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GROWTH AND DEVELOPMENT OF LETTUCE (LACTUCA SATIVA L.) UNDER DIFFERENT LIGHTING SYSTEMS IN HYDROPONIC SYSTEMS

by

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Abstract

(*Lactuca sativa crispa*. "Lollo bionda") lettuce were planted in a multi-tier three-level vertical hydroponic system for 45 days under different light qualities and quantities of natural light in the upper level, 60% shade light in the middle level and red (R), blue (B), green (G) provided by light-emitting diodes (LEDs) which was automatically controlled to be 12/12 (day/night) in the lower level. Three levels of vertical hydroponics were also prepared in the same levels of three treatments, while were exposed to natural light as a control group. Therefore, the goal of this study was to investigate the influences of three different qualities and quantities of light systems, which were solar natural light, 60% shade and (RGB) LED on growth parameters (fresh and dry weight, height and width, number of leaves and leaf area) furthermore, accumulation of chlorophylls (Chl), carotenoids (Car) in the leaves of lettuce were measured at harvest time. The marketable sensory characteristics (shape, and color) of fresh plants were also evaluated. Overall results indicate that, the upper level of control which was the nearest to the source of natural light, found significantly the highest value and PPF of peak wavelength at 778 nm, followed by middle control at 777 nm, while the lowest value and PPF of peak wavelength was in the lower control level which was at 778 nm, it was observed that, all peak values of control group in the range of infrared wavelength. The content of Chl a was approximately more than three times as much as that of Chlb irrespective of the various light treatments except (RGB) LED. Compared with Shade, the content of Chla, Chlb, total Chl and Car under NL were significantly increased by (1.14±0.15, 0.91±0.11, 0.24±0.04 and 0.50±0.06mg/g.) respectively. No values were detected under (RGB) LED light for the pigment contents mentioned above. For treatments, lettuce exposed to natural light, with high light intensity, showed the highest values in all growth parameters as well as pigments, while lettuce under the 60% shade, the result showed all growth parameters were low except the length was close to the length value to the natural light treatment, the pigments values were also fairly close to the natural light treatment. As for the lettuce exposed to the (RGB) LED which recorded lowest light intensity, was a significantly lowest value at all parameters, while no pigments value. As for the control group, all of which were exposed to natural light, where the light quality was equal, while the light intensity was decreased gradually from top to bottom. It was noted that, length, width, leaves number and leaf area were slightly high in the middle level, while the fresh and dry weight were highest at the upper level with no significant difference. It was concluded that, under local conditions of high solar irradiance, vertical hydroponics can have up to three tiers with no significant difference and with no need for supplementary light as well.

Keywords: Lettuce (*Lactuca sativa L.*); natural light; 60% shade; (RGB) Light-emitting diode (LED); photosynthetically active radiation (PAR), Vertical hydroponic system.