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Abstract of Doctoral Thesis

Adam Adamski, MSc., Eng.

"Development a system for intelligent control of greenhouse lightening management based on LED

Currently, one of the most important problems of growing plants in greenhouses is the selection of appropriate lighting control, its intensity and wavelength, so as to get the most optimal conditions for growing plants. The aim of this work was to develop a system of intelligent lighting control in greenhouses, which with imposed boundary conditions will wirelessly manage the work of lamps in a way as close as possible to natural conditions. With the use of intelligent lighting control, the energy consumption will be reduced without losing the assumed number of micromoles of light supplied to the plants in a 24-hour cycle. The system was designed in two versions (LED Plantalux and LED Plantalux 2), tested in the greenhouse SGGW in Warsaw and compared with control conditions (only daylight) and with available on the market lighting LED mix and HPSC 450 W. Additionally, a natural lightening method was implemented and dimming lamps, depending on the geographical location - sunrises and sunsets. The tomato was selected as the reference plant. In order to determine the response of plants to individual lighting variants, measurements of chlorophyll fluorescence, greenness index, flavonoid content and NBI nitrogen balance were performed. Based on the assumed reference values in the range of boundary parameters 110 - 230 μmol s^{-1} , the system's operation in the field of light regulation in a given range of photosynthetic PPF photon flux was found. The system can regulate the intensity of lighting, and thus maintaining the assumed value of PPF to create conditions close to natural, thereby increasing the yield and condition of plants. The results of measurements of indicators of the physiological state of the studied plants have shown that the prototype used has a positive effect on the condition of the plants. Energy saving caused by dynamic control of light intensity due to a constant PPF balance (together with natural lighting) does not affect the reduction of yields in relation to continuous lighting. Although the range of radio modules in a greenhouse environment is reduced tenfold, further work is needed on a new type of connections (e.g. changing the current "star" to "grid"), allowing for longer range, greater reliability and system scalability.