LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY

The role of LED illumination intensity for improved iron and zinc uptake in microgreens

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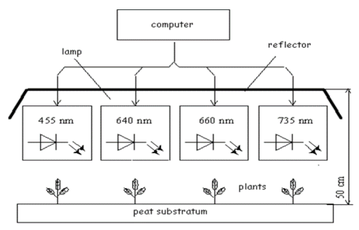
Introduction. Mineral nutrients are inorganic elements found in food which cannot be synthesized in human body. Trace elements such iron and zinc are essential for living cells, metabolism processes and immune system. Light intensity thought to be one of the environmental factors which influence the uptake of mineral elements in leafy vegetables, including microgreens. This study was aimed to evaluate the role of light intensity produced by solid-state light-emitting diodes (LED) on the absorption of iron and zinc in microgreens.

Materials and methods. Radish (*Raphanus sativus*, 'Rioja Improved'), beet (*Beta vulgaris*, 'Bulls Blood') and basil (*Ocimum basilicum* L., 'Sweet Genovese' ir 'Dark Opal') microgreens were grown in growth chambers for 12, 15, 20 days, respectively, from sowing till harvest. The average amounts of nutrients (mg L^{-1}) according produces in the substrate were as follows: N, 110; P_2O_5, 50; K_2O, 160 and other elements Ca, 91; Mg, 9; Na, 1; S, 5; Fe, 4; Mn, 0.2; Cu, 0.1; B, 2; Zn, 0.1. Electrical conductivity was 0.5–0.7 mS cm_{-1}. Day/night temperatures of 21 ± 2/17 ± 2 °C were established with a 16-h photoperiod and a relative air humidity of 50–60%. A system of five high-power, solid-state illumination modules with common blue 445-, red 640-, 660- and far-red 735-nm LEDs was used for lighting treatments. The total photosynthetic photon flux densities (PPFD) of LEDs modules were set at 100-, 200-, 300-, 400- and 500 ± 20 µmol m^{-2} s^{-1}. The spectrometric ICP-OES method was used to determine the concentrations of iron and zinc in plants. Values are expressed as mean ± standard error; a - values are significantly (P ≤ 0.05) higher than average; b - values significantly (P ≤ 0.05) lower than average.



Lighting module with the main set of 445-, 640-, 660 and 735 nm LEDs

Results

Basil 'Dark Opal'

Basil DO https://microgreenssf.com/products/dark-opal-basil

Basil 'Sweet Genovese'

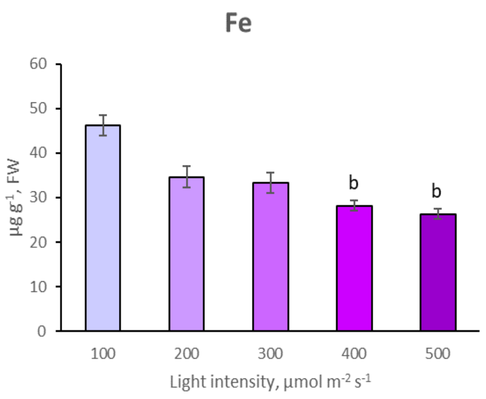
https://www.fruitionseeds.com/shop/featured/microgreens-featured/organic-genovese-basil-for-microgreens/

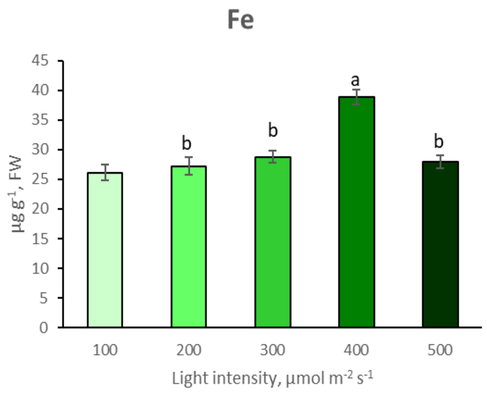
Beet

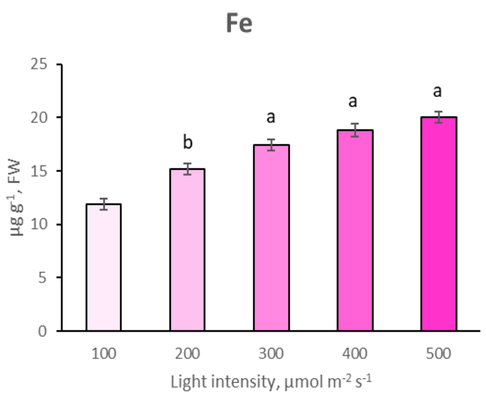
https://homemicrogreens.com/growing-beet-microgreens/

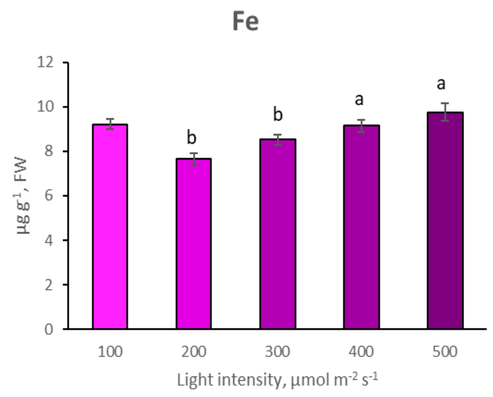
Radish

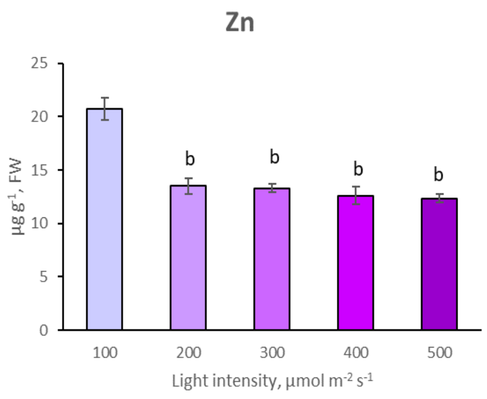
http://www.truleaf.co.uk/

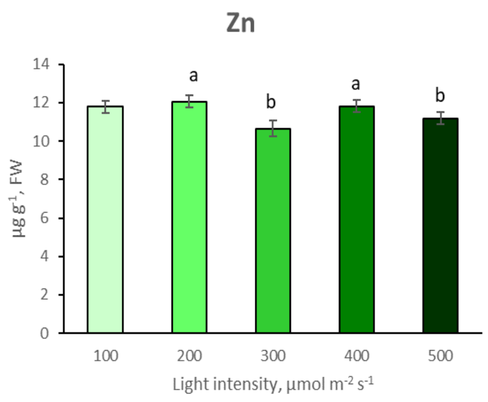


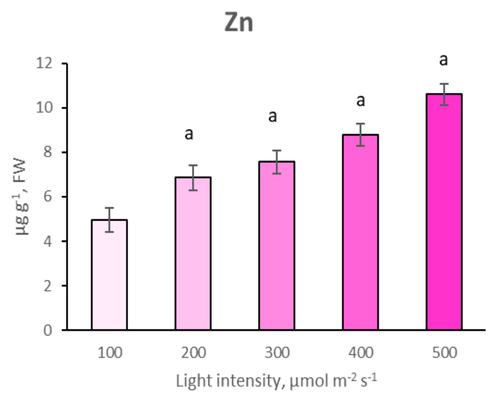


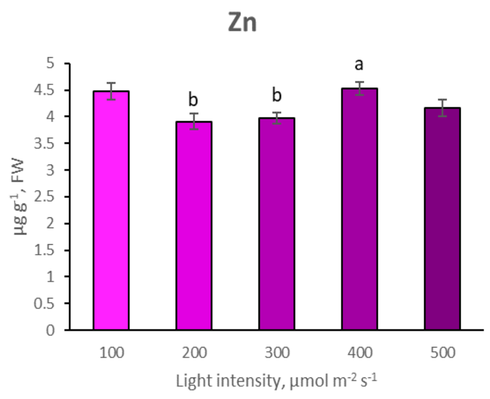












Conclussions. The results revealed that the role of LED illumination intensity for iron and zinc uptake in microgreens was depended on their species and variety. The lowest light (100 µmol m^{-2} s^{-1}) intensity of LED modules resulted in the highest content of iron in 'Dark Opal' basils, but in 'Sweet Genovese' the content increased due to 400 µmol m^{-2} s^{-1} PPFD. Light intensity effect on zinc uptake in basil 'Dark Opal' was similar as for Fe, but in 'Sweet Genovese' clear trend was not observed. For beet microgreens, the contents of investigated microelements were greater because of intensified LED illumination. 100 µmol m^{-2} s^{-1} and/or 400 – 500 µmol m^{-2} s^{-1} intensity resulted in positive effect on Fe and Zn content in radish microgreens.

Acknowledgement. This project has received funding from the Research Council of Lithuania (LMTLT), agreement No. S-MIP-19-2.