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Advanced phenomics, breeding, and postharvest: a synergism to improve fruit quality

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Fruit quality can be defined by the achievement of four key factors: appearance, flavor, texture and nutritional properties. Among these, texture, flavor, and appearance directly impact the postharvest performance and consumers' appreciation, therefore the fruit marketability. Although the importance of these factors can hardly be underestimated, breeding efforts have historically been mainly oriented to improve fruit appearance and storability. However, often, selection for yield, fruit size, color, and shelf life properties had unintended negative consequences on other fruit quality traits, such as taste and aroma. Defining and quantifying these quality components, in relation with distinct segments of the production chain, needs comprehensive investigations and a tight synergy of analytical approaches with a particular focus on rapid and non-invasive methods. In particular, understanding the stability of each quality trait during different storage conditions may allow a better definition of future breeding strategies aimed, for example, at the selection of accessions suitable to improve distinct markets.

The breeding research activity at the Foundation E. Mach, based on genomics, sensory and conventional characterization tools, has been recently complemented with advanced phenotyping tools, such as PTR-ToF-MS and texture analyzer, and with tailored postharvest studies aimed to simulate the "from farm to fork" chain. This synergism of novel analytical approaches is fully applied into the breeding activities of apple, blueberry, raspberry and strawberry in order to develop new cultivars characterized by both prolonged storability and high perceived quality. Moreover, this research approach was valuable to deeply investigate and step forward in the comprehension of the genetic and physiological aspects controlling fruit quality. These studies allowed to determine the possible direct role of the cell wall architectural structure both on textural properties and in the regulation of VOC synthesis and release in apple and strawberry fruit and the interaction between genetic variability and fruit ripening stages on the aroma development of raspberry during cold conservation.

This knowledge would enable, in a close future, for a more precise selection of the most favorable new accessions distinguished by superior fruit quality.