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Light-emitting diodes allow for the precise control of the indoor lighting environment. Quality attributes of leafy greens such as nutritional quality, coloration, and taste are especially sensitive to changes in the lighting spectrum. Here we summarize the effects of spectral manipulations on leafy green quality attributes based on a review paper by Kelly and Runkle (2020).

Phenolic compounds are a group of light-sensitive natural chemicals that are abundant in plant tissues and are of nutritional value to humans. High proportions of blue light typically increase phenolic concentrations, while far-red light decrease them. Additionally, the lighting spectrum regulates healthful compounds such as carotenoids, lutein, and glucosinolates. Carotenoid concentrations increase when blue light is added to white light, while concentrations decrease when far-red light is added to white light. Finally, research indicates that red light can increase lutein and glucosinolate concentrations to a greater extent than other monochromatic wavebands.

Anthocyanins are phenolic compounds that give red- and purple-leaf plants their color. Blue and ultraviolet (UV) light typically increase anthocyanin concentrations and therefore leaf redness, while far-red light has the opposite effect. Blue or UV light can also be applied towards the end of production to enhance leaf redness.

While high nutritional value is desirable, taste is one of the most important preference traits for consumers. Unfortunately, compounds that are nutritious and colorful usually have a more bitter taste. There is little research on how lighting influences taste, but plants grown under greater proportions of red light commonly have more sugars and therefore are sweeter but have less nutritional value. Conversely, plants grown under blue or UV light have greater concentrations of nutritious phenolic compounds but have a more bitter taste.

Summary of Findings

Nutritional value:

- Blue and UV light increase phenolic concentrations.
- Far-red light tends to dilute nutrient concentrations.
- Blue and red light can increase concentrations of healthful compounds such as carotenoids, lutein, and glucosinolates.

Leaf coloration:

- Blue and UV light increase leaf redness by increasing the concentrations of anthocyanins.
- Far-red light decreases leaf coloration.

Taste:

- Red light (or low blue light) increases sugar concentrations and plant sweetness.
- Blue and UV light increase plant bitterness.

Take-Home Message

- Blue and UV light increase leaf color and nutrient density but might also decrease yields.
- More research is needed to determine how lighting influences consumer taste preferences.

