Title	Improving our understanding of the relationship between chlorophyll fluorescence-based F-alpha, oxygen, temperature and anaerobic volatiles
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Abstract

The HarvestWatch™ system, a relatively recent fluorescence-based technology used to facilitate a form of dynamic controlled atmosphere (DCA) for fruits and vegetables, is based on the simple premise chlorophyll-containing plant material stored under non-stressed atmospheric conditions (e.g. ≈ 20 → 1% O_2) maintain a flat fluorescence (Fα) baseline while those brought below a species and product-specific lower oxygen limit (LOL), produce an Fα signal 'spike'. Low-O_2-induced fluorescence shifts occur, and are measurable, within minutes of a fruit or vegetable dropping below its LOL, likely before the metabolic shift from aerobic to anaerobic conditions fully occurs. Conversely, Fα returns to pre-stressed levels within seconds of the fruit or vegetable returning to normoxia. Identifying such shifts through the measurement of volatiles requires much more time, since it relies on end product-based detection of anaerobic activity and not the cell conditions that presumably led to the metabolic shift. That some fruit naturally emit high anaerobic volatile levels under normoxic conditions, or do so for days after a hypoxic event has occurred and been corrected, further complicates identifying the LOL using volatile compounds. Temperature has been shown to affect the Fα baseline, the detected LOL and the low-O_2-induced spike intensity. Temperature is positively correlated with the LOL and spike intensity, and negatively correlated with the Fα baseline in apples. Commercial users of the HarvestWatch™ system must be mindful of the effects of light and the fluorescence scan interval. Because Fα is a measurement requiring dark adaptation, the scan interval significantly affects the LOL spike intensity. Work with apples shows that although the LOL or ambient atmosphere Fα baseline is not greatly affected by the scan interval, maximum low-O_2 spike intensities are generated when measurements are in excess of 2 h, while spikes from scan intervals < 1 h are severely quenched. Future work with DCA technology may focus on better understanding of long term trends observed in the Fα signals of produce stored above the LOL which may be indicative of changing metabolic and oxygen needs.