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Enhancement of Biomass and Bioactive Compounds in Kale Subjected to UV-A LED Lights

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Abstract : The application of temporary abiotic stresses before crop harvest is a potential strategy to enhance phytochemical content. The objective of this study was to determine the effect of various UV-A LED lights on the growth and content of bioactive compounds in kale (Brassica oleracea var. acephala). Fourteen-day-old kale seedlings were cultivated in a plant factory with artificial lighting (air temperature of 20℃, relative humidity of 60%, photosynthesis photon flux density (PPFD) of 125 μmol·m^{-2}·s^{-1}) for 3 weeks. Kale plants were irradiated by four types of UV-A LEDs (peak wavelength; 365, 375, 385, and 395 nm) with 30 W/m^2 for 7 days. As a result, image chlorophyll fluorescence (Fv/Fm) value of kale leaves was lower as the UV-A LEDs peak wavelength was shorter. Fresh and dry weights of shoots and roots of kale plants were significantly higher in the plants under UV-A than the control at 7 days of treatment. In particular, the growth was significantly increased with a longer peak wavelength of the UV-A LEDs. The results of leaf area and specific leaf weight showed a similar pattern with those of growth characteristics. Chlorophyll content was highest in kale leaves subjected to UV-A LEDs with the peak wavelength of 395 nm at 3 days of treatment compared with the control. Total phenolic contents of UV-A LEDs with the peak wavelength of 395 nm at 5 and 6 days of treatment were 44% and 47% higher than those of the control, respectively. Antioxidant capacity showed almost the same pattern as the results of total phenol content. The activity of phenylalanine ammonia-lyase was approximately 11% and 8% higher in the UV-A LEDs with the peak wavelength of 395 nm compared to the control at 5 and 6 days of treatment, respectively. Our results imply that the UV-A LEDs with relative longer peak wavelength were effective to improve growth as well as the content of bioactive compounds of kale plants.

Keywords : bioactive compounds, growth, Kale, UV-A LEDs
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