

Quality or Freshness? How to Evaluate Fruits and Vegetables during Postharvest

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Editorial

The economic value of plant-derived food depends on its quality and how it is preserved over the whole production chain, until it reaches the final consumer. The concept of quality is wide and covers several aspects such as, external appearance, nutritional value, presence of health-related compounds, safety and security. On the other hand, freshness is strictly connected to the “age” of the product and though it is an attribute related to quality, these two are different concepts and nowadays it is no longer possible to evaluate produce quality only on the basis of its freshness.

At harvest, for the growers the quality is essentially represented by the visual appearance which includes shape, color, and dimensions. During the distribution chain, instead, quality is mainly defined by the technological proprieties of the fruits of vegetables such as firmness and storage ability. Finally, the consumer is first attracted by the appearance of the product but later on he has to be satisfied by the taste and aroma. The visual appearance is very important since it attracts the consumer, while the edible quality and the correct information about nutraceutical and nutritional aspects, will make the consumer to re-purchase the product. Today several retailers consider the term “freshness” as synonymous of quality and use it as a claim to promote their products, thus there is an active debate on how to define quality.

Quality, sometimes, can be hardly quantified since, as said, it is an overall representation of several parameters. Moreover quality can be independent from time since different technological approaches can preserve the quality for long time even for weeks, but the product is not fresh anymore.

Postharvest storage under controlled temperature and atmosphere together with specific treatments are commonly used to control produce decay and assure a significant extension of the product life. Moreover, packaging has a key role in maintaining the product during the postharvest life.

A multidisciplinary approach can be used with the aim to identify potential markers of quality and develop new technologies to be used over the whole product pipeline.

During the postharvest the vegetal tissue is subjected to several kinds of stresses, both biotic and abiotic. The chain of events which are triggered by a stressful condition finally leads to products quality decrement. It is thus fundamental to study the physiological aspects of stress response to find physiological, biochemical and molecular markers to be used as basis in the quality evaluation.

Under optimal grow conditions, the redox state of tissues is kept under control by the action of several antioxidant systems, which are

based on the activity of specific enzymes and/or the direct action of specific molecules [1]. When plant tissues, are subjected to a stress (such as mechanical damages, stressful temperatures, diverse light conditions), it is possible to observe an oxidative burst which leads to an accumulation of high levels of oxidant species. As a consequence macromolecules and cellular tissues are damaged by a succession of oxidative chain reactions. The quantification of products derived by the disruption of macromolecules (such as malondialdehyde) can be used as a method of estimation of the oxidative status of the tissue and, as a consequence, as a quality marker, in the case of produce during the postharvest [2].

The changes in the concentration of specific compounds, which are normally involved in maintaining the redox status of cells, is a common and well known feature of stress response. Sugars, proteins, ascorbic acid, phenolic compounds, carotenoids [3-5] as well as the specific activity of enzymes deputized to keep antioxidants level under control are interested by significant changes in response to stress and so, the evaluation and quantification of these compounds is also useful in the estimation of quality. Moreover the mechanisms of stress responses and adaptation to postharvest conditions are modulated by the action of plant hormones [6].

The application of new non-invasive methods for quality evaluation and sorting of agricultural products is growing and several techniques are applied also in the postharvest evaluation of quality. These methods are based on the measurement of physical properties which correlate well with the physiological events which take place during the postharvest [7]. Modeling analyses can be also applied during postharvest with the aim to predict changes in quality parameters of produce [8].

At the transcriptomic level it is possible to observe genes which rapidly change their expression in response to the stress stimuli and in correlation with physiological and biochemical events.

The use of the “omic” systems represents a new approach which is used for interpreting the functional elements of the transcriptome, proteome and metabolome and revealing, for example, the responses to diverse environmental conditions. The use of these innovative techniques has been recently applied in studies aiming to better understand the responses to different postharvest conditions or to study the basis of physiological disorders which can take place during storage [9-12].

Fresh fruits and vegetables have a central role in human diet. In order to develop health promoting crops with high nutritional value and quality traits, a better understanding of the mechanisms and physiological events which affect quality is crucial. The constant development of new techniques represents an important and

significant improvement in science and through these approaches is now possible to obtain a wide range of information at multiple levels. New research challenges are now open. All this, creates a great opportunity to study and improve the quality of plant-derived food.

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