Expression of Chlorophyll Cycle-related Genes of Chinese Cabbage Seedlings Grown under Different Light Qualities

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In this study, we investigated changes in gene expressions associated with the synthesis of chlorophyll (Chl), which is a major factor in plant growth, including photosynthesis in order to reveal how Chl synthesis and the ratio of Chls a and b in plants are controlled and adapted in response to changes in light quality. Chinese cabbage (Brassica rapa ssp. pakinesis cv. Chifu) were cultivated at PPF of 70 µmol·m\(^{-2}\)·s\(^{-1}\), photoperiod of 16 h·d\(^{-1}\), air temperature during photo- and dark periods of 25/22°C, respectively, and relative humidity of 60%. Seedlings were grown under cool-white fluorescent lamp for 4 days. Then the 4-day-old seedlings were irradiated with cool white fluorescent lamps (FL) as a control. FL mixed with red LED (R, 638 nm), or FL mixed with blue LED (B, 474 nm) for 2 days. Microarray analysis of five genes in the Chl synthesis pathway from the Brassica database was used to identify the changes in the expression of the Chl synthesis pathway-related genes of B. rapa seedlings grown under different light conditions. The Bra036948 and Bra040893; the orthologous genes of Q9MBA1 (Chl a oxygenase) and Q38833 (Chl synthase) in Arabidopsis, were highly expressed in B. rapa under FL mixed with blue light conditions. Furthermore, Bra005827 and Bra015335; the orthologous genes of Q8LEU3 (Chl b reductase), and Q8GS60 (7HM Chl a reductase) in Arabidopsis, were highly expressed in B. rapa grown under FL mixed with red light conditions. Results indicate that the Chl a oxygenase, Chl b reductase, and 7HM Chl a reductase enzymes that convert Chl ratio, were induced in different light conditions, and the supplemental red and blue lighting can be properly adjusted to regulate the chlorophyll contents and ratios of Chinese cabbage.

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