Title A review of dynamic controlled atmosphere (DCA), apples and more

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Abstract

Since its introduction in 2001, the chlorophyll fluorescence-based HarvestWatch technology has attracted considerable research and industry interest, especially when used in its Dynamic Controlled Atmosphere (DCA) mode. This review will summarise research and commercial experience with this system since 200l. The interest in this technology appears to be due to one or more of the following features of its Fα fluorescence signal: large scan area, rapid stress response stress, repeatable, non-destructive, non-chemical, not subject to calibration and highly sensitive to any stress (temperature, O_2, CO_2, water, decay) imposed on a fruit or vegetable. All chlorophyll-containing fruits and vegetables tested have produced a Fα signal, even when the chlorophyll content was low. Its most popular use has been monitoring the dynamic changes in the lower O_2 limit (LOL) of fruits or vegetables placed in a CA environment. The LOL value appears to depend on commodity, cultivar, and season, and can vary during DCA storage. Research shows that the Fα -based LOL may be linked to the Anaerobic Compensation Point (ACP) (O_2 concentration where the increase in fermentative CO_2 production equals the decrease in aerobic CO_2 production). Since the introduction of DCA, O_2 concentrations have been kept at O_2 levels previously not thought possible, frequently below 1 kPa 0_2 and as low as 0.3 kPa. Most DCA research and its application have been in the storage of apples, especially 'organic' and residue-free fruit. Currently, it is in commercial use in > 250 DCA store rooms in > 7 countries. Over 20 apple cultivars have been successfully stored in DCA, with most being superficial scald - susceptible types like 'Delicious' and 'Granny Smith'; DCA can produce scald-free apples, even after long-term (> 8 months) storage. Research reports also show that it is superior to ULO-CA in retention of other quality parameters and, in some reports, DCA matches 1-MCP in maintaining firmness. DCA has tended to decrease the incidence of apple disorders compared with other CA storage treatments. There are virtually no reports of DCA-induced, CO_2 related disorders, probably due to its ability to identify the ACP where CO_2 production is at its lowest. In addition to apple, a summary of results with other fruits and vegetables will be presented. The ability of DCA to detect temperature, CO_2 and other stresses such as ammonia gas leaks and osmotic stress will be briefly discussed.