Diffuse Light & Cucumber:

Optimization of sunlight

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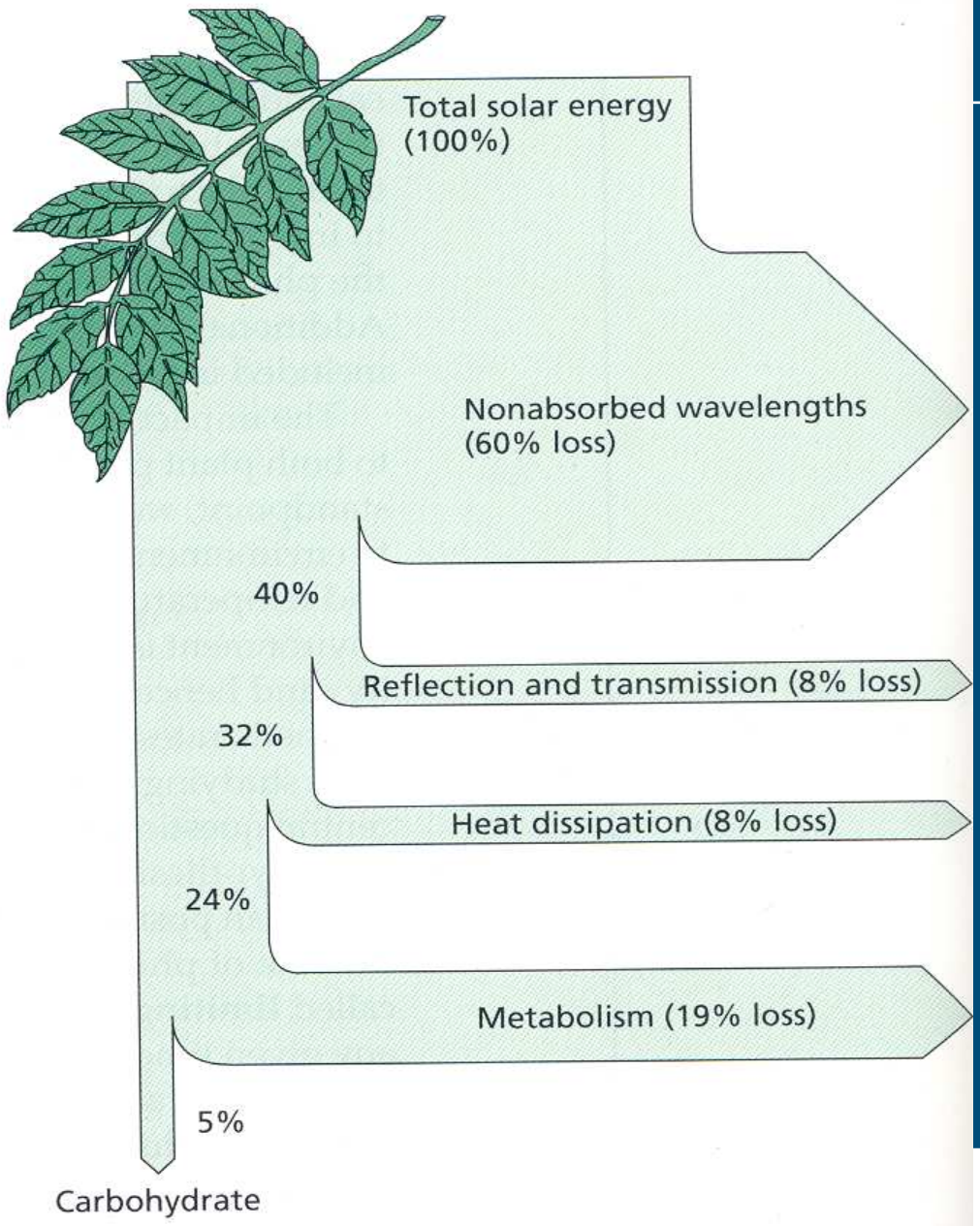
Light is the most important factor…

- Photomorphogenesis – red, far red, blue, UV (LEDs)
- Grow light – HPS, sunlight

- Assimilation lighting – expensive, be thrifty with sunlight

Efficiency of sunlight in terms of crop growth



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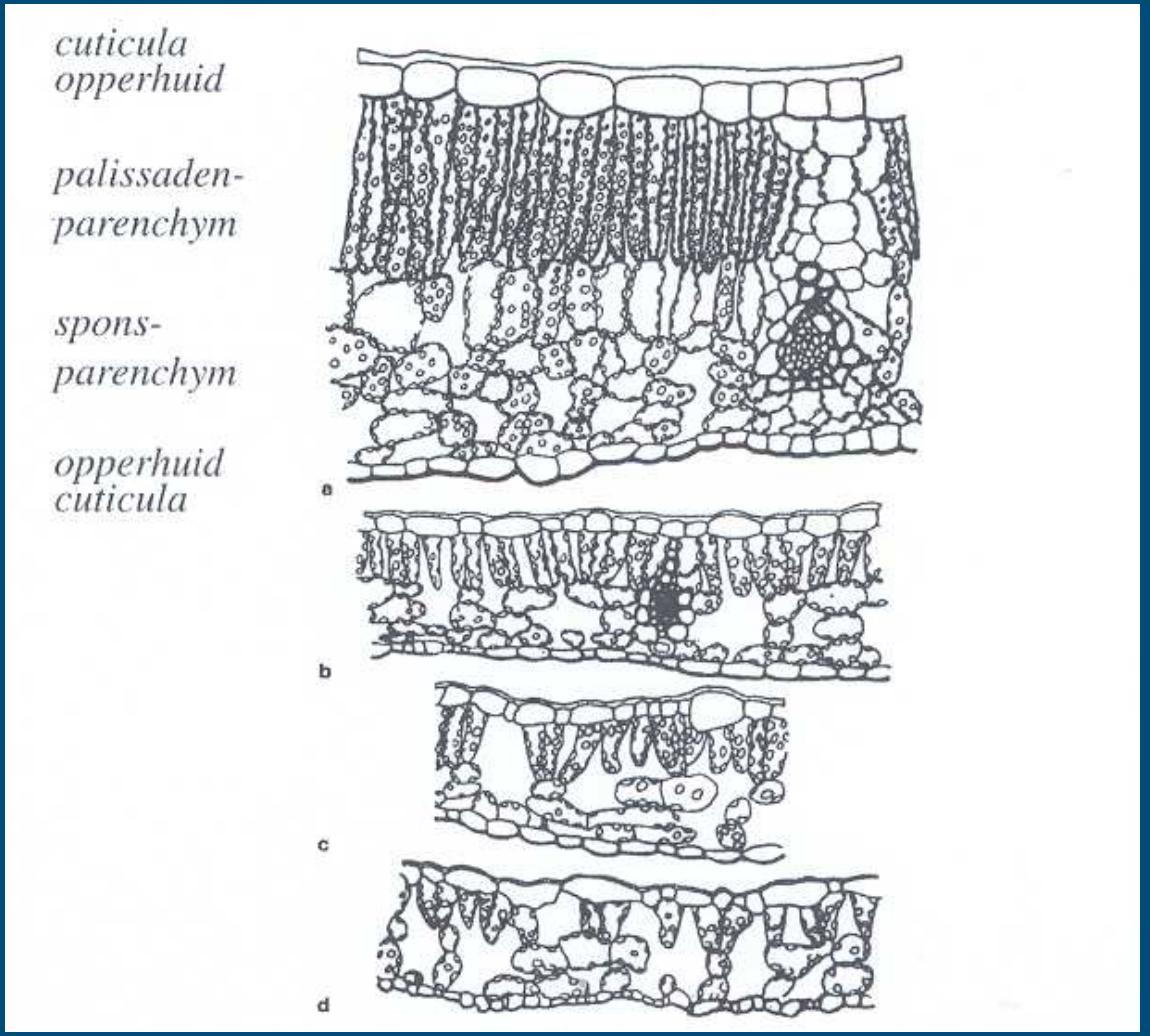
Leaf development and light

Sun leaf

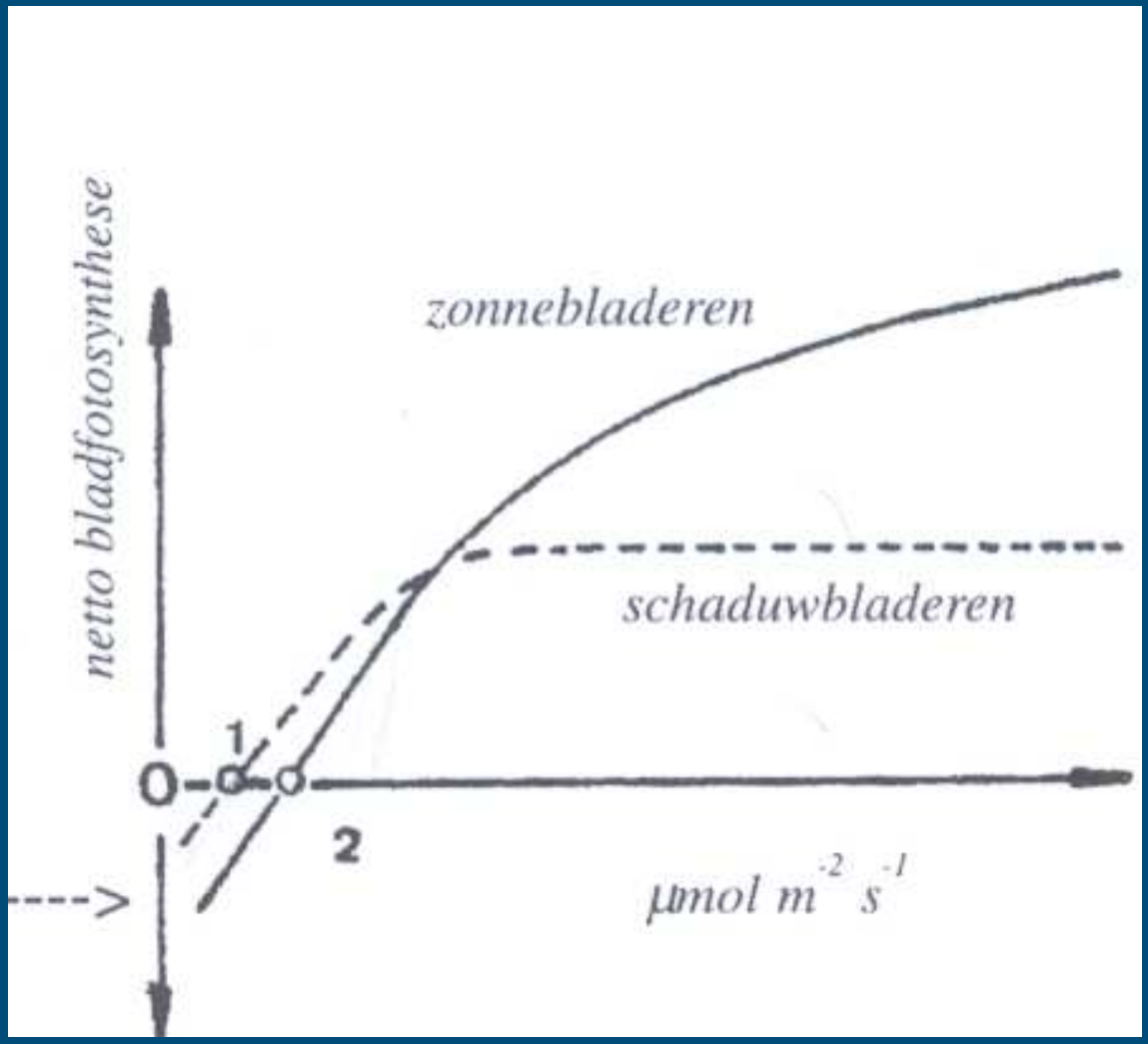
↓

↓

Shade leaf



Fotosynthesis capacity and light



Diffuse light – scattered light

Winter: on average 80% diffuse light

Summer: on average 60% diffuse light

Advantages:

- Homogenous light (no shadow)
- Better light penetration in the crop
- Less chance of light saturation
- Milder micro climate

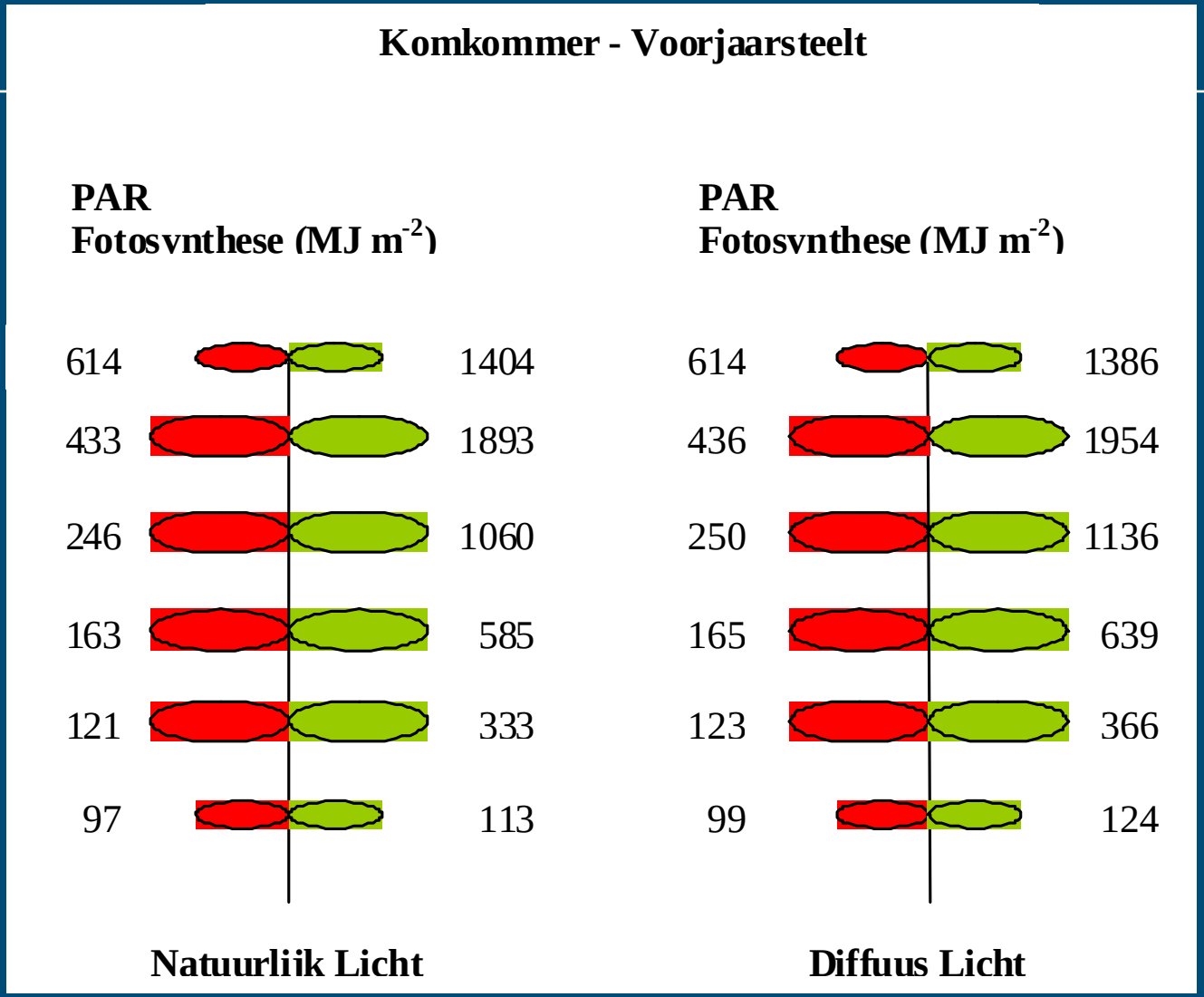
Theory

Annual basis:

Crop photosynthesis +4%

Production + 5.9%

+ 2.3 kg/m2



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Based on traditional crop

Diffuse Light – what does it look like?

Some greenhouse roof materials can scatter light, transforming direct light into diffuse light

50% 0%

Haze

Diffuse light and cucumber: 2008

Research questions:

- Can sunlight be better utilized under diffuse glass?
- Relationship haze ~ light transmission?
- Effect of greenhouse climate on production?

WUR Experimental Facilities in Bleiswijk

	Control	Low haze	High haze
Haze	0%	30%	70%
Transmission	83%	83%	80%

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First high wire crop to be tested

- Febr 15 to July 20
- Greenhouse climate
- Crop growth
- Crop physiology
- Production

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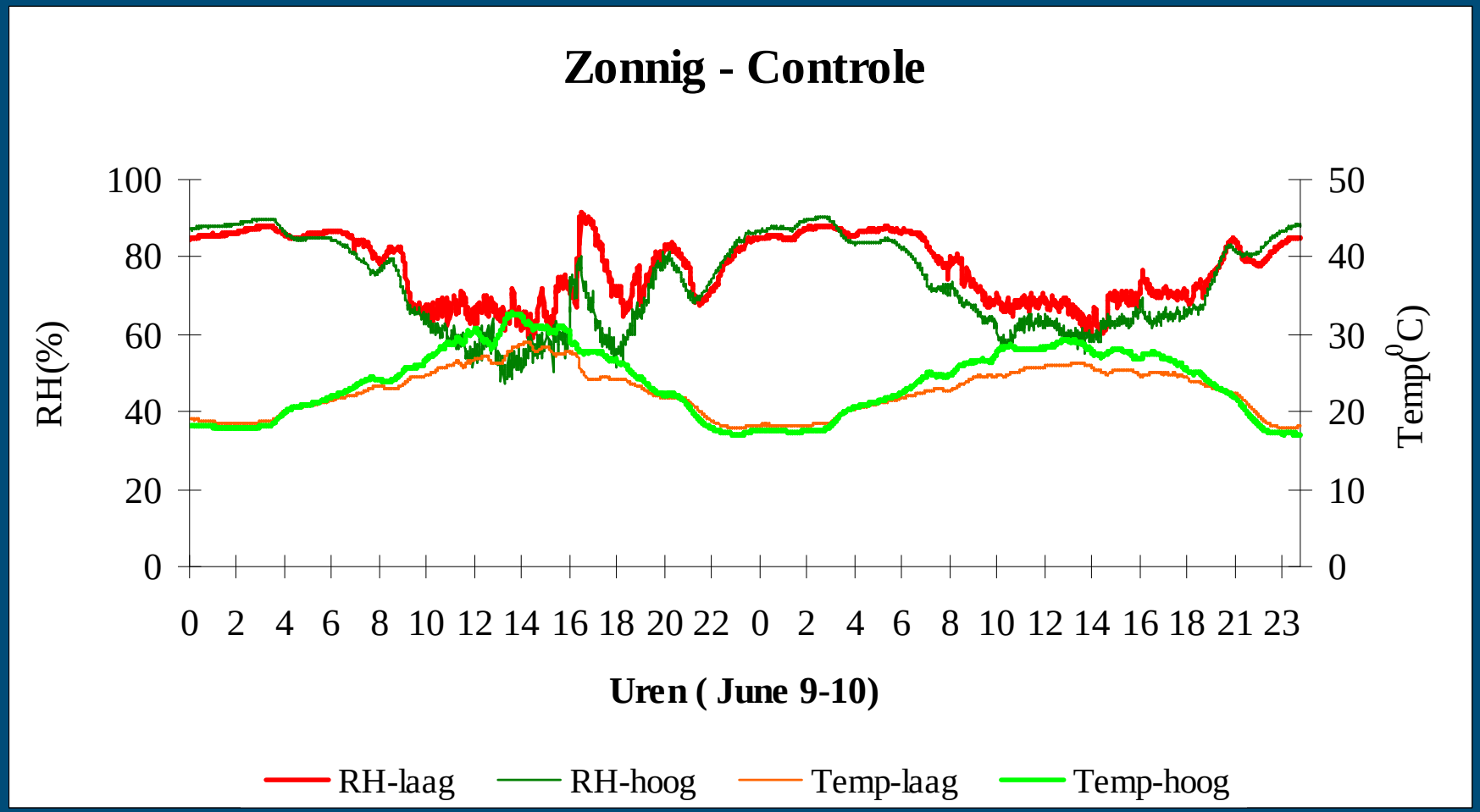
Example of (micro) climate on 2 sunny days



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Greenhouse climate – sunny days, high crop level

	Temperature (°C)	Humidity (%)
Control	29.8	59.2
Low haze	29.4	59.7
High haze	29.1	60.8

Crop physiology – leaf temp (°C), sunny days

	head	High in the crop	Low in the crop
Control	34.5	34.8	25.4
Low haze	32.8	34.4	24.7
High haze	32.4	33.7	24.6

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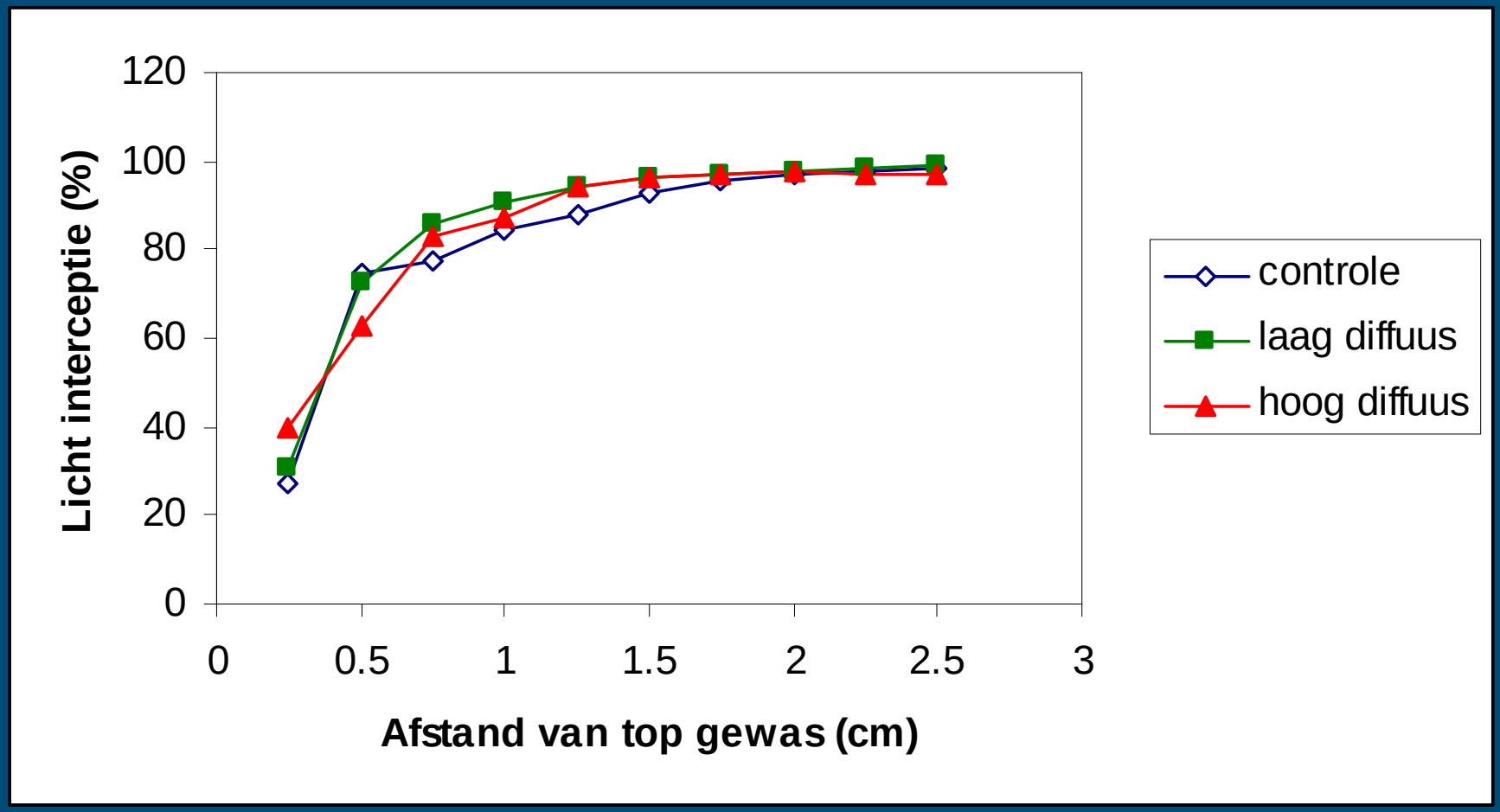
Crop growth - stem

	Stem length (cm/wk)	Stem diameter (mm)
Control	71	8.5
Low haze	67	8.8
High haze	68	8.7

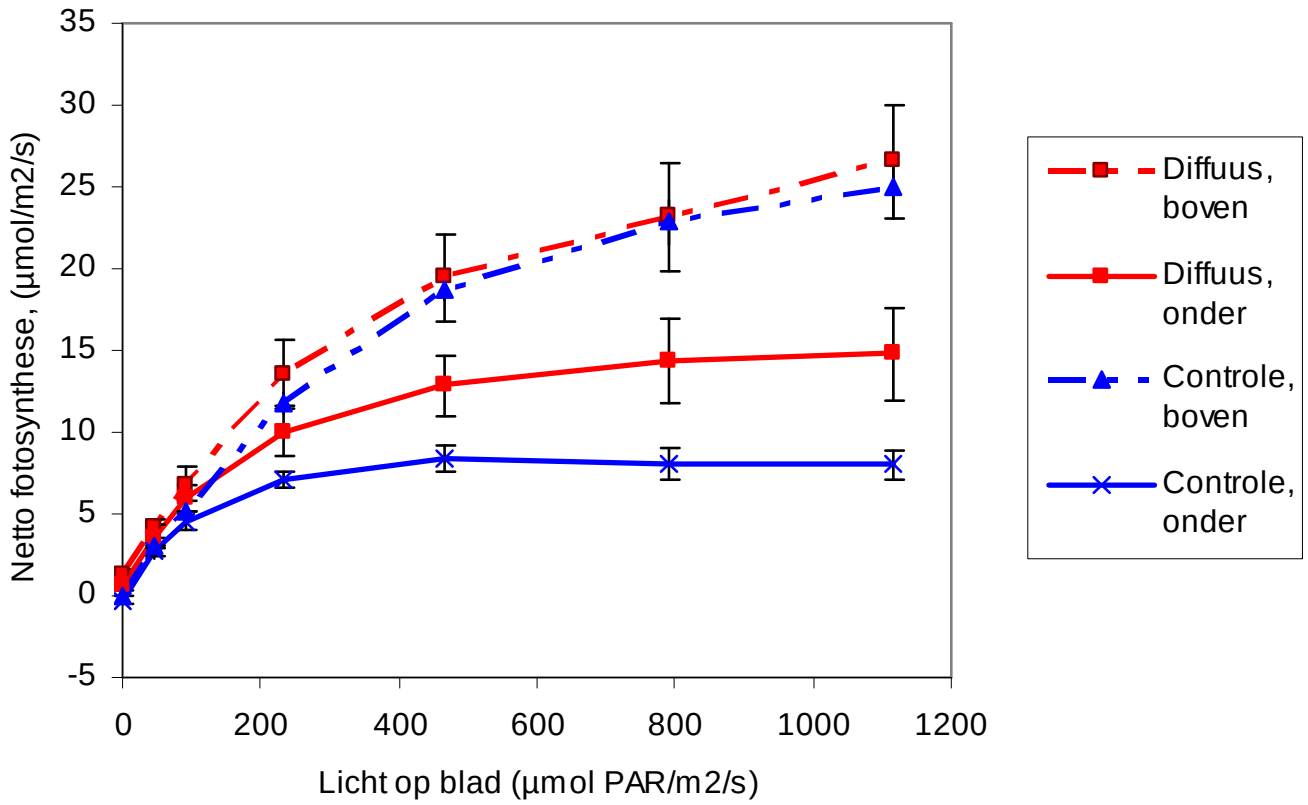
Crop growth - leaves

	Leaf development (#/wk)	LAI (m2/m2)	SLA (cm2/g)
Control	6.1	4.6	344
Low haze	5.7	4.2	338
High haze	5.9	4.1	322

Licht interception



Crop physiology – photosynthesis capacity



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Production – time of flowering to fruit harvest

	Wk 19-21 (days)	Wk 24-26 (days)
Control	15.5	16.3
Low haze	15.2	15.9
High haze	14.6	15.9

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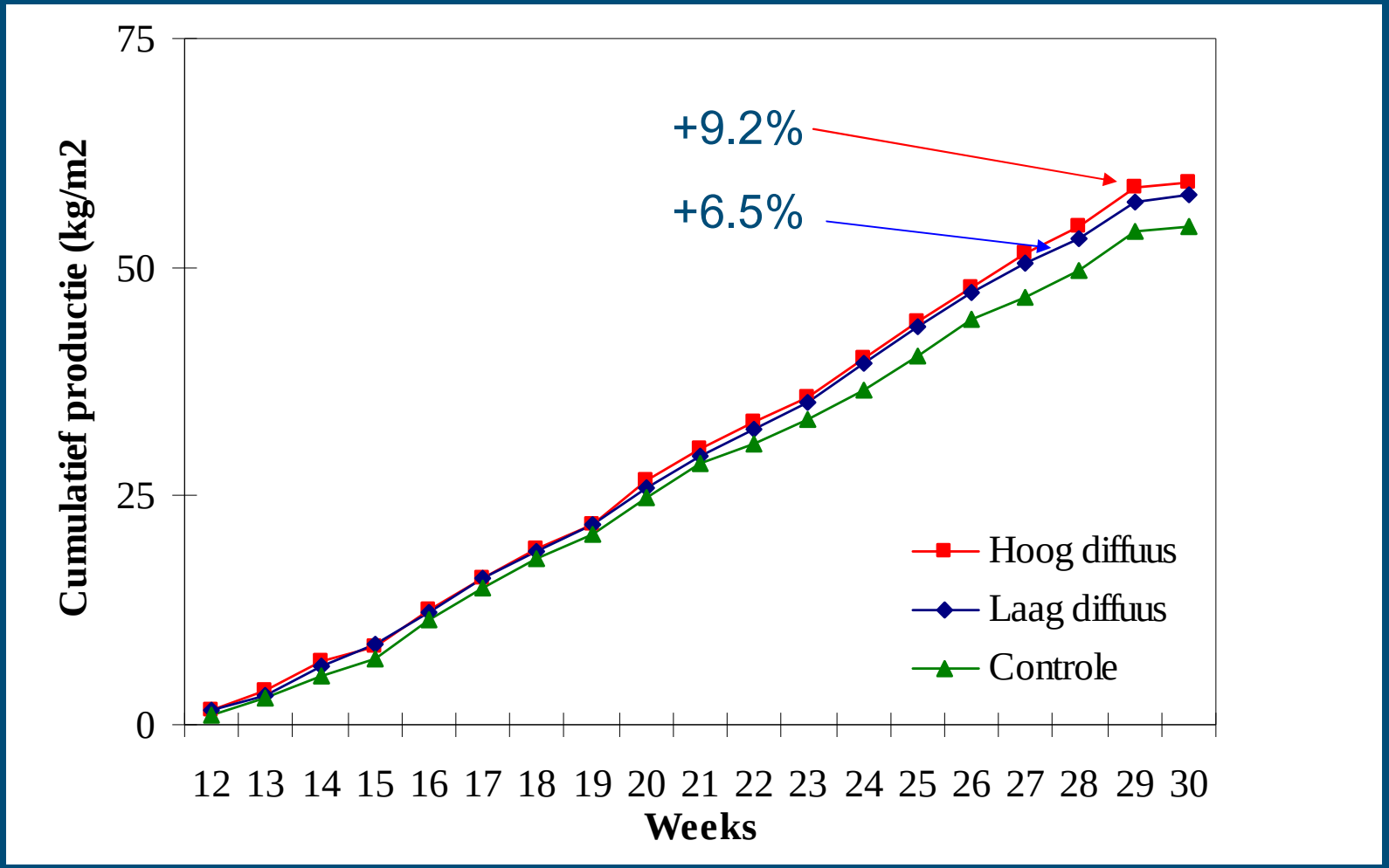
Production



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Summary production – first crop

	Fruit weight (g)	Production (kg/m2)	Production (#/m2)
Control	401.3	54.4	135.9
Low haze	412.4	57.9 (6.5%)	140.6 (+3.5%)
High haze	417.0	59.4 (9.2%)	142.9 (+5.2%)

Production 2008 – spring and autumn crops

Spring crop	Low haze	High haze
Kg/m2	+6.5%	+9.2%
Nr/m2	+3.5%	+5.2%
Autumn crop		
Kg/m2	+8.8%	+9.7%
Nr/m2	+5.3%	+6.1%

Conclusions

- Diffuse light resulted in:
  - Milder greenhouse climate
  - Changes in crop morphology
  - More light interception lower in the crop
  - Increase in photosynthesis lower in the crop
- Roof materials with higher haze -> increase in production
- Effect is highest on sunny days

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Thank you for your attention!

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