Assimilation lighting with LEDs: now possible?

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Advantages of LEDs (in horticulture)

- Efficiency (light without excess heat, lamps closer to crop)
- Less light pollution
- Intensity change via dimmers
- Physiological process steering via specific emission-spectra
- LEDs are small, easy to place and result in less shadow, have a longer lifetime

Marketing: some incorrect ideas re: LEDs

- LEDs are more efficient than HPS
- LEDs produce less heat
- Some parts of the (day light, HPS) spectrum is not utilized by plants, making LEDs more efficient
- Pulsed LEDs are more efficient

Use of LEDs in horticulture

- Grow light (high intensity artificial lighting)
- Photo-morphogenesis (lower intensity, specific colour)

2007: Is assimilation lighting possible in crops?

Red and blue separately

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Combination red and blue

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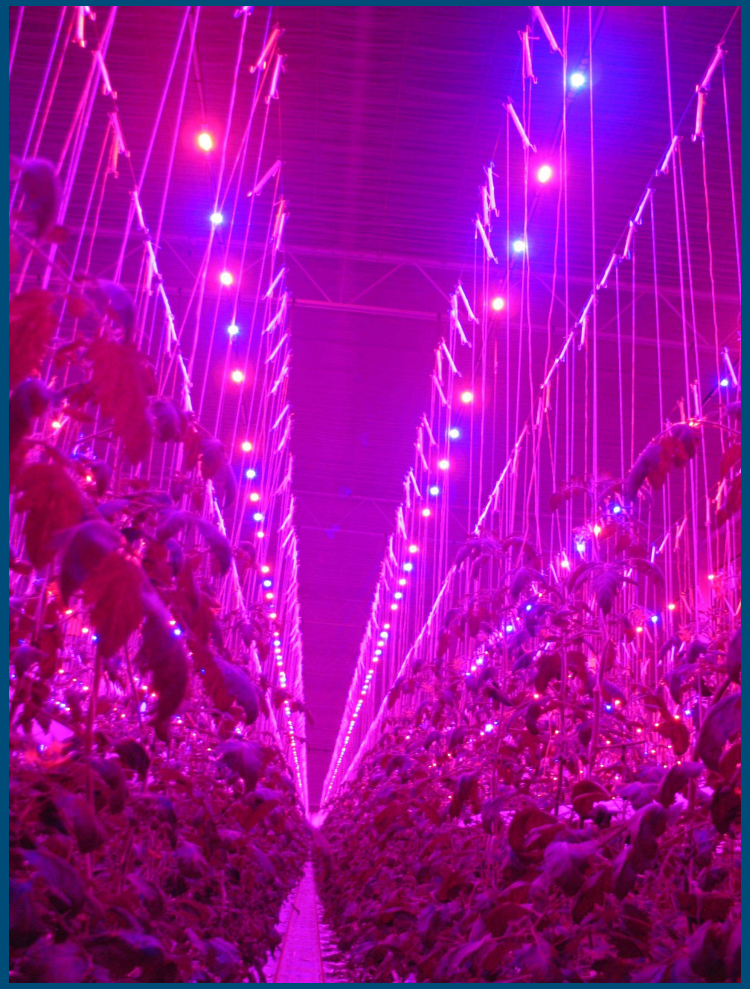
Indications from 2007/2008 research

- Crops can grow under red/blue LEDs (with sunlight)
- LEDs seem to improve crop morphology (bell pepper)
- Blue LEDs seem to influence fruit setting (bell pepper)
- LEDs 20 µmol ~ HPS 100 µmol: >20% production in tomato (in addition to sunlight)

Research in 2008/2009

- LEDs and tomato
  - Production, crop growth & morphology, energy budget (kg tomato/MJ greenhouse in)
- LEDs and bell pepper
  - Crop growth & morphology, fruit setting, water use, vertical greenhouse climate (temp, RH)
- LEDs and rose
  - Production, leaf colour i.r.t. light absorption, interlighting

LEDs above tomato



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Production

- LED treatment
  - 8000 m2 greenhouse, planted 5 december 2008
  - Intensity 92 µmol/m2/s
- SON-T treatments
  - 46000 m2 greenhouse, planted 4 october 2008
  - Intensity 182 µmol/m2/s

- Differences in crop physiology/age equalized and compared via crop growth model

Bell pepper, red LEDs

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Bell pepper, blue LEDs

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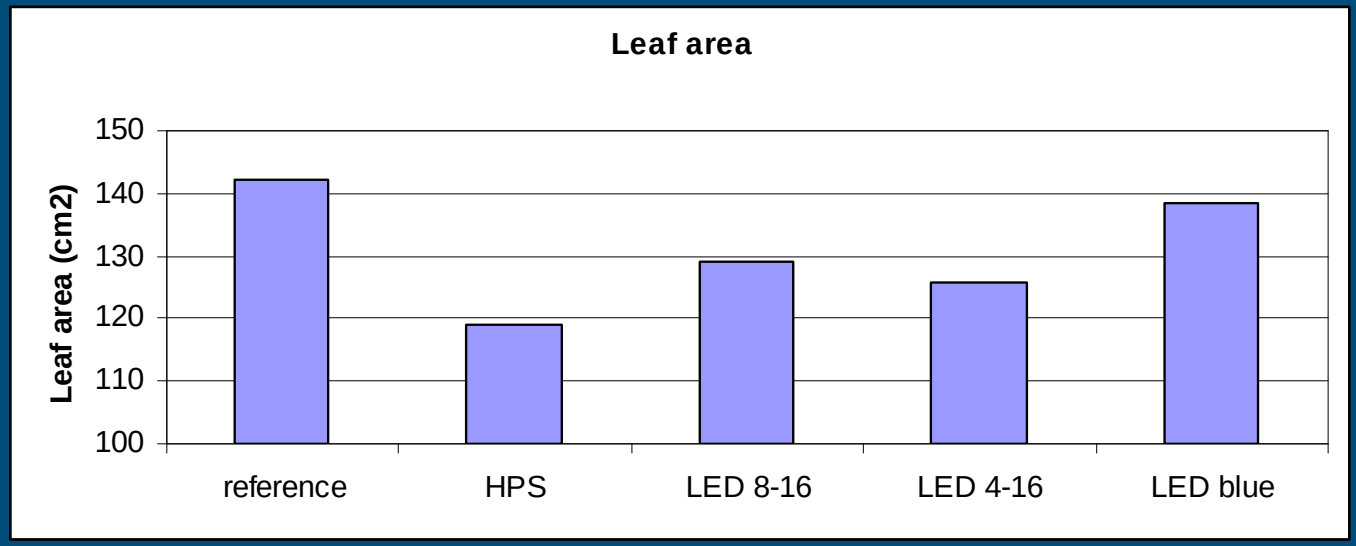
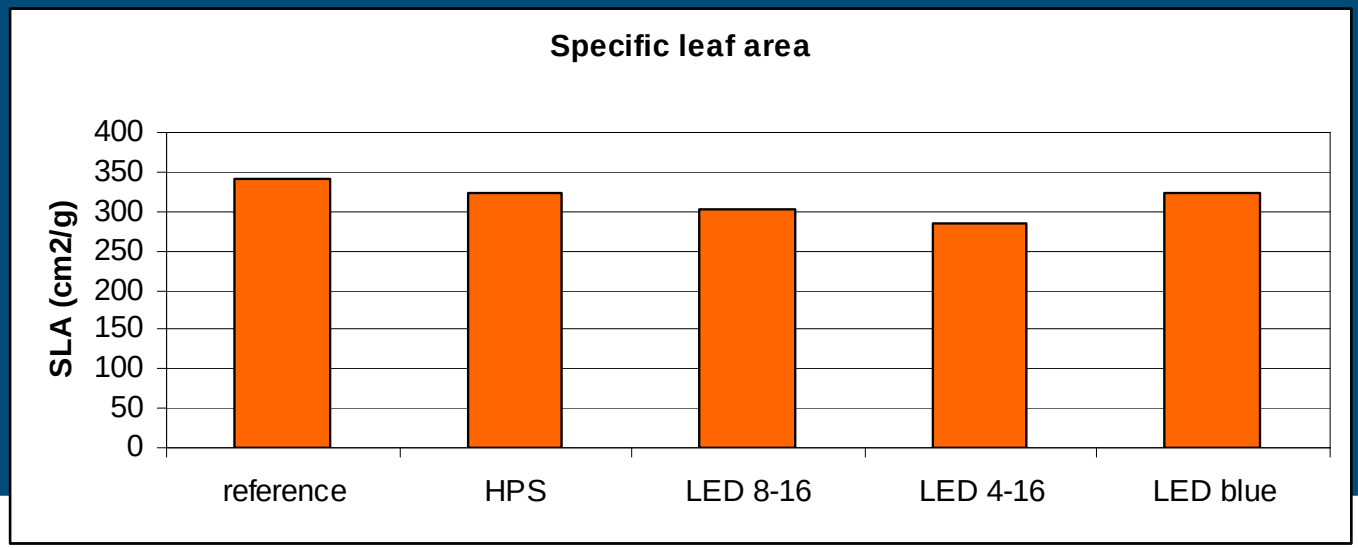
Observations with bell pepper

- First 2 months, young crop, possibly too much light
  - Change in morphology, compact crop, smaller dark green leaves (assmilate problem?)
- Production just started

Influence LEDs on leaf morphology

Differences in leaf area are larger than differences in leaf thickness





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LEDs and rose

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LEDs and rose

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Interlighting and rose

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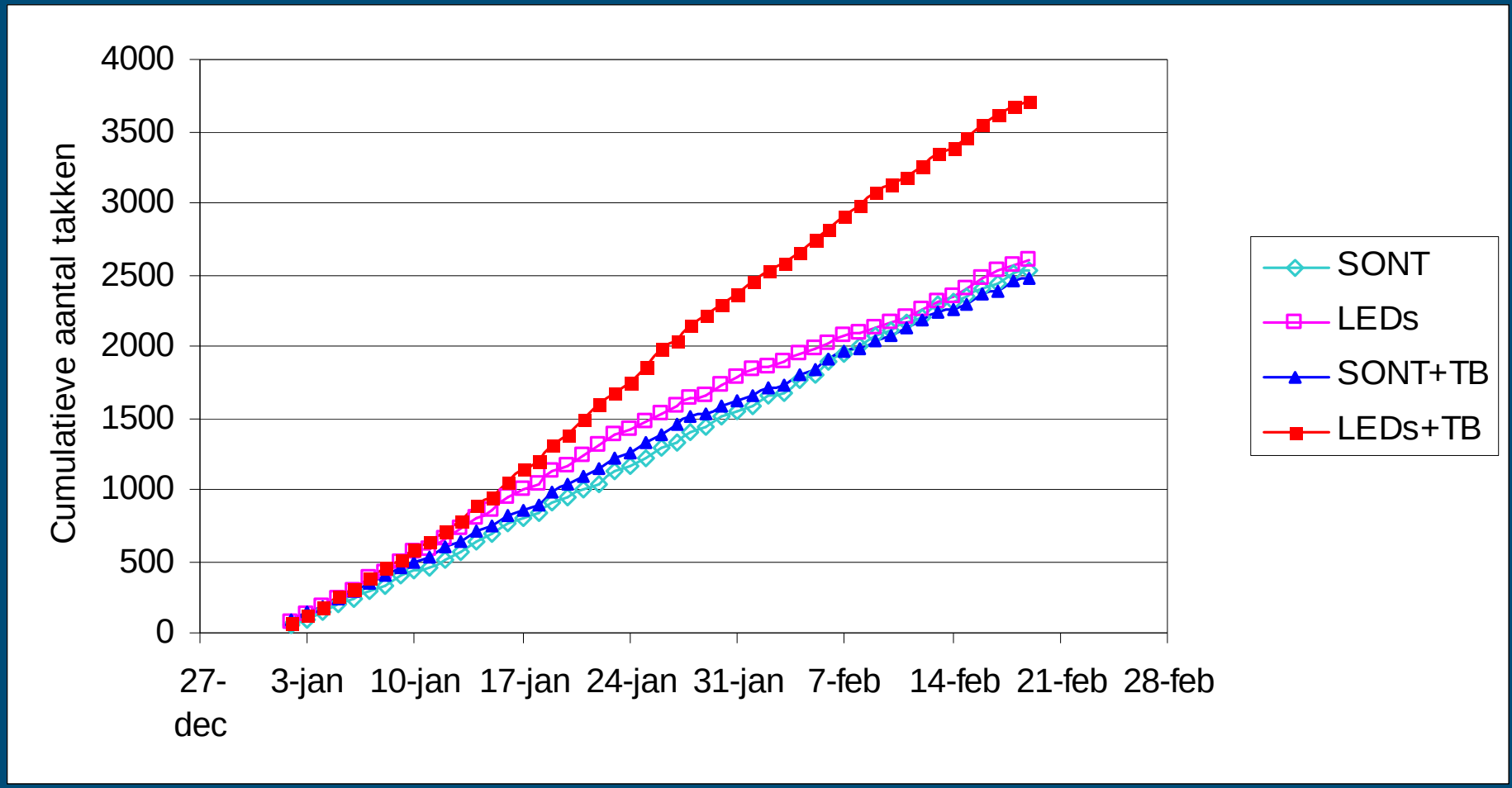
LEDs and rose

- Crop morphology
- Leaf colour i.r.t. light absorption and reflection
- Influence red light on bud break
- Flower quality

Production



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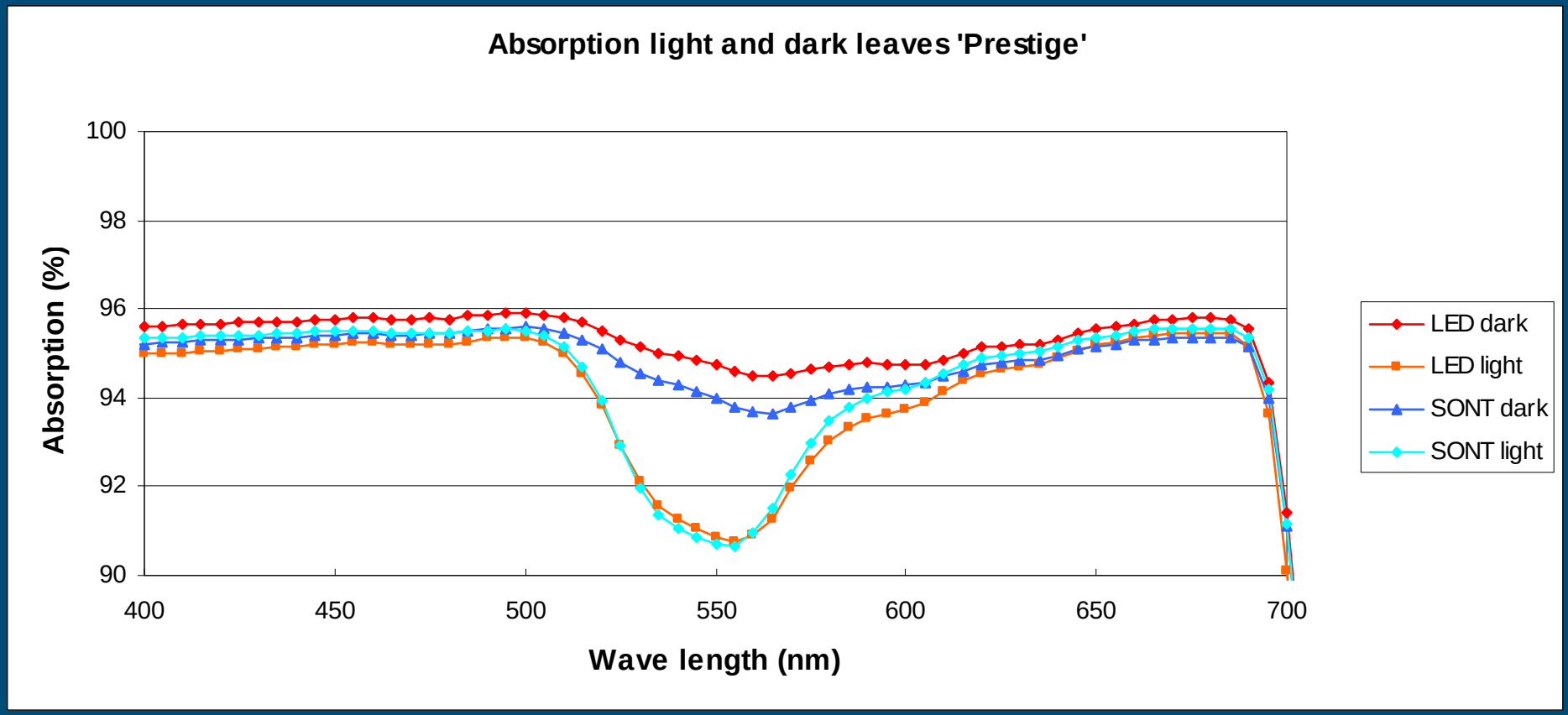
SON-T and LED-light absorption



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Is a red photon equal to a HPS foton?

- Experiment not yet begun
- Chrysanthemum growth (and flowering) under HPS and LEDs at high and medium light intensity
- In climate chamber without sunlight
- Parameters: photosynthesis, light use, growth, flowering, quality

Aims for 2008/2009

- Quantitative results
  - Production ~ light intensity
  - Effect red photon ~ white (HPS) photon in absence of daylight
  - Effect of LEDs (without excess heat) on crop growth and morphology
- Indications
  - Energy input ~ production
  - Effect LED-lighting on various aspects of growth, physiology and morphology in different crops

Thanks for your attention

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