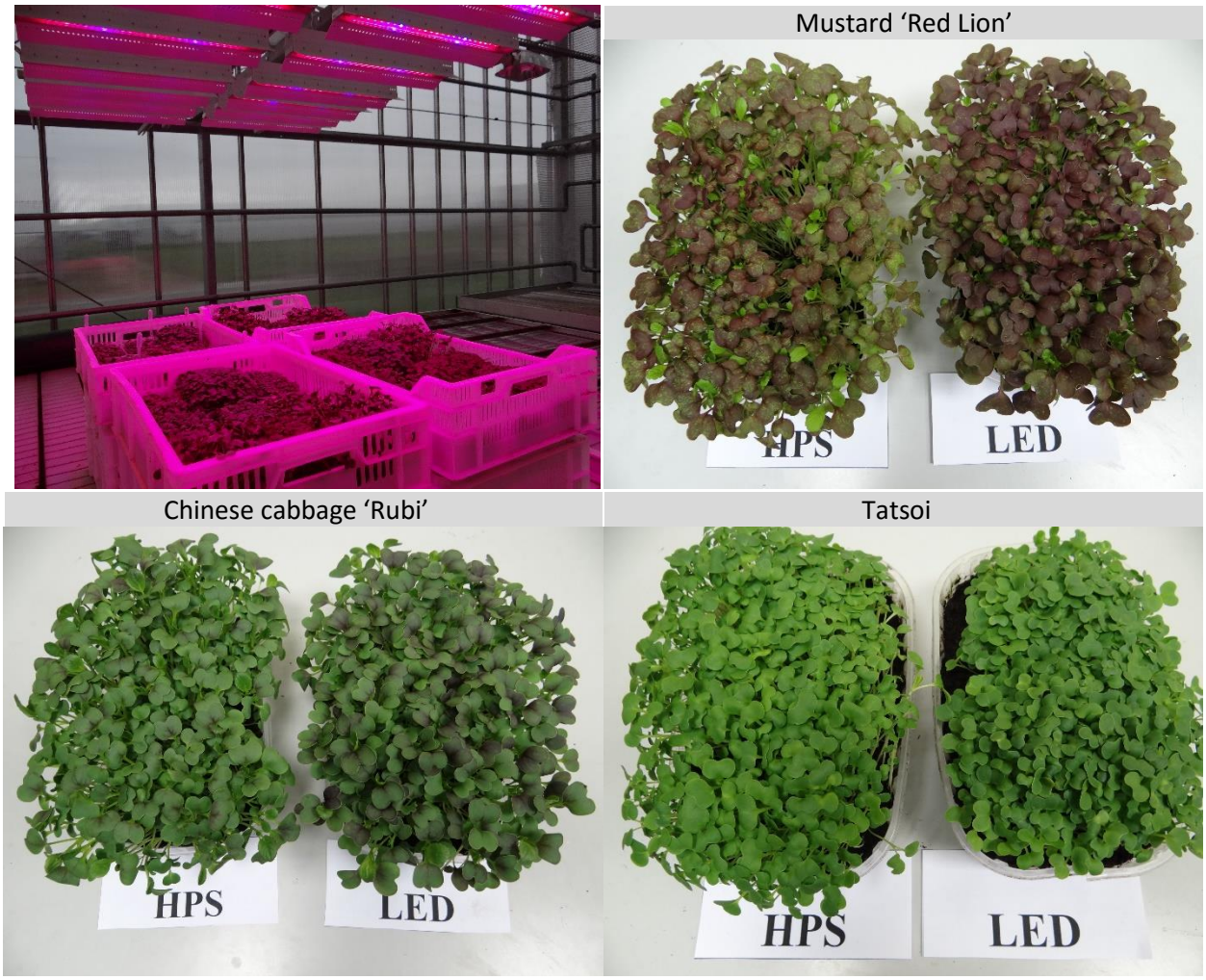
HLAC series lighting for microgreens

HLAC series LED lighting is adapted for different plant cultivation in greenhouse and growth chambers. On the basis of experience and research of LRCAF Institute of Horticulture, this solid-state lighting unit was designed and it‘s spectra is optimal for high internal and external quality of microgreens.

Fig 1. Microgreens of different varieties, raised under HLAC series LED or high pressure sodium (HPS) lighting, photosynthetic photon flux density - 200 µmol m^{-2} s^{-1}



According to the results of experiments, performed in November, 2013, HLAC series LED light spectra inhibited excess elongation of microgreen hypocotyls, resulted in higher cotyledon area, but it had no significant effect on their green weight (Fig.1, table 1).

Led lighting affected different microgreen varieties unequally (Fig 2.). Tatsoi, which is more sensitive to light and other environmental factors, cultivated under HLAC series LED lamps, accumulated higher contents of ascorbic acid, however contained lower contents and sucrose, lower free radical scavenging activity, what correlates with lower contents of phenolic

Breslaujos 3-115
LT-44403 Kaunas
Lietuva / Lithuania

phone +370 37 401978
cell +370 698 87770

info@hortiled.lt
www.hortiled.lt

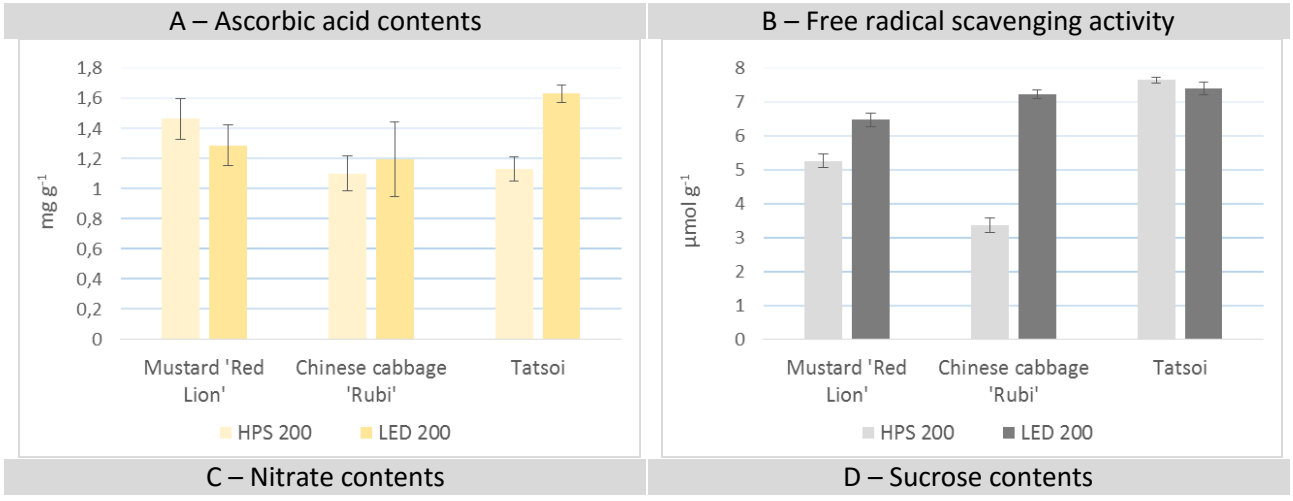
compounds. In the mustard and Chinese cabbage, which are more resistant to environment, accumulated high level of sucrose, possessed higher antiradical activity that reflects the higher nutritional value and taste properties. Worth to mention, that microgreens, cultivated under HLAC series LEDs, contained 32-40% lower contents of nitrates, as compared to microgreens, raised under HPS lamps.

Table 1. Biometric parameters of microgreens, cultivated under HPS or HLAC series LED lighting in greenhouse.

Biometric parameters	HPS 200	LED 200	$R_{0,5}$
Mustard 'Red Lion'			
Height, cm	6,26	**4,95**[b]	0,41
Leaf area, cm^2	1,67	**2,12**[a]	0,27
Green weight, g	0,071	0,058	0,02
Chinese cabbage 'Rubi'			
Height, cm	7,08	**5,47**[b]	0,46
Leaf area, cm^2	2,31	2,47	0,34
Green weight, g	0,094	0,071[b]	0,012
Tatsoi			
Height, cm	6,13	5,95	0,76
Leaf area, cm^2	1,44	**1,88**[a]	0,21
Green weight, g	0,056	0,056	0,010

a – significantly higher, b – significantly lower than HPS 200; when p≤0,05.

Fig 2. Biochemical parameters of microgreens, raised under HPS or HLAC series LED lams, photosynthetically active photon flux ~200 µmol m^{-2} s^{-1}. Results are presented in green weight.



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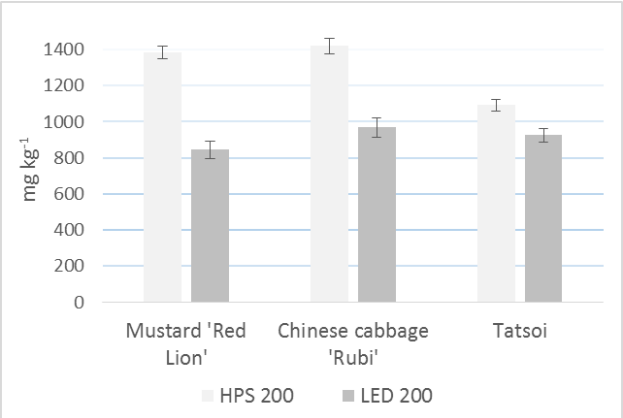

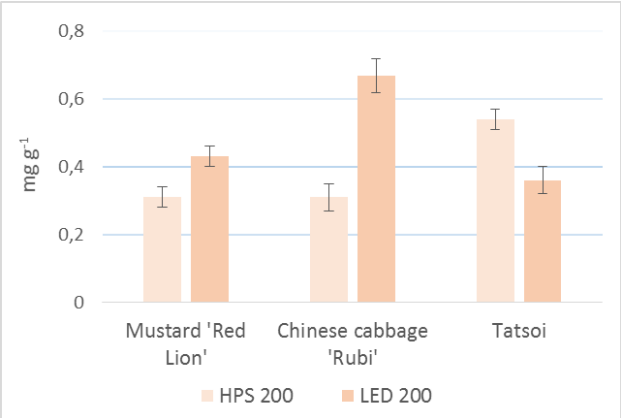

Conclusions

- HLAC series LED lighting is suitable for microgreen cultivation in greenhouses and growth chambers.
- 200 µmol $m^{-2}s^{-1}$ photosynthetic photon flux density is high enough for qualitative microgreen cultivation.
- HLAC series LED lighting resulted in reduced elongation and bigger leaf area formation due to high (~20%) percentage of blue light in its spectra.
- The nutritional value of vegetable microgreens, more resistant for environmental factors, is significantly higher, when cultivated under HLAC LED lighting, when in microgreens, more sensitive for environment, slight antioxidant metabolite imbalance might occur.

Methods

Mustard ‘Red Lion’, Chinese cabbage ‘Rubi’ and Tatsoi were cultivated in plastic V-type greenhouse, in plastic trays with neutralized peat substrate PG miv, for 11 days form sowing. Day/night temperature was maintained ~21/17±2°C, sprayed with tap water, when necessary.

HLAC series LED lighting units were used for supplemental illumination from sowing time at photosynthetic photon flux density of 200 µmol m^{-2} s^{-1}. High pressure sodium lighting (HPS; Son-T Agro, Philips), 200 µmol m^{-2} s^{-1} flux density was used for reference.

10 occasionally selected plants, suitable to represent the treatment were used for biometric analysis. For biochemical analysis, the conjugated biological sample from representative plants was prepared. Ascorbic acid, DPPH free radical scavenging activity were determined b spectrophotometric method. Nitrate contents – by potentiometric method, using nitrate selective electrode. Sucrose contents- by HPLC method. Results are presented as the average ±standard deviation.

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Source:

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