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Effect of supplementary lighting on quality of tomato plant (*Solanum lycopersicum* L.) in autumn-winter cultivation

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetables. In Poland tomato is main vegetable species grown in greenhouses. In the world tomato is the most often consumed as fresh. It is appreciated for it's beneficial effects on the human body, especially for heart diseases.

The light is one of the most important factors influencing chemical compounds concentration and physical properties in higher plants. Fruits lighted by direct light have higher levels of nutritious substances and secondary metabolites, so it may be useful to supplement or replace traditional method of lighting in greenhouses by LED lamps, which are the source of blue and red light. Those lamps emit light radiation spectrum consisting of a selected wavelength adjusted to the absorption spectrum of chlorophyll a and b, which leads to increase of the photosynthetic system efficiency and synthesis of primary and secondary metabolites. Certain wavelength and light quality promotes various benefits for plants. The blue and red light promotes the plants growth, also increases the content of fresh and dry weight. LED lamps also allow promoting or inhibiting the growth of roots and stems, and influence the flowering.

MATERIAL AND METHODS

The research was carried out in autumn-winter period in late 2011 and early 2012. The effect of HPS and LED lamps supplementary lighting on physical and chemical properties of tomato fruits cultivars 'Komeett F1' and 'Starbuck F1' was investigated. Used lamp types had similar level of light output, but LED lamps had lower power consumption. Both lamp types had the average light intensity of 100 µmol m^{-2} s^{-1} at the 1m distance from lamp in 60 cm wide strip over the table. The lamps were automatically switched on when the natural light intensity was below 175 W m^{-2} and switched off when the natural light intensity was above 225 W m^{-2}. Plants growing under natural light conditions were used as a control. Seeds were sown in early August and after five weeks seedlings were planted into the greenhouse. During the harvest cycle, fruit weight and marketable yield were determined, while the quality parameters (dry matter, total sugars, phenolic acids and carotenoids content, firmness and CIE L*a*b system) were determined on three sampling dates. Samples for chemical analysis were obtained at: December 13th, January 4th, and February 8th, close to the end of cultivation.

Statistical analysis was done with the ANOVA using the multiple Tukey's test at the significance level $\alpha = 0.05$.

RESULTS

The CIE L*a*b system from 15th has shown that supplementary lighting by LED lamps increase content of component a*(red color) and b* value (yellow color).

The LED lamps positively affected on L* value (lightness) and b* value in tomato fruits harvested in December and January.

Both types of lamp significantly affected firmness of investigated fruits, particulary in 4th January and 11st February . Supplementary lighting by HPS lamps led to synthesis and higher accumulation of phenolic acid.

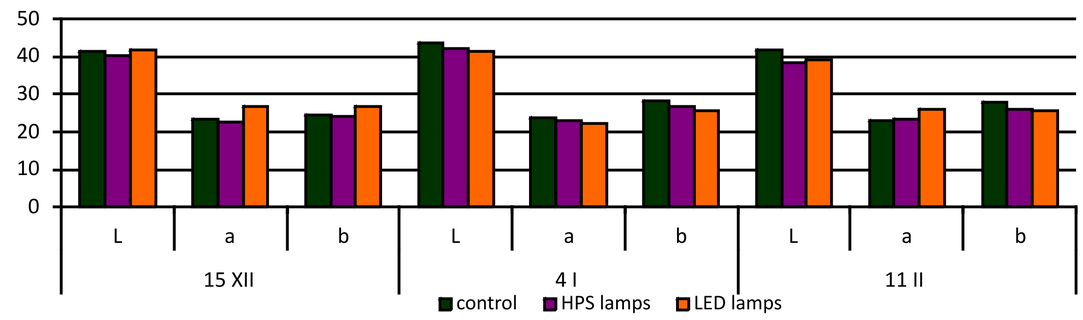

Figure 1. Effect of supplementary lighting on tint of 'Komeett' fruits in autumn-winter period

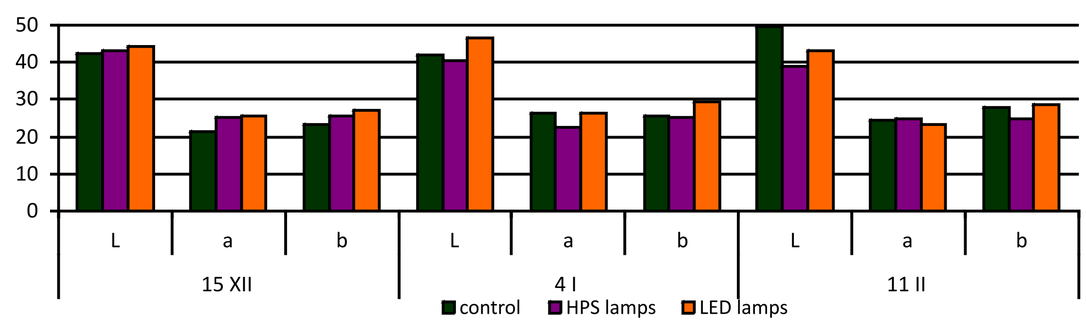

Figure 2. Effect of supplementary lighting on tint of 'Starbuck' fruits in autumn-winter period

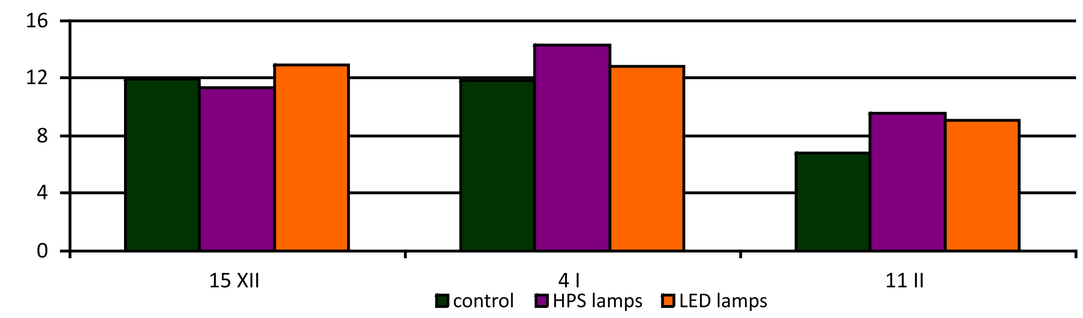

Figure 3. Effect of supplementary lighting on firmness (N) of 'Komeett' fruits in autumn-winter period

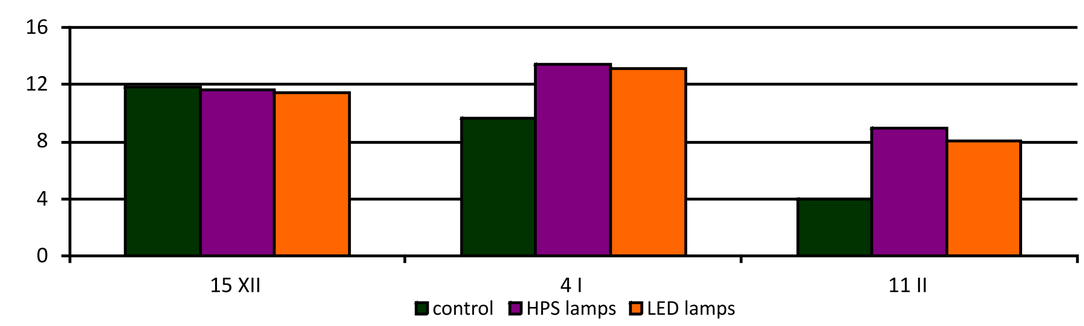

Figure 4. Effect of supplementary lighting on firmness (N) of 'Starbuck' fruits in autumn-winter period

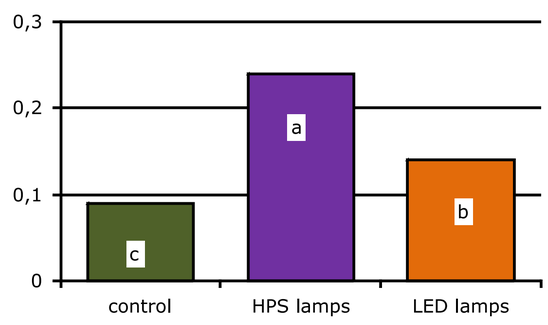

Figure 5. Effect of supplementary lighting on content of phenolic acids in autumn-winter period (based on caffeic acid)

ACKNOWLEDGMENT

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CONCLUSIONS

1. **Supplementary lighting by HPS and LED lamps positively influence physical properties of tomato fruits.**
2. **Supplementary lighting effect on firmness of tomato fruits.**
3. **Tomato fruits treats by LED lamps characterize with higher component a*.**

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