

Title Chlorophyll fluorescence for non-destructive measurement of flavonoids in broccoli
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Abstract

Chlorophyll fluorescence (ChlF) by excitation with two radiation beams of different wavelengths can be used for non-destructive quantitation of epidermal flavonoids in leaves. The method was tested on marketable broccoli heads, but including red light (685 nm) and green light (530 nm) in addition to ultraviolet (UV) radiation (382 nm) and blue light (450 nm) for excitation of ChlF. As a reference, the content of flavonoids was measured with high performance liquid chromatography. To induce flavonoids, postharvest treatment during 12 days with various combinations of visible and UV radiation was tried, but the achieved changes in the flavonoid levels were not statistically significant. Instead a large natural variation of flavonoid content among the broccoli heads was used to correlate it with the fluorescence data. It was possible to estimate the content of flavonoids in flower buds by means of ChlF: relative epidermal absorbance of blue light was well correlated with flavonoid content ($r = 0.69, p < 0.001$). For quercetin alone the correlation was higher ($r = 0.77, p < 0.001$). On the other hand, relative epidermal absorbance of UV radiation or green light had a much weaker correlation with flavonoid content ($r \leq 0.40, p < 0.05$). Within the broccoli heads, flower buds had 15 times higher levels of flavonoids than the floret stalks, which in turn had five times higher contents than the main stem. Repeated ChlF measurements on individual broccoli heads during cold storage could monitor small but significant changes in flower buds, possibly indicating a breakdown of constituents absorbing UV and green light.