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Editorial

Evolution of Compounds and Characteristics of Crops during Ripening and after Harvest

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1. Introduction

Consumers are increasingly asking for products with better organoleptic characteristics, flavors, aromas, colors, attractiveness, etc. Farmers must estimate, with maximum precision, the optimum harvest time, so that their product reaches the consumer or industry in the best condition, thus providing a product with the highest quality. In addition, once the fruit or food has been collected, it must be ensured that the quality, organoleptic and food safety characteristics remain in within the optimal range until it reaches the consumer or the food processing plant.

With respect to the optimal ripening time of the fruit, in recent decades there have been hundreds of works that study the optimum time for fruit harvesting based on its compositional and organoleptic characteristics [1–3]. In addition to genetic factors [4], there are many other factors (both environmental conditions and agronomic factors) involved in the development of fruits and plants regarding the optimum stage of ripening or harvesting depending on the specific characteristics to be achieved. Among these factors, the availability of water [5], the growth temperature [6], the type of soil [7], the fertilization of the soil [8], the irradiance [9], irrigation [10], the age of the plant [11], among many others, stand out. With all these factors, farmers have multiple tools to modulate the growth of their crops and harvest them under optimal conditions according to the desired characteristics.

Once the crop has been collected in the best conditions, it must be ensured that these characteristics are preserved in the best possible way until it reaches the consumer or the crop is processed. There are many factors that can affect the stability of crops once harvested, such as time after harvest [12], storage temperature [13], storage humidity [14], thermal drying treatments [15], amount of oxygen [16], microbiological contamination [17], addition of chemical agents [18], postharvest treatments (washing, cutting, and waxing) [19,20], etc. The instability that can affect the harvested crops can produce a loss of organoleptic characteristics, the degradation or loss of compounds with biological interest, such as antioxidant compounds, or the complete degradation of the product. In any case, farmers have a large number of tools and scientific knowledge at their disposal in order to minimize these effects.

2. Overview of the Special Issue

This Special Issue, "Evolution of compounds and characteristics of crops during ripening and after harvest", comprises seven articles addressing the evolution of the compounds present in crops and plants during maturation, in order to determine the optimal time of harvest based on the characteristics required and bearing in mind the evolution of crops and their characteristics after harvest. These original research papers can be grouped into two categories:

(1) Evolution of compounds and characteristics of crops during ripening [21–24];
(2) Evolution of compounds and characteristics of crops after harvest [25–27].

2.1. Evolution of Compounds and Characteristics of Crops during Ripening

In the first article, Szalóki et al. [21] determined the threshability of four local temperate japonica rice varieties during the ripening phase over three consecutive years with the application of an improved threshing meter. In this context, harvesting and threshing are crucial processes that influence the quality, quantity, and economic efficiency of rice production. In this sense, the threshability of rice varieties is an important agronomic trait for breeding programs, but the selection for threshability is hardly standardized. Seed moisture content was measured parallel to panicle threshing force in order to describe the differences in the ripening habits of the genotypes. The different threshability patterns of the genotypes were found to be quite stable across these periods. In addition, correlations between the threshing force, moisture content, and 5-day averages of meteorological parameters during the ripening phase were determined. The average temperature, the maximum temperature, precipitation, and relative humidity had a significant influence on the moisture content.

In the second article, Sokolova et al. [22] studied the betalain content and morphological characteristics of different table beet accessions, depending on different abiotic factors such as temperature or precipitation level. Table beet (*Beta vulgaris* L.) is widely used as a source of the natural red food coloring (E162), which is in high demand for its coloring power, its natural origin, and its high biological interest in organisms. Despite the importance of this natural colorant in the food industry, there is still a lack of knowledge about the factors that modulate changes in crop betalain content during the growing season. This fact makes it impossible to identify the optimal harvest time to obtain beets in their optimum color state. This work provides the results of the individual investigations of both betacyanins and betaxanthins, in the peel and the pulp of the roots, in 15 table beet accessions of different colors. A high correlation was found between the content of betacyanins and betaxanthins in the peel and the pulp of the red varieties studied. It was also determined that the beetroot peel was more sensitive to changes in temperature in contrast to the pulp, presenting a lower level of betalains as the temperature increased. The betalain composition of the pulp was less susceptible to the negative impact of increased temperatures, but reacted negatively to rainfall. Finally, it was determined that, in order to obtain a higher coloring level, a mid-ripening, with rounded and medium-sized roots, short and thin petioles, and a large number of narrow leaf blades, is required.

In the following article, Ledenčan et al. [23] estimated the quality at harvest of sweet corn hybrids (su1), based on the maximum content of compounds of biological interest in the grain (total phenolic compounds and antioxidant capacity) and the change in the content of the moisture of the grain and total sugars during ripening. In this sense, to achieve a high-quality food, sweet corn must be harvested at the optimal state of maturation. For this, the factors that most influence the flavor of sweet corn are the moisture of the grain and the total sugar content, while its healthy properties are associated with the content of total phenolic compounds and antioxidant activity. In this study, two growing seasons were evaluated, performing five harvests per year at 2-day intervals, from 17 to 25 days after pollination. It was confirmed that the grain quality of su1 sweet corn hybrids changes significantly during fruit ripening. A rapid decrease in grain moisture and sugar content resulted in a narrower optimum harvest window. Depending on the type of corn being harvested, the duration of the optimal harvest period was from two to four successive harvest dates. According to the results obtained, it is possible to recommend the use of hybrid varieties of corn with a higher sugar content and also a slower loss of moisture and sugars in the grain.

Finally, Vazquez-Espinosa et al. [24] determined the optimal harvest time of the Bolilla pepper, based on the concentration of capsaicinoids (pungent compounds in peppers) in the pericarp and placenta in two different maturation stages of the plant (young and adult), in order to maximize the yields of the capsaicinoids at harvest. Peppers are a very popular ingredient in many dishes, either directly or as by-products. Peppers in many cultures are valued for their pungent characteristics, so it is necessary to determine the optimum moment for harvesting their fruits. The Bolilla pepper, in particular, is a pepper widely used for the production of spicy paprika in the area of La Vera (Spain). In the case of the pericarp, the maximum concentration of capsaicinoids was reached 30 days post-anthesis for the young and adult plant while, in the placenta, it was recorded 41 days post-anthesis, with values significantly higher than those of the pericarp. In any case, from that moment, there was a drastic reduction in capsaicinoid content both in the placenta and in the pericarp. This work makes it possible to determine the optimal moment of harvest for these peppers, making the most of its beneficial health effects, as well as its organoleptic characteristics.

2.2. Evolution of Compounds and Characteristics of Crops after Harvest

In this first article, Noguera et al. [25] presented a complete methodology based on a new, low-cost, multispectral sensor for assessing the quality parameters of intact olive fruits. The methods mostly used to determine the quality of olives involve chemical methods that are time-consuming and expensive. These limitations lead growers to assess the homogeneity of their crops using subjective criteria such as intuition and visual decisions. In recent years, precision agriculture techniques, such as spectroscopy, are being introduced for the evaluation of the quality of crops. These novel techniques generally require expensive equipment, which limit their use in olive mills. The device evaluated was a reflectance sensor. The 18 reflectance signals acquired by the sensor were used as input and three olive quality indicators (moisture, acidity, and fat content) were used as objectives to be determined. This procedure was applied to a set of 507 olive samples. After data preprocessing, artificial neural network models were trained. The responses from these models were promising, reaching good correlation coefficients for fruit acidity, moisture, and fat content. These results show the suitability of the proposed device to assess the quality status of intact olives. Its obtaining of good results, its ease of use, and its low cost will allow the implementation of this system, for the quality assessment of olive fruit, to become more affordable for olive growers.

In the following article, Leliana et al. [26] evaluated the functionality of the by-products (both endo and mesocarp) of coconuts (*Cocos nucifera*) at early and mature harvest stages. Coconut is a widely used food in producing countries and, during consumption, the waste generated must be reduced through the processing of by-products to ensure environmental sustainability. In this work, aqueous and ethanolic extracts (50 and 100% ethanol in water) of coconut by-products were obtained, which were evaluated to detect the DPPH radical scavenging activity, in addition to being subjected to a linoleic acid-β-carotene system assay in contrast to synthetic antioxidants. To obtain the extracts, ultrasound-assisted extraction was used. Superior results of antioxidant capacity were obtained in those extracts from the mesocarp of young coconut, so these by-products can be used as an alternative natural antioxidant.

Finally, ElGamal et al. [27] conducted a comprehensive overview on the thermal degradation of bioactive compounds during the drying process of horticultural and agronomic products. The main objective of this paper was to provide an updated overview of recent research studies related to the effects of the drying process on the main bioactive/effective compounds in agricultural products. In this sense, during the last decades, many researchers have investigated in detail both the beneficial characteristics and the stability of bioactive compounds, such as phenolic compounds, vitamins, flavonoids, and glycosides, and volatile compounds in fruits, vegetables, and medicinal and aromatic plants, that possess beneficial properties. In this work, special emphasis has been placed on the details related to the changes that occur in vitamin C, phenolic compounds, flavonoids, glycosides, and volatile compounds, as well as the antioxidant activity during the drying process of fruits and plants. An analysis of the degradation mechanisms of these compounds shows that phenolic compounds, vitamin C, glycosides, and flavonoids react with oxygen during the drying process at high temperatures, and that the reaction rate results in the degradation of these bioactive compounds due to their high reducibility. In conclusion, to maintain the bioactive components of the plant matrices, convection drying at relatively low drying temperatures is strongly recommended.

3. Conclusions

This Special Issue entitled "Evolution of compounds and characteristics of crops during ripening and after harvest" presents a general and up-to-date vision of the factors that affect the maturation of crops up to the optimum point of harvest, as well as those factors that affect the conservation of crops once harvested. A general approach to the state of the art in these aspects has been adopted in order to give a global vision of the problem. In view of the data, farmers have numerous tools and knowledge to modulate the maturation of their crops, as well as to keep their crops in the best possible condition once harvested.

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