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NON-DESTRUCTIVE TECHNIQUES FOR EVALUATING FRUIT QUALITY

by Guglielmo Costa January 22 2016

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The degree of maturity reached by the fruits at harvest is closely connected to the quality of the fruit at consumption, their shelf life, and susceptibility to diseases in cold storage. Furthermore, although fruit quality is recognized as an important aspect, only some characteristics (soluble solids, flesh firmness, etc.) are determined with simple instrumentation (refractometer, penetrometer, etc.). Fruit ripening could be more

accurately defined by considering simple sugars, organic acids, volatile substances, etc., However, these determinations require well-equipped laboratories, trained personnel, and they do not provide real-time information. Finally, the above mentioned techniques destroy the fruits in the course of the examination and are hardly representative.
Techniques have recently been introduced to assess the ripening of fruit that do not require their destruction. One of the first to be introduced, and the one most used, is the near-infrared spectroscopy (NIR). The University of Bologna has developed simplified VIS/NIR instrumentation to determine the ripeness of the fruit, expressed as the Index of Absorbance Difference (IAD), which is calculated as the difference between the spectrum of absorbance between two wavelengths (670 and 720nm), near the peak absorbance of chlorophyll-a and with the latter strongly correlated in the outer layers of the pericarp. The IAD does not determine the traditional quality parameters (soluble solids-SSC-, flesh firmness-FF-, acidity, etc.) but there is a close correlation with them on different species of fruits. In particular, it was noted on some stone fruit (peaches and apricots) that the IAD values measured at harvest are the same in successive years, whereas the SSC or FF values change. In addition, during the test years,the IAD at harvest coincided with the ethylene peak and it was strongly correlated with the gene-transcript levels related to ripening.
One application of the index along the "field to fork" production chain could help determine the optimal time to harvest, to group the warehoused fruits on the basis of the degree of ripeness, and to follow in the cold room the progress of ripening. All this would reduce the heterogeneous nature of ripening that characterizes a batch of fruit by simplifying harvesting operations, choosing the most appropriate cold-storage strategy, and continuously monitoring the evolution of the maturation of the fruits in the fridge to determine at what point the fruit can leave cold storage and be sold.
The devices developed to determine the IAD are the DA-Meter, a portable instrument that facilitates determining the best time to harvest and the stationary DA, a device used in warehouses to grouping the fruits that move at a speed of 10 fruits/second along belts and sorts them into homogeneous classes of ripening. The other device that determines the IAD is called the difference absorbance fruit logger (DAFL). Positioned in contact with the fruit, it continuously monitors the progress of maturation and its temperature by transmitting the information at programmed times to a receiver unit placed outside the cold room.