



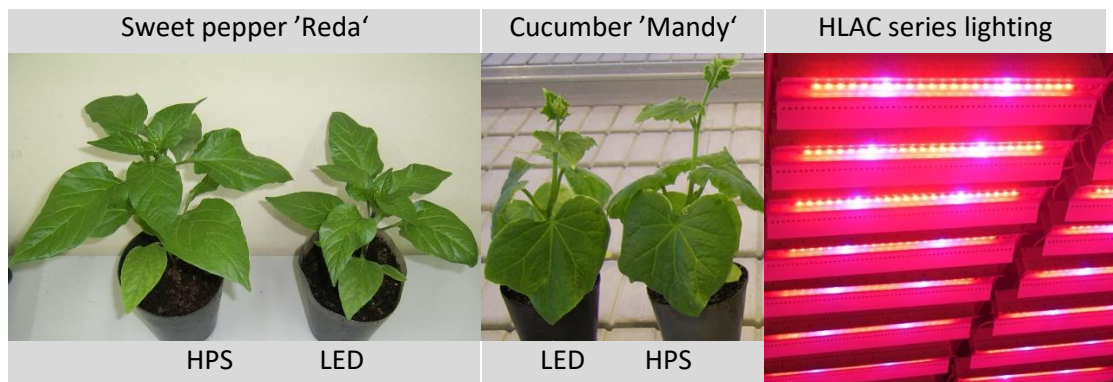
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## HLAC series lighting for vegetable transplants

HLAC series LED lighting units were designed as energetically more efficient displacement for high pressure sodium lamps. Their spectra consists of red and blue LEDs. The bi-component spectra is suitable for the most of greenhouse plants. Adding of other spectral components, like yellow, green, far red results in remarkably lower photon efficacy of the lighting unit ( $\mu\text{mol J}^{-1}$ ).

Experiments were performed in LRCAF Institute of Horticulture comparing HLAC series lighting unit and high pressure sodium (HPS) lamps, currently widely used in greenhouse horticulture for cucumber, tomato and pepper transplant cultivation (fig.1).

**Fig. 1.** Cucumber and sweet pepper transplants, grown under HLAC series LED lighting and High pressure sodium (HPS) lamps, when photosynthetic photon flux density was  $200 \mu\text{mol m}^{-2} \text{s}^{-1}$



**Table 1.** Biometric parameters of cucumber, sweet pepper and tomato transplants, grown under HLAC series LED lighting or high pressure sodium lamps.

| Biometric parameters            | Lighting in greenhouse |                   |
|---------------------------------|------------------------|-------------------|
|                                 | HPS                    | LED               |
| Cucumber 'Mandy' F1 transplants |                        |                   |
| Hypocotyl height, cm            | 3,1±0,4                | 3,1±0,2           |
| Hypocotyl diameter, cm          | 0,5±0,00               | 0,5±0,00          |
| Plant height, cm                | 30,7±1,4               | <b>12,6±0,5</b>   |
| Leaf number, vnt.               | 7,3±0,1                | 6,5±0,2           |
| Leaf area, cm <sup>2</sup>      | 738,9±70,1             | <b>612,4±55,1</b> |
| Green weight (aboveground), g   | 26,0±1,3               | 22,0±2,6          |
| Root green weight, g            | 6,02±0,9               | 6,01±1,2          |
| Sweet pepper 'Reda' transplants |                        |                   |
| Hypocotyl height, cm            | 1,3±0,1                | <b>1,1±0,1</b>    |
| Hypocotyl diameter, cm          | 0,41±0,01              | 0,42±0,01         |
| Plant height, cm                | 15,9±0,3               | 12,34±0,2         |
| Leaf number, vnt.               | 11,6±0,1               | 11,2±0,2          |
| Leaf area, cm <sup>2</sup>      | 325,1±16,2             | <b>235,5±19,8</b> |
| Green weight (aboveground), g   | 10,13±1,54             | <b>8,09±0,69</b>  |
| Root green weight, g            | 4,86±0,70              | 4,88±0,88         |



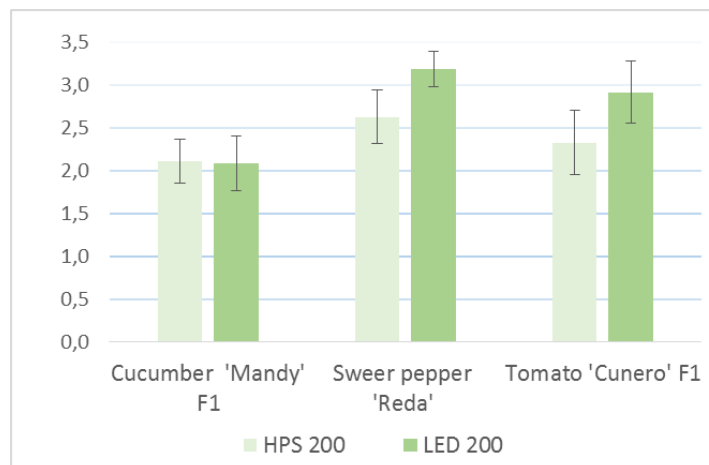
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| Tomato 'Cunero' F1 transplants |            |                   |
|--------------------------------|------------|-------------------|
| Hypocotyl height, cm           | 3,2±0,2    | 3,0±0,2           |
| Hypocotyl diameter, cm         | 0,48±0,01  | 0,48±0,01         |
| Plant height, cm               | 26,3±0,9   | <b>15,58±0,3</b>  |
| Leaf number, vnt.              | 5,9±0,2    | 5,6±0,1           |
| Leaf area, cm <sup>2</sup>     | 464,8±54,9 | <b>350,6±74,2</b> |
| Green weight (aboveground), g  | 7,68±1,1   | 7,14±1,0          |
| Rootgreen weight, g            | 2,7±0,32   | 3,1±0,44          |

a – significantly higher, b – significantly lower, when  $p \leq 0,05$

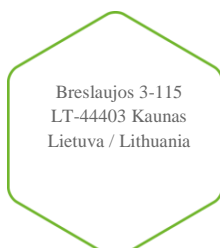
It was determined, that vegetable transplants raised under HPLS and HLAC series LED lighting were of equal quality. Transplants, raised under red and blue LED light were less elongated, however, leaves also were smaller, what resulted in less of total plant leaf area (table 1). In cucumber and sweet pepper transplants, it resulted in reduced aboveground biomass and in tomato, green biomass remains the same even at smaller leaf area (thicker leaves). These HLAC LED lighting effects determines the compact morphology of transplants, however despite the smaller leaf area, high ratio of photosynthetic pigments and intense photosynthesis are preserved.

**Fig.2.** Ratio of photosynthetic pigments (chlorophyll a/b) in the leaves of vegetable transplants, raised under HLAC series LED or HPS lighting.



## Conclusions

- Transplants, raised under HLAC LED and HPS lighting at the same photosynthetic photon flux density ( $200 \mu\text{mol m}^{-2}\text{s}^{-1}$ ) were of equal quality, however energy consumption under LEDs was significantly lower.
- HLAC series LED lighting results in less elongation, compared to HPS lighting, however, weak inhibiting light effect on leaf area formation was observed.
- In cucumber and sweet pepper transplants, reduction in total leaf area is associated with slight reduction in biomass, however in tomato, due to bigger specific leaf weight value, this inhibiting effect did not occur.



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## Methods

Experiments were performed in 2014 November – December at LRCAF Institute of horticulture, industrial greenhouses. The objective of investigations – transplants of cucumber 'Mandy' F1, sweet pepper 'Reda' and tomato 'Cunero' F1. Transplants were cultivated in plastic pots, filled with peat substrate (pH 6–6,5, contains fertilizer PG MIX (NPK 14-16-18; 1,3 kg/m<sup>3</sup>). 16 h photoperiod, ~22/18°C day/night temperature and 60-70 proc. relative air humidity was maintained. Natural background lighting was supplemented with HLAC series lighting at 200  $\mu\text{mol m}^{-2}\text{s}^{-1}$  or high pressure sodium lamps for reference (HPS, Son-T Agro 400 W, Philips). After the experiment, biometric measurements performed, the contents of photosynthetic pigments were determined by spectrophotometric methods.

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## References:

Bagdonavičienė A., Jaankauskienė J., Brazaitytė A., Duchovskis P., Novičkovas A., Dabašinskas L. 2014. COMPARISON OF LIGHT-EMITTING DIODES AND HIGH-PRESSURE SODIUM LAMPS ON CUCUMBER TRANSPLANTS GROWN IN DIFFERENT SUBSTRATES (In Lithuanian). Sodininkystė ir daržininkystė, 33 (1-2):61-73.

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Bagdonavičienė A., Jaankauskienė J., Brazaitytė A., Duchovskis P., Novičkovas A., Dabašinskas L. 2014. LIGHT EMITTING DIODES AND HIGH PRESSURE SODIUM LAMPS LIGHTING EFFECTS ON TOMATO TRANSPLANTS GROWN IN DIFFERENT SUBSTRATES (In Lithuanian). Sodininkystė ir daržininkystė, 33 (1-2): 39-51.

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