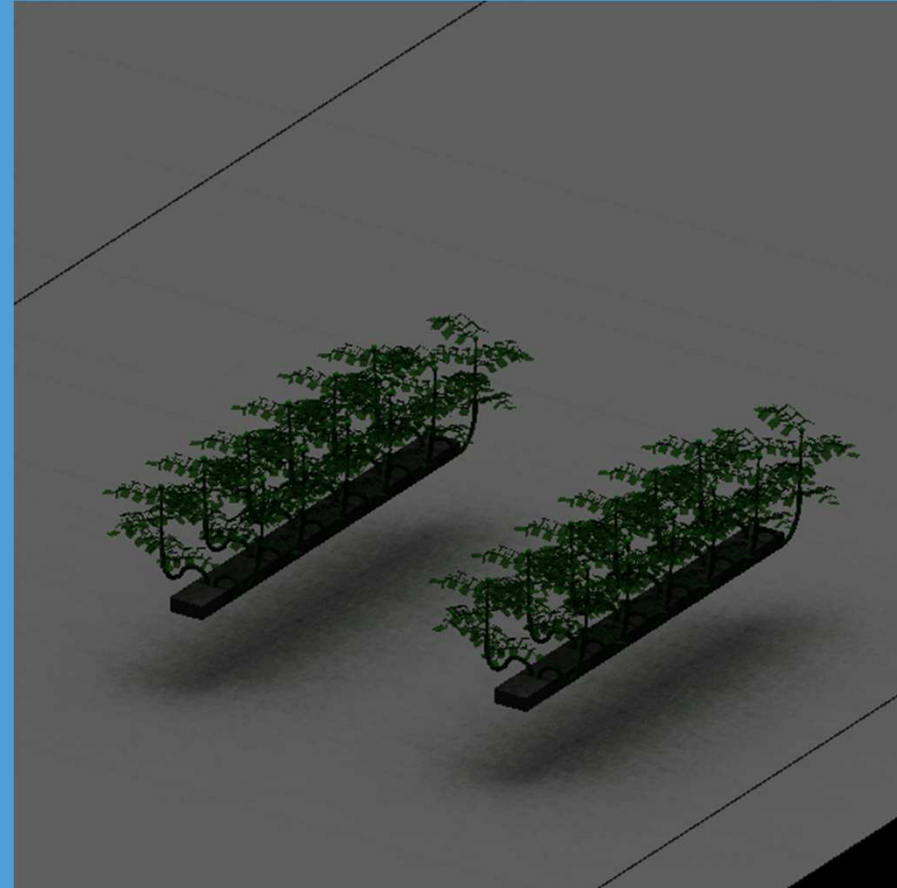
3.5  $\text{pl m}^{-2}$



# Diffuus versus direkt licht



Direkt licht



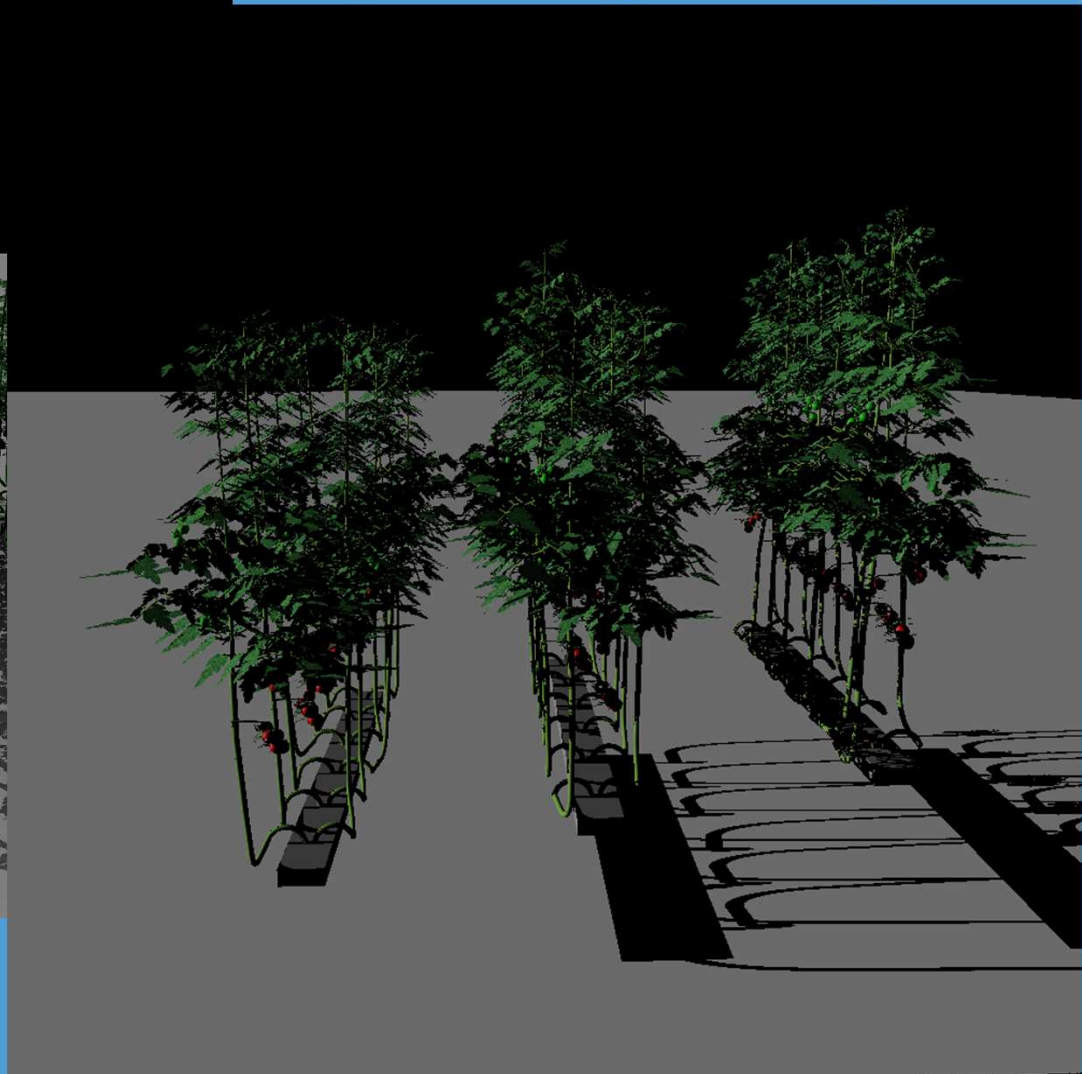
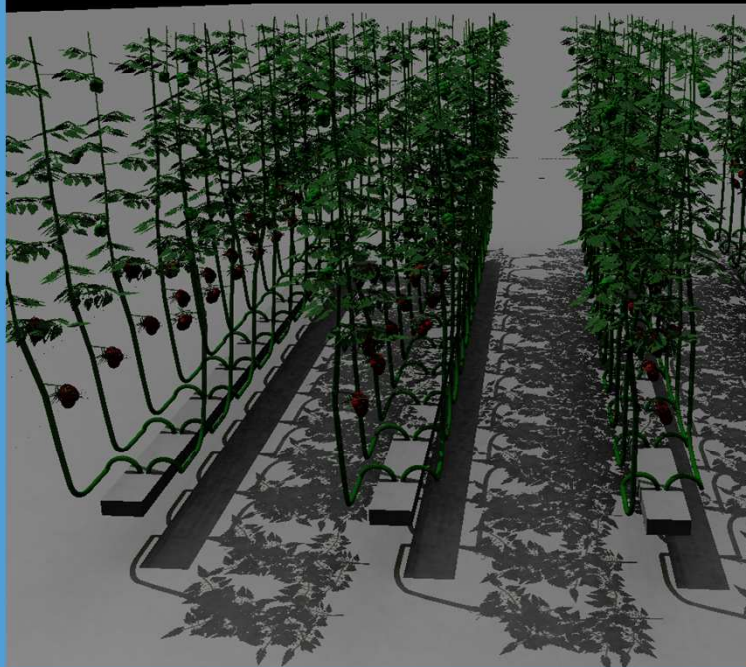
Diffuus licht



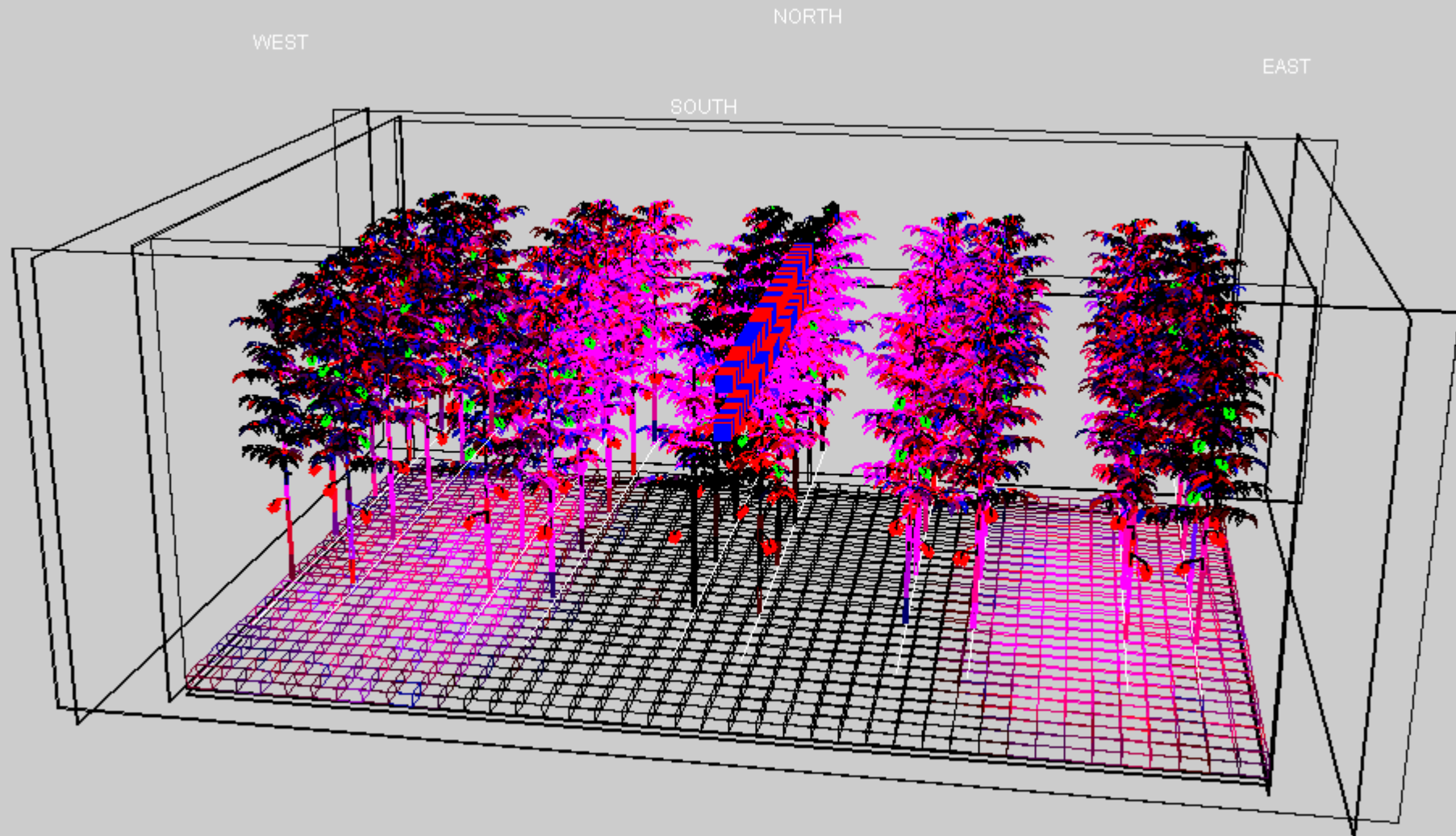
Direkt licht:

Meer lichtopvang bij plantrij in trapje?

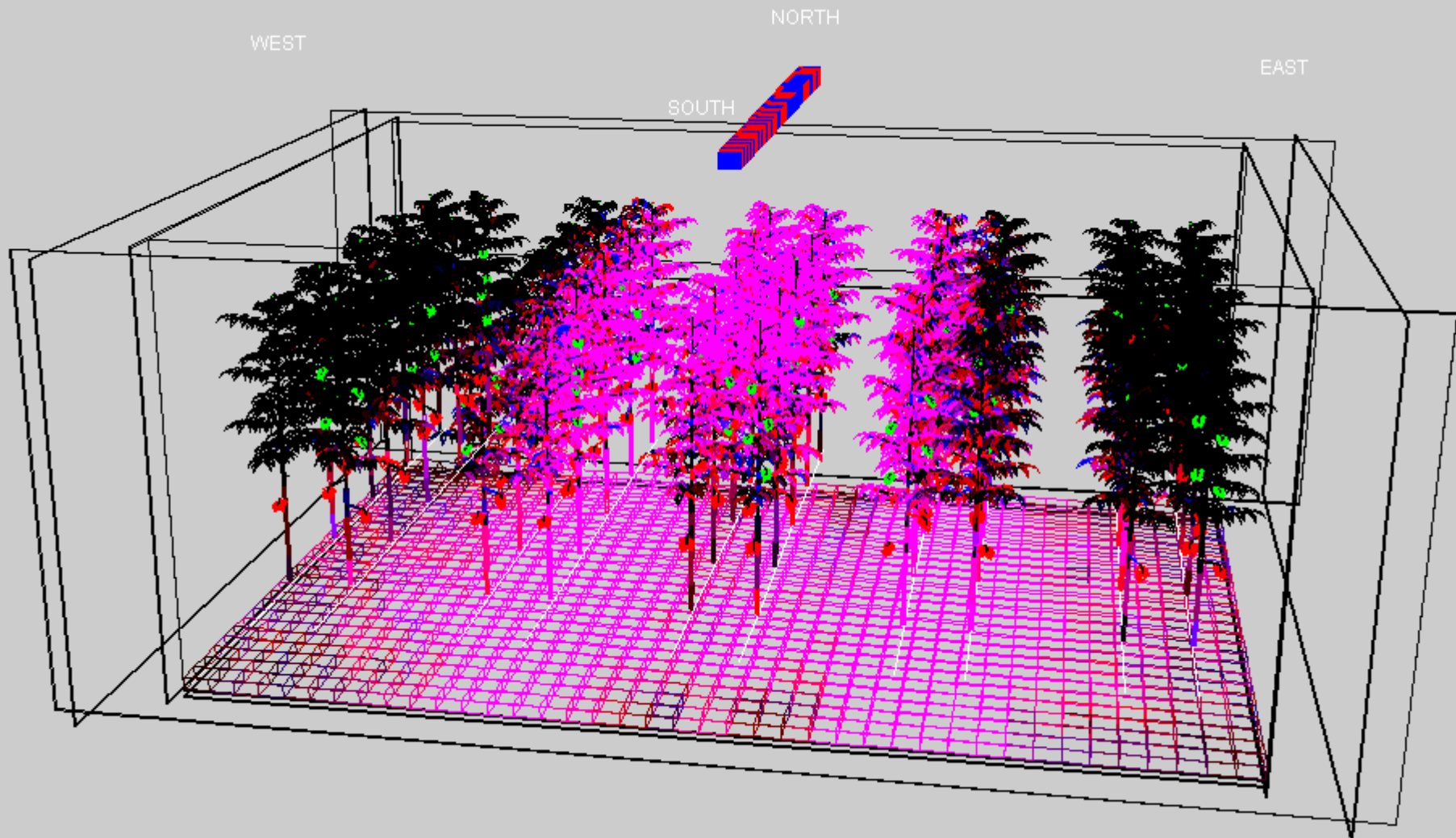
Bij O-W rij, 12hr: ja



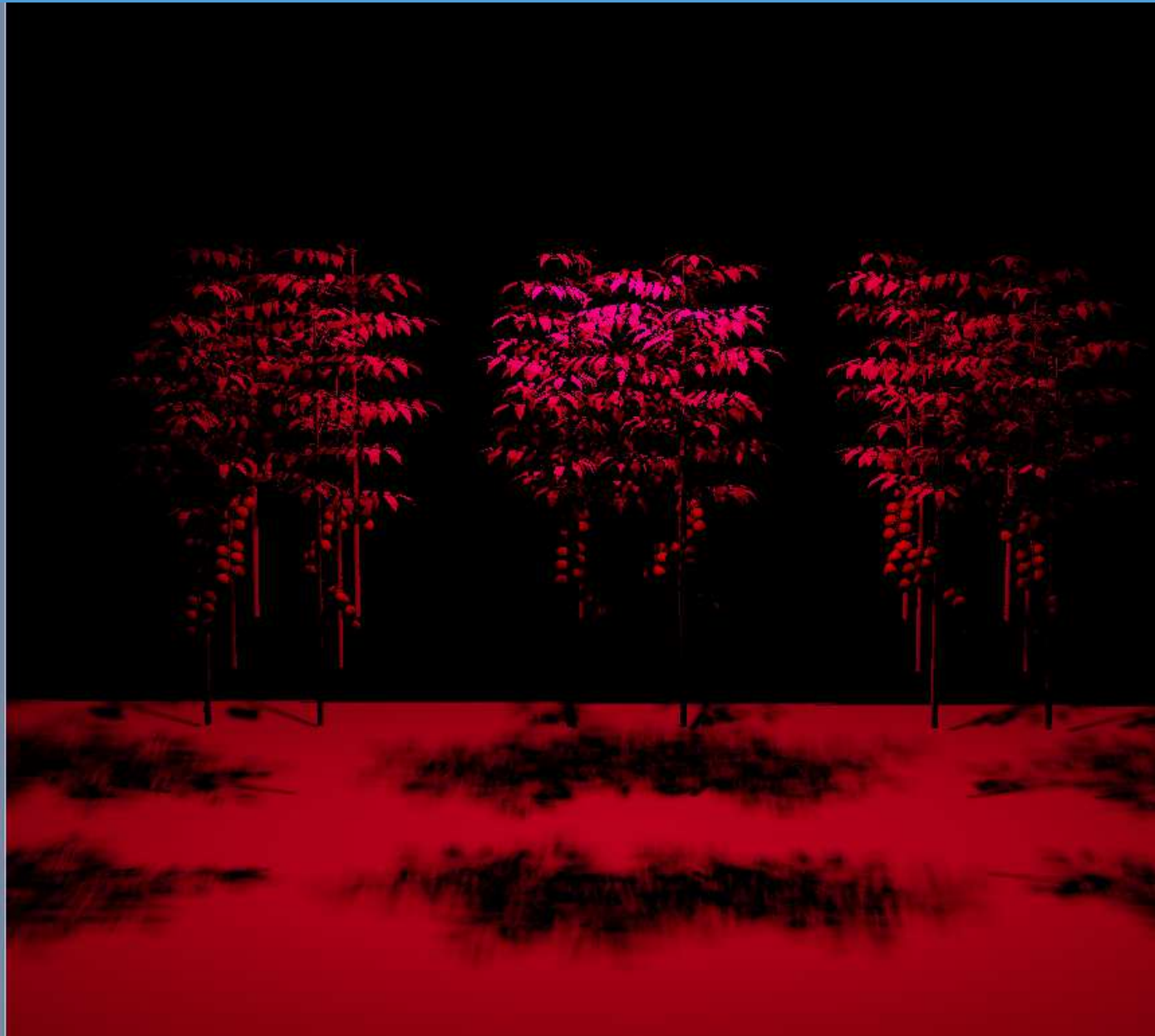
# Tussenbelichting met LEDs: zijaanzicht



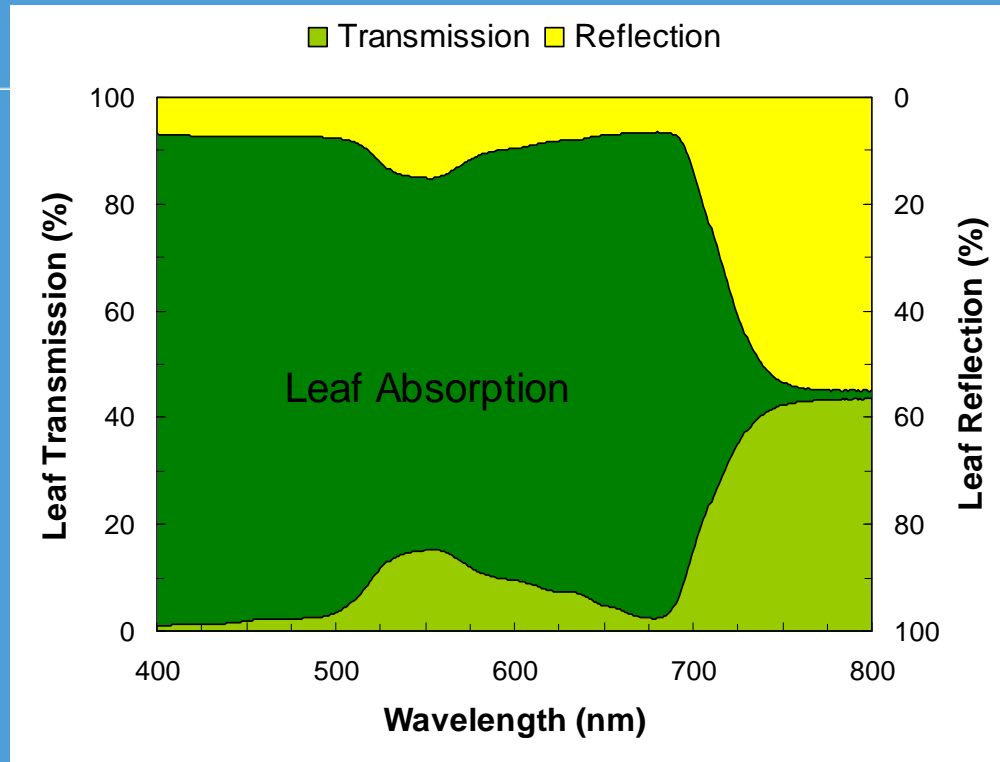
# Topbelichting LEDs



# LEDs boven gewas: rendered



# Lichtopvang per kleur (t.o.v. rood), tomatenblad

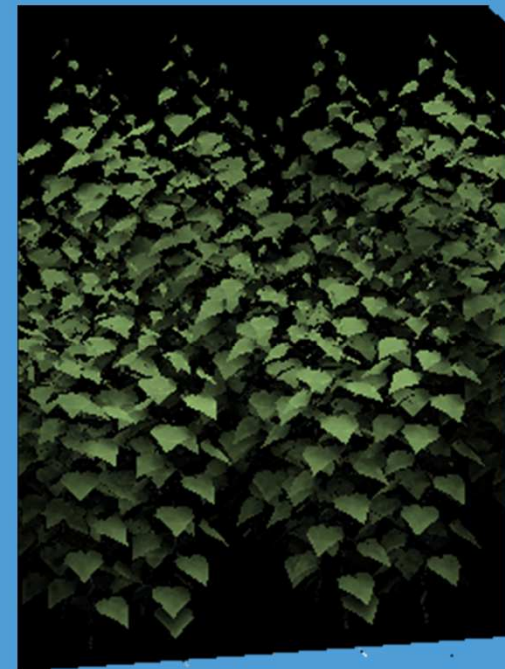
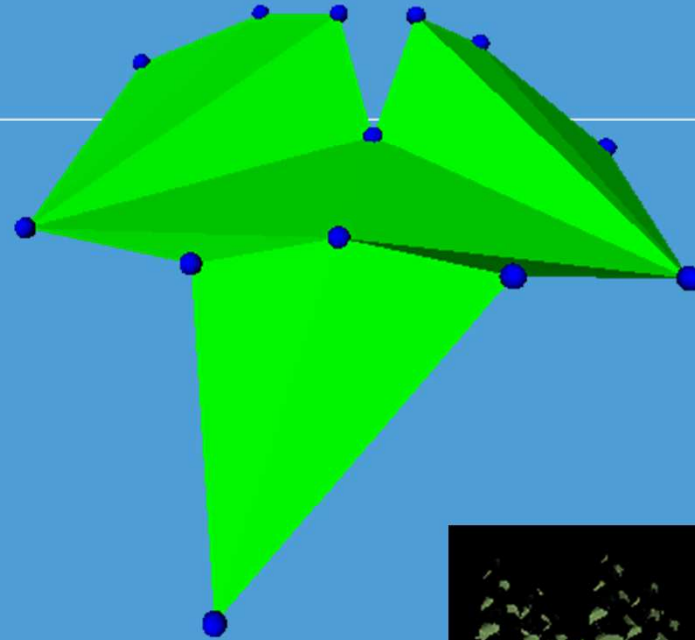
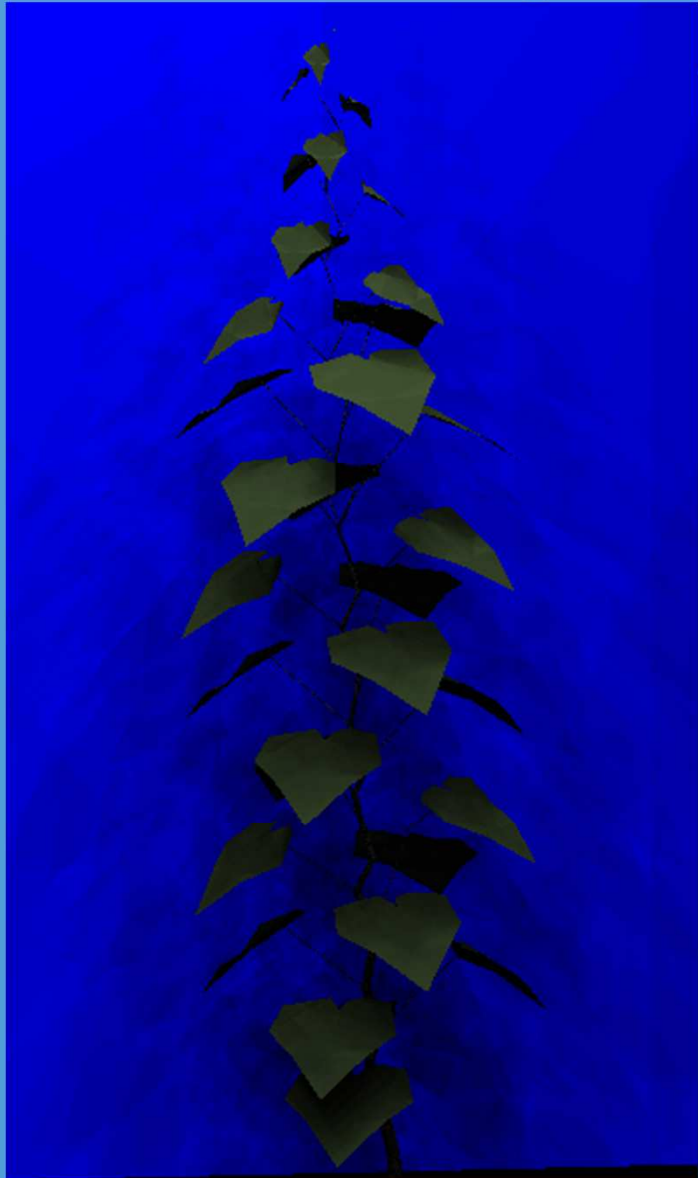


Gewas:	Jong (7 bl.)	Volgroeid
Groen	97% lichtopvang	99
Rood	100	100
Blauw	103	101





# Komkommer: hoeveel licht onderscheept winterlichtgewas?



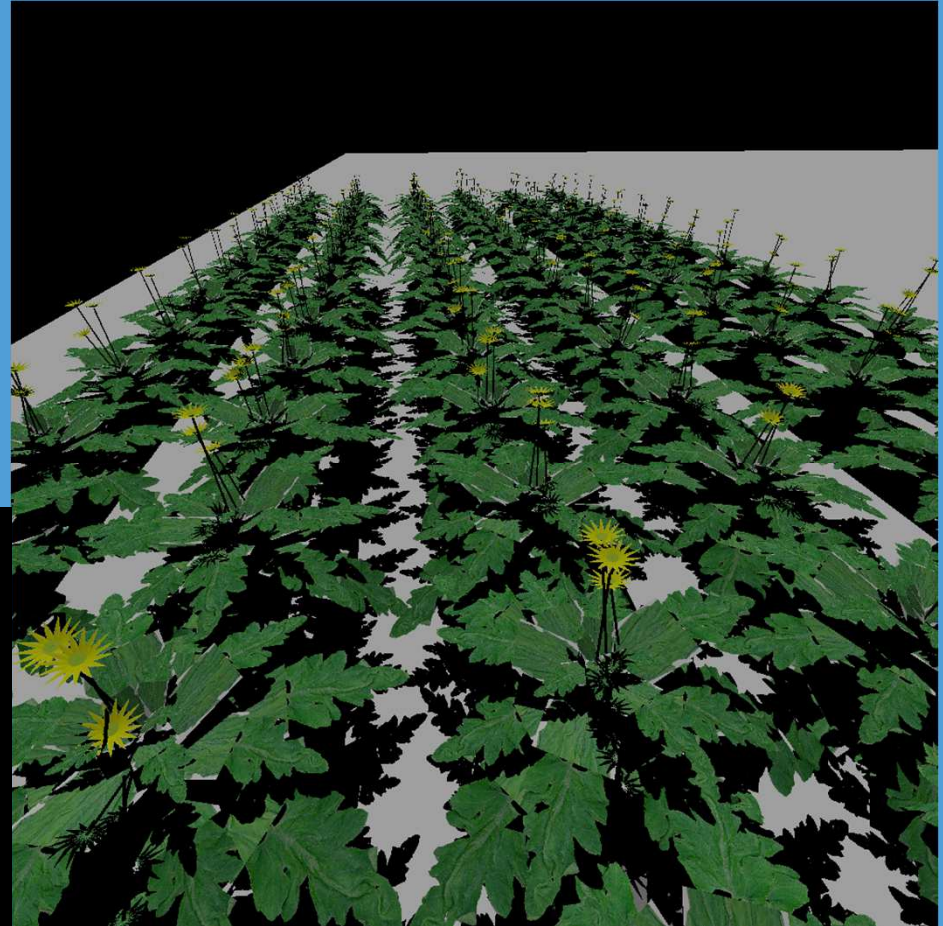
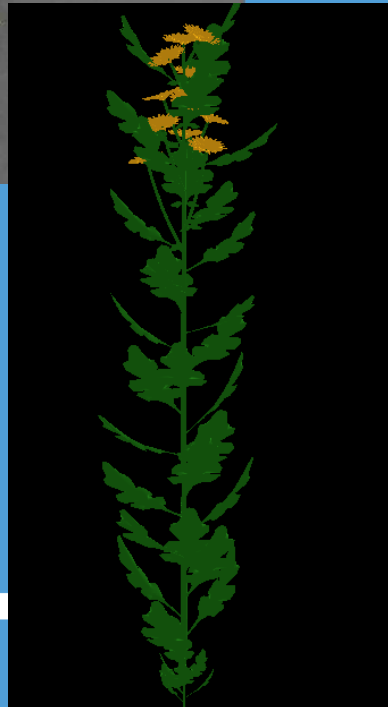
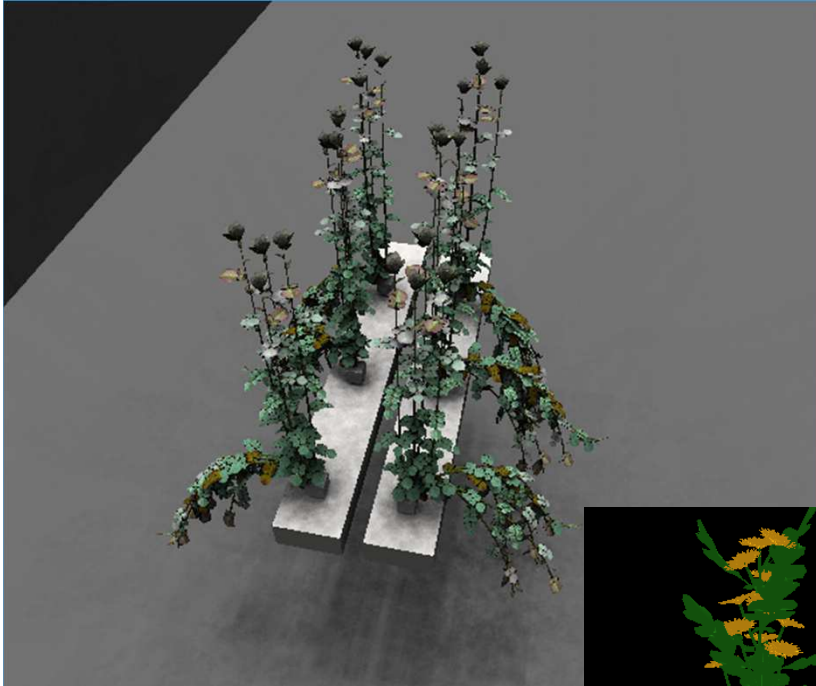
# Lichtonderschepping en fotosynthese:

Direct zonlicht (12 hr) of diffuus licht, medio februari:  
Paden lopen Oost-West of Noord-Zuid

LAI 3.2	Padbreedte	% licht onderschept	Fotosynthese (g CO <sub>2</sub> /m <sup>2</sup> /s)
O-W	1.4	97.0	20.4
	1.5	96.6	20.5
	1.6	96.7	20.7
N-Z	1.4	78.3	18.4
	1.5	76.8	17.9
	1.6	68.5	15.9
Diffuus	1.4	84.3	22.3
	1.5	84.0	22.2
	1.6	79.7	21.1



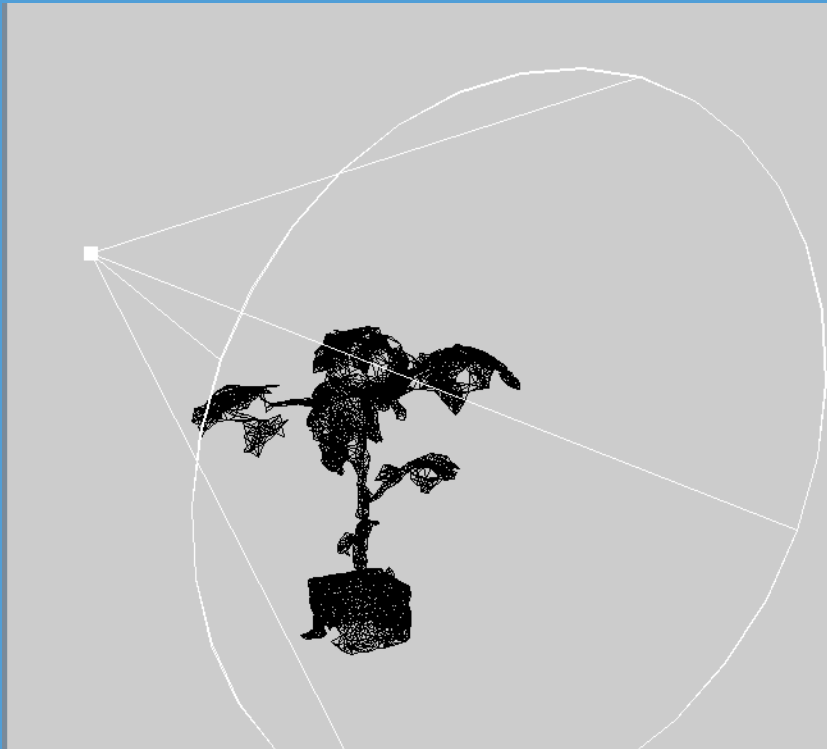
# Andere gewassen: roos, gerbera, chryasant



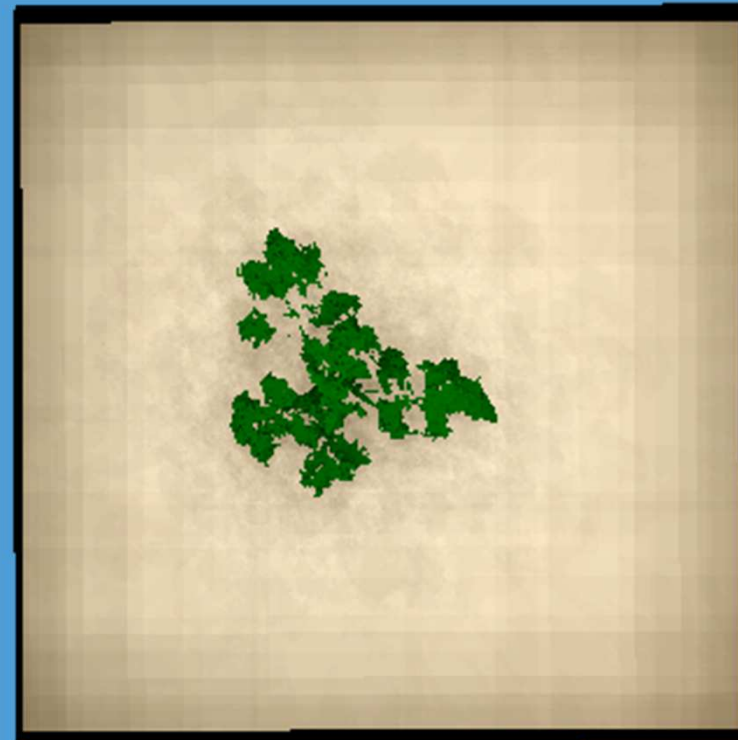
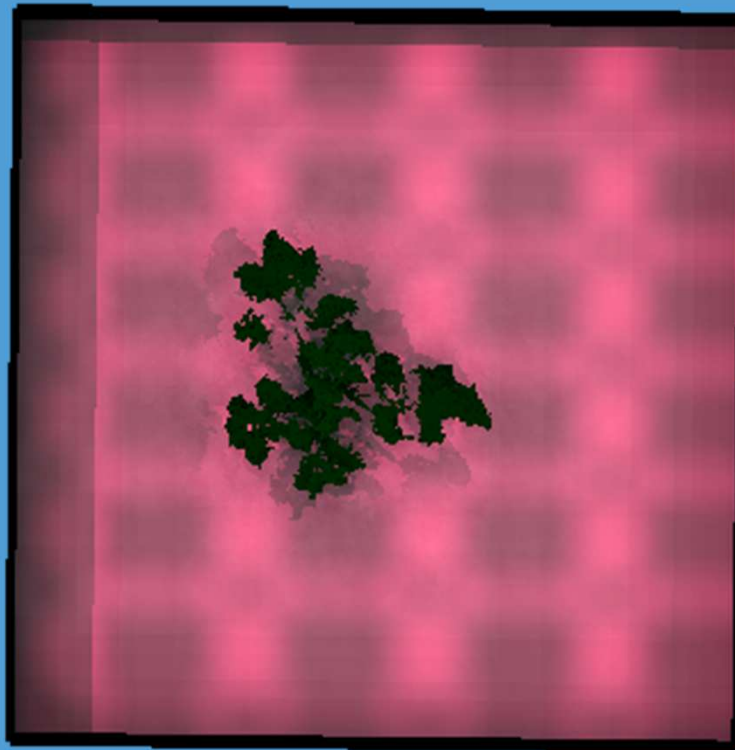
Nog vele toepassingen, zoals:  
Hijsbare goten, Guardian glas,  
Maai-robot, etc.



# Gescand genotype: simuleren licht onderschepping met 3D model



# Test gescande plant bij LED of SON-T



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Bedankt voor  
uw aandacht

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